THE DISTRIBUTIONAL EFFECTS OF VALUE-ADDED TAXES IN OECD COUNTRIES

BY

ALASTAIR G A THOMAS

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Chapters 3 and 5 of this thesis revise and substantially extend work previously published in chapters 2 and 3 of OECD/KIPF (2014). Section 2.2 of chapter 2 revises and updates work previously published in chapter 1 of OECD/KIPF (2014). I was the sole author of these three chapters in OECD/KIPF (2014).

ABSTRACT

Most OECD countries' value-added tax (VAT) systems apply reduced VAT rates to a selection of expenditure items in order to achieve distributional goals, and – to a lesser extent – social, cultural and employment-related goals. This thesis investigates the distributional effects of the VAT in OECD countries, and the merits of using reduced VAT rates to achieve distributional goals. The research adopts a microsimulation modelling approach that draws on household expenditure microdata from household budget surveys for an unprecedented 27 OECD countries. A consistent microsimulation methodology is adopted to ensure cross-country comparability of results.

Non-behavioural VAT microsimulation models are first built to examine the overall distributional impact of the current VAT systems in each country. The research assesses the competing methodological approaches used in previous studies, highlighting the misleading effect of savings patterns on cross-sectional analysis when VAT burdens are measured relative to income. Measuring VAT burdens relative to expenditure – thereby removing the influence of savings – is found to provide a more reliable picture of the distributional impact of the VAT. On this basis, the VAT is found to be either roughly proportional or slightly progressive in most of the 27 OECD countries examined. Nevertheless, results for a small number of countries (Chile, Hungary, Latvia and New Zealand) highlight that broad-based VAT systems that have few reduced VAT rates or exemptions can produce a small degree of regressivity. Results also show that even a roughly proportional VAT can still have significant equity implications for the poor – potentially pushing some households into poverty.

Behavioural VAT microsimulation models are then built for 23 OECD countries to investigate whether reduced VAT rates are an effective way to support poorer households, and whether the use of targeted cash transfers would be more effective. The behavioural microsimulation methodology follows the Linear Expenditure System based approach of Creedy and Sleeman (2006). Complementing this approach, a Quadratic Almost Ideal Demand System (QUAIDS) is estimated specifically for New Zealand, thereby providing the first estimates of a QUAIDS model based on New Zealand data.

Simulation results show that, as a whole, the reduced VAT rates present in most OECD countries tend to have a small progressive impact. However, despite this progressivity, reduced VAT rates are shown to be a highly ineffective mechanism for targeting support to poorer households: not only do rich households benefit from reduced rates, but they benefit more in aggregate terms than poor households do. When looking at reduced VAT rates applied to specific products, results are found to vary considerably. Reduced VAT rates specifically introduced to support the poor (such as reduced rates on food consumed at home and domestic utilities) are generally found to have a progressive impact, though rich households still receive a larger aggregate benefit than poor households. In contrast, reduced VAT rates introduced to address non-distributional goals (such as reduced rates on restaurants, hotels, and cultural and social expenditure) often have a regressive impact.

Additional simulation results show that an income-tested cash transfer will better target support to poorer households than reduced VAT rates in all countries. Furthermore, even a universal cash transfer is found to better target poorer households than reduced VAT rates. However, results also show that it is very difficult for an income-tested cash transfer to fully compensate all poor households for the removal of reduced VAT rates. This is due to the significant variation in the underlying consumption patterns across households. While a small number of poor households lose out from replacing reduced VAT rates with targeted cash transfers, those that receive support are instead determined by income and family characteristics as opposed to consumption tastes – thereby increasing horizontal equity. Furthermore, many households are lifted out of poverty as revenue previously transferred to richer households is now transferred to poorer households.

These results empirically confirm the theoretical expectation that, where available, direct mechanisms (whether via the income tax or benefit system) will better achieve distributional goals than reduced VAT rates. Countries that currently employ reduced VAT rates to achieve distributional goals should therefore consider removing these reduced rates and adjusting their income tax or benefit systems to achieve these distributional goals instead. Countries should also consider removing reduced VAT rates aimed at non-distributional goals where a more effective instrument is available to achieve the particular policy goal. At a minimum, the merits of these reduced VAT rates should be reassessed in light of their negative distributional impact.

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ISO COUNTRY CODES

Australia	AUS
Austria	AUT
Belgium	BEL
Canada	CAN
Chile	CHL
Colombia	COL
Czech Republic	CZE
Denmark	DNK
Estonia	EST
Finland	FIN
France	FRA
Germany	DEU
Greece	GRC
Hungary	HUN
Iceland	ISL
Ireland	IRL
Israel	ISR
Italy	ITA
Japan	JPN
Korea	KOR
Latvia	LVA
Lithuania	LTU
Luxembourg	LUX
Mexico	MEX
Netherlands	NLD
New Zealand	NZL
Norway	NOR
Poland	POL
Portugal	PRT
Slovak Republic	SVK
Slovenia	SVN
Spain	ESP
Sweden	SWE
Switzerland	CHE
Turkey	TUR
United Kingdom	GBR
United States	USA

CHAPTER 1. INTRODUCTION

1.1. Research question and motivation

This thesis examines the distributional effects of the value-added tax (VAT) in OECD countries and the merits of using reduced VAT rates to address distributional concerns. It specifically seeks to answer three questions: whether the commonly held perception that the VAT is regressive is supported by evidence; whether reduced VAT rates are an effective way to provide support to poorer households; and whether targeted cash transfers (whether implemented through the income tax or benefit system[1]) are a superior policy instrument for providing support to poorer households. The thesis also aims to determine whether the answers to these research questions are consistent across OECD countries, or whether country specific factors – such as varying VAT design characteristics and consumption patterns – lead to different conclusions. Finally, the research aims to derive broad policy recommendations regarding VAT design.

The motivation for this research comes from observation of the strong contrast between New Zealand's broad-based single-rate VAT (called the "goods and services tax", GST) and the multi-rate VAT systems in place in most other OECD countries. The predominant motivation for these multi-rate VAT structures has been to achieve distributional goals – particularly in light of the perceived regressivity of the VAT. This has led to reduced rates being applied to consumption items that typically make up a greater proportion of the expenditure of poorer as compared to richer households. Meanwhile, the pursuit of cultural and social objectives, amongst others, have led to the application of reduced VAT rates on an even broader range of consumption in many OECD countries. In contrast, New Zealand's approach has been to address distributional concerns about the VAT through the use of income-targeted transfers (currently reflected in the "Working for Families" tax credit package).

The appropriate rate structure for indirect taxation has been the subject of much theoretical work dating back as far as Ramsey (1927). A key implication of the optimal taxation literature is that the availability of an income tax weakens the case for using indirect taxes – such as the VAT – to redistribute income

[1] Cash transfers are defined broadly as any transfer made to individuals or households by government, whether implemented through the tax system (e.g. as a tax credit) or through the benefit system.

(Crawford et al., 2010). For example, the seminal work of Atkinson and Stiglitz (1976) shows that if an optimal non-linear income tax is available and preferences between consumption and leisure are "weakly separable" (or, in other words, all goods are equally complementary with leisure), then rate differentiation should not be used to aid income redistribution.[2]

More generally, the VAT can be expected to be a blunt instrument for achieving distributional goals. As eligibility for a reduced VAT rate is based solely on the decision to consume the particular item subject to the reduced rate, rich households can be expected to benefit to some degree from reduced rates as well as poor households. To the extent that reduced rates are targeted at consumption items that make up a greater proportion of the expenditure of poor households than rich households, reduced rates can be expected to have a progressive effect in that they give a greater relative tax reduction to the poor than to the rich. However, because richer households are likely to consume more in aggregate terms than poorer households, rich households can still be expected to gain more in aggregate terms from a reduced VAT rate.

Efficiency arguments regarding the removal of tax-induced distortions to consumption decisions and practical benefits in terms of reduced compliance and administrative costs further strengthen the case for movement towards a single-rate structure. Consequently, there is now a broad academic consensus that redistribution is better achieved directly through income tax and/or benefit systems than through the VAT (see, for example, Mirrlees et al., 2011; Institute for Fiscal Studies (IFS), 2011a,b; Ebrill et al., 2001). From a practical perspective, there are sometimes limits to the extent to which direct tax and benefit systems can be used to achieve distributional goals – particularly in developing countries. However, all OECD countries have well developed income tax and benefit systems in place that could feasibly be adjusted or extended to pursue the distributional goals for which reduced VAT rates are currently used. Nevertheless, reduced VAT rates remain commonplace across the OECD.

Given the crucial role that distributional concerns have played in the adoption of reduced VAT rates, it is surprising that there is little empirical evidence on the distributional effects of reduced VAT rates in OECD countries, and even less examining the merits of adopting more direct mechanisms to achieve distributional goals. This research seeks to address these gaps. Furthermore, it also seeks to re-examine

[2] Kaplow (2006) and Laroque (2005) both show that this result still holds when the income tax is not optimal. Limited empirical evidence (see, e.g., Browning and Meghir, 1991) suggests that weak separability is unlikely to hold in practice. However, the empirical difficulty in determining appropriate tax rates based on complementarities with leisure suggests that uniform indirect taxation remains preferable from an efficiency perspective (Crawford et al., 2010). Chapter 2 provides further discussion of the optimal indirect tax literature.

the overall distributional effect of the VAT as much previous empirical research has misleadingly ignored the impact of savings behaviour on the measurement of VAT burdens. The research is based on VAT microsimulation models built for 27 OECD countries using household expenditure microdata and following a consistent methodology that enables cross-country comparison of results.

The rest of this introductory chapter is structured as follows: Section 1.2 summarises the previous empirical literature examining the distributional effects of the VAT, before Section 1.3 highlights the contribution of this thesis to that literature. Section 1.4 then provides a brief outline of the contents of the thesis.

1.2. Previous research on the distributional effects of the VAT

This section provides a brief summary of the empirical literature examining: (1) the overall distributional effect of the VAT; (2) the distributional effects of reduced VAT rates; and (3) the use of alternative mechanisms to reduced VAT rates to achieve distributional goals. More detailed literature reviews are provided in the relevant chapters throughout the thesis.

A number of empirical studies have examined the overall distributional effect of the VAT. These have typically been undertaken using household expenditure survey microdata.[3] The use of microdata enables the fine distinctions present in many countries between expenditure categories subject to different VAT rates to be accurately modelled. It also provides flexibility regarding how to measure distributional effects. In most cases, average VAT burdens measured as a percentage of disposable income or expenditure are presented across disposable income or expenditure deciles, though summary measures of redistribution, progressivity and poverty effects are sometimes also used.

The often-made conclusion that the VAT is regressive has followed from analysis of VAT burdens measured as a percentage of income across the income distribution for a single year. Numerous European country studies (e.g., Leahy et al., 2011; Ruiz and Trannoy, 2008; O'Donoghue et al., 2004) adopt this analytical approach, and as a result conclude the VAT is a highly regressive tax. However, as has been highlighted by various authors (e.g. IFS, 2011a; Creedy, 1998a; Metcalf, 1994), a key problem with this approach is that it fails to account for savings behaviour. More specifically, it ignores the fact that income that is saved in the current year will still incur VAT when it is eventually consumed (as this VAT cannot be captured by an analysis based on data from a single year). Similarly, current

[3] Warren (2008) provides a summary of different approaches that can be taken to modelling the distributional effects of consumption taxes more broadly.

expenditure, and the VAT incurred on it, may have been funded from income earned in a previous year. Because savings rates tend to increase with income, this biases income-based VAT burden results downwards at higher income levels – hence the common conclusion that the VAT is regressive.

In contrast, studies that present VAT burdens as a proportion of expenditure across either the income or expenditure distribution (e.g. Bird and Smart, 2016; IFS, 2011a; Metcalf, 1994) tend to find that VAT systems are relatively proportional, or even slightly progressive. The largest cross-country study favouring the expenditure-based approach is IFS (2011a) who drew together nine different country-specific studies with broadly similar microsimulation methodologies. They find the VAT to be either roughly proportional or progressive in eight of their nine European countries when measured as a percentage of expenditure across equivalised income deciles. The progressivity was found to be driven by the presence of reduced VAT rates.

Research looking specifically at the distributional effects of reduced VAT rates has been less common. The studies that have been undertaken use microsimulation models to simulate either the introduction or removal of reduced VAT rates in order to assess who gains and loses from the reduced rates. Research has predominantly focused on the impact of either all reduced VAT rates, or of reduced rates applied to food and/or necessities.

Single country studies have used non-behavioural models to examine the distributional impact of all reduced VAT rates (Davis and Kay, 1985, for the United Kingdom), reduced rates on food and children's clothing (Leahy et al., 2011, for Ireland), and on food, housing and medical care (Caspersen and Metcalf, 1994, for the United States). These studies broadly show that reduced VAT rates produce a degree of progressivity, but that both poor and rich households benefit significantly. Meanwhile, the Irish Department of Finance (2018) find that Ireland's 9% reduced VAT rate – which applies to restaurant food, hotel accommodation and a range of cultural and recreational expenditure – provides a greater aggregate benefit to richer households than poorer households.

The largest scale non-behavioural study is again by IFS (2011a), who extend their broad distributional analysis of the VAT for nine European countries to also examine the impact of reduced rates. They find reduced rates as a whole to have a progressive impact, but with richer households benefiting more in aggregate terms than poorer households. While they do not present results for different types of reduced rates, they note that a key reason for the overall progressive results is the application of reduced rates to the majority of food in all nine countries. Meanwhile, Harris et al. (2018) examine the distributional impact of reduced VAT rates as a whole in four developing countries (Ethiopia, Ghana, Senegal and Zambia). They find both progressive and regressive results, depending on the country.

A small number of studies account for changes in consumption patterns in response to price changes (hereafter, "behavioural responses") when simulating the introduction or removal of reduced VAT rates. Creedy (2001) for Australia, and Ball et al. (2016) for New Zealand, adopt a Linear Expenditure System (LES) based approach, finding reduced rates on necessities and food, respectively, to be progressive but poorly targeted. In addition to their non-behavioural analysis, IFS (2011a) estimate Quadratic Almost Ideal Demand Systems (QUAIDS) for Belgium, Germany and the United Kingdom, finding broadly consistent results with their non-behavioural analysis. Meanwhile, Cseres-Gergely et al. (2017) and Gaarder (2018) estimate QUAIDS models for Hungary and Norway, finding reduced rates on food to have a progressive impact.

These studies, while showing that reduced VAT rates often have a progressive effect, also show them to be badly targeted at the poor. Nevertheless, a case only exists for removing reduced rates if a better alternative policy instrument exists with which to achieve distributional goals. Unfortunately, there are few empirical studies that examine whether an alternative instrument would be better, and even fewer that take account of behavioural responses to the removal of reduced VAT rates in such analysis.

Non-behavioural studies for the United Kingdom by Davis and Kay (1985), Crawford et al. (2010) and Mirrlees et al. (2011) find reform packages involving the replacement of reduced VAT rates with changes to direct taxes and transfer payments can improve distributional outcomes. Crawford et al. (2010), for example, find that such a reform can, on average, fully compensate poorer households for the removal of reduced rates while generating additional revenue to fund other government expenditure priorities. Similarly, Brashares et al. (1988) find that income-tested credits or reimbursements would benefit poor households far more than zero-rating necessities in a VAT in the United States. Meanwhile, Harris et al. (2018), for their four developing countries, find that even a universal benefit would better target poor households than the reduced VAT rates in these countries.

Two recent studies use QUAIDS models to take account of behavioural responses in their analyses. Cseres-Gergely et al. (2017) use their QUAIDS model for Hungary to simulate the introduction of a range of potential policy measures to help poorer households, finding that an income transfer to the unemployed would be better targeted at the poor than reduced VAT rates on food. Van Oordt (2018) uses a QUAIDS model for South Africa to simulate removing reduced VAT rates and using the revenue to extend existing cash transfers. He finds that low- and middle-income households would benefit from the reform, while high-income households would lose. However, he highlights concerns regarding the effective implementation of cash transfers in a developing country context. Meanwhile, Gcabo et al. (2019), in their non-behavioural analysis for South Africa, find better targeting would be achieved with the introduction of new cash transfers rather than the extension of existing cash transfers.

1.3. Contribution of this research

This research extends the above literature in several ways. Its main contributions are:

- Reassessing whether or not the VAT is regressive – extending previous analysis both in terms of country coverage and cross-country comparability.
- Examining the distributional effects of reduced VAT rates – extending previous analysis in terms of country coverage, by incorporating behavioural responses into the analysis, and by separately analysing the distributional effects of reduced rates on different types of expenditure.
- Examining the replacement of reduced VAT rates with targeted cash transfers – extending previous analysis in terms of country coverage and by incorporating behavioural responses into the analysis.

The research adopts a microsimulation modelling approach that draws on household expenditure microdata from household budget surveys (HBSs) for an unprecedented 27 OECD countries. This dataset consists of cross-sectional HBS microdata for 22 European Union (EU) countries, as standardised and provided by Eurostat, plus HBS microdata for an additional five non-EU countries (Chile, Korea, New Zealand, Switzerland and Turkey) obtained directly from National Statistical Offices and then adjusted into the standardised Eurostat format. The HBS data relate to various years, in most cases between 2008 and 2012. The standardised format breaks household expenditure into more than 200 different categories, thereby enabling the often fine distinctions between expenditure categories subject to different VAT rates to be accurately modelled. A consistent microsimulation methodology is adopted to ensure cross-country comparability of results.

Non-behavioural microsimulation models are first built to examine the distributional effects of the current VAT systems in each of the 27 countries. The analysis of the "current" VAT systems – more precisely, the systems in place in the year of the HBS data – give particular focus to assessing whether or not the VAT is a regressive tax. This is an important question not just in terms of providing a descriptive assessment of the overall distributional effect of a VAT, but because of the pejorative nature of the term "regressive" and the consequent political economy challenge such an assessment creates to undertaking reform.

Consideration is also given to assessing the magnitude of regressivity/progressivity and the overall redistributive effect of the VAT. Additionally, acknowledging that even a proportional tax would have a larger impact on the purchasing power of the poor than the rich, the models are also used to consider the impact of the VAT on poverty in each country.

Behavioural microsimulation models are then built to investigate the use of reduced VAT rates in more detail. The models are first used to examine the distributional effects of reduced VAT rates, both as a whole, and for reduced rates applied to different types of expenditure. The key question examined here is whether reduced VAT rates are an effective way to provide support to poorer households. The analysis is undertaken by simulating the removal of reduced VAT rates and comparing revenue and welfare effects pre- and post-reform.

As already noted, even if reduced VAT rates are found to be an ineffective means of supporting poorer households, a case only exists for removing reduced rates if a better alternative policy instrument exists. The behavioural models are therefore also used to simulate the revenue-neutral replacement of reduced VAT rates with targeted cash transfers. Theoretically, a targeted cash transfer (whether implemented through the tax or benefit system) should be able to better target support to poor households because the targeting mechanism can exclude some households, whereas a reduced VAT rate will benefit all taxpayers that consume the goods subject to the reduced rate. Furthermore, all OECD countries already have some type of targeted cash transfer system in place – meaning it would be administratively feasible to adjust or extend these systems to compensate targeted households for the removal of reduced VAT rates. This contrasts with many developing countries that do not yet have the administrative capacity to implement an effective targeted cash transfer system.

It is necessary to account for behavioural responses in these simulations because they alter the relative prices of goods and services, and the resulting changes in consumption patterns will affect post-reform revenue and welfare. Ideally, this would involve the estimation of a demand system for each country to produce the necessary price and cross-price elasticities. However, full estimation of a demand system has large data and resource requirements – with both household expenditure microdata and corresponding disaggregated price data typically needed across a number of years for each country. Even where data are available, the resource requirements are extensive.[4] While unrealistic, the

[4] For example, IFS (2011a) utilised separate research teams in each of the countries they covered in order to estimate their QUAIDS models.

assumption of no behavioural response that has been typically made in previous studies can be seen as a pragmatic response to these large data and resource requirements.

For the majority of the 27 countries considered in this study, only a single year of HBS data is available, while matching disaggregated price data are also only available for a subset of countries. Furthermore, even if sufficient time-series expenditure and price data had been available, estimating 27 demand systems would be well beyond the scope of a doctoral thesis.

Given these constraints, an approach is needed based on a single year of cross-sectional household expenditure data. Creedy and Sleeman (2006) propose such an approach based on the Linear Expenditure System (LES). The approach extends earlier work by Cornwell and Creedy (1996, 1997) and Creedy (1998b), and was most recently adopted by Ball et al. (2016) for New Zealand. This approach is adopted for 23 of the 27 countries covered by this study, with the remaining four countries excluded due to various data limitations.

As a first step, the LES-based approach uses cross-sectional household expenditure data to estimate expenditure elasticities for a range of expenditure groupings and household types. With these expenditure elasticities, a simplifying result for additive utility functions found by Frisch (1959) is then applied to compute price and cross-price elasticities. These estimated elasticities can then be used to estimate revenue changes as well as the underlying parameters of the LES – enabling welfare effects to also be estimated.

The LES-based approach is more restrictive in its assumptions on behaviour than the QUAIDS approach adopted, for example, by Van Oordt (2018), Cseres-Gergely et al. (2017) and IFS (2011a). The assumption of additive preferences excludes the possibility of both inferior goods and complements – although these limitations can be minimised by adopting broad expenditure groups in the modelling. Nevertheless, price elasticity estimates are driven far more by the structure of the model itself, than by the data as compared to demand system estimation that uses price variation for identification. Creedy (1998b), however, emphasises that this is a reasonable trade-off to make for the ability to produce a large number of elasticity estimates drawing only on cross-sectional household expenditure data.

Given the restrictions necessarily imposed with the LES-based approach, the thesis also examines an alternative approach – the modelling of a full QUAIDS model. Given the significant data and resource requirements, this is limited to one country. New Zealand is chosen for several reasons: first, it is naturally a country of particular interest in a thesis undertaken at a New Zealand university; second, no

QUAIDS model has previously been estimated using New Zealand data; third, data has recently become available making such estimation feasible; and fourth, the New Zealand GST's broad-base single-rate structure provides a contrasting opportunity to examine the effects of the introduction, rather than removal, of reduced rates. A LES-based model is also estimated for New Zealand enabling results based on the QUAIDS and LES models to be compared.

Taken as a whole, the above analysis aims to provide an assessment of both the extent of distributional concerns with the VAT across OECD countries, and whether or not reduced VAT rates should be used to address those concerns. It therefore aims to provide policy makers with a sound empirical basis on which to assess the merits of wholesale reform of the VAT structure in OECD countries. However, it also aims to enable more nuanced analysis. For example, as the analysis identifies the distributional effects of reduced rates applied to different types of expenditure, it may also be of use to governments constrained by political economy factors to considering more moderate adjustments to their VAT rate structures. Additionally, this decomposition of results should enable the broader merits of reduced rates introduced for non-distributional reasons to be more transparently assessed against the specific distributional effects of these concessions.

1.4. Thesis outline

This thesis comprises eight chapters, including this introduction. Chapter 2 provides, as background to the subsequent analysis, a summary of VAT rate structures – both in theory and as implemented in OECD countries.

Chapter 3 introduces the underlying 27-country HBS dataset used in the thesis, details the non-behavioural microsimulation methodology, and uses the non-behavioural models to examine the distributional effects of the VAT in 27 OECD countries.

The next three chapters focus on the LES-based behavioural microsimulation models. Chapter 4 presents the LES-based behavioural microsimulation methodology for 23 OECD countries. Chapter 5 uses these behavioural models to investigate the distributional effects of reduced VAT rates, both as a whole, and for reduced rates applied to different types of expenditure. Chapter 6 then uses the behavioural models to examine the distributional effects of replacing reduced VAT rates with targeted cash transfers.

Chapter 7 details the construction and estimation of the Quadratic Almost Ideal Demand System for New Zealand. The chapter also presents simulation results for the introduction of reduced GST rates in New Zealand, and for the replacement of targeted cash transfers with reduced GST rates.

Chapter 8 brings together the various findings of the research, highlights their tax policy implications, and points to future research.

CHAPTER 2. VAT RATE STRUCTURES IN THEORY AND PRACTICE

2.1. Introduction

As noted in Chapter 1, most OECD countries have adopted multi-rate VAT structures. The predominant motivation for these multi-rate structures has been to achieve distributional goals – particularly in light of the perceived regressivity of the VAT. This has led to reduced rates being applied to consumption items that typically make up a greater proportion of the expenditure of poorer as compared to richer households. Meanwhile, the pursuit of cultural and social objectives, amongst others, have led to the application of reduced VAT rates on an even broader range of consumption in many OECD countries.

This chapter provides background information for the subsequent analysis of the distributional effects of the VAT. It first summarises the VAT rate structures currently in place in OECD countries, highlighting the widespread use of reduced VAT rates. It then reviews the optimal indirect taxation literature on the choice between uniform and multi-rate structures. Drawing on this literature, it then assesses the various arguments used in practice for and against the adoption of reduced VAT rates in OECD countries.

2.2. VAT rate structures in OECD countries

As of 2020, 170 countries have adopted a VAT (OECD, 2020). This includes 36 of the 37 OECD member countries – the exception being the United States, which operates a range of state-level retail sales taxes instead. Although the general principles underlying each VAT system are the same, there are still significant differences in the systems implemented in different countries, and, in particular, in the rate structures adopted.[5]

Table 2.1 shows the variation in rate structures across OECD countries. Most "older" VAT systems tend to have multi-rate structures, with one or more reduced rates (including zero rates) applying to a significant number of goods and services. This is particularly the case in Europe where countries' VAT

[5] VAT systems also differ in terms of the extent of exemptions, the registration thresholds for businesses, the use of special taxation methods for specific supplies, and restrictions on the right to deduct VAT on specific inputs. OECD (2020) discusses these in more detail.

Table 2.1. VAT rates in OECD countries as at 1 January 2020

	Standard rate	Reduced rates**
AUS	10.0	0.0
AUT*	20.0	10.0/13.0
BEL	21.0	0.0/6.0/12.0
CAN*	5.0	0.0
COL*	19.0	0.0/5.0
CHE	7.7	0.0/2.5/3.7
CHL	19.0	-
CZE	21.0	10.0/15.0
DEU	19.0	7.0
DNK	25.0	0.0
ESP*	21.0	4.0/10.0
EST	20.0	0.0/9.0
FIN	24.0	0.0/10.0/14.0
FRA*	20.0	2.1/5.5/10.0
GBR	20.0	0.0/5.0
GRC	24.0	6.0/13.0
HUN	27.0	5.0/18.0
IRL	23.0	0.0/4.8/9.0/13.5
ISL	24.0	0.0/11.0
ISR*	17.0	0.0
ITA	22.0	4.0/5.0/10.0
JPN	10.0	8.0
KOR	10.0	0.0
LTU	21.0	5.9/9.0
LUX	17.0	3.0/8.0/14.0
LVA	21.0	5.0/12.0
MEX	16.0	0.0
NLD	21.0	9.0
NZL	15.0	0.0
NOR	25.0	0.0/12.0/15.0
POL	23.0	5.0/8.0
PRT*	23.0	6.0/13.0
SLV	22.0	5.0/9.5
SVK	20.0	10.0
SWE	25.0	0.0/6.0/12.0
TUR	18.0	1.0/8.0

Source: OECD (2020)

Table notes

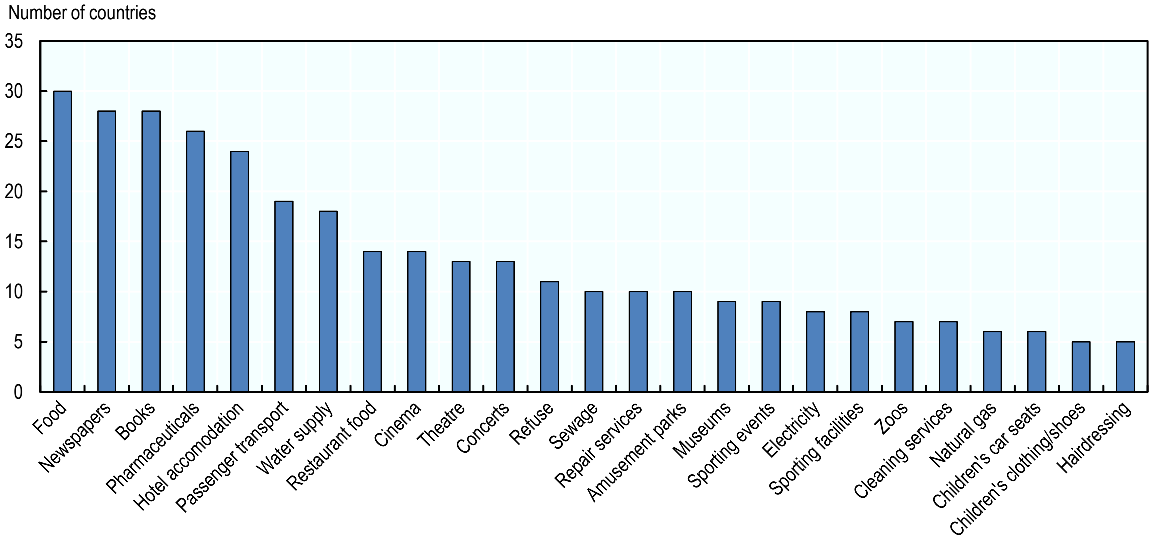
*Austria: a standard rate of 19% applies in Jungholz and Mittelberg. Canada: provincial sales taxes also apply. Colombia: Colombia became a member of the OECD on 28 April 2020. France: rates of 0.9%, 2.1%, 10.0%, 13.0% and 20.0% apply in Corsica; rates of 1.05%, 1.75%, 2.1% and 8.5% apply to overseas departments excluding French Guyana and Mayotte. Israel: a rate of 0% applies when an Eilat resident dealer buys goods from Eilat non-residents. Portugal: rates of 5%, 10% and 18% apply in the Azores; rates of 5%, 10% and 22% apply in Madeira. Spain: rates of 0%, 2.75%, 3%, 7%, 9.5%, 13.5% and 20% apply in the Canary Islands; rates of 0.5% and 10% apply in Ceuta and Melila.

**Includes zero rates on domestic supplies. Excludes zero rates on exports and other supplies subject to similar treatment such as international transport or supplies to embassies, international organisations and diplomatic missions.

rate structures are guided by the EU VAT Directive, which generally allows for up to two reduced VAT rates in addition to the standard rate.[6] Meanwhile, the VAT systems in a small number of countries – such as Chile and New Zealand – apply a single rate to most, if not all, goods and services.

The types of goods and services subject to these reduced rates also varies. Nevertheless, there are some common trends. For example, as illustrated in Figure 2.1, the vast majority (30 of 36 countries) apply a reduced rate to either basic food products or, more often, to a very broad range of food and non-alcoholic beverages purchased for home consumption ("food" hereafter).[7] The general rationale for providing a reduced rate on food is distributional – i.e. to provide support to poorer households. Following a similar rationale, many countries also provide a reduced rate for pharmaceutical products and water supply. Meanwhile, a smaller number of countries apply reduced rates to refuse and sewage services, energy products, and to children's clothing or shoes. Due to its significant budget share, the reduced rate on food is by far the most significant reduced VAT rate applied in OECD countries.[8]

Figure 2.1. Common reduced VAT rates in OECD countries as at 1 January 2020



Source: Author's calculations based on OECD (2020) and European Commission (2020).

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[6] The 2006 EU VAT Directive requires the standard rate to be at least 15%. Reduced rates must be at least 5% and can only be applied to the set of goods and services specified in Annex III of the Directive, though a number of derogations are provided that allow some countries to maintain reduced rates at a rate lower than 5% on some goods and services.

[7] Unless otherwise specified, expenditure on food and non-alcoholic beverages is separated into two categories in this thesis: food and non-alcoholic beverages purchased for home consumption, including takeaway food ("food"); and food and non-alcoholic beverages consumed in restaurants, canteens and cafeterias ("restaurant food").

[8] Food makes up 18.5% of total household expenditure, on average, in 23 OECD countries for which microdata (that includes actual and imputed housing expenditure) has been obtained for this study. In contrast, the next most common expenditure categories – newspapers and books – together make up only around 1% of total household expenditure, on average, in the same 23 countries. See Chapter 3 for more detail on this data.

Most countries also use reduced VAT rates to encourage the consumption of certain goods and services with perceived social or cultural benefits. The most common examples are newspapers and books, which are subject to reduced VAT rates in 28 of the 36 OECD countries that have a VAT. As Figure 2.1 shows, countries often also provide reduced rates for cinema, theatre and concerts, and to a lesser extent for amusement parks, museums, sporting events, sporting facilities and zoos.

Some countries also introduce reduced rates on services that are close substitutes with home supply in order to encourage (market) employment, such as repair, domestic cleaning and hairdressing services. Many countries also provide reduced rates with a less clear policy rationale. The most common of these are for hotel (and/or other) accommodation, restaurant food, and passenger transport. Reduced rates for hotels and restaurant food may, for example, be introduced to encourage the employment of low-skilled workers, or for a perceived social benefit. Reduced rates for (domestic) passenger transport may be motivated by environmental concerns, but they may also be justified on employment or distributional grounds (on the basis that they lower the cost of commuting to work).[9] The existence of these reduced rates may also partially result from interest group pressure rather than from a clear policy rationale.

Though not the focus of this thesis, it is also common for countries to exempt certain expenditures from VAT (i.e. zero rating with no ability to deduct input tax). Again, it is European countries that tend to have the greatest number of exemptions, whereas Chile, Japan and New Zealand tend to have the fewest.[10] Most countries exempt certain sectors considered essential for social reasons – particularly education, healthcare and charities. In some cases, practical reasons have led countries to use exemptions – for example, in every OECD country, most or all financial services are exempted due to the difficulty in determining the appropriate margin on which to apply VAT. Other sectors, such as postal services and gambling have often been exempted for a variety of historical reasons.[11]

The application of VAT registration thresholds also reduce the size of the VAT base. These are generally aimed at removing small businesses from the tax net where the associated compliance and

[9] International air travel is universally zero-rated due to the practical difficulty in assigning taxation rights to a service that may occur across multiple countries. Some countries also apply zero rates to other forms of international passenger travel.

[10] Unlike a zero rate, some VAT will still generally be payable on exempted goods and services. This is because the inability to deduct input tax will increase the cost, and hence the price, of the final good or service (unless the cost is fully borne by a party within the supply chain).

[11] Exemptions are also often applied to cultural services, legal aid, precious metals, public transport and water supply. There is only limited consistency in the types of goods and services that countries apply exemptions to as opposed to applying reduced rates. For example cultural services, public transport and water supply are exempt in some countries but subject to a reduced rate in others. This can even be the case for the most commonly applied exemptions – for example, Australia zero-rates rather than exempts education and healthcare. In contrast, Korea provides no reduced rates and instead uses exemptions to address the distributional, cultural and social goals that many countries attempt to address through reduced VAT rates.

administrative costs would be disproportionate relative to the amount of VAT revenue generated. The level of these thresholds varies significantly across OECD countries.[12]

2.3. Optimal indirect tax theory

Before assessing the various arguments used for and against the adoption of these reduced VAT rates, this section first reviews the optimal indirect taxation literature on the choice between uniform and differentiated rate structures. The appropriate rate structure for indirect taxation has been the subject of much theoretical work. While early papers by Ramsey (1927) and Corlett and Hague (1953) focused purely on efficiency, the modern optimal indirect taxation literature – beginning with Diamond and Mirrlees (1971) – has attempted to balance equity and efficiency objectives within a single framework.

In a world with a single representative consumer, Ramsey (1927) examines how to raise a given amount of tax revenue from indirect taxation at the lowest distortionary cost. His model excludes the use of any other tax.[13] If cross-price effects are zero, then the famous "inverse elasticity" rule results – where more inelastic goods should be taxed more heavily, and vice versa. If there are cross-price effects then the less prescriptive result is found that taxes should be levied to produce equal proportional reductions in the consumption of each good.[14]

Corlett and Hague (1953) also consider a single representative consumer model, but with three goods: leisure and two taxed goods. They examine whether a shift away from uniform taxation would be efficiency improving. They find that efficiency can be improved by taxing more heavily the good that is more complementary with leisure. The rationale here is that, by taxing complements with leisure more heavily than other goods, this will discourage leisure and so reduce the underlying distortion to the labour supply decision. In contrast, if all goods are equally complementary with leisure then uniformity will be optimal.[15]

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[12] Full details on VAT design features in each OECD country, including reduced rates, exemptions and registration thresholds, are provided in the OECD's biennial *Consumption Tax Trends* publication (see OECD, 2020, for the latest edition).

[13] Atkinson and Stiglitz (1980) extend the Ramsey model to show that if a lump sum tax is possible and the government only cares about efficiency then there should be no indirect tax at all. This is because the lump sum tax would be a more efficient means of raising the required revenue than the distortionary indirect tax.

[14] As Heady (1993) notes, this technically only applies for small revenue requirements, and that additional assumptions of no income effects and linear demand curves are necessary for it to hold for large revenue requirements.

[15] Atkinson and Stiglitz (1972) highlight that Corlett and Hague's result is driven by the untaxed nature of leisure, not leisure itself. They note the general principle in such a three good model that if there is one untaxed good then we should tax the greater complement with it more heavily as this is a way of indirectly taxing the untaxed good. The uniformity result in the absence of complements with leisure is also found by Sandmo (1974).

Diamond and Mirrlees (1971) and Diamond (1975) extend the Ramsey model to a many person setting in order to take account of distributional considerations.[16] They maximise social welfare functions that apply different weightings to the utility of different individuals. Both studies find that the Ramsey proportional reduction rule must be altered to depend on who consumes the goods. If the weights of the social welfare function are based on income, then the optimal set of tax rates should result in a smaller proportional reduction in demand for goods consumed in greater proportions by the poor.[17]

While the above models exclude the possibility of an income tax, the seminal paper by Atkinson and Stiglitz (1976) brings together the optimal income tax and indirect tax literature to examine the simultaneous optimisation of both income and consumption taxes. Following Mirrlees (1971), the government's problem is shaped as one of optimisation subject to information constraints. Individuals are assumed to have identical preferences, but to differ in ability level. As ability is not directly observable, income – and potentially consumption – must be taxed instead. Within this framework, they show that if an optimal non-linear income tax is available and preferences between consumption and leisure are "weakly separable" (or, in other words, all goods are equally complementary with leisure), then a uniform indirect tax will be optimal.[18] Equivalently, as in their model a uniform indirect tax can be subsumed within an income tax, no indirect taxation is necessary at all.[19]

Subsequent papers, such as Christiansen (1984) and Edwards et al. (1994), confirm the uniformity result where preferences are weakly separable. Where weak separability does not hold, they show that higher indirect taxes should be imposed on goods that are more complementary with leisure – consistent with the Corlett and Hague (1953) result.[20] Unlike Diamond and Mirrlees (1971) and Diamond (1975), the usefulness of indirect taxes is purely to improve efficiency as opposed to assist redistribution – which can now be more effectively addressed through the income tax.

[16] Diamond's (1975) model also includes the presence of a lump sum tax.

[17] Diamond and Mirrlees (1971) also develop the famous production efficiency result that, externalities aside, indirect taxes should not be levied on intermediate goods but only on final consumption. The intuition behind this result, as succinctly summarised by Crawford et al. (2010), is that "any distortion of production decisions reduces aggregate output, which cannot be wise so long as there is some useful purpose to which that output could be put." (p283).

[18] Subsequent work by Kaplow (2006) and Laroque (2005) shows that this result still holds even if the income tax is not optimal.

[19] In the Atkinson and Stiglitz (1976) model, there is no savings and the only source of income is labour (so the income tax is effectively a wage tax). All references in this section to an income tax should be interpreted as a wage tax.

[20] Atkinson and Stiglitz (1976) actually make the opposite conclusion to Corlett and Hague (1953) when consumption and labour are not weakly separable: that you should tax more heavily goods that are complements with labour – i.e. substitutes with leisure. Kaplow (2010) examines the discrepancy in detail and points to a revised interpretation of the Atkinson and Stiglitz model's setup where results become consistent with Corlett and Hague (1953).

The intuition behind this is drawn out by Edwards et al. (1994) using a model where individuals have just two ability levels.[21] They show that taxing complements with leisure makes it less attractive for higher ability individuals to "mimic" lower ability individuals (by working less), and this relaxes the incentive compatibility constraint that otherwise restricts the degree of redistribution that can be achieved through the income tax. This efficiency rationale for differential taxation is in striking contrast to the redistribution-based arguments typically used in practice to justify differential VAT rates. Meanwhile, if all goods are equally complementary with leisure, a mimicking high ability individual will consume the exact same bundle of goods as a lower ability individual with the same income, so consumption will not provide any additional information on ability and hence indirect taxes cannot be used to relax the incentive compatibility constraint.

The latter case emphasises the importance of the assumption of homogeneous tastes. In contrast, if individuals have heterogeneous tastes then a higher and lower ability individual earning the same income would no longer consume the exact same bundle of goods, and so consumption patterns may once again provide information about ability. Mirrlees (1976), Saez (2002) and Gauthier and Henriet (2018) consider models with heterogeneous tastes. They show that if tastes depend on ability, then a higher indirect tax should, in general, be imposed on a good if higher ability individuals have a relatively strong taste for that good.[22]

Another strand of literature has considered the impact of home production on optimal tax rates. Kleven et al. (2000) develop a single representative consumer model incorporating home production. This effectively produces a modified Corlett and Hague (1953) rule where the tax distortion favouring (untaxed) home production pushes down the optimal tax rate on consumer services that are substitutes for home production (e.g. house repairs, cleaning services). Where goods and services are equally complementary with leisure (so that uniform taxation would otherwise be optimal), they show that substitutes for home production should unequivocally face a relatively low tax rate. Piggott and Whalley (2001) develop a very similar model incorporating home production. They simulate their model based on Canadian data and find that Canada's 1990 VAT reform that brought consumer services into the indirect tax net was welfare reducing.[23]

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[21] A similar analysis is undertaken by Nava et al. (1996).

[22] Cremer et al. (2001) also show a role for differential taxation if individuals have different initial endowments of goods.

[23] Cremer and Gahvari (2015) also show in an Atkinson and Stiglitz (1976) framework that weak separability in preferences between consumption and leisure is no longer sufficient for uniformity when there is household production. However, if preferences are weakly-separable in market goods versus leisure and household production, then uniformity becomes optimal.

Kleven (2004) and Boadway and Gahvari (2006) consider models where both goods and time must be allocated. Kleven (2004) finds that market goods that take more time to be consumed should be taxed more heavily than those that take less time, or those that save time. Boadway and Gahvari (2006) find that goods that are less pleasurable to consume should be taxed more heavily than those that are more pleasurable and that, for less pleasurable goods, those that take longer to be consumed should be taxed more heavily. As Crawford et al. (2010) note, intuitively this is once again acting to reduce tax-induced disincentives to engage in market work, but additionally recognising that it is preferable to spend any given amount of time in a pleasurable activity as compared to an unpleasurable one. They give the example that DVDs (which are pleasurable but time consuming) should be taxed less heavily than ironing boards (as ironing is dull and time consuming).

A key question arising from the above literature is whether preferences between consumption and leisure are in fact weakly separable. Unfortunately, only a small number of empirical studies have examined this question. Browning and Meghir (1991) and Crawford et al. (2010) estimate demand systems for the United Kingdom and both reject weak separability – suggesting a role for differential taxation. Crawford et al. (2010), for example, find that most food products, fuels, tobacco, children's clothing and public transport are complements with leisure. Meanwhile, alcoholic drinks, food eaten out, motor fuels and leisure goods are complements with work.[24]

Pirttila and Suoniemi (2014), estimate a model using commodity demands and additional administrative data to explain hours worked for Finland. Their results also reject weak separability, although they find statistically significant relationships between consumption and hours worked for a smaller number of consumption categories than Crawford et al. (2010). Expenditure on housing and on books and magazines are found to be negatively related to hours worked, while office meals and car use are positively related to hours worked.[25] They also examine the use of public services and find that the use of childcare is positively related to hours of work.

While these results suggest an efficiency case for differential taxation, the practical implementation of such an optimal rate structure is challenging. Crawford et al. (2010), for example, emphasise that optimal tax rates will depend not just on the sign of demand responses but also on their magnitudes as

[24] Crawford et al. (2010) suggest the latter result may reflect the use of leisure goods as substitutes for time spent producing relaxation, as per the arguments in Kleven (2004) and Boadway and Gahvari (2006).

[25] Additionally, they find capital income to be significantly negatively related to hours of work. Gordon and Kopczuk (2014) make a similar finding based on United States data. Both papers argue therefore that capital income should be taxed. They also argue that current direct tax concessions (e.g. mortgage interest deductibility) for housing should be removed.

well as on cross-price effects. They conclude that "the limitations and uncertainties of both the theory and empirical work are such that, at least as yet, they provide little firm basis for policy prescription" (p350). They further note that, given the small size of their complementarity estimates, the social gain from implementing differential rates is likely to be small, and these would need to be weighed against the administrative burden (see section 2.4.4) of implementing a highly differentiated rate structure.

The Mirrlees Review (Mirrlees et al., 2011) to which Crawford et al. (2010) contribute, consequently recommends the adoption of a uniform VAT rate structure for the United Kingdom, with the possible exception of childcare to which a zero rate could be applied.[26] More generally, Sørensen (2007, 2010) argues that a lack of elasticity information, combined with administrative and political economy considerations, suggests that "uniform taxation should be the main guideline for indirect taxation" (Sørensen, 2010; p241). Nevertheless, he also adds that there is now a strong case for applying relatively low indirect tax rates to substitutes for home production activities.

2.4. The case for reduced VAT rates

With the above lessons from theory in mind, this section now briefly assesses the main arguments that have been used in practice both for and against the adoption of reduced VAT rates. As already noted, the primary rationale for the adoption of reduced VAT rates has been to achieve distributional goals. That said, merit good and efficiency-based arguments are also used to justify the introduction of reduced rates. Meanwhile, a number of practical arguments favour simplification and the use of a single-rate VAT structure.

2.4.1. Redistribution

The discussion above has shown that the theoretical case for using reduced VAT rates to achieve redistributive goals is very weak, particularly when other more direct instruments are available. In spite of this, redistribution has been the predominant motivation for reduced VAT rates. On this basis, reduced rates are frequently applied to consumption items that tend to make up a greater proportion of

[26] Bastani et al. (2015) argue that Mirrlees et al. (2011) are effectively considering a situation where all goods are separable from leisure with the exception of one good needed for work. They develop a model to show that in such a case there remains an equity argument to apply differential tax rates to the goods that are separable from leisure. The rationale is that, because a family needs to pay for child care in order to work, a high ability "mimicking" family (that works less hours than a non-mimicking family) actually has higher disposable income than a non-mimicking family earning the same gross income because they need to pay for less childcare. Their higher disposable income creates an equity-based rationale for taxing goods consumed proportionately more by higher income households. If childcare is publicly provided, this rationale disappears and uniform taxation is once again optimal.

the expenditure of poorer as compared to richer households. As shown in Section 2.2, these include food, water supply, pharmaceuticals, refuse, sewage, energy and children's clothing.

Redistributional arguments are generally premised on the view that the VAT is regressive, and hence measures are necessary to reduce the negative distributional consequences of the VAT. This is problematic for several reasons: first, it is by no means clear that the VAT is indeed regressive; second, even if it is regressive, it is unlikely that reduced VAT rates will be a well targeted instrument for addressing the problem; and third, as the theoretical literature emphasises, other more direct instruments – if available – are likely to be better targeted. In this regard, it is important to remember that it is the progressivity of the overall tax-benefit system (together with expenditure programs) that matters, not one particular component. As such, distributional concerns regarding the VAT do not need to be addressed through the VAT system itself.

The distributional impact of a VAT system, including who benefits from reduced VAT rates, will in practice depend on both the design of the VAT system and the consumption patterns of households (including their responses to price changes). As such, whether the VAT is regressive, whether reduced VAT rates are well targeted at poorer households, and whether alternative instruments can better target poorer households are all empirical questions that can be tested. Empirical evidence available for a limited number of countries (and summarised in subsequent chapters of this thesis) casts significant doubt on the regressivity of the VAT, and on the ability of reduced VAT rates to effectively target poor households. The subsequent chapters of this thesis significantly extend such empirical analysis.

In addition to redistribution (which addresses vertical equity concerns), there are also horizontal equity implications to the adoption of reduced VAT rates. As noted by IFS (2011b), multi-rate VAT systems will effectively reward some households for their preferences and penalise others. This will breach horizontal equity as, for example, two otherwise identical households with different consumption preferences for reduced vs standard-rated goods and services, will face different VAT burdens. In contrast, a single-rate VAT system would result in the same tax burden for both households, irrespective of their consumption preferences.[27]

[27] IFS (2011b) also discuss the specific egalitarianism argument of Tobin (1970). This argument supposes that society has preferences regarding inequality in the consumption of specific products – such as necessities – as opposed to over total consumption. However, as they note, this argument assumes that households would buy too little of the product if they were provided with the money to buy them (e.g. through a tax credit or benefit). As such, it is more in the nature of a merit good or internality argument, rather than an equity-based argument.

2.4.2. Merit goods/externalities

Another common argument for the introduction of reduced VAT rates is merit good, or externality, arguments. That is, if consumption of a good or service has benefits to society that the consumer does not take into account in their consumption decision, then there is *prima facie* a market-failure based case for government intervention to encourage consumption up to the socially optimal level. (Equally, there is a case to discourage consumption of goods and services with negative external effects).[28]

On this basis, as noted in Section 2.2, many countries have introduced reduced VAT rates on a range of goods and services with perceived cultural or social merit to encourage their consumption. These include: books, newspapers, cinema, theatre, concerts, museums, zoos, amusement parks, and sporting events and facilities. Reduced rates are also applied on environmental externality grounds in some countries to solar panels, insulation, and other environmentally beneficial goods and services. Reduced rates applied to passenger transport may in some cases also be based on environmental externality grounds. Total expenditure on such goods and services typically makes up a far smaller proportion of total household expenditure than on those introduced for distributional reasons, due, in particular, to the large budget share of food.

While the basic externality rationale is valid, a key question arises, as it did with redistribution, regarding whether a reduced VAT rate is the most effective way of achieving the desired policy goal. Various authors have suggested this is unlikely to be the case (see, for example, IFS, 2011b; Institut für Höhere Studien (IHS) et al., 2015; Abramovsky et al., 2017). IFS (2011b), for example, argue that "[i]f the social problem one wishes to address is affected by business use of a product, or is associated with the consumption of only particular kinds of consumers (e.g. the poor or children), or is unrelated to the price of the product, then applying reduced rates may not be an appropriate policy response" (p554).

The first of these points relates to the ability of businesses to claim input tax credits, meaning that a reduced VAT rate will not lower the price a business pays for a product. As such, where business consumption of a product (e.g. passenger transport, insulation or solar panels) produces positive externalities, then reduced rates – which only incentivise final consumers – will not be well targeted. Second, as reduced VAT rates apply equally to all consumers, they will not be well targeted if under-

[28] Similar arguments may be made regarding "internalities" where consumption may provide additional benefits to the consumer that they do not fully take into account due, for example, to a lack of knowledge. Negative internality arguments are often used in relation to proposals for health-related excise taxes (see, for example, Marron, 2015). Negative externalities are, of course, a common justification for health-related excise taxes on alcohol and tobacco.

consumption is specific to a subset of the population – for example, under-consumption of books by young people or poor people.

Perhaps most significantly, reduced VAT rates provide a larger subsidy for more expensive purchases. This implies that, for a reduced rate to be well targeted, the positive externality should be correlated with the price of the product subject to the reduced rate. However, in many cases this will not be true. For example, reading an inexpensive paperback book will not provide less social benefit than reading an expensive hard-back version of the book. Similarly, taking a taxi is unlikely to provide a greater environmental benefit than taking a bus for the same journey. IFS (2011b) suggest better targeted mechanisms are likely to be available in many cases. For example, income-based or age-based subsidies are likely to better target concerns about under-consumption of certain products by young or poor people. Subsidies can also be made available to businesses.

Applying a reduced VAT rate for social or cultural purposes may also have broader distributional effects. For example, certain cultural activities may be consumed disproportionately by better-off households, who would then benefit disproportionately from a reduced rate on these activities. (This possibility is investigated in Chapter 5).

2.4.3. Efficiency

As Mirrlees et al. (2011) note, there is an initial presumption on efficiency grounds in favour of uniformity of indirect taxes to avoid distorting consumption decisions. The optimal tax literature discussed above then points to a theoretical case for differentiated rates on efficiency grounds, but not one in practice due to the lack of reliable elasticity information. As such, efficiency arguments point broadly towards a single-rate VAT structure.

Nevertheless, following Kleven et al. (2000) and subsequent literature, there is a restricted case for applying reduced VAT rates to substitutes for home production activities. This provides support for the reduced rates in place in a number of countries for services such as domestic cleaning, repair services and hairdressing. That said, an assessment by the European Commission (2003) of reduced rates introduced in nine member countries on such labour-intensive services concluded that the reduced rates did not appear to have a positive impact on employment (or on the informal economy). More generally, they concluded that "[c]ompared with other measures, particularly those that directly target labour costs, the budgetary cost of any job creation effects through VAT reductions is always high."

Another argument used to justify applying reduced VAT rates to labour-intensive sectors – such as restaurants and hotels – is to reduce structural unemployment of low-skilled workers (Copenhagen Economics, 2007; IFS, 2011b, IHS et al., 2015). Applying a reduced VAT rate to such sectors that primarily hire low-skilled workers is intended to boost demand for low-skilled workers, and thereby reduce structural unemployment that may have arisen due to factors such as restrictive labour market regulations, high minimum wages, and high non-wage labour costs.[29]

Little empirical evidence is available on the effectiveness of such measures. However, a study by Copenhagen Economics (2007) suggests that reduced VAT rates are unlikely to be an effective mechanism to increase low-skilled employment. Using a general equilibrium model for the European economy as a whole, they find that reduced VAT rates can lower structural unemployment in sectors such as hotels and restaurants, without significantly reducing employment in other sectors. However, they find that this provides only a very limited boost to overall employment of low-skilled workers, as such sectors only employ a small fraction of all low-skilled workers. Furthermore, they find that applying the standard VAT rate to all sectors currently benefiting from reduced rates would be likely to create a similar boost in demand for low-skilled workers, but without distorting consumption decisions. They note that direct subsidies may be a better-targeted and more transparent approach, with lower compliance costs. IFS (2011b), meanwhile, argue that alternative mechanisms such as active labour market policies, employment regulation reform, and education investment would be likely to be better targeted ways of addressing structural unemployment of low-skilled workers.

Finally, applying a reduced VAT rate to increase employment is also likely to have broader distributional effects. In particular, restaurant food and hotel accommodation are likely to be consumed disproportionately by better-off households, who would then benefit disproportionately from a reduced rate on these activities. (This possibility is also investigated in Chapter 5).

2.4.4. Practical implementation issues

Finally, the application of a multi-rate VAT system increases the complexity of the system, thereby increasing administrative and compliance costs, creating opportunities for tax avoidance and evasion, as well as increasing susceptibility to lobbying.

[29] Copenhagen Economics (2007) and IHS et al. (2015) emphasise that this argument also requires disproportionate structural unemployment of low-skilled workers as compared to higher skilled workers. If not, any demand-induced reduction in structural unemployment of low-skilled workers would be countered by a demand-induced increase in structural unemployment of higher skilled workers. They also note that a reduced VAT rate would be unlikely to reduce structural unemployment if it was applied to tradeable goods and services, as part of the impact would be to increase imports.

A large number of studies point to the increased compliance and administration costs associated with multi-rate VAT structures (e.g., Ebrill et al., 2001; Copenhagen Economics, 2007; IFS, 2011b; IHS et al., 2015; Abramovsky et al., 2017). In particular, the use of multiple rates requires accounting, invoicing and tax reporting systems to separately record purchases and sales involving different VAT rates. In contrast, a single VAT rate enables simpler reporting systems with less possibility of error. Ebrill et al. (2001) argue further that simple records, invoices and tax forms will in turn support the effective operation of self-assessment systems as well as more effective taxpayer education and staff training. A single rate will also aid audit activity, as verification is not required of the breakdown of purchases and sales between different rates. A single rate will also reduce scope for disputes over classifications (and limit fraud by reducing possibilities for deliberate misclassification). A single rate will also reduce the number of refunds that tax administrations must process.

While there is significant empirical evidence on the overall compliance and administrative costs of the VAT, there is unfortunately only limited evidence specifically on the impact of rate structure. An early study by Sandford et al. (1981) found that the average compliance costs of firms in the United Kingdom with output subject to multiple rates were more than twice those of firms with output only subject to a single rate. Copenhagen Economics (2007), meanwhile, point to practical evidence from Sweden showing roughly 20 percent of all VAT disputes to be linked to arguments about whether a particular product should be subjected to a low or high VAT rate. Abramovsky et al. (2017) provide examples of court cases from the United Kingdom involving disputes over classifications. These include cases considering whether Pringles should be classified as potato crisps (standard-rated) or savoury snacks (zero-rated), and whether Jaffa Cakes are chocolate-covered biscuits (standard-rated) or chocolate cakes (zero-rated). Meanwhile, for a sample of OECD countries, Agha and Haughton (1996), find that VAT compliance decreases significantly the greater the number of VAT rates – suggesting these problems manifest in lower compliance.

Finally, the application of reduced VAT rates to some products, increases vulnerability to lobby group pressure to apply reduced rates to additional products. IFS (2011b) argue this is particularly likely for substitutes for goods already subject to reduced rates, or if the rationale for the existing concessions can be argued as also applicable to other goods. Mirrlees et al. (2011), for example, suggest that lobby group pressure has influenced decisions in the United Kingdom to extend VAT concessions. Drawing on the New Zealand experience, Benge et al. (2013) argue that it is "much easier to deny special treatment in all cases rather than allow certain special cases but not others", and that "once certain special cases are allowed, decisions on whether or not to allow others are much more likely to be driven by lobbying and political realities than unbiased econometric analysis" (p496).

2.5. Conclusion

This background chapter has highlighted the prevalence of reduced VAT rates across OECD countries. At the same time, it has also shown that the case for their use is weak. In particular, the optimal indirect tax literature finds no redistributive role for reduced rates when other more direct instruments are available. Similarly, reduced VAT rates are unlikely to be a well-targeted way to encourage consumption of merit goods. Meanwhile, efficiency arguments, with the restricted exception of some substitutes for home production, favour the adoption of a single-rate VAT structure, which would also bring significant administrative benefits.

Given its prevalence in most OECD countries, the redistributive rationale warrants particular attention. The subsequent chapters of this thesis therefore seek to provide empirical evidence for a wide range of OECD countries to either confirm or counter the theoretical case against the use of reduced rates to achieve redistributive goals. At the same time, having an understanding of the distributional effects of reduced rates introduced for non-distributional reasons is also important so that policy makers can weigh the impact on distributional goals against the other policy goals they may seek to address. Consequently, the distributional analysis in this thesis considers reduced rates across the board, irrespective of the particular policy rationale for their introduction.

CHAPTER 3. REASSESSING THE REGRESSIVITY OF THE VAT

3.1. Introduction

This chapter reassesses the often-made conclusion that the VAT is a regressive tax. The chapter first assesses the competing methodological approaches used in previous studies of the distributional effects of the VAT. It then draws on a household expenditure microdata set of unprecedented size to examine the distributional effects of the VAT in 27 OECD countries. A consistent microsimulation methodology is adopted to ensure cross-country comparability of results.

Most previous studies examining the distributional effects of the VAT have used cross-sectional household expenditure microdata to calculate and present average VAT rates measured in relation to either income or expenditure. This choice between income- or expenditure-based analysis has proved determinative. The common finding that the VAT is regressive has followed from the analysis of VAT burdens measured as a percentage of current income across the income distribution. Numerous European country studies (e.g., Leahy et al., 2011; Ruiz and Trannoy, 2008; O'Donoghue et al., 2004) adopt this analytical approach, and as a result conclude the VAT is a highly regressive tax. In contrast, studies that present VAT burdens as a proportion of current expenditure across either the income or expenditure distribution (e.g. Bird and Smart, 2016; IFS, 2011a; Metcalf, 1994) tend to find that VAT systems are relatively proportional, or even slightly progressive.

As has been highlighted by various authors (e.g. IFS, 2011a; Creedy, 1998a; Metcalf, 1994), a key problem with the income-based approach is that it fails to account for savings behaviour. More specifically, it ignores the fact that income that is saved in the current year will still incur VAT when it is eventually consumed (as this VAT cannot be captured by an analysis based on data from a single year). Similarly, current expenditure, and the VAT incurred on it, may have been funded from income earned in a previous year. Because savings rates tend to increase with income, this biases income-based VAT burden results downwards at higher income levels – hence the common conclusion that the VAT is regressive.

To fully take account of the impact of savings behaviour, a lifetime (or at least multi-period) analysis would ideally be undertaken, including the calculation of both lifetime income and lifetime VAT burdens. Unfortunately, any attempt at estimating lifetime income and lifetime VAT burdens is highly complex, even in a single-country context, and simply impracticable in a 27-country study such as this. However, in the absence of such information, this chapter shows that measuring VAT burdens relative to current expenditure will provide a far more reliable estimate of the lifetime distributional impact of the VAT than measuring VAT burdens relative to current income.

Effectively, measuring VAT burdens relative to current expenditure removes the influence of savings behaviour. It instead identifies how the presence of reduced VAT rates and exemptions move the actual VAT burden away from what would be due under a perfectly broad-based single-rate system (where all households would pay the same proportion of their expenditure in VAT). If consumption preferences and tax rates do not change over time, then such expenditure-based analysis will perfectly proxy a lifetime analysis. However, even where these assumptions fail to hold, as it is unaffected by savings behaviour, an expenditure-based analysis will still be preferable to an income-based analysis.

The microsimulation results for the 27 countries examined broadly confirm the dichotomous results from the previous smaller-scale studies: the VAT appears to be regressive when measured as a percentage of current income in all 27 countries, but appears generally either proportional or slightly progressive when measured as a percentage of current expenditure. Savings patterns are also shown to be consistent across all 27 countries, with savings rates increasing as income increases and thereby driving the regressivity of the income-based results.

The expenditure-based average tax rate results are confirmed by calculations of expenditure-based summary indicators of progressivity and redistribution. Kakwani progressivity index results show a low degree of progressivity of the VAT in almost all countries, often extremely close to proportionality. The exceptions are Chile, Hungary, Latvia and New Zealand, where a very small degree of regressivity is found. Reynolds-Smolensky and Atkinson index results show the VAT to have minimal redistributive effect, despite significant average tax rates being applied.

To examine the effect of the VAT on the poor, the paper also calculates a range of Foster-Greer-Thorbecke (1984) poverty indices. Based on a relative poverty line of 50% of median equivalised individual gross expenditure, results show that the imposition of VAT increases the number of individuals below the poverty line (the poverty headcount) by three percentage points, on average, from 8.1 to 11.1%. Poverty gap and squared poverty gap index calculations show similar increases.

Overall, the chapter concludes that the VAT is generally either roughly proportional or slightly progressive, with this progressivity driven by the presence of reduced VAT rates and exemptions. This strongly contrasts with the general public perception, and the conclusion of much of the previous academic literature, that the VAT is regressive. Nevertheless, the results for Chile, Hungary, Latvia and New Zealand highlight that broad-based VAT systems that have few reduced VAT rates or exemptions can produce a small degree of regressivity.

Furthermore, the results clearly show that even a roughly proportional VAT can still have a significant impact on the wellbeing of the poor. This emphasises the importance of ensuring the progressivity of the tax/benefit system as a whole in order to compensate poor households for the loss in purchasing power from paying VAT. The merits of using reduced VAT rates to achieve such distributional goals is investigated further in subsequent chapters of this thesis.

This chapter proceeds as follows: Section 3.2 provides a brief literature review of empirical studies examining the distributional effects of the VAT. Section 3.3 then presents a simple two-period model to illustrate the misleading impact that savings behaviour has on distributional analysis based on cross-sectional data when VAT burdens are measured relative to income. Section 3.4 introduces the non-behavioural microsimulation methodology, and Section 3.5 presents the modelling results for 27 OECD countries. Section 3.6 provides some concluding comments.

3.2. Literature review

A number of empirical studies have examined the distributional impact of the VAT. These have typically been undertaken using household expenditure survey microdata. The use of microdata enables the fine distinctions present in many countries between expenditure categories subject to different VAT rates to be accurately modelled. It also provides flexibility regarding how to measure distributional effects. In most cases, average VAT burdens measured as a percentage of disposable income or gross (VAT-inclusive) expenditure are presented across equivalised disposable income or gross expenditure deciles, though summary measures of redistribution, progressivity and poverty effects are also often applied.[30] This section provides a summary of recent microdata-based studies of the distributional effects of the VAT.[31] It first discusses papers that favour analysing VAT burdens relative to current income, and then papers favouring an expenditure-based approach.

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[30] Disposable, rather than gross, income is typically used to remove the influence of the personal income tax.
[31] Warren (2008) summarises a number of earlier studies and provides a broad review of the different approaches to modelling the distributional effects of consumption taxes.

The most substantial cross-country study following the income-based approach is O'Donoghue et al. (2004). They incorporate household expenditure information into the EUROMOD tax-benefit microsimulation models for 12 European countries in order to compare the redistributive effects of consumption taxes with income taxes and social security contributions. The countries covered were Belgium, Finland, France, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom, drawing on household expenditure survey microdata from 1990-1996, depending on the country. They present tax burdens as a percentage of both disposable income and expenditure across equivalised disposable income deciles (as well as income-based Kakwani progressivity index results). However, they favour measuring consumption tax burdens as a percentage of income, and consequently conclude that both VAT and excise taxes are strongly regressive. In contrast, they find that benefits, pensions, and direct taxes produce significant progressivity.

Leahy et al., (2011) make the same regressive conclusion regarding the VAT in Ireland based on 2005 household expenditure survey microdata. They also find that removing the reduced VAT rates (i.e. aligning these rates with the standard VAT rate) on food and children's clothing would be regressive. Ruiz and Trannoy (2008) use 2001 household expenditure microdata for France, concluding also that consumption taxes are highly regressive (measured as a percentage of disposable income across equivalised disposable income deciles). They also simulate several reforms, including a revenue-neutral move to a single-rate VAT system. The simulation results highlight that in each income decile there are both winners and losers from such a reform. They conclude that the income tax, rather than consumption taxes, should be used for addressing redistributive objectives. Barreix, Bes and Roca (2009) present the results of several studies undertaken in Latin American countries between 2000-2004 which find similar regressive results following an income-based approach.[32]

Decoster et al. (2010) present results both as a proportion of disposable income and expenditure, noting the case for each approach but not stating a definitive preference for either. Using 1999-2005 household expenditure survey microdata for Belgium, Greece, Hungary, Ireland and the United Kingdom, they find consumption taxes to be regressive in all five countries when measured as a proportion of disposable income across income deciles, and proportional or progressive as a proportion of expenditure. Figari and Paulus (2012) draw on the same models as Decoster et al. (2010) to examine

[32] Bachas et al. (2020) estimate informality Engel curves (relating the informal budget share to log total expenditure) for 26 predominantly developing countries. They find that informality decreases as household expenditure increases, and conclude that this will create a degree of progressivity in the VAT in developing countries. Similarly, Jenkins et al. (2006) find that informality creates progressivity in the VAT in the Dominican Republic.

the redistributive impact of indirect taxes, imputed rent, cash transfers and direct taxes in the same five countries. They favour measuring indirect tax burdens relative to income in order to compare results with direct taxes, and conclude that indirect taxes are regressive in all five countries.

ONS (2019) presents results for the United Kingdom as a proportion of both disposable income and expenditure, but, as with Decoster et al. (2010), they do not express a clear preference for either approach. Using 2018 household expenditure survey microdata, they conclude that the VAT, and indirect taxes as a whole, are regressive when measured as a percentage of disposable income and "broadly neutral" when measured as a percentage of expenditure across the income distribution.

The most substantial cross-country study definitively favouring the expenditure-based approach is IFS (2011a). They drew together nine different country-specific studies with broadly similar microsimulation methodologies. The countries covered were Belgium, France, Germany, Greece, Hungary, Italy, Poland, Spain and the United Kingdom. The household expenditure survey microdata used ranged from 2004 to 2009, depending on the country. IFS (2011a) present tax burdens as a percentage of both disposable income and expenditure (but across both equivalised disposable income and expenditure deciles). They argue that, due to the ability to borrow and save, measuring VAT as a percentage of income can create a misleading impression of the distributional effect of the VAT. As such, they conclude that expenditure-based results provide a better picture of the distributional effect of the VAT. Unsurprisingly, they find the VAT to be regressive in all nine countries when measured as a percentage of disposable income across income deciles. However, they found the VAT to be either roughly proportional or progressive in eight of the nine countries (Spain being the exception) when measured as a percentage of expenditure across equivalised income deciles (and in all nine countries across expenditure deciles). This progressivity was found to be driven by the presence of reduced VAT rates.

Bird and Smart (2016) use 2009 household expenditure microdata to examine consumption taxes in Canada. As with IFS (2011a), they argue that there is a better case for using consumption rather than income as the base for evaluating the progressivity of consumption taxes. On this basis, they conclude that the GST in Canada is mildly progressive. They find excise taxes to be regressive, although the progressivity of the GST means that the overall impact of consumption taxes is roughly proportional. Meanwhile, Bover et al. (2017) present results based on 2015 household expenditure data for Spain as a percentage of both disposable income and expenditure, finding regressive and broadly proportional patterns, respectively. They prefer the expenditure-based approach on the grounds that expenditure rather than income is the legal base of the tax.

While the United States does not have a VAT, earlier work by Metcalf (1994) uses household expenditure microdata for 1990 to simulate its introduction. He presents simulated VAT burdens measured as a percentage of both gross income and expenditure, concluding that a VAT in the United States would be roughly proportional on a lifetime basis with expenditure used as a proxy for lifetime income. As with other studies, he finds the VAT would be regressive as a percentage of current income.[33] Caspersen and Metcalf (1994) go further and attempt to estimate lifetime income using panel income data for the United States that they then match with 1988 household expenditure microdata to simulate household VAT burdens as a percentage of lifetime income. They conclude a VAT in the United States would be slightly regressive based on their measure of lifetime income, and proportional using current expenditure as a proxy for lifetime income.

While not based on microdata, a final study of interest given its wide country coverage is IHS et al. (2015) which uses semi-aggregate expenditure data from 2005 to examine the distributional effects of the VAT in the 27 European Union (EU) member countries. They follow IFS (2011a) in favouring the expenditure-based approach, and present average VAT burdens as a percentage of expenditure across disposable income quintiles. They find VAT systems to be broadly proportional or slightly progressive in all 27 EU member countries, with the exception of Hungary where the VAT was found to be slightly regressive. Their results must be considered with some caution because the use of aggregated data imposes a number of limitations on the analysis – in particular, it limits the ability to match expenditure categories to the correct VAT rates, and precludes household equivalisation adjustments. That said, they compare their aggregated data results with microdata-based results for three countries (Austria, Italy and the United Kingdom) and find them to be broadly similar.

3.3. The impact of savings on cross-sectional analysis of VAT burdens

As has been highlighted by various authors (e.g. IFS, 2011a; Creedy, 1998a; Metcalf, 1994; Caspersen and Metcalf, 1994), the driver of the stark difference in results between the income-based and expenditure-based approaches to measuring the distributional impact of a VAT (or other broad-based consumption tax) is the influence of savings behaviour. Specifically, a single-year income-based analysis ignores the fact that income that is saved in the current year will still incur VAT when it is eventually consumed. Similarly, current expenditure, and the VAT incurred on it, may have been funded from income earned in a previous year. Because savings rates tend to increase with income, this biases

[33] Brashares et al. (1988) also present regressive income-based results for the United States, though they note there is a case for considering a lifetime analysis. The focus of their study is on examining design options to lower the VAT burden on low-income households (see Chapter 6 for further discussion).

income-based VAT burden results downwards at higher income levels – hence the common conclusion that the VAT is regressive.

To fully account for the impact of saving behaviour, a lifetime (or at least multi-period) analysis – including calculation of both lifetime income and lifetime VAT burdens – would ideally be undertaken. Unfortunately, any attempt at estimating lifetime income and lifetime VAT burdens is highly complex, even in a single-country context, and simply impracticable in a 27-country study such as this. However, in the absence of such information, measuring VAT burdens relative to current expenditure will provide a far more reliable estimate of the lifetime distributional impact of the VAT than current income would. This is illustrated below in a simple two-period model.

Consider a taxpayer that earns income of y_1 in period 1 and y_2 in period 2. Savings, equal to s, occurs in period 1 and is fully spent in period 2. For simplicity, bequests are ignored (although they could be incorporated without altering the results).[34] Also for simplicity, a two-rate VAT system is assumed, with x% of the taxpayer's consumption subject to taxation at rate t, and $(1-x)$% subject to a zero tax rate. If income from savings is not taxed[35] and the return on savings equals the discount rate, savings will cancel out over the two periods, so that the net present value of lifetime income, Y_{npv}, and lifetime consumption, C_{npv}, are the same and are equal to:

$$Y_{npv} = C_{npv} = (y_1 - s) + \frac{(y_2 + s(1+r))}{1+r}$$

$$= y_1 + \frac{y_2}{1+r}$$

The net present value of tax payments, T_{npv}, is:

$$T_{npv} = tx(y_1 - s) + \frac{tx(y_2 + s(1+r))}{1+r}$$

$$= tx(y_1 + \frac{y_2}{1+r})$$

[34] In order to avoid the double counting of income, bequests received would be included in period 1 income, and bequests given would be subtracted from period 2 income. The analysis then remains unchanged as long as t and x remain constant for both donor and recipient. Note that, while it could be argued that donors derive some consumption value out of providing a bequest, this would lead to the double counting of at least some income.

[35] If income from savings is taxed (as is common), then the income saved may incur higher total (income plus consumption) taxation than income immediately spent. However, as Creedy (1998a) emphasises, it would be erroneous to attribute this increased tax burden to the VAT. Indeed, the NPV of the VAT paid (as opposed to income tax) will be unaffected by the taxation of income from savings as long as the taxpayer's discount rate equals the after-tax return on savings.

As such, the average tax rate paid over the taxpayer's lifetime is:

$$\frac{T_{npv}}{Y_{npv}} = tx$$

Knowing the lifetime average tax rate, this can then be compared with income-based and expenditure-based calculations of the average tax rate for a single period. If data are only available for period 1, the income-based average tax rate, calculated as t_1/y_1, is:

$$t_1/y_1 = \frac{tx(y_1 - s)}{y_1}$$

It is clear from this that, if any savings occurs, the income-based single period average tax rate will be an inaccurate measure of the lifetime average tax rate. Households that save will have a lower single period average tax rate than their lifetime average tax rate (the greater the amount of savings the lower the average tax rate). Meanwhile, households that dis-save will have a higher average tax rate than their lifetime average tax rate. If richer households save a greater proportion of their income than poorer households (which, as shown in Section 3.5, is true on average in all 27 countries), then the average tax rate for richer households will be lower than for poorer households and the VAT will appear regressive.

In contrast, the expenditure-based average tax rate, calculated as t_1/c_1, is exactly the same as the lifetime average tax rate:

$$t_1/c_1 = \frac{tx(y_1 - s)}{(y_1 - s)}$$

$$= tx$$

Measuring VAT burdens relative to current expenditure, rather than income, removes the influence of savings behaviour. The average tax rate is instead driven by the consumption pattern of the household, as captured by x. The distributional impact of the VAT is therefore driven by how x varies across taxpayers. If x is constant across all taxpayers then the VAT will be proportional. However, if x is lower for poorer taxpayers – i.e. if a smaller proportion of poorer households' expenditure is subject to the standard VAT rate than of richer households' expenditure – then the VAT will be progressive. Conversely, if x is higher for poorer taxpayers then the VAT will be regressive. This is of course an empirical question, which is examined in the microsimulation modelling to follow.[36]

[36] In practice, VAT structures are typically more complex than in this simple model, often involving multiple reduced VAT rates as well as exemptions. However, it remains the variation in consumption patterns across households that drives the distributional impact of the VAT – variation which is captured in the underlying HBS data used in the modelling to follow.

In practice, the expenditure-based current period average tax rate will still be an imperfect estimate of the lifetime average tax rate. In particular, the above model assumes that both t and x are constant over the taxpayer's lifetime. If, however, VAT rates decrease over time then the taxpayer's lifetime tax burden will be overestimated (and vice versa). Likewise, if the household's expenditure pattern shifts over time towards less heavily taxed goods, then the lifetime tax burden would also be overestimated (and vice versa).[37] This could have a regressive impact if, for example, the richest households spend a greater proportion of their savings on less-taxed items such as private education than other households do. Despite these limitations, by removing the strong influence of savings behaviour, analysis based on current expenditure will still provide a far more accurate picture of the distributional effect of the VAT than an analysis based on current income.

A number of additional arguments can also be made for preferring an expenditure-based analysis over an income-based analysis. These include that current expenditure may provide a better measure of an individual's welfare than current income (see, for example, Meyer and Sullivan, 2003), and that current expenditure may be a better proxy for lifetime income than current income (see, for example, Metcalf, 1994). More generally, it is arguable that any tax should be assessed relative to its base because a tax cannot redistribute something that it is not applied to – and the base of the VAT is expenditure. Importantly, though, the above savings-based rationale does not rely in any way on these additional arguments.[38] Eliminating the misleading impact of savings behaviour remains the clearest rationale for preferring an expenditure-based analysis.

Section 3.5 presents both income- and expenditure-based results, together with savings patterns, for all 27 countries to further illustrate the misleading impact of savings behaviour on income-based results. But conclusions regarding the distributional effects of the VAT reflect the expenditure-based results.

3.4. Methodology

This section outlines the non-behavioural VAT microsimulation methodology, discussing first the data used, then the microsimulation approach adopted, and finally the calculation of the results of the models.

3.4.1. Data

The microsimulation models use expenditure microdata from household budget surveys (HBSs) to model the VAT in 27 OECD countries. The HBSs are sample surveys of households carried out

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[37] As noted above, if bequests are incorporated into the model, then t and x should also be constant for both donor and recipient.

[38] This point is emphasised by IFS (2011a).

periodically by National Statistical Offices. They provide detailed information on household consumption expenditure on goods and services, possession of durable goods and housing. They also offer demographic and socio-economic characteristics, including disposable income.

To enhance consistency across countries, standardised Eurostat-format HBS microdata are used where possible. For countries where data are not available in this format, national survey data are adjusted to match as closely as possible the Eurostat format. This harmonised format enables a standard model to be developed and applied to each country. Microdata for 27 OECD countries has been obtained.

The Eurostat-format HBS microdata are provided by European Union countries to Eurostat once every five years. The data in the most recent data-provision round (the "2010 wave") relate to various years from 2008 to 2012, and were made available to researchers in 2016. The countries for which Eurostat-format data have been obtained (with year in parenthesis) are: Finland (2012); France, Portugal (2011); Belgium, the Czech Republic, Denmark, Estonia, Greece, Hungary, Ireland, Italy[39], Latvia, Luxembourg, Poland, the Slovak Republic, Slovenia, Spain, Sweden, the United Kingdom (2010); Austria (2009); Germany (2008); and the Netherlands (2004). Data for the Netherlands is from Eurostat's 2005 data-provision round. Non-Eurostat format microdata has also been obtained for: New Zealand (2016)[40]; Chile, Korea (2012); Switzerland (2011); and Turkey (2010).[41]

The standardised Eurostat format breaks household expenditure into more than 200 different categories, thereby enabling the often fine distinctions between expenditure categories subject to different VAT rates to be accurately modelled. Data for Chile, New Zealand, Korea and Switzerland provide an even greater number of expenditure categories.

As with any survey data, the HBS data are subject to some limitations. In particular, the representativeness of the data may be affected by sampling error, though this will be lower the larger the sample size. While sample sizes vary considerably, they are greater than 3,000 in 23 of the 27 countries (see Table 3.1). The representativeness of the Czech Republic and German surveys is also questionable as these two countries adopt a quota selection rather than probability sampling approach.[42]

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[39] Note that the data for Italy does not include an income variable, which limits some of the analysis that can be undertaken for this country.
[40] Access to the New Zealand Household Economic Survey data used in this study was provided by Statistics New Zealand under conditions designed to give effect to the security and confidentiality provisions of the Statistics Act 1975. The results presented in the study are the work of the author, not Statistics New Zealand.
[41] A new round of HBS microdata (relating for the majority of countries to surveys undertaken in 2015) is expected to be made available to researchers by Eurostat in late 2020.
[42] See Eurostat (2015) for a discussion of the accuracy of the 2010 wave of Eurostat HBS microdata.

Table 3.1. Household Budget Survey datasets

	Year	Sample size
AUT	2009	6,534
BEL	2010	7,177
CHE	2011	9,730
CHL	2012	10,528
CZE	2010	2,932
DEU	2008	53,996
DNK	2010	2,484
ESP	2010	22,203
EST	2010	3,632
FIN	2012	3,551
FRA	2011	15,797
GBR	2010	5,263
GRC	2010	3,512
HUN	2010	9,937
IRL	2010	5,891
ITA	2010	22,246
KOR	2012	13,463
LUX	2010	3,492
LVA	2010	3,798
NLD	2004	1,570
NZL	2016	3,490
POL	2010	37,412
PRT	2011	9,489
SLV	2010	3,924
SVK	2010	6,143
SWE	2010	2,047
TUR	2010	10,082

Source: HBS datasets.

Non-sampling errors are also possible. For example, measurement error may occur – due either to inaccurate recall or to intentional under-reporting of certain types of expenditure (such as alcohol, tobacco and gambling). Non-response bias may occur, although survey weights are typically adjusted to account for non-response. There are also coverage limitations, as surveys typically aim to measure only expenditure in private households (excluding, therefore, collective households such as retirement homes, boarding schools and prisons). Finally, a small number of data entry errors also appear to have occurred in some surveys – with, for example, an unrealistically high expenditure level for a particular item, or zero expenditure being reported for all food categories.[43]

The reliability of the income data is also an issue. Previous studies (e.g. Decoster et al., 2010) suggest that income is generally under-reported to at least some extent in household budget surveys. There is also evidence to suggest that income may tend to be under-reported to a greater extent for some income sources (e.g. self-employment income) than others (see, for example, Hurst et al., 2014). Additionally, income data at low income levels may be misleading due to the presence of households with transitorily low income (Bozio et al., 2012; Decoster et al., 2010).

To mitigate data quality concerns, a number of observations were removed from the sample prior to undertaking simulations. These were: observations with an expenditure-to-income ratio greater than four; observations with negative income; and observations with zero food expenditure.

3.4.2. The microsimulation models

The microsimulation models are constructed for each country by matching the detailed expenditure categories from the HBS data to their corresponding VAT rates (as applicable in the year of the HBS data).[44] A microsimulation program then calculates the amount of VAT paid by each household by applying the VAT rates to the corresponding expenditure amounts (working backwards from gross expenditure, as the tax base is net expenditure). The models calculate VAT burdens for each household, and these amounts are then weighted up to the population using household survey weights. A number of assumptions and adjustments are made in undertaking these calculations as described below.

The modelling assumes that the VAT is fully passed through to the final consumer in prices. This is a standard assumption made in the empirical literature (see, for example, IFS, 2011a; Leahy et al., 2011; Decoster et al., 2010). In theory, it is possible for the VAT to be less than fully or even more than fully passed on to consumers, depending on the structure of the particular market. Empirical evidence,

[43] Unless otherwise noted, expenditure on food and non-alcoholic beverages is separated into two categories in this thesis: food and non-alcoholic beverages purchased for home consumption, including takeaway food (“food”); and food and non-alcoholic beverages consumed in restaurants, canteens and cafeterias (“restaurant food”).

[44] VAT rates were taken from various editions of the OECD’s “Consumption Tax Trends” publication (OECD, 2006-2016) and the European Commission’s “VAT Rates Applied in the Member States of the European Union” publication (European Commission, 2004-2012), and were verified by country delegates to Working Party No. 9 on Consumption Taxes of the OECD’s Committee on Fiscal Affairs. Verification of rates by national officials occurred as part of an OECD project undertaken by the author on the “Distributional Effects of Consumption Taxes in OECD Countries”.

however, is inconclusive, and so full pass-through is assumed in the absence of clear guidance to the contrary.[45]

Modelling consumer durables and housing poses a problem as these are infrequent purchases and the HBS data only provides a snapshot of expenditure. For example, a car is likely to be owned for several years before being replaced, so it would be relatively arbitrary whether or not a car was purchased in the survey period (and therefore was included as expenditure). Ideally, the cost of durables would be apportioned over their useful life in order to reduce any overstatement of expenditure for households that have undertaken such purchases during the survey period (or any understatement for households that made such purchases outside the survey period). However, this would require accurate information on length of ownership and expenditure on durables (both purchased within and outside the survey period), and is therefore not a feasible option. On the other hand, not modelling consumer durables would underestimate consumption and tax revenue significantly. I therefore include consumer durables in the modelling with the sole exception of motor vehicles. Motor vehicles are excluded on the basis that they are the largest infrequently purchased consumer durable and their inclusion would be the most likely to impact the expenditure-based ranking of households implicit in the summary indicators presented in Section 3.5.[46]

The HBS data does not include a variable for house purchases. However, actual rental expenditure is available in all 27 countries and imputed rental expenditure in 23 countries. For countries where both rental and imputed rental expenditure data are available, both are included in the modelling to ensure comparability between renters and homeowners. For countries where only actual rental expenditure is available, this is excluded from the modelling – again to ensure comparability between renters and homeowners. Imputed rental income (varying from imputed rental expenditure due to mortgage costs) is available for 20 countries and is included where available.

[45] IHS (2011) present a detailed review of both the theoretical and empirical literature on VAT pass-through. They find a wide range of empirical results in the literature, covering full, less than full, and more than full pass-through. They conclude that full pass-through is more likely to be found in more competitive markets and for broader VAT reforms. More recently, Benzarti et al. (2020) find evidence for European countries of significantly stronger pass-through of VAT increases than VAT decreases. In contrast, Benedek et al. (2019) find no significant evidence of asymmetric responses to price changes in European countries. They also find roughly full pass-through of standard VAT rate changes, but only around 30% pass-through for changes in reduced VAT rates. Meanwhile, Gaarder (2018) finds the introduction of a reduced VAT rate on food in Norway to have resulted in full pass-through to prices.

[46] In contrast, for analysis of averages across decile groupings in Section 3.5 there is likely to be less inaccuracy as, within each decile group, the number of households that purchase durables in that period, and the number that do not are likely to "average out" to some extent.

A final modelling difficulty relates to exempted goods and services. While no VAT is imposed on sale to the final consumer, some VAT may still be embedded in the final price due to the inability of businesses to claim input tax credits in relation to the production of exempted goods and services. Input-output tables could potentially be used to estimate this embedded tax separately for each country.[47] However, such a resource intensive exercise is beyond the scope of this thesis. Instead, VAT exemptions are treated as zero rates in the modelling. This assumption, however, is likely to result in some underestimation of actual VAT revenue in the models.

3.4.3. Accuracy of the models

The aggregate VAT revenue simulated by the models does not correspond with the VAT revenue actually collected in the corresponding year (in general it is underestimated). This is largely due to issues already discussed above: the under-reporting of some expenditure by households; coverage being limited to private households; the exclusion of expenditure on motorcars and housing (as new house purchases are often subject to VAT); and treatment of VAT exemptions as zero rates.[48] In addition, fraud is not simulated in the models – which may result in some overestimation of revenue.

Regarding the coverage of the HBS data, in addition to omitting VAT paid by collective households, VAT paid by the public sector, charities and businesses will also not be accounted for. That said, as businesses can be expected to pass on the VAT to the final consumer this VAT will still generally be captured in the micro-data. Note that National Accounts annual revenue figures may include some VAT paid by businesses that has not yet been passed on to the consumer (and not yet claimed back by the business), but this VAT will not be simulated by the model.

3.4.4. Presentation of results

The models are used to produce a range of results that are presented in the next section. Average VAT rates are calculated for each household, using both disposable income and gross expenditure as the welfare metric, and are calculated across both disposable income and gross expenditure deciles.

Disposable income, rather than gross income, is used as the base for average tax rate calculations to avoid the influence of progressive personal income taxes on the results. Using gross income would increase the regressive appearance of the VAT because, as income increases, the base would include increasingly larger income tax payments that would not be consumed and subject to VAT. Additionally,

[47] See Warren (2008) for a discussion of the use of input-output tables.
[48] The imposition of VAT on new house purchases is intended to proxy for the imposition of VAT on housing rent. The actual incidence is subject to some debate, but where the VAT is passed on in the form of higher rent, this embedded VAT will not be captured in the modelling.

from a practical perspective, gross income is not available in the majority of the HBS datasets. As with most previous studies, gross (VAT-inclusive) expenditure, rather than net (VAT-exclusive) expenditure, is used as the base for average tax rate calculations.[49] Note that this is different to the VAT-exclusive manner in which statutory VAT rates are typically expressed.

In calculating the results, the individual rather than the household is adopted as the unit of analysis. This ensures that equal weighting is given in the analysis to the welfare of each individual. In contrast, use of the household as the unit of analysis would mean that the welfare of a one-person household was given as much weight as that of a large household with many individuals. That approach, while often adopted for ease of computation, is difficult to justify for welfare analysis.

The key difficulty in applying the individual as the unit of analysis is the fact that while some demographic information in the HBS microdata is provided on an individual basis, income and expenditure data are provided on a household basis. To adjust the unit of analysis to the individual it is therefore necessary to multiply household survey weights by household size (this is done for all analyses with the exception of aggregate tax revenue estimation). Implicit in this approach is the assumption of equal sharing of resources within a family so that the measured welfare of each household member (whether income or expenditure) is identical.

Prior to adjusting the welfare metric to an individual basis, it is also necessary to make adjustment for different degrees of need within a household. For example, a child will require less food to maintain the same welfare level as an adult. Additionally, households can be expected to benefit from economies of scale – for example, additional heating costs associated with a second occupant of a house will be significantly lower than for the first occupant. Equivalisation is undertaken using the following parametric equivalence scale:

$$m_i = \left(n_{a,i} + \theta n_{c,i}\right)^{\alpha}$$

where m_i is the equivalent size of household i, θ measures the degree of need of children relative to adults; α specifies economies of scale in consumption; $n_{a,i}$ is the number of adults in household i and $n_{c,i}$ is the number of children.

[49] Sensitivity analysis shows that the choice of gross or net expenditure has minimal impact on the results throughout the thesis (average tax rates are naturally slightly lower with gross rather than net expenditure as the base), and has no impact on any of the conclusions drawn.

As noted by Creedy and Sleeman (2006), this parametric scale was introduced by Cutler and Katz (1992) and is an extension of the simpler n_i^{α} form used by Buhmann et al. (1988) and Coulter et al. (1992). The scale explicitly allows for adjustment of need between adults and children, and for economies of scale with increases in need-adjusted household size. A further benefit of the approach is that its explicit nature easily enables sensitivity analysis. The parameters adopted in the paper are $\theta = 0.5$ and $\alpha = 0.7$.[50]

In addition to average tax rate results, three summary indicators of progressivity and redistribution are calculated. The first indicator is the well-known Kakwani (1977) progressivity index. The Kakwani index is an indicator of global progressivity, traditionally of the income tax, but commonly also applied to benefit systems and expenditure programs. Adapting it to examine VAT with expenditure as the welfare metric, it can be calculated as the difference between: the VAT concentration coefficient calculated with individuals ranked by equivalised gross expenditure; and the Gini coefficient of equivalised gross expenditure.

Gini and concentration coefficients are both measures of dispersion from equality across a cumulative frequency distribution. As such, the Kakwani index measures how much further from equality is the distribution of VAT paid than the distribution of gross expenditure (without changing the ranking of individuals). It can range from -1 to 1; with a positive figure reflecting progressivity and a negative figure reflecting regressivity. The Kakwani index (π^K) can be expressed as follows:

$$\pi^K = C_{VAT}^{G} - G_G$$

or:

$$\pi^K = 2\int_0^1 \left[L_G(p) - L_{VAT}^{G}(p)\right] dp$$

where C_{VAT}^{G} is the concentration coefficient for VAT (with individuals ranked by gross expenditure); G_G is the Gini coefficient for gross expenditure; $L_G(p)$ is the Lorenz curve for gross expenditure and $L_{VAT}^{G}(p)$ is the concentration curve for VAT (with individuals ranked by gross expenditure).

[50] A commonly used alternative equivalence scale is the "OECD modified" scale which gives a fixed weighting of 1 to the first adult household member, 0.5 to the second and additional household members aged 14 and over, and 0.3 to each child under 14. While this scale adjusts for the relative need of adults and children, it does not continuously adjust for economies of scale as second and subsequent children all receive the same weighting. The equivalence scale parameters chosen in this paper produce a close match with the OECD modified scale, but provide for additional economies of scale at greater household sizes. Sensitivity analysis conducted on the two parameters shows some variation in results for changes in both parameters, but not significant enough to alter the study's overall conclusions. See Appendix 1 for detail.

The second indicator computed is the Reynolds-Smolensky (1977) index, which provides a measure of the overall redistributive effect of a tax (and/or transfer). It is also typically used in an income tax context, but can again be adapted to examine VAT with expenditure as the welfare metric. In this context, it is calculated as the difference between the Gini coefficient on equivalised gross expenditure and the concentration coefficient on equivalised net expenditure, ranked by gross expenditure. As such, the Reynolds-Smolensky index measures how much further from equality is net expenditure than gross expenditure (without changing the ranking of individuals). It can be expressed as follows:

$$\pi^{RS} = G_G - C_N^G$$

or:

$$\pi^{RS} = 2\int_0^1 \left[L_N^G(p) - L_G(p)\right] dp$$

where C_N^G is the concentration coefficient for net expenditure (with individuals ranked by gross expenditure) and $L_N^G(p)$ is the concentration curve for net expenditure (with individuals ranked by gross expenditure).[51]

The Kakwani and Reynolds-Smolensky indices are linked. The overall redistributive effect measured by the Reynolds-Smolensky index can be broken down into two components, a progressivity component measured by the Kakwani index, and an average tax rate component, as follows:

$$\pi^{RS} = \frac{t}{1-t}\pi^K$$

where t is the effective average tax rate.

This relationship highlights the fact that redistribution can be achieved even by a tax system with only a small degree of progressivity if the average tax paid is high. Equally, a tax system with low tax rates requires a highly progressive system to achieve the same degree of redistribution.

A characteristic of the Gini-based dispersion measures on which the Kakwani and Reynolds-Smolensky indices are based is that they are less responsive to changes at the tails as compared to the middle of the

[51] An alternative measure of the redistributive effect simply compares the Gini coefficient on gross expenditure with the Gini coefficient on net expenditure. Unlike the Reynolds-Smolensky (RS) index, ranking of individuals now differs between the two component indices. The difference between this redistributive effect (RE) index and the Reynolds-Smolensky index reflects a ("Atkinson-Plotnick") re-ranking effect. The RE index can be expressed as: $\pi^{RE} = G_G - G_N$, or: $\pi^{RE} = 2\int_0^1 [L_N(p) - L_G(p)]\, dp$, where G_N is the Gini coefficient for net expenditure and $L_N(p)$ is the Lorenz curve for net expenditure.

distribution being examined. The third indicator computed – the change in the Atkinson (1970) inequality index – enables greater emphasis to be applied to the bottom of the distribution by specifying the degree of inequality aversion. The Atkinson index is based on the social welfare function:

$$W = \frac{1}{n}\sum_{i=1}^{n} \frac{x_i^{1-\varepsilon}}{1-\varepsilon}$$

for $\varepsilon \geq 0$ and $\varepsilon \neq 1$. If $\varepsilon = 1$, $W = 1/n \sum_{i=1}^{n} log\, x_i$. W is social welfare, x is the welfare metric (usually income, but in this case, expenditure), and ε is the inequality aversion parameter. A higher value of ε can be seen to result in greater weight being placed on lower levels of expenditure in calculating social welfare. From this function, the "equally distributed equivalent" expenditure can be derived. The "equally distributed equivalent" expenditure (x_{ede}) is the expenditure level that, if it were attained by every individual, would give the same total welfare as the actual distribution. It is given by:

$$x_{ede} = \left(\frac{1}{n}\sum_{i=1}^{n} x_i^{1-\varepsilon}\right)^{1/(1-\varepsilon)}$$

The Atkinson index (A_ε) itself is then defined as the proportional difference between the arithmetic mean ($\bar{x}$) and the "equally distributed equivalent" expenditure, as follows:

$$A_\varepsilon = 1 - \frac{x_{ede}}{\bar{x}}$$

The difference between the index calculated using equivalised gross and equivalised net expenditure can then be calculated as an alternative measure of redistribution to the Reynolds-Smolensky indicator. Calculations are made for three levels of inequality aversion: $\varepsilon = 0.2$, 0.7 and 1.2.

Finally, a range of poverty measures are also calculated to examine the effect of the VAT on the poor. By comparing poverty measures based on gross expenditure vs net expenditure, the analysis identifies the extent to which the imposition of VAT can increase poverty. While the academic literature provides a wide range of potential poverty measures, I focus on three indices in the Foster-Greer-Thorbecke (1984) family of poverty measures. Foster-Greer-Thorbecke (FGT) poverty measures follow the form:

$$P_\alpha = \frac{1}{n}\sum_{i=1}^{q} \left(\frac{z - y_i}{z}\right)^{\alpha}$$

where α is a measure of the index's sensitivity to poverty, z is the poverty line, y_i is the chosen welfare metric (in our case equivalised expenditure), n is the number of individuals, and q is the number of poor (individuals with expenditure below the poverty line).

By varying α, the FGT index can examine different aspects of poverty. I present results for three values of α: 0, 1 and 2. For $\alpha = 0$, the index presents the "poverty headcount" – the proportion of the population that are below the poverty line. While this is a very commonly used measure, and has immediate intuitive appeal, by focusing purely on the frequency of poverty it fails to account for two additional aspects of poverty: the depth of poverty and the degree of inequality among those in poverty.

Setting $\alpha = 1$, presents the "poverty gap" index – the average distance between the poverty line and the level of equivalised expenditure (as a percentage of the poverty line). This provides a measure of the depth of poverty. Finally, setting $\alpha = 2$ presents the "squared poverty gap" index. This measure weights each individual's poverty gap (as a percentage of the poverty line) by the size of their poverty gap (as a percentage of the poverty line), thereby giving greater importance to the poverty gap of those experiencing more severe levels of poverty. As such, the index takes into account the degree of inequality amongst the poor in addition to the frequency and depth of poverty.

To calculate each index, a poverty line must be determined to distinguish poor from non-poor. This is, to a large extent, an arbitrary decision and has a significant effect on the magnitude of the computed poverty indices.[52] A poverty line can be set in absolute terms (i.e. as a fixed expenditure level) or relative terms (e.g. as a percentage of median expenditure). In the context of a cross-country study such as this, a relative poverty measure has the advantage of providing a comparable point across countries. Eurostat, for example, adopts a relative poverty line of 60% of median equivalised disposable income in its cross-country analyses, while the OECD Income Distribution Database adopts a poverty line of 50% of median equivalised disposable income for computing its headline poverty indicator.[53] In this and subsequent chapters, I apply a fixed poverty line of 50% of median equivalised gross expenditure.

[52] Sensitivity analysis in Appendix 1 shows the significant variation in results for different poverty lines. While the magnitudes vary, the overall conclusion that the imposition of VAT increases poverty is unaffected.
[53] See Eurostat (2018), OECD (2016, 2018b).

3.5. Simulation results

3.5.1. Average tax rate results

Tables 3.2-3.3 present, for each of the 27 OECD countries, the average VAT burdens faced by households as a percentage of disposable income and as a percentage of expenditure, respectively, across equivalised disposable income deciles. Tables 3.4-3.5 present the same calculations across equivalised expenditure deciles. The overall trends are summarised in Figure 3.1 which presents the simple averages across all countries of the results presented in Tables 3.2-3.5.

Table 3.2 (and the left hand panel of Figure 3.1) shows VAT payments as a percentage of disposable income decreasing as income increases in all countries. For example, the proportional VAT burdens faced by the top income decile are less than half those faced by the bottom income decile in Chile, France, Ireland, Korea, Luxembourg, Latvia and New Zealand. Much smaller differences are observed in the Czech Republic, Germany, Finland, Poland and the Slovak Republic, but the VAT clearly still has a regressive effect in every country. This trend is confirmed by the strongly downward sloping 27-country average shown in the left hand panel of Figure 3.1.

As the averages in Figure 3.1 highlight, the results presented in Tables 3.3-3.5 strongly contrast with the regressive trend in Table 3.2. Table 3.3 shows VAT payments as a proportion of expenditure to be either roughly proportional, or slightly progressive (across income deciles) in most countries – though generally average tax rates do not increase monotonically. The results for Estonia, Hungary, Luxembourg, Latvia and New Zealand arguably suggest a small degree of regressivity (though again average tax rates are not monotonically decreasing). A small number of countries – e.g. Chile, Germany and Korea – show a peak in the middle of the income distribution, though the average VAT burden in Germany and Korea is still higher for the top income decile than the bottom.

Turning to the expenditure decile results, Table 3.4 shows a highly progressive trend for VAT burdens measured as a percentage of income. This strong progressive trend is highlighted in the right hand panel of Figure 3.1. In contrast, when measured as a percentage of expenditure, the VAT appears slightly progressive in most countries (Table 3.5). In Latvia the VAT appears roughly proportional, while in Chile there is again a peak in the middle deciles. In Hungary, Korea and New Zealand the VAT appears slightly regressive (though, again, results are not monotonically decreasing).

The highly regressive results in Table 3.2 when measuring VAT as a percentage of income across income deciles are consistent with previous analyses of VAT burdens as a percentage of income (as summarised in Section 3.2). The driving influence of savings behaviour on these results is illustrated by the expenditure-to-income ratios presented across income deciles in Table 3.6 and in the left-hand panel of Figure 3.2. At low income levels, households tend to be net borrowers in all countries, so average VAT burdens as a percentage of income appear relatively high. Savings rates then rise with income, lowering average VAT burdens. At high income levels, households tend to be net savers, and consequently VAT burdens as a percentage of income appear relatively low.

Equally, the highly progressive results shown in Table 3.4 are driven by savings behaviour. This is illustrated by the expenditure-to-income ratios presented across expenditure deciles in Table 3.7 and in Figure 3.2 (right hand panel). At low expenditure levels, households tend to be net savers, so VAT burdens as a percentage of income appear relatively low. Savings rates then fall as expenditure increases, increasing the average VAT burdens. At very high expenditure levels, households tend to be net borrowers, and so VAT burdens as a percentage of expenditure appear relatively high.[54]

In contrast, the expenditure-based results in Tables 3.3 and 3.5 remove the influence of savings behaviour. As noted in Section 3.3, they instead identify how the presence of reduced VAT rates and exemptions move the actual VAT burden away from what would be due under a perfectly broad-based single-rate system (where all households would pay the same proportion of their expenditure in VAT). As such, they provide a far more reliable estimate of the distributional impact of the VAT.[55]

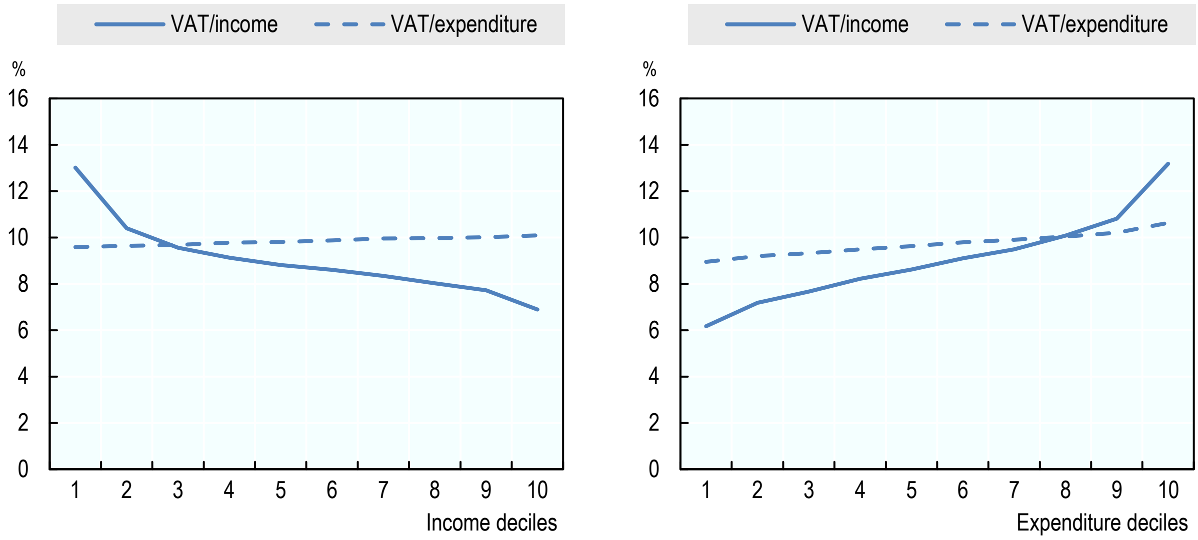
Focusing on the expenditure-based results, the broad conclusion can be drawn that the VAT in most of the countries covered is either roughly proportional or slightly progressive. This confirms other recent expenditure-based analysis for several countries by IFS (2011a), and challenges the general public perception, and the conclusion of much of the previous academic literature, that the VAT is regressive.

[54] As these savings patterns suggest, income deciles and expenditure deciles are not perfectly correlated. On average across 25 countries, 72% of individuals in a particular expenditure decile are within (plus or minus) two deciles of the same income decile. However, only 22% of individuals, on average, are in the exact same income and expenditure decile. For the bottom and top deciles, there is a greater correlation – with 42% and 43% of individuals, respectively, in the same income and expenditure decile (and 64% and 65% within one decile). Note that the calculations presented in this footnote exclude Korea and New Zealand due to data access limitations.

[55] With regard to ranking households from lifetime poor to lifetime rich, there is an arguable case for measuring tax burdens across the income and expenditure distributions. Current expenditure has arguably a more direct link to well-being as it is the consumption of goods and services that produces utility rather than the earning of the income that funds the consumption. Additionally, ranking by current income can misrepresent some households – e.g. students, retirees – as poor, when they may be significantly better off in a lifetime context. That said, ranking by current expenditure can also misrepresent some households – e.g. those currently saving heavily to fund future spending – as worse off than they are in a lifetime context. For households that are not saving or borrowing, either measure is likely to be as good a proxy for lifetime income, and hence a good means of ranking households.

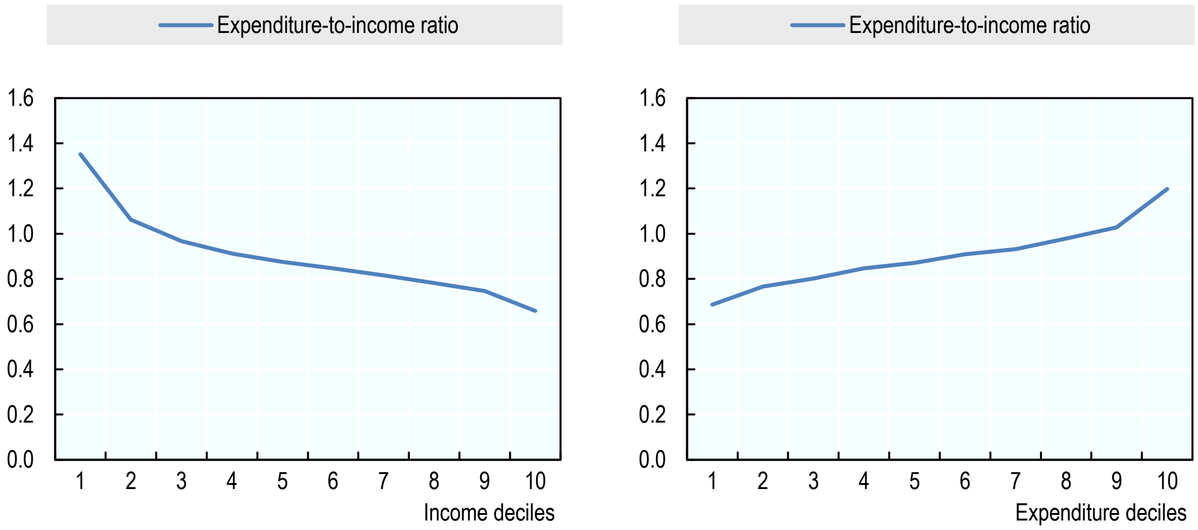
A weakness of the above decile-based analysis is that it does not always provide a conclusive picture of the overall distributive impact of the VAT as non-monotonic patterns can arise across deciles. As such, a range of summary measures are presented in the next section. While imposing additional value judgements, their more structured framework enables definitive conclusions to be made regarding the overall distributional impact of the VAT in each country.

Figure 3.1. Household average VAT burdens: all-country simple average



Notes. Results calculated using microsimulation models for 27 countries based on household expenditure survey microdata. "VAT/income" results present the simple mean across all countries of the within-country weighted mean of the VAT paid per household as a percentage of total household income. "VAT/expenditure" results present the simple mean across all countries of the within-country weighted mean of the VAT paid per household as a percentage of total household expenditure. Results presented across equivalised income/expenditure deciles, with the individual as unit of analysis. See text for further detail. Italy only included for VAT/expenditure across expenditure deciles.

Figure 3.2. Expenditure-to-income ratio: all country simple average



Notes. Results calculated using microsimulation models for 27 countries based on household expenditure survey microdata. "Expenditure-to-income ratio" results present the simple mean across all countries of the within-country weighted mean of total expenditure divided by total income per household. Results presented across equivalised income/expenditure deciles, with the individual as unit of analysis. See text for further detail. Italy excluded as income data not available.

Table 3.2. Average VAT as a percentage of income across income deciles

	1	2	3	4	5	6	7	8	9	10
AUT	15.3	11.5	10.6	10.3	10.5	10.1	9.7	9.5	8.9	8.5
BEL	11.3	9.4	9.2	9.4	9.2	9.2	8.9	8.3	8.1	6.2
CHE	5.4	4.2	4.0	3.8	3.8	3.6	3.6	3.5	3.4	3.0
CHL	18.1	15.1	12.7	11.5	10.7	11.1	9.9	9.2	8.7	7.4
CZE	11.1	10.8	10.6	10.2	10.3	10.1	9.9	9.4	9.2	8.3
DEU	8.8	8.5	8.5	8.2	8.0	7.8	7.6	7.3	7.0	6.2
DNK	15.9	13.1	12.6	11.6	11.3	10.7	10.2	9.9	9.8	8.2
ESP	11.6	9.4	8.8	8.2	7.9	7.5	7.4	7.2	6.8	6.2
EST	18.8	13.7	12.1	11.7	11.0	11.2	11.7	10.3	10.4	9.8
FIN	11.9	9.6	9.8	9.6	9.9	9.0	9.3	9.4	9.0	7.7
FRA	10.9	7.7	7.2	6.9	6.3	6.2	5.9	6.0	5.6	4.7
GBR	9.3	7.8	7.2	7.2	6.2	6.3	6.3	5.9	5.9	5.4
GRC	13.5	10.6	9.8	9.1	8.8	8.6	7.7	8.1	8.0	7.2
HUN	16.2	14.1	12.9	12.5	11.5	11.2	11.1	10.8	10.1	9.5
IRL	13.8	8.9	8.4	7.8	7.3	7.4	6.6	6.2	6.1	4.9
ITA	-	-	-	-	-	-	-	-	-	-
KOR	6.4	4.4	3.9	3.8	3.7	3.5	3.2	3.0	2.8	2.5
LUX	6.8	5.2	3.2	2.3	2.0	1.8	1.8	1.5	1.4	1.1
LVA	24.1	19.3	16.7	15.8	15.1	14.7	13.2	12.5	11.9	10.3
NLD	13.6	10.2	9.3	8.7	8.8	8.3	8.7	8.4	8.5	7.5
NZL	13.8	10.3	9.2	9.2	8.9	8.6	8.0	7.7	6.9	6.4
POL	12.3	10.5	9.8	9.6	9.4	9.4	9.0	9.1	9.0	8.4
PRT	13.6	11.0	9.8	8.8	9.1	9.2	8.7	8.5	7.8	6.9
SLV	16.8	13.4	11.4	11.7	10.6	10.3	10.9	10.4	10.0	9.5
SVK	14.5	13.1	12.4	12.1	12.1	11.5	11.4	11.1	10.5	9.8
SWE	12.0	8.0	8.1	7.9	7.8	8.0	7.3	7.4	7.1	6.4
TUR	12.5	10.6	10.0	9.5	9.2	8.8	8.7	8.2	7.7	7.2
Average	**13.0**	**10.4**	**9.6**	**9.1**	**8.8**	**8.6**	**8.3**	**8.0**	**7.7**	**6.9**

Notes. Results calculated using microsimulation models for 27 countries based on household expenditure survey microdata. Results are calculated as the weighted mean of the VAT paid per household as a percentage of total household income. Results presented across equivalised income deciles, with the individual as unit of analysis. See text for further detail. Italy excluded as income data unavailable.

Table 3.3. Average VAT as a percentage of expenditure across income deciles

	1	2	3	4	5	6	7	8	9	10
AUT	10.9	10.8	10.7	10.9	11.1	11.0	11.1	11.3	11.2	11.3
BEL	8.9	9.0	9.2	9.4	9.6	9.7	9.8	9.9	10.1	10.3
CHE	3.8	4.0	4.1	4.2	4.3	4.4	4.4	4.5	4.6	4.7
CHL	9.9	10.2	10.0	10.1	10.1	10.4	10.2	10.0	9.6	9.5
CZE	13.1	13.2	13.4	13.3	13.5	13.5	13.6	13.7	13.7	13.8
DEU	7.8	8.4	8.8	8.9	9.0	9.1	9.2	9.1	9.1	8.9
DNK	13.2	12.9	12.9	14.0	14.1	14.3	14.3	14.4	14.2	14.5
ESP	7.0	7.0	7.1	7.1	7.0	7.1	7.2	7.2	7.2	7.3
EST	13.9	13.7	13.3	13.2	12.9	12.7	13.6	13.3	13.2	13.1
FIN	9.8	10.0	10.3	10.4	10.9	10.7	11.1	11.2	11.3	11.1
FRA	8.3	7.8	7.5	7.5	7.3	7.5	7.5	7.6	7.8	7.9
GBR	8.5	8.6	8.9	9.1	9.1	9.4	9.6	9.4	9.7	9.6
GRC	8.4	8.4	8.5	8.6	8.7	8.9	8.9	9.1	9.2	9.4
HUN	15.7	15.1	14.5	14.4	14.0	13.7	13.8	13.8	13.7	14.0
IRL	7.8	7.6	7.8	7.7	7.8	8.0	8.0	7.9	8.1	8.2
ITA	-	-	-	-	-	-	-	-	-	-
KOR	5.0	5.2	5.3	5.4	5.5	5.6	5.4	5.6	5.6	5.5
LUX	5.8	6.4	6.6	6.4	6.3	6.1	6.1	5.7	5.5	5.0
LVA	13.7	13.8	13.7	13.4	13.4	13.2	13.4	13.2	13.3	13.0
NLD	7.9	8.1	8.1	8.2	8.2	8.4	8.7	8.8	8.9	9.1
NZL	12.4	12.4	12.0	11.8	12.0	11.8	11.6	11.3	11.2	11.3
POL	9.2	9.7	9.9	10.1	10.3	10.4	10.5	10.7	11.0	11.4
PRT	8.6	8.6	8.5	8.7	8.7	8.9	9.1	9.1	9.2	9.5
SLV	9.0	9.3	9.1	9.5	9.4	9.6	9.9	9.8	10.0	10.3
SVK	12.8	13.1	13.0	13.0	13.1	13.1	13.2	13.2	13.2	13.3
SWE	9.2	8.8	9.4	9.9	9.8	10.5	9.9	10.3	10.6	11.3
TUR	8.4	8.7	8.8	8.8	8.8	8.9	8.9	9.0	8.9	9.2
Average	**9.6**	**9.6**	**9.7**	**9.8**	**9.8**	**9.9**	**10.0**	**10.0**	**10.0**	**10.1**

Notes. Results calculated using microsimulation models for 27 countries based on household expenditure survey microdata. Results are calculated as the weighted mean of the VAT paid per household as a percentage of total household expenditure. Results presented across equivalised income deciles, with the individual as unit of analysis. See text for further detail. Italy excluded as income data unavailable.

Table 3.4. Average VAT as a percentage of income across expenditure deciles

	1	2	3	4	5	6	7	8	9	10
AUT	5.4	6.5	7.6	8.3	9.4	10.2	11.6	12.9	14.1	18.8
BEL	5.5	6.2	6.6	7.4	7.8	8.0	9.0	9.8	11.1	17.8
CHE	2.2	2.8	3.2	3.4	3.7	3.9	4.1	4.4	4.7	5.9
CHL	7.9	9.2	9.7	12.2	11.6	13.9	13.0	13.7	11.9	11.5
CZE	7.4	8.4	9.1	9.6	9.9	9.9	10.4	10.6	11.1	13.2
DEU	6.2	6.6	6.9	7.1	7.2	7.6	7.7	8.1	8.5	12.2
DNK	8.3	9.2	9.7	10.2	10.6	12.0	11.4	12.1	13.0	16.7
ESP	6.0	6.6	6.8	7.2	7.5	8.0	8.5	8.9	9.7	11.7
EST	5.9	8.7	9.4	10.7	10.7	12.4	13.8	14.6	15.7	18.7
FIN	5.8	7.3	7.5	8.4	8.9	9.3	10.1	10.7	12.4	14.7
FRA	4.7	5.5	5.7	6.1	6.2	6.5	7.1	7.3	8.1	10.3
GBR	3.2	4.5	5.2	5.6	6.4	6.8	7.3	7.6	9.1	11.8
GRC	6.0	7.9	8.1	8.2	9.5	9.2	9.8	10.3	10.5	12.0
HUN	10.5	11.1	11.3	10.9	11.7	11.9	11.9	12.6	13.0	15.1
IRL	4.9	6.3	6.5	8.0	7.9	8.3	8.5	8.6	8.9	9.5
ITA	-	-	-	-	-	-	-	-	-	-
KOR	3.3	3.3	3.4	3.5	3.6	3.7	3.8	3.8	4.0	4.8
LUX	2.2	2.5	2.5	2.3	2.4	2.9	3.0	2.8	3.0	3.5
LVA	11.9	12.4	13.3	14.0	15.7	15.9	15.1	17.1	18.8	19.5
NLD	6.3	7.9	7.7	7.6	8.2	9.4	9.4	10.1	11.5	13.8
NZL	4.6	6.8	8.5	8.9	9.4	8.6	9.8	9.3	10.7	12.6
POL	6.8	7.6	8.1	8.5	8.8	9.4	10.1	10.6	11.5	15.2
PRT	4.7	6.4	7.2	8.4	9.3	9.9	10.6	12.1	12.0	12.8
SLV	8.0	8.8	9.4	9.8	10.5	11.0	11.5	13.2	14.3	18.4
SVK	10.1	10.3	10.8	11.3	11.2	11.5	11.7	12.3	12.7	16.7
SWE	5.0	5.4	6.1	7.0	7.1	7.3	7.9	8.9	10.8	14.2
TUR	7.5	8.5	8.8	9.0	9.0	9.2	9.5	9.7	10.2	11.2
Average	**6.2**	**7.2**	**7.7**	**8.2**	**8.6**	**9.1**	**9.5**	**10.1**	**10.8**	**13.2**

Notes. Results calculated using microsimulation models for 27 countries based on household expenditure survey microdata. Results are calculated as the weighted mean of the VAT paid per household as a percentage of total household income. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail. Italy excluded as income data unavailable.

Table 3.5. Average VAT as a percentage of expenditure across expenditure deciles

	1	2	3	4	5	6	7	8	9	10
AUT	9.6	10.1	10.3	10.6	10.8	11.2	11.3	11.8	12.0	12.6
BEL	7.8	8.4	8.6	9.1	9.4	9.6	9.8	10.3	10.8	12.1
CHE	3.6	3.9	4.1	4.2	4.3	4.4	4.4	4.6	4.6	4.9
CHL	9.3	9.9	9.8	10.2	10.1	10.5	10.4	10.1	9.9	9.6
CZE	13.1	13.2	13.3	13.3	13.5	13.4	13.6	13.7	13.8	14.0
DEU	7.6	8.1	8.4	8.7	8.8	9.0	9.0	9.2	9.3	10.2
DNK	12.5	12.6	13.2	13.4	13.6	14.4	14.3	14.4	15.0	15.6
ESP	6.2	6.6	6.8	6.9	7.0	7.1	7.3	7.5	7.6	8.1
EST	13.5	13.0	13.0	12.9	12.8	13.2	13.4	13.6	13.8	13.8
FIN	9.6	9.8	10.2	10.3	10.7	10.9	11.0	11.2	11.5	11.8
FRA	7.5	7.2	7.1	7.2	7.3	7.5	7.7	7.9	8.2	9.0
GBR	7.7	8.2	8.8	8.9	9.5	9.6	9.9	9.6	9.9	9.9
GRC	7.6	8.0	8.2	8.5	8.7	9.1	9.1	9.5	9.4	9.9
HUN	15.4	14.8	14.4	14.1	14.1	14.0	13.7	13.9	13.9	14.3
IRL	7.4	7.6	7.4	8.0	7.9	8.0	8.1	8.1	8.3	8.4
ITA	5.3	5.8	5.9	6.3	6.3	6.5	6.6	6.8	7.0	8.5
KOR	5.3	5.6	5.7	5.6	5.6	5.5	5.4	5.3	5.3	4.7
LUX	5.0	5.4	5.7	5.7	5.9	6.0	6.1	6.5	6.6	6.9
LVA	13.5	13.5	13.4	13.4	13.4	13.5	13.3	13.4	13.6	13.2
NLD	7.2	7.7	7.6	7.9	8.2	8.5	8.8	9.1	9.3	10.0
NZL	12.5	12.5	12.3	12.1	11.9	11.4	11.7	11.3	11.3	11.1
POL	8.6	9.3	9.7	9.9	10.2	10.4	10.7	11.0	11.3	12.2
PRT	7.4	8.2	8.2	8.6	9.0	8.9	9.2	9.6	9.7	9.9
SLV	8.8	8.7	9.0	9.1	9.2	9.6	9.6	10.1	10.4	11.2
SVK	12.8	13.1	13.2	13.1	13.1	13.2	13.0	13.2	13.0	13.5
SWE	8.5	8.8	8.9	9.4	9.4	10.0	10.6	10.5	11.0	12.3
TUR	8.2	8.5	8.8	8.7	9.0	9.0	9.1	9.0	9.0	9.0
Average	**8.9**	**9.2**	**9.3**	**9.5**	**9.6**	**9.8**	**9.9**	**10.0**	**10.2**	**10.6**

Notes. Results calculated using microsimulation models for 27 countries based on household expenditure survey microdata. Results are calculated as the weighted mean of the VAT paid per household as a percentage of total household expenditure. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

Table 3.6. Expenditure-to-income ratios across income deciles

	1	2	3	4	5	6	7	8	9	10
AUT	1.35	1.03	0.95	0.91	0.91	0.87	0.84	0.81	0.77	0.72
BEL	1.18	0.99	0.97	0.95	0.92	0.90	0.86	0.82	0.77	0.58
CHE	1.37	1.02	0.94	0.88	0.85	0.82	0.80	0.76	0.72	0.63
CHL	1.80	1.47	1.25	1.14	1.05	1.05	0.96	0.90	0.91	0.78
CZE	0.84	0.81	0.79	0.77	0.76	0.74	0.72	0.68	0.67	0.60
DEU	1.11	1.00	0.95	0.90	0.86	0.83	0.81	0.78	0.75	0.67
DNK	1.18	0.99	0.95	0.82	0.79	0.74	0.70	0.67	0.67	0.56
ESP	1.60	1.29	1.20	1.11	1.08	1.03	1.01	0.97	0.92	0.83
EST	1.33	0.99	0.89	0.87	0.83	0.85	0.87	0.77	0.77	0.74
FIN	1.19	0.94	0.94	0.90	0.90	0.82	0.83	0.82	0.78	0.69
FRA	1.31	0.98	0.93	0.87	0.83	0.80	0.76	0.75	0.69	0.57
GBR	1.05	0.86	0.77	0.77	0.65	0.65	0.65	0.62	0.60	0.56
GRC	1.58	1.22	1.11	1.03	0.98	0.94	0.84	0.86	0.86	0.76
HUN	1.04	0.94	0.89	0.87	0.82	0.82	0.80	0.78	0.73	0.67
IRL	1.74	1.17	1.06	1.00	0.93	0.91	0.81	0.77	0.74	0.59
ITA	-	-	-	-	-	-	-	-	-	-
KOR	1.28	0.87	0.76	0.73	0.70	0.64	0.62	0.55	0.52	0.47
LUX	1.11	0.79	0.46	0.34	0.30	0.27	0.27	0.25	0.23	0.20
LVA	1.75	1.40	1.22	1.17	1.12	1.10	0.99	0.95	0.90	0.78
NLD	1.67	1.21	1.12	1.04	1.04	0.98	0.97	0.94	0.92	0.80
NZL	1.11	0.83	0.77	0.79	0.75	0.74	0.70	0.69	0.62	0.57
POL	1.29	1.05	0.96	0.92	0.89	0.88	0.83	0.82	0.80	0.71
PRT	1.52	1.23	1.10	0.97	1.01	0.99	0.94	0.90	0.83	0.71
SLV	1.86	1.42	1.23	1.20	1.10	1.05	1.08	1.02	0.97	0.89
SVK	1.14	1.00	0.96	0.94	0.92	0.88	0.86	0.84	0.79	0.73
SWE	1.25	0.89	0.83	0.78	0.75	0.74	0.70	0.68	0.65	0.55
TUR	1.45	1.20	1.13	1.08	1.04	0.99	0.98	0.92	0.87	0.77
Average	**1.35**	**1.06**	**0.97**	**0.91**	**0.88**	**0.85**	**0.82**	**0.78**	**0.75**	**0.66**

Notes. Results calculated using microsimulation models for 27 countries based on household expenditure survey microdata. Results present the weighted mean of total expenditure divided by total income per household. Results presented across equivalised income deciles, with the individual as unit of analysis. See text for further detail. Italy excluded as income data not available. Calculations for Chile, Ireland, Slovenia, Sweden and Turkey include imputed rental expenditure but not imputed rental income (as not reported in the HBS data), potentially biasing upward expenditure-to-income ratios.

Table 3.7. Expenditure-to-income ratios across expenditure deciles

	1	2	3	4	5	6	7	8	9	10
AUT	0.57	0.63	0.72	0.79	0.84	0.92	0.99	1.09	1.16	1.46
BEL	0.69	0.74	0.76	0.81	0.81	0.84	0.91	0.93	1.03	1.42
CHE	0.62	0.72	0.78	0.82	0.85	0.90	0.93	0.96	1.02	1.20
CHL	0.84	0.93	0.98	1.18	1.13	1.29	1.24	1.35	1.18	1.18
CZE	0.57	0.63	0.69	0.72	0.73	0.74	0.77	0.77	0.82	0.94
DEU	0.81	0.82	0.81	0.82	0.82	0.84	0.85	0.86	0.89	1.12
DNK	0.66	0.74	0.76	0.75	0.79	0.82	0.80	0.83	0.88	1.05
ESP	0.97	0.97	0.99	1.04	1.06	1.08	1.13	1.16	1.23	1.39
EST	0.46	0.67	0.72	0.82	0.85	0.89	1.00	1.06	1.11	1.31
FIN	0.62	0.73	0.77	0.81	0.83	0.88	0.89	0.96	1.06	1.25
FRA	0.64	0.74	0.78	0.80	0.81	0.85	0.90	0.92	0.96	1.10
GBR	0.42	0.53	0.60	0.64	0.67	0.70	0.73	0.83	0.88	1.19
GRC	0.81	0.95	0.96	0.98	1.02	1.04	1.06	1.07	1.11	1.18
HUN	0.70	0.73	0.78	0.77	0.82	0.84	0.86	0.89	0.93	1.04
IRL	0.67	0.84	0.89	0.98	1.02	1.07	1.00	1.09	1.07	1.12
ITA	-	-	-	-	-	-	-	-	-	-
KOR	0.63	0.60	0.61	0.63	0.66	0.70	0.71	0.75	0.79	1.06
LUX	0.46	0.42	0.41	0.38	0.40	0.46	0.41	0.40	0.42	0.45
LVA	0.89	0.92	0.96	1.05	1.16	1.15	1.17	1.26	1.35	1.46
NLD	0.85	1.05	0.98	0.99	0.98	1.10	1.10	1.05	1.24	1.34
NZL	0.37	0.54	0.68	0.75	0.76	0.77	0.83	0.83	0.94	1.13
POL	0.78	0.81	0.84	0.85	0.87	0.90	0.94	0.96	1.01	1.20
PRT	0.63	0.78	0.85	0.97	1.00	1.09	1.15	1.23	1.22	1.27
SLV	0.92	1.02	1.03	1.08	1.14	1.14	1.20	1.30	1.37	1.63
SVK	0.78	0.78	0.82	0.85	0.87	0.87	0.90	0.94	1.00	1.24
SWE	0.57	0.63	0.68	0.76	0.75	0.74	0.75	0.89	0.95	1.12
TUR	0.90	0.99	1.00	1.00	1.00	1.02	1.05	1.06	1.13	1.27
Average	**0.69**	**0.77**	**0.80**	**0.85**	**0.87**	**0.91**	**0.93**	**0.98**	**1.03**	**1.20**

Notes. Results calculated using microsimulation models for 27 countries based on household expenditure survey microdata. Results present the weighted mean of total expenditure divided by total income per household. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail. Italy excluded as income data not available. Calculations for Chile, Ireland, Slovenia, Sweden and Turkey include imputed rental expenditure but not imputed rental income (as not reported in the HBS data), potentially biasing upward expenditure-to-income ratios.

3.5.2. Summary measures of progressivity and redistribution

This section presents three summary indicators of progressivity and redistribution to complement the decile averages presented in the previous section. These summary indicators enable clearer judgements to be drawn on the distributional impact of a VAT and for comparisons to be made that are not always possible from the analysis of simple decile averages – such as when non-monotonic patterns arise.

Table 3.8 presents the Kakwani, Reynolds-Smolensky and (change in) Atkinson index results for 26 of the 27 countries. Results for Korea were unable to be calculated due to data access restrictions.[56] Kakwani index results are all low, ranging from 0.0822 in Italy to -0.0188 in New Zealand. In 22 of 26 countries the results are positive, showing the VAT to have a small (but statistically significant) progressive effect. In four countries (Chile, Hungary, Latvia and New Zealand) the results are negative (though not statistically significantly different from zero in Latvia), showing the VAT has a small regressive effect.[57] The Kakwani results are consistent with the decile average results in Table 3.5, which pointed to Chile, Hungary, Korea, Latvia and New Zealand as having the least progressive or potentially regressive VAT.

The slightly regressive results in Chile, Hungary, Latvia and New Zealand provide two interesting insights: first, low spending households in these countries do not benefit significantly from reduced VAT rates. On close consideration, this result is not surprising: Chile and New Zealand both have very few, if any, reduced rates in comparison to the majority of countries covered in this study. Hungary and Latvia also have relatively few reduced rates, and importantly the vast majority of food products (which make up a substantial proportion of total household expenditure) are subject to the standard rate.[58] Second, higher spending households in these – and presumably other – countries spend a greater proportion of their total expenditure on items that are either untaxed or exempt from tax (for example, financial services, international air travel).

[56] HBS microdata for Korea was provided in 2014 for use in an OECD project undertaken by the author on "The Distributional Effects of Consumption Taxes in OECD Countries". That project, and hence the results presented in this chapter, was limited to the production of average tax rates across income and expenditure deciles. The Korea Institute of Public Finance is thanked for its financial support of the 2014 project and for providing access to the Korean data.

[57] Furthermore, sensitivity analysis (see Appendix 1) shows that if a higher degree of economies of scale was applied in the equivalence scale, then the slightly regressive results for Hungary and Latvia could change to slightly progressive.

[58] Note that while Latvia applied the standard VAT rate to all food products except baby food in 2010 (the year modelled), it now also applies a reduced VAT rate to some fresh fruit and vegetables. Hungary now also applies a reduced VAT rate to a wider range of basic food products than in 2010.

Table 3.8. Summary indicators of progressivity and redistribution

	Kakwani	Reynolds-Smolensky	$\frac{t}{1-t}$	Change in Atkinson		
				ε=0.2	ε=0.7	ε=1.2
AUT	0.0428	0.0056	0.1300	0.0010	0.0032	0.0051
BEL	0.0738	0.0082	0.1117	0.0015	0.0045	0.0069
CHE	0.0419	0.0020	0.0469	0.0003	0.0011	0.0018
CHL	-0.0080	-0.0009	0.1099	-0.0004	-0.0009	-0.0007
CZE	0.0114	0.0018	0.1572	0.0002	0.0007	0.0012
DEU	0.0477	0.0049	0.1017	0.0010	0.0029	0.0043
DNK	0.0382	0.0064	0.1665	0.0008	0.0028	0.0045
ESP	0.0401	0.0032	0.0799	0.0006	0.0018	0.0029
EST	0.0153	0.0024	0.1558	0.0004	0.0012	0.0013
FIN	0.0346	0.0043	0.1237	0.0007	0.0022	0.0034
FRA	0.0457	0.0040	0.0867	0.0007	0.0021	0.0030
GBR	0.0277	0.0029	0.1059	0.0006	0.0022	0.0037
GRC	0.0394	0.0040	0.1010	0.0007	0.0024	0.0038
HUN	-0.0059	-0.0010	0.1651	-0.0002	-0.0008	-0.0016
IRL	0.0215	0.0019	0.0876	0.0002	0.0008	0.0014
ITA	0.0822	0.0063	0.0766	0.0016	0.0043	0.0060
LUX	0.0464	0.0031	0.0667	0.0005	0.0018	0.0028
LVA	-0.0007	-0.0001	0.1550	0.0000	-0.0002	-0.0003
NLD	0.0561	0.0054	0.0961	0.0007	0.0024	0.0038
NZL	-0.0188	-0.0025	0.1301	-0.0006	-0.0019	-0.0031
POL	0.0562	0.0069	0.1228	0.0014	0.0042	0.0064
PRT	0.0378	0.0039	0.1026	0.0008	0.0026	0.0042
SLV	0.0478	0.0053	0.1103	0.0009	0.0027	0.0041
SVK	0.0067	0.0010	0.1520	0.0002	0.0006	0.0008
SWE	0.0631	0.0074	0.1175	0.0011	0.0034	0.0049
TUR	0.0106	0.0010	0.0988	0.0003	0.0009	0.0014
Average	**0.0328**	**0.0034**	**0.1138**	**0.0006**	**0.0018**	**0.0028**

Notes. Results calculated using microsimulation models for 27 countries based on household expenditure survey microdata. Kakwani = Kakwani progressivity index; Reynolds-Smolensky = Reynolds-Smolensky redistribution index; $t/(1-t)$ = average tax rate; Change in Atkinson = change in Atkinson inequality index, with ε = degree of inequality aversion. Results calculated using equivalised variables, with the individual as unit of analysis. See text for further detail.

Even the most progressive countries in Table 3.8 exhibit only a low degree of progressivity. This can be seen when compared to typical Kakwani results for the personal income tax. For example, Joumard et al. (2012) found Kakwani indices of between 0.05 and 0.25 for personal income taxes (including employee social security contributions) in 27 of 30 OECD countries examined. More recently, Causa and Hermansen (2017) found Kakwani indices of between 0.1 and 0.25 for personal income taxes in 13 of 15 OECD countries examined. In contrast, the Kakwani index for VAT in Table 3.8 is at most 0.08

(in Italy), and only reaches above 0.05 in another four countries (Belgium, the Netherlands, Poland and Switzerland). These countries all make extensive use of reduced rates and exemptions, but even then this creates only limited progressivity.

Turning to the Reynolds-Smolensky results, it follows logically that the 22 countries with a positive Kakwani index, also have a positive Reynolds-Smolensky redistribution index – showing that inequality has fallen in these countries. Conversely, the four countries with a negative Kakwani index, also have a negative Reynolds-Smolensky index – indicating an increase in inequality. However, in all cases the redistributive effect is very low, ranging from 0.0082 in Belgium to -0.0025 in New Zealand. (For comparison, Joumard et al. (2012) and Causa and Hermansen (2017) found Reynolds-Smolensky indices greater than 0.01 for personal income taxes in 28 of 30 countries, and 14 of 15 countries, respectively). Redistribution is low despite average tax rates typically being above 11%, further emphasising the very low degree of progressivity (or regressivity) in the VAT. This highlights that even in the countries with the most extensive use of reduced rates and exemptions, there is very little impact the VAT can have on redistribution.[59]

The (change in) Atkinson index results support the above findings. Inequality falls in the same 22 countries as with the Reynolds-Smolensky results, and rises in the same four. The largest reduction in inequality is again in Belgium (for medium and high levels of inequality aversion, but in Italy for a low level of inequality aversion), while the largest increase is again in New Zealand. The magnitudes are once again very low, indicating minimal redistribution through the VAT. A higher degree of inequality aversion increases the magnitude of the redistributive effect, though again it remains small, while country rankings remain very similar.

Overall, the results in this section allow us to nuance the conclusions from the average tax rate results to say that the VAT systems in most countries are indeed slightly progressive, but only to a very limited extent and consequently provide very limited redistribution despite significant average tax rates being imposed. Meanwhile, the results for Chile, Hungary, Latvia and New Zealand highlight that broad-based VAT systems that have few reduced VAT rates or exemptions can still produce a small degree of regressivity.

[59] Alternative calculations of the redistributive effect – measured as the difference between the Gini coefficient on gross expenditure and the Gini coefficient on net expenditure (see footnote 51) – are almost identical, indicating almost no re-ranking effect in any country.

3.5.3. Poverty effects of the VAT

The conclusion that the VAT is generally not regressive does not mean that policy makers should not be concerned about its impact on the poor. Assuming diminishing marginal utility of consumption, a proportional VAT will have a greater negative impact on the wellbeing of the poor than of the rich. At the extreme, it may reduce the consumption of necessities by the poor, but merely the consumption of luxuries by the rich.

This section presents three Foster-Greer-Thorbecke (FGT) poverty measures: the "poverty headcount", "poverty gap", and "squared poverty gap" indices. Table 3.9 presents results for the 26 countries for which data were available for the analysis. Looking first at the poverty headcount results, in each country the imposition of the VAT is shown to increase the proportion of individuals below the poverty line. The increase ranges from 1.2 percentage points in the Netherlands, to 5.8 percentage points in Hungary. On average, the imposition of the VAT increases the poverty headcount by three percentage points, from 8.1% to 11.1%.[60]

Some caution needs to be taken in comparing the results for the Czech Republic, New Zealand, Switzerland and the United Kingdom with other countries. Analysis for these four countries excludes housing expenditure due to the unavailability of imputed rental expenditure data. Sensitivity analysis (presented in Appendix 1) shows that the inclusion of housing expenditure has an equalising effect, lowering the net poverty headcount in all 22 countries where housing data was available, and the gross headcount in 20 of 22 countries. It also shows the change in the poverty headcount to be lower (but still positive) in all 22 countries when housing expenditure is included. As such, the results for the Czech Republic, New Zealand, Switzerland and the United Kingdom can be expected to be overstated, though the overall conclusion that the VAT increases the poverty headcount stands.

Turning to the poverty gap calculations, these also increase with the imposition of the VAT in every country. On average, the poverty gap is 1.8% of the poverty line for gross expenditure, but 2.5% for net expenditure. Similarly, the squared poverty gap index increases on average from 0.7% to 0.9%. While these figures may not appear substantial, it should be recalled that they are weighted down by the majority of individuals that are above the poverty line (and hence have a poverty gap of zero).

[60] Sensitivity analysis (see Appendix 1) was again undertaken by applying different equivalence scale parameters, with results showing a small degree of variation in the poverty headcount for both net and gross expenditure. However, as with the results presented in the main text, the poverty headcount was always larger for net expenditure than gross expenditure with the difference between the two measures relatively consistent. As noted in the main text, sensitivity analysis on the impact of housing expenditure was also undertaken for the subset of countries where both actual and imputed rental expenditure data was available. See Appendix 1 for details.

Table 3.9. Poverty indices

Poverty line = 50% of median gross expenditure

	Poverty headcount			Poverty gap			Squared poverty gap		
	gross	**net**	**diff**	**gross**	**net**	**diff**	**gross**	**net**	**diff**
AUT	8.8	12.3	**3.5**	1.9	2.8	**0.8**	0.7	1.0	**0.3**
BEL	7.1	9.2	**2.0**	1.4	2.0	**0.5**	0.4	0.6	**0.2**
CHE	7.4	8.7	**1.3**	1.3	1.6	**0.2**	0.4	0.4	**0.1**
CHL	14.7	19.2	**4.5**	3.7	5.0	**1.3**	1.4	2.0	**0.5**
CZE	4.2	7.3	**3.1**	0.9	1.5	**0.6**	0.3	0.5	**0.2**
DEU	4.2	6.5	**2.3**	0.5	0.9	**0.4**	0.1	0.2	**0.1**
DNK	3.8	7.4	**3.7**	0.5	1.1	**0.6**	0.1	0.3	**0.2**
ESP	8.4	10.6	**2.2**	1.8	2.3	**0.5**	0.6	0.8	**0.2**
EST	13.7	19.5	**5.7**	3.6	5.3	**1.7**	1.5	2.2	**0.7**
FIN	7.2	10.4	**3.2**	1.4	2.1	**0.7**	0.4	0.7	**0.3**
FRA	9.5	11.7	**2.2**	2.3	2.9	**0.6**	0.9	1.1	**0.3**
GBR	12.8	15.8	**3.0**	3.5	4.4	**0.9**	1.4	1.8	**0.4**
GRC	7.7	11.1	**3.3**	1.3	2.0	**0.6**	0.4	0.5	**0.2**
HUN	5.7	11.6	**5.8**	1.0	2.2	**1.2**	0.3	0.6	**0.4**
IRL	6.9	10.0	**3.1**	1.4	1.9	**0.5**	0.5	0.6	**0.2**
ITA	8.4	10.4	**2.0**	1.7	2.2	**0.4**	0.6	0.7	**0.1**
LUX	7.4	9.6	**2.1**	1.3	1.7	**0.4**	0.4	0.5	**0.1**
LVA	10.1	14.5	**4.3**	2.4	3.7	**1.3**	0.9	1.4	**0.5**
NLD	2.9	4.1	**1.2**	0.4	0.6	**0.2**	0.1	0.1	**0.1**
NZL	15.7	20.3	**4.7**	5.0	6.7	**1.7**	2.3	3.1	**0.8**
POL	5.7	8.6	**2.9**	0.9	1.4	**0.5**	0.2	0.4	**0.1**
PRT	11.4	14.7	**3.3**	2.9	3.7	**0.8**	1.1	1.4	**0.3**
SLV	4.2	6.9	**2.7**	0.7	1.1	**0.4**	0.2	0.3	**0.1**
SVK	3.1	6.3	**3.2**	0.5	1.0	**0.5**	0.1	0.3	**0.1**
SWE	4.4	6.5	**2.0**	0.9	1.4	**0.4**	0.5	0.7	**0.2**
TUR	14.2	16.9	**2.7**	3.9	4.9	**1.0**	1.6	2.0	**0.4**
Average	**8.1**	**11.1**	**3.1**	**1.8**	**2.5**	**0.7**	**0.7**	**0.9**	**0.3**

Notes. Results calculated using microsimulation models for 27 countries based on household expenditure survey microdata. Poverty indices expressed as percentages; gross = gross expenditure; net = net expenditure; diff = percentage point difference. Results calculated using equivalised expenditure, with the individual as unit of analysis. See text for further detail.

When comparing results across the three indices, there is generally very little variation in terms of where countries rank. However, a small number of countries exhibit more significant changes. Greece has the 11th highest (net) poverty headcount, but when also taking account of the depth of poverty, it falls four places to 15th (poverty gap index), and a further two places to 17th when also accounting for the degree of inequality amongst the poor (squared poverty gap index). Similarly, Luxembourg drops from 16th (headcount) to 19th (squared poverty gap). In contrast, the Czech Republic increases from 21st (headcount) to 18th (squared poverty gap). Sweden has the 21st highest poverty gap index but the 12th highest squared poverty gap index, highlighting the impact of the VAT on inequality amongst the poor. These variations illustrate the importance of considering broader aspects of poverty than just frequency alone.

3.6. Conclusion

This chapter has used a household expenditure microdata set of unprecedented size to examine the distributional effects of the VAT in 27 OECD countries. It has followed a consistent microsimulation methodology across countries to ensure comparability of results.

Average tax rate results presented across disposable income and expenditure deciles broadly confirm the dichotomous results from previous smaller-scale studies: the VAT appears to be regressive when measured as a percentage of current income in all 27 countries, but appears generally either proportional or slightly progressive when measured as a percentage of current expenditure. The paper has illustrated the misleading effect of savings behaviour on results when measured as a percentage of income, showing that expenditure-based results provide a more reliable means of assessing the distributional effect of the VAT.

Using equivalised expenditure as the welfare metric, these results are then confirmed by calculations of summary indicators of progressivity and redistributive effect. Kakwani progressivity index results show a low degree of progressivity in almost all countries, often extremely close to proportionality. The exceptions are Chile, Hungary, Latvia and New Zealand where a very small degree of regressivity is found. Reynolds-Smolensky and (change in) Atkinson index results show the VAT to have minimal redistributive effect – driven by the very low degree of progressivity and despite significant average tax rates being applied.

The chapter has also examined the effect of the VAT on the poor by calculating a range of Foster-Greer-Thorbecke poverty indices. Based on a relative poverty line of 50% of median equivalised gross expenditure, results show that the imposition of VAT increases the number of individuals below the poverty line (the poverty headcount) by three percentage points, on average, from 8.1% to 11.1%. Poverty gap and squared poverty gap index calculations also show similar increases.

Overall, the chapter finds that the VAT is generally either roughly proportional or slightly progressive in a lifetime context, with this progressivity driven by the presence of reduced VAT rates and exemptions. This strongly contrasts with the general public perception that VAT systems are regressive.

Nevertheless, the results for Chile, Hungary, Latvia and New Zealand highlight that broad-based VAT systems that have few reduced VAT rates or exemptions can still produce a small degree of regressivity. Furthermore, the results clearly show that even a roughly proportional VAT can have significant equity implications for the poor. This emphasises the importance of ensuring the progressivity of the tax/benefit system as a whole in order to compensate poor households for the loss in purchasing power from paying VAT. The merits of using reduced VAT rates to achieve such distributional goals is the focus of the next chapters.

CHAPTER 4. ESTIMATING BEHAVIOURAL RESPONSES TO VAT RATE CHANGES

4.1. Introduction

Reduced VAT rates are used in most OECD countries to achieve distributional goals. Chapter 3 found that the presence of reduced VAT rates leads to a small degree of progressivity in many countries' VAT systems. The next three chapters focus on the distributional effects of reduced VAT rates, examining whether they are an effective way to provide support to poorer households, and whether the use of targeted cash transfers would be more effective.

This analysis is undertaken by extending the non-behavioural microsimulation models developed in Chapter 3 to take account of behavioural effects, and then using these models to simulate a range of policy reforms. It is necessary to account for behavioural responses in these simulations because they alter the relative prices of goods and services, and the resulting changes in consumption patterns will affect post-reform revenue and welfare. This chapter presents the methodology for incorporating behavioural effects into the microsimulation models, while the subsequent two chapters apply the models to simulate policy reforms.

Ideally, behavioural responses would be incorporated into the models through the estimation of a demand system for each country. However, full estimation of a demand system has large data and resource requirements – with both household expenditure microdata and corresponding disaggregated price data typically needed across a number of years for each country. For the majority of the 27 countries considered in this study, only a single year of household expenditure microdata is available, and matching disaggregated price data are also only available for a subset of the countries. Furthermore, the resource requirements of modelling a demand system are extensive, meaning that, even if data were available, estimation of 27 demand systems would be well beyond the scope of a doctoral thesis.[61]

Given these data constraints, an approach is needed based on a single year of cross-sectional household expenditure data. Creedy and Sleeman (2006) propose such an approach based on the Linear

[61] For example, IFS (2011a) utilised separate research teams in each of the five countries they covered in order to estimate their Quadratic Almost Ideal Demand System (QUAIDS) models.

Expenditure System (LES). This approach first uses cross-sectional household expenditure data to estimate expenditure elasticities for a range of expenditure groupings and household types. With these expenditure elasticities, a simplifying result for additive utility functions found by Frisch (1959) is then applied to compute price and cross-price elasticities. These estimated elasticities can then be used to estimate revenue changes as well as the underlying parameters of the LES – enabling welfare effects to also be estimated. This approach is adopted for 23 of the 27 countries covered in the previous chapter, with the remaining four countries (Chile, Denmark, Korea and New Zealand) excluded due to various data limitations.

The LES-based approach is not without limitations. In particular, the assumption of additive preferences excludes the possibility of both inferior goods and complements – although these limitations can be minimised by adopting broad expenditure groups in the modelling. Nevertheless, price elasticity estimates are driven far more by the structure of the model itself, than by the data as compared to typical demand system estimation that uses price variation for identification. Creedy (1998b), however, emphasises that this is a reasonable trade-off to make for the ability to produce a large number of elasticity estimates drawing only on cross-sectional household expenditure data.

The behavioural models cover between eight and 18 different expenditure groups, depending on the country, with elasticities estimated separately for 11 different household types to allow for heterogeneity of preferences. Expenditure and price elasticity estimates are highly plausible. Food (including non-alcoholic beverages), housing rental, domestic energy and housing services are generally found to be necessities. Clothing, cultural expenditure, and restaurants and hotels are almost always found to be luxuries. Food, in particular is always a clear necessity. Furthermore, reduced-rated food is found to be more inelastic than standard-rated food in six of the eight countries where multiple rates are modelled for food, reflecting the "staple" nature of food products typically subject to reduced VAT rates.

By construction, the price elasticities follow a similar pattern to the expenditure elasticities with own-price elasticities roughly (negative) 50-60 percent of the value of the corresponding expenditure elasticities. This illustrates the fact that, while expenditure elasticity estimates are data-driven, the model itself – rather than the data – drives significantly the price elasticity results. Given this rough proportionality between expenditure and price elasticities, it is the necessities that are the least price responsive and luxuries that are the most price responsive. In almost all cases though, own-price elasticities are below one, though in many countries the luxury groupings tend to be very close to (and occasionally slightly over) one.

The chapter proceeds as follows: Section 4.2 discusses the methodological approach, including the data used; Section 4.3 presents the expenditure and price elasticity results for the 23 countries examined; and Section 4.4 concludes.

4.2. Methodology

The empirical methodology adopted follows broadly that proposed by Creedy and Sleeman (2006) to examine the welfare effects of indirect tax reforms. This approach builds on earlier work by Cornwell and Creedy (1996, 1997) and Creedy (1998b), and was most recently adopted by Ball et al. (2016) to examine the distributional effects of zero-rating GST on food in New Zealand.

The approach first utilises cross-sectional household expenditure microdata to estimate expenditure elasticities for a range of expenditure groups and household types. It then utilises a result obtained by Frisch (1959) for additive utility functions to estimate price elasticities using the expenditure elasticities, predicted budget shares and the (exogenously determined) elasticity of the marginal utility of total expenditure with respect to total expenditure (the "Frisch parameter"). These elasticity estimates are then incorporated within the framework of the (additive preference-based) Linear Expenditure System (LES) to enable welfare analysis of tax reforms. In addition to welfare analysis, I also estimate changes in post-reform expenditure and VAT revenue by incorporating the estimated elasticities into a tax microsimulation model.

While the assumption of additive preferences enables the calculation of price elasticities when price data are not available, this ability does come at a cost. As highlighted by Deaton (1974, 1980), additive preferences exclude the possibility of inferior goods (expenditure elasticities must be positive) and complements (cross-price elasticities must be positive), and also imposes a rough proportionality between expenditure and price elasticities. The plausibility of the first two restrictions can be significantly increased by applying the model to relatively broad expenditure groupings. The rough proportionality between expenditure and price elasticities cannot be avoided and is not, in general, supported by the results of modelling utilising price data.[62]

Creedy (1998b) argues that the restrictiveness of the LES is a reasonable trade-off to make for the ability to produce a large number of elasticity estimates drawing only on cross-sectional household expenditure data. Furthermore, as Ball et al. (2016) point out, the alternative is to make the clearly unrealistic assumption of no behavioural response to price changes. Additionally, while a comparison of simulation

[62] This is a well-established criticism – first illustrated by Deaton (1974).

results from LES and QUAIDS models for New Zealand (see Appendix 2) shows some variation in elasticity estimates, the resulting policy conclusions are consistent – suggesting the LES-based approach provides a reasonable estimate of behavioural responses to VAT rate changes. Nevertheless, the restrictive assumptions underlying the price elasticity results means they should be considered with some caution.

The general approach is outlined in more detail below (including elasticity estimation, incorporation within the tax microsimulation model, and the LES), before the data and estimation of the approach is discussed.

4.2.1. Estimating expenditure and price elasticities

The first step in the approach is to estimate expenditure elasticities from cross-sectional household expenditure microdata. Following Creedy and Sleeman (2006), the following relationship between budget shares and total household expenditure is estimated separately for each household type:

$$w_i = \delta_{1i} + \delta_{2i} \log m + \frac{\delta_{3i}}{m} \tag{1}$$

where w_i is the budget share for good i, and m is total household expenditure. This functional form is an extension of the basic Working-Leser (Working, 1943; Leser, 1963) model, which is the basis for the almost ideal (AI) model of Deaton and Muellbauer (1980a,b).[63] As noted by Creedy and Sleeman (2006), a convenient property of this functional form is that OLS estimation ensures that the adding up condition, $\sum_{i=1}^{n} w_i = 1$, holds for the predicted budget shares. Creedy and Sleeman (2006) find this extended Working-Leser form provides a close fit using New Zealand data, while Creedy (1998c) finds a good fit using Australian data.

The expenditure elasticity can be defined as:

$$e_i = 1 + \frac{dw_i}{dm}\frac{m}{w_i} \tag{2}$$

Given equation (1), this can be expressed as:

$$e_i = 1 + \frac{(m/\delta_{3i})\delta_{2i} - 1}{(m/\delta_{3i})(\delta_{1i} + \delta_{2i} \log m) + 1} \tag{3}$$

[63] The Working-Leser model excludes the final term. The AI model extends the Working-Leser model to include the effects of prices (see Deaton and Muellbauer, 1980b, p75).

The relevant parameters from the budget share regressions can then be used to calculate the expenditure elasticities for each good for each household.

Knowing e_i, the price- and cross-price elasticities can then be calculated by applying Frisch's (1959) result for directly additive utility functions. Frisch (1959) showed that price and cross-price elasticities can be written as:

$$e_{ij} = -e_i w_j \left(1 + \frac{e_j}{\xi}\right) + \frac{e_i \delta_{ij}}{\xi} \tag{4}$$

where δ_{ij} is the Kroneker delta ($\delta_{ij} = 1$ if $i = j$, and zero otherwise), and ξ is the elasticity of the marginal utility of total expenditure with respect to total expenditure (the "Frisch parameter").[64] The Frisch parameter cannot be determined from cross-sectional expenditure data and so an assumption must be made regarding its level.

4.2.2. The tax microsimulation model

These elasticity estimates can be incorporated into a tax microsimulation model to enable the change in tax paid as result of a tax reform to be simulated. The basic input into the model is the predicted pre- and post-reform budget shares for each household. The predicted pre-reform budget shares are calculated using equation (1). The predicted pre-reform budget shares are used rather than the actual budget shares from the microdata. As noted by Capéau et al. (2014), this avoids "ascribing deviations from the model to effects of the tax reform" (p242). Total expenditure is assumed to remain unchanged post-reform, so it is only the budget shares that change. The post-reform budget shares are calculated under the assumption that the tax rate changes are fully passed on to the consumer in prices.[65] Following Creedy (1998b), the post-reform budget share of good i can be calculated as follows[66]:

$$w_i^{new} = \widehat{w}_i\left(1 + \dot{p}_i + \textstyle\sum_j^n e_{ij}\dot{p}_j\right) \tag{5}$$

where w_i^{new} is the post-reform budget share of good i, $\widehat{w}_i$ is the predicted budget share of good i from equation (1), and $\dot{p}_i$ and $\dot{p}_j$ are the percentage changes in the prices of goods i and j.

[64] More precisely, Frisch (1959) showed that with additive preferences cross-price elasticities can be expressed as $e_{ij} = -e_i w_j \left(1 + \frac{e_j}{\xi}\right)$ and own-price elasticities as $e_{ii} = -e_i \left(w_i - \frac{1 - w_i e_i}{\xi}\right)$. (Frisch refers to "want independence" rather than additive preferences, though they are equivalent in meaning).

[65] This is a standard assumption in the literature. See Chapter 3 for further discussion.

[66] Creedy (1998b) presents equation (5) in terms of post-reform expenditure level rather than post-reform budget share as expressed here.

The microsimulation model allocates the applicable pre- and post-reform VAT rates to the expenditure groupings in the model and then calculates the tax paid in each scenario. VAT rates for the pre-reform scenario are those corresponding to the year of the underlying HBS data in each country.

4.2.3. The Linear Expenditure System and welfare analysis

While the elasticity estimates alone are sufficient to model the changes in tax payments from a reform, it is necessary to use a demand model in order to undertake welfare analysis. As the Linear Expenditure System (LES) is based on additive preferences, it is feasible to incorporate the elasticity estimates derived from Frisch's (1959) result into the LES. The LES is based on the following additive utility function:

$$U = \prod_{i=1}^{n} (x_i - \gamma_i)^{\beta_i} \qquad (6)$$

where U is utility, x_i is the total consumption (quantity) of good i, and γ_i is the committed consumption of good i. The restrictions that $x_i > \gamma_i$, $0 \leq \beta_i \leq 1$ and $\sum_{i=1}^{n} \beta_i = 1$ are imposed. Maximising equation (6) subject to the budget constraint $m = \sum_{i=1}^{n} p_i x_i$ results in the linear expenditure functions:

$$p_i x_i = \gamma_i p_i + \beta_i \left(m - \sum_{j=1}^{n} p_j \gamma_j \right) \qquad (7)$$

Expenditure and price elasticities can be obtained by differentiating equation (7) and rearranging. Expenditure elasticities are:

$$e_i = \frac{\beta_i}{w_i} \qquad (8)$$

Own-price elasticities are:

$$e_{ii} = \frac{\gamma_i (1 - \beta_i)}{x_i} - 1 \qquad (9)$$

Cross-price elasticities are:

$$e_{ij} = \frac{\beta_i \gamma_j p_j}{p_i x_i} \qquad (10)$$

Rather than estimating equation (7), following Creedy and Sleeman (2006) it is possible to indirectly calculate the parameters of the LES to undertake welfare analysis. Crucially, this only requires the percentage changes in prices to be known, not the actual prices. Rearranging equations (8) and (9), respectively, gives:

$$\beta_i = e_i w_i \qquad (11)$$

and

$$p_i \gamma_i = \frac{m w_i (1 + e_{ii})}{1 - \beta_i} \tag{12}$$

Having estimated e_i and e_{ii}, both β_i and $p_i \gamma_i$ can then be calculated and used to estmate the welfare change of a reform. To calculate the welfare change of a reform, the compensating or equivalent variation can be calculated from the expenditure function. The compensating variation (CV) can be calculated as:

$$CV = E(u^0, p^1) - E(u^0, p^0) \tag{13}$$

where p^0 and p^1 are pre- and post-reform prices, respectively, and u^0 is pre-reform utility.

The indirect utility function of the LES can be obtained from equation (6) as:

$$V(p, m) = (m - A)/B \tag{14}$$

where:

$$A = \sum_{i=1}^{n} p_i \gamma_i \tag{15}$$

$$B = \prod_{i}^{n} \left(\frac{p_i}{\beta_i} \right)^{\beta_i} \tag{16}$$

Rearranging equation (14) gives the expenditure function:

$$E(p, u) = A + Bu \tag{17}$$

Substituting equation (17) into (13), gives:

$$CV = (A^1 + B^1 u^0) - (A^0 + B^0 u^0) \tag{18}$$

Further substituting equation (14) for u^0 in (18) then gives:

$$CV = A^0 \left[\frac{A^1}{A^0} + \frac{B^1}{B^0} \left(\frac{m^0}{A^0} - 1 \right) \right] - m^0 \tag{19}$$

A^1/A^0 and B^1/B^0 can be calculated as follows to evaluate equation (19) using the estimated LES parameters and the percentage changes in prices ($\dot{p}_i$):

$$\frac{A^1}{A^0} = 1 + \sum_{i=1}^{n} s_i \, \dot{p}_i \tag{20}$$

where:

$$s_i = \frac{p_i^0 \gamma_i}{\sum_{i=1}^{n} p_i^0 \gamma_i} \tag{21}$$

and

$$\frac{B^1}{B^0} = \prod_{i}^{n} (1 + \dot{p}_i)^{\beta_i} \tag{22}$$

As with the tax calculations, the price changes are calculated under the assumption that the tax rate changes are fully passed on to the consumer in prices.

4.2.4. Data and expenditure groupings

Estimation of equation (1) requires only cross-sectional household expenditure microdata. As such, the Eurostat-format Household Budget Survey (HBS) dataset used in Chapter 3 can also be used here. This dataset includes cross-sectional HBS microdata for 22 European Union (EU) countries, as standardised and provided by Eurostat, plus microdata for an additional five non-EU countries obtained directly from National Statistical Offices and then adjusted into the standardised Eurostat format. The data relate to various years, in most cases between 2008 and 2012. Access to data for Korea was only provided for the non-behavioural modelling and analysis undertaken in Chapter 3, and hence was not able to be utilised in the behavioural modelling in this and subsequent chapters. Additionally, as the subsequent analysis focuses on the effects of removal of reduced VAT rates, three countries with insufficient reduced rates to enable such analysis (Chile, Denmark and New Zealand) are also excluded from the analysis – leaving a dataset comprising 23 countries.[67]

The HBS microdata includes over 200 expenditure categories and these must be grouped together in order to feasibly estimate the expenditure elasticities. Expenditure groupings are determined based on two factors. First, the groupings are made to match as accurately as possible the structure of the VAT system in each country. This is both to maximise the accuracy of the modelling of tax revenue and to ensure that the model can accommodate the types of simulations to be undertaken in the subsequent analysis in Chapters 5 and 6 – specifically the removal of reduced rates applying to specific types of expenditure.

[67] Chile and New Zealand were excluded as they have no reduced VAT rates matching the available HBS expenditure categories (though they do have a number of exemptions). Denmark has reduced rates that are able to be matched to HBS categories, but data limitations meant none of these expenditure categories subject to reduced VAT rates were able to be isolated and examined in the behavioural modelling.

Second, broad expenditure groupings are maintained where feasible. This ensures the data conforms as much as possible with the limitations imposed by the assumption of additive preferences. Specifically, by adopting broad expenditure groupings, inferior goods and complements are more likely to be subsumed within a broader expenditure grouping. From a practical modelling perspective, adopting broad groupings minimises the number of extremely low (but non-zero) predicted budget shares arising from estimation of equation (1) which, for some observations, can mechanically produce negative expenditure elasticities.[68] Given the degree of variation in the underlying budget shares in the microdata, it is impossible to eliminate all negative expenditure elasticities. However, by applying broad groupings, it is possible in almost all cases to limit the number of negative expenditure elasticities to less than 3% of observations in any expenditure group. To maintain consistency with the LES, these remaining negative expenditure elasticities are set equal to zero.[69]

Unfortunately, the above two criteria sometimes conflict, meaning that it was not always feasible to separate out all expenditure categories subject to reduced rates. The following base scenario of 16 expenditure groupings was used for each country and was then adapted as necessary to meet the above criteria:

1. Food and non-alcoholic beverages (for home consumption)
2. Alcohol and tobacco
3. Clothing and footwear
4. Housing rental (actual and imputed)
5. Domestic utilities (energy, water, refuse and sewage)
6. Household durables
7. Household services
8. Pharmaceuticals
9. Healthcare services
10. Transport fuels
11. Passenger transport
12. Cultural expenditure (cinema, theatre, concerts; museums, zoos; books; newspapers and magazines)
13. Restaurants and hotels

[68] Equation (3) can be expressed as $e_i = 1 + [\delta_{2i} - (\delta_{3i}/m)]/\widehat{w}_i$, where $\widehat{w}_i$ is the predicted budget share of good i. Where the term $[\delta_{2i} - (\delta_{3i}/m)]$ is negative, a very low predicted budget share can magnify this term to a value greater than one, resulting in a negative expenditure elasticity estimate for the particular observation.
[69] Minor adjustment is consequently made to the predicted expenditure levels in the model (maintaining the predicted post-reform budget shares) to ensure that total expenditure remains unchanged post-reform.

14. Financial services
15. Other expenditure taxed at the standard VAT rate
16. Other expenditure not taxed at the standard VAT rate

Food

Food and non-alcoholic beverages for home consumption ("food" hereafter) is the most common expenditure type to be subject to reduced VAT rates in OECD countries. In only two of the 23 countries modelled (Estonia and the Slovak Republic) are no reduced rates levied on any food products. In 12 countries (out of the 23 modelled) all food is subject to a single reduced VAT rate. Two countries (Poland and Portugal) apply a standard, reduced and super-reduced rate to food, and all three groupings can be separately modelled. Four countries apply a standard rate and a single reduced VAT rate to some food products with both able to be modelled separately.

Latvia only applies a reduced VAT rate to baby food, but this expenditure category is too small to be separated from standard-rated food without producing a large number of negative expenditure elasticities. As such, it is grouped together with standard-rated food. In Spain and Turkey, a reduced and a super-reduced VAT rate is applied to food, but the small size of the super-reduced categories means they are unable to be separated out in the modelling. In these last three countries, an average VAT rate is applied to the single food grouping (weighted by the average budget shares of the two sub-groups in the sample).[70]

Clothing and footwear

Four countries apply a reduced VAT rate to children's clothing and footwear (Ireland, Luxembourg, Turkey and the United Kingdom) and, for these countries, adult's and children's clothing expenditure can be separated in the modelling. Turkey in fact applies a reduced rate to both adult's and children's clothing and footwear and they are able to be modelled separately. Meanwhile, Poland applies a reduced rate just to baby clothes, but this category is too small to be separated out in the modelling.

Domestic utilities

Various types of domestic utilities are often subject to reduced VAT rates in OECD countries. The underlying HBS microdata includes expenditure categories for six types of domestic energy (electricity;

[70] Negative expenditure elasticities for food were found for a surprisingly large number of households in Ireland (approximately 6% of households). This was driven by the general variation in the data, and combining both standard- and reduced-rated food together did not reduce the number of households with negative expenditure elasticities to the level observed in other countries (approximately 2-3% of households). Therefore, the standard- and reduced-rated groups are maintained as separate groups in the modelling, with the negative expenditure elasticities set equal to zero.

town and natural gas; liquefied hydrocarbons; liquid fuels; solid fuels; and district heating) and three types of housing services (water supply; refuse collection; and sewage collection). Ideally, those categories subject to reduced rates in each country would be included separately in the behavioural modelling. Unfortunately, each category makes up only a very small component of total expenditure thereby often creating the same problem as above with negative expenditure elasticities. As such, it was necessary to group together either all domestic energy, all housing services, or all utilities (i.e. all domestic energy and housing services).

In 10 countries, the tax treatment of different utilities is sufficiently similar to allow all utilities to be grouped together. In four of these countries (Finland, the Slovak Republic, Switzerland and Turkey), the standard VAT rate applies to all categories. In the other six countries, an average rate is applied (again, weighted by the average budget shares of the sub-groups in the sample). In light of the imperfect nature of this grouping, only the two countries where more than 90% of the overall grouping is subject to reduced rates (Ireland and Luxembourg) are used for simulating the removal of reduced rates in the subsequent chapters.

In the remaining 13 countries, the tax treatment of utilities is sufficiently different that they cannot be easily combined. In eight of these countries (Austria, Belgium, the Czech Republic, Germany, Greece, Latvia, the Netherlands and Slovenia), it is possible to model separately domestic energy, although housing services expenditure is too small, on average, for it to be modelled separately. In these countries, housing services expenditure is instead included in one of the two "other expenditure" groupings according to their tax treatment. In contrast, in Poland, housing services can be modelled separately, but not domestic energy – which is included in the "other expenditure (standard-rated)" grouping. In Spain, it is possible to model domestic energy and housing services as separate groupings. In the remaining three countries (Estonia, Sweden and the United Kingdom), it was not possible to include either domestic energy or housing services separately, and so both were included in the appropriate "other expenditure" grouping.

Pharmaceuticals and healthcare

Pharmaceuticals are another common expenditure type that is typically subject to a reduced VAT rate. This is the case in 22 of the 23 countries modelled (the exception being Germany). While expenditure on pharmaceuticals varies considerably across countries, it is possible to include pharmaceuticals separately in the behavioural model for 17 countries. Meanwhile, expenditure on doctors, dentists and hospitals – which are exempt in most countries – can be grouped into a separate "other healthcare" grouping and included in the behavioural model in 13 countries.

In four countries (Finland, Hungary, Ireland and the United Kingdom), the comparatively low expenditure level on pharmaceuticals meant it was necessary to combine pharmaceuticals with other healthcare. In these countries, an average rate was then applied (treating exemptions as zero rates). Due to the differential rates of taxation applied in these groupings, their tax rate is not altered in the subsequent simulations.

In Greece, it was possible to model separately the "other healthcare" grouping but not pharmaceuticals, and so pharmaceuticals were included in the "other expenditure (reduced/exempt)" grouping. In Sweden, it was not possible to include pharmaceuticals or other healthcare either separately or grouped together. As such, the two components were included in the respective "other expenditure" groupings. In a further five countries (Estonia, Germany, Italy, Latvia and the Slovak Republic), pharmaceuticals were able to be modelled separately, but other healthcare could not. In these cases, other healthcare was again included in the relevant "other expenditure" grouping.

Transport

Passenger transport, which is also often subject to reduced VAT rates, can be modelled separately in 18 of the 23 countries. Meanwhile, transport fuels can be modelled separately in 17 countries. In three countries (Estonia, Hungary and Sweden), standard-rated passenger transport and transport fuels are grouped together in the modelling. In the Czech Republic and the United Kingdom, reduced-rated passenger transport cannot be modelled separately, and so is included in the "other expenditure (reduced/exempt)" grouping rather than being combined with standard-rated transport fuels. In Latvia, Poland and Switzerland, (standard-rated) transport fuel expenditure is not able to be modelled separately, and so is included in the "other expenditure (standard-rated)" grouping rather than being combined with reduced-rated passenger transport.

An additional modelling difficulty arises regarding international air transport, which is zero-rated in every country (due to the difficulty in allocating taxing rights between countries). Unfortunately, domestic and international passenger transport cannot be distinguished in the HBS data. As such, a simplifying assumption is made that all passenger transport is domestic. Due to this modelling limitation, the passenger transport grouping's tax rate is not altered in the subsequent simulations.

Cultural expenditure

The underlying HBS microdata includes four cultural expenditure categories that are commonly subject to concessionary VAT treatment: cinema, theatre and concerts; museums, zoos and the like; books; and newspapers and magazines. In general, these categories are relatively small thereby creating the same problem as above regarding negative expenditure elasticities. However, due to the either identical or very similar rate structure for these four categories they have been able to be grouped together in 19 countries so that the behavioural model can still examine the effect of reduced VAT rates on cultural expenditure as a whole.

In six countries (the Czech Republic, Germany, Luxembourg, the Netherlands, Slovenia and Sweden) the same VAT rate applies to all four categories making their aggregation straight forward. In a further nine countries (Belgium, Finland, France, Greece, Ireland, Poland, Portugal, Spain and Turkey) a mix of reduced and super-reduced VAT rates are applied to the four categories.[71] In these countries all four categories are grouped together with a weighted average rate applied. In Austria and Italy, one of the four categories is exempt while the others are subject to reduced rates. In these two cases, the exempt category is treated as zero-rated and the four categories are again grouped with an average rate applied. As noted previously, treating an exemption as a zero rate overlooks the embedded VAT within the production chain. However, the small budget shares (less than 4% of the overall culture group in each case) suggest any resulting inaccuracy will be minimal and this cost is judged to be outweighed by the benefit of being able to group and examine the overall cultural expenditure group for these two countries.

In five countries (Estonia, Hungary, Latvia, Switzerland and the United Kingdom), the books and newspaper categories are reduced-rated, but the cinema and museum categories are standard rated. In these countries, the books and newspaper categories are able to be grouped together. However, the smaller cinema and museum categories are not able to be grouped together and are instead included in the "other expenditure (standard-rated)" grouping.

In the Slovak Republic only books are subject to a reduced rate. Fortunately, it is of sufficient size to be a group on its own. The remaining cultural expenditure categories are not able to be separated and are instead grouped together. Museums are exempt, while the cinema and newspaper categories are subject to the standard rate. A weighted average rate is therefore applied, but due to the mix of concessionary and non-concessionary rates no simulations are undertaken with this grouping.

Restaurants and hotels

Restaurants (including canteens and cafeterias) and hotels (including other accommodation services, such as motels and "bed and breakfasts") are two further expenditure categories in the HBS data that

[71] In Ireland and Portugal, recreation expenditure is also reduced-rated, and is added to the culture grouping.

are very commonly subject to reduced rates in OECD countries. However, as with the cultural expenditure categories, these categories are too small to be included separately in the behavioural model. As such, they are combined into one group, where feasible.

In 14 countries the same VAT rate (whether standard or reduced) applies to both categories so the two can be grouped easily. In another three countries (Belgium, Finland and Portugal) a combination of reduced and super-reduced rates are applied, so a weighted average VAT rate is applied to the combined group.[72] In the remaining six countries (the Czech Republic, Estonia, Hungary, Latvia, Sweden and Switzerland), only one of the two categories is subject to a reduced rate. Unfortunately, the individual categories are too small to include separately in the behavioural model and so both categories are included in one of the two "other expenditure" groupings according to their tax treatment.

Other trade-offs

A number of other trade-offs are required in constructing the expenditure groupings to minimise the number of negative expenditure elasticities. In Italy and Poland, household durables were included in the "other expenditure (standard rated)" grouping. In Estonia, Finland, Germany and Turkey, financial services were included in the "other expenditure (reduced/exempt)" grouping. Also in Estonia, alcoholic beverages were grouped together with food and non-alcoholic beverages, leaving tobacco in a group on its own.

A further modelling complexity relates to durables. Most pertinently, the inclusion of one-off vehicle purchases consistently resulted in large numbers of negative expenditure elasticities in all 23 countries. As such, vehicle purchases were excluded from the analysis. For 20 of 23 countries, imputed housing rental expenditure was available. For these countries, a single (actual plus imputed) housing expenditure grouping was included in the analysis. However, in the three countries where imputed rental expenditure was not available (the Czech Republic, Switzerland and the United Kingdom) actual rental expenditure was also excluded from the analysis to avoid creating a bias between homeowners and renters.[73]

[72] Some countries (e.g. Austria, Belgium) apply a reduced VAT rate to food consumed in a restaurant but not to alcohol consumed with the meal. The HBS data typically does not separate out restaurant food and alcohol, and so for such countries the modelling effectively assumes that all restaurant expenditure is on food.

[73] In two countries (Austria and Ireland) the inclusion of the (actual plus imputed) rental expenditure grouping resulted in a large number of negative expenditure elasticities (around 7% of observations). Given the importance of the grouping and the lack of similar expenditure to group it with, the rental expenditure grouping has still been included in the behavioural model. As with other instances, negative expenditure elasticities are set equal to zero in the modelling.

4.2.5. Estimation

Equation (1) is estimated by ordinary least squares, with robust standard errors applied to account for potential heteroscedasticity.[74] To improve the fit of the model, regressions are run separately for 11 different household types for each expenditure group. Creedy and Sleeman (2006) broke their data into 36 household types (18 groups with a smoking and non-smoking version). However, a smaller number of household types was necessary here due to the often limited sample sizes across the 23 countries covered in this study. Nevertheless, this still results in between 88 and 198 regressions being run per country, and 3,740 in total.

Given the large number of regressions, the underlying regression results are not reported – with analysis focusing instead on the elasticity estimates. As found by Creedy and Sleeman (2006), distinguishing between smoking and non-smoking households was found to significantly improve the fit of the regressions. The 11 household types adopted are as follows:

1. Single individual without children
2. Single individual with children
3. Two adults without children
4. Two adults with children
5. More than two adults without children
6. More than two adults with children
7. Single individual with or without children, smoker[75]
8. Two adults without children, smoker
9. Two adults with children, smoker
10. More than two adults without children, smoker
11. More than two adults with children, smoker

As noted previously, ordinary least squares estimation ensures that the predicted budget shares for each observation add to one. However, it does not ensure that the predicted budget shares are all positive. As such, an adjustment is made, when necessary, setting the small number of negative predicted budget shares to zero and adjusting the other budget shares accordingly to ensure adding up. These 'adjusted' predicted budget shares are used in equation (3) to calculate the expenditure elasticities.

[74] Prior to estimation, a number of observations were removed from the sample to address data quality concerns. These were: observations with an expenditure-to-income ratio greater than two; observations with negative income; and observations with zero food expenditure.

[75] A smoking household is defined as a household with positive expenditure on tobacco products.

The small number of negative expenditure elasticities that result from equation (3) are set to zero prior to calculation of price elasticities as per equation (4). The variability in the underlying data also results in a small number of unrealistically large expenditure elasticities. To address this, any elasticity estimate greater than four is set equal to four.[76]

Following Creedy and Sleeman (2006), a Frisch parameter of -1.9 is used in equation (4) to calculate price elasticities. As with Creedy and Sleeman (2006), I undertake sensitivity analysis around this figure, finding no impact on the overall conclusions of the analysis based on the models unless large variation in the Frisch parameter is assumed for households with different expenditure levels. This sensitivity analysis is summarised in Appendix 1.[77]

4.3. Results

Expenditure and own-price elasticity results for the 23 countries covered in the chapter are presented in Tables 4.1 and 4.2, respectively. Due to the large number of cross-price elasticities, these are not reported. Tables 4.1 and 4.2 present the weighted means of the elasticity estimates for each expenditure group. An alternative approach would be to present elasticities evaluated at the means of the variables. Such an approach is adopted in the QUAIDS model for New Zealand in Chapter 7, but is not possible here because the individual elasticity estimates are calculated based on 11 different sets of regression parameters relating to each household type. That said, both approaches produce very similar figures for the QUAIDs model, so both can be expected to provide a good summary figure of elasticity results. A further consequence of the separate parameter estimates for each household type is that standard errors cannot be computed for the means presented in Tables 4.1 and 4.2.

4.3.1. Expenditure elasticities

Expenditure elasticity results, in general, broadly conform with ex ante expectations of typical necessity or luxury goods. The food, housing rental, domestic energy and housing services groupings are generally found to be necessities, with elasticity values less than unity; clothing, cultural expenditure, and restaurants and hotels are almost always found to be luxuries, with elasticity values above unity.

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[76] These two adjustments to the expenditure elasticity estimates result in a very small difference between pre-reform total expenditure and predicted post-reform total expenditure. As such, a further adjustment is made to ensure total expenditure remains unchanged (maintaining the predicted post-reform budget shares). This typically involves less than 1% variation in predicted total expenditure.

[77] It may be expected that the Frisch parameter would fall (in absolute value terms) as expenditure rises. This was indeed the expectation expressed by Frisch. Cornwall and Creedy (1997, 1998), for example, consequently applied a Frisch parameter that fell with expenditure. More recent papers have, however, adopted a fixed Frisch parameter. For example, Creedy and Sleeman (2006) apply a fixed value of -1.9 and carry out sensitivity analysis around this, finding that analytical results were not sensitive to the adoption of a fixed rather than falling parameter.

Food, in particular is always a clear necessity. Furthermore, reduced-rated food is found to be more inelastic than standard-rated food in all eight countries where multiple rates are modelled for food, reflecting the 'staple' nature of food products typicaally subject to reduced VAT rates. This pattern is most clearly illustrated in Poland and Portugal where three VAT rates are applied to food with typical staple food groups subject to the super-reduced rate.

The results for alcohol and tobacco are mixed. In Estonia, where only tobacco is modelled, the expenditure elasticity is very low, whereas in most other countries it is relatively close to unity. The result in Estonia suggests that the need to group alcohol and tobacco together may mask differences in responsiveness between the two expenditure types. That said, Bover et al. (2017) find very similar elasticity estimates for alcohol and tobacco in their QUAIDS model for Spain.

Clothing is always found to be a luxury, except in France where the expenditure elasticity is slightly below unity. Additionally, children's clothing is less elastic than adult's clothing in Ireland, Turkey and the United Kingdom. Surprisingly, though, children's clothing is found to be more elastic than adult's clothing in Luxembourg.

Housing expenditure (imputed and actual) is always found to be a necessity, and always clearly so – with the exception of Hungary where it is close to unity. Where modelled, domestic energy is also always found to be a clear necessity. This is also the case in countries where domestic energy and housing services are combined together. In the two countries where housing services are separated out (Poland and Spain), it is also found to be a necessity. In contrast, the household durables grouping is always found to be a clear luxury, though results for household services are mixed across countries.

There is considerable variation in the results for pharmaceuticals across countries. In contrast, other healthcare (including doctor, dentist and hospital care) is found to be a luxury in all 13 countries where it is separately modelled. The latter result is likely due to the public provision of healthcare services, so that private healthcare can be expected to make up a significant proportion of expenditure in the group in most countries. The greater variation for pharmaceuticals likely reflects a greater variation in the degree of public support for pharmaceutical products both across countries and potentially within the different products within the expenditure group.

Transport fuels are found to be a luxury in 16 of the 17 countries where it is separately modelled, though there is considerable variation in the size of the elasticities. Passenger transport is typically also a luxury, though not in all countries, with many countries having an elasticity close to unity.

Cultural expenditure (including books, newspapers and magazines) is a luxury in all countries with the exception of Finland. In five of the six countries where books, newspapers and magazines can be grouped separately, they are also found to be luxuries. The exception is the United Kingdom where they are a necessity. Expenditure in restaurants and hotels is also, as expected, a luxury in all countries. Furthermore, in 14 of 17 countries where comparison is possible, restaurants and hotels are found to be more elastic than cultural expenditure (including books and newspapers). The exceptions are Austria, Greece and Turkey.

There is considerable variation across countries in the expenditure elasticity for financial services, surprisingly being a necessity in nine of 19 countries. Meanwhile, the two composite "other expenditure" categories tend to be luxuries.

4.3.2. Own-price elasticities

By construction, the price elasticities follow a similar pattern to the expenditure elasticities. A comparison of Tables 4.1 and 4.2 shows the own-price elasticities to be roughly (negative) 50-60 percent of the value of the corresponding expenditure elasticity. This clearly illustrates the fact that, while expenditure elasticity estimates are data-driven, the model itself – rather than the data – drives significantly the price elasticity results.

Given this rough proportionality between expenditure and price elasticities, it is the necessities from Table 4.1 – food, housing rental, domestic energy and housing services groupings – that are shown to be the least price responsive in Table 4.2. Meanwhile luxuries – typically clothing, other healthcare, cultural expenditure, and restaurants and hotels – are the most price responsive. In almost all cases though, own-price elasticities are below one, though in many countries the luxury groups tend to be very close to (and occasionally slightly over) one.

The price elasticity results are also sensitive to the choice of Frisch parameter. For example, a Frisch parameter of -1.7 instead of -1.9 would lead to a roughly 7-10% increase in the magnitude of the price elasticities. Despite this sensitivity, Appendix 1 highlights that such variation in the Frisch parameter does not alter the policy conclusions from the analysis undertaken in Chapters 5 and 6. Nevertheless, it remains important to bear in mind the sensitivity of the elasticity estimates to the underlying assumptions. The elasticity estimates should therefore be considered as indicative of the likely behavioural response to a price change.

Table 4.1. Expenditure elasticities

	AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST[1] (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	ITA (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK[2] (2010)	SWE (2010)	TUR (2010)
Food: std-rated	0.531	-	-	-	0.468	-	0.716	-	-	0.587	-	0.679	0.531	0.703	-	0.619	-	0.748	0.917	-	0.642	-	-
Food: red-rated	0.490	0.571	0.557	0.545	0.453	0.521	-	0.538	0.783	0.484	0.460	0.545	0.392	0.585	0.503		0.676	0.552	0.790	0.626	-	0.564	0.637
Food: super red-rated	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	0.442	0.547	-	-	-	
Alcohol and tobacco	0.938	1.240	1.226	0.707	0.891	0.669	0.125	1.079	1.170	1.075	0.920	1.099	1.166	1.052	0.792	1.106	1.345	1.288	0.836	0.770	1.072	1.296	1.186
Clothing: std-rated	1.801	1.631	1.603	1.265	1.278	1.463	2.094	1.555	0.960	1.568	1.730	1.395	1.625	1.560	1.192	2.063	1.446	1.994	1.484	1.487	1.748	-	1.510
Clothing: red-rated	-	-	-	-	-	-	-	-	-	1.227	-	-	1.556	-	1.447	-	-		-	-	-	-	1.271
Housing rental	0.449	0.408	-	-	0.520	0.696	0.755	0.732	0.753	-	0.729	0.987	0.832	0.711	0.738	0.612	0.510	0.493	0.681	0.759	0.629	-	0.725
Domestic energy	0.300	0.445	0.439	0.425	0.608	0.505	-	0.648	0.495	-	0.417	0.497	0.400	0.625	0.355	0.519	0.333	-	0.574	0.481	0.542	-	0.755
Housing services	-	-		-	-	0.453	-			-	-					-	-	0.678				-	
Household durables	1.657	1.974	1.895	1.714	1.714	1.427	1.751	1.349	1.448	1.922	1.949	1.684	1.368	-	1.542	2.079	1.679	-	1.820	1.800	1.505	1.984	1.516
Household services	1.220	1.058	0.544	0.643	0.644	1.144	-	0.488	0.726	0.694	1.210	1.156	0.780	1.018	0.864	0.985	0.886	0.932	1.101	0.624	-	-	1.216
Pharmaceuticals	1.013	0.746	1.060	0.770	1.091	1.167	1.133	0.710	0.767	1.400	-	0.849	2.438	0.869	0.711	1.214	0.829	0.837	0.777	1.147	0.686	-	0.549
Other healthcare	1.826	1.417	1.648	1.192	-	1.693	-		1.061		1.536			-	1.143	-	1.818	1.917	1.762	1.747	-	-	1.370
Transport fuels	1.069	1.180	-	1.222	1.205	1.273	1.991	1.408	1.229	1.148	1.585	1.801	1.051	1.077	0.856	-	1.400	-	1.544	1.436	1.760	0.916	1.813
Passenger transport	1.137	1.571	1.275	-	0.913	1.158		1.400	1.346	-	0.902		1.786	1.633	1.160	1.456	1.253	1.296	1.153	1.148	0.781		0.892
Culture	1.617	1.619	-	1.106	1.223	1.539	-	0.870	1.534	-	1.739	-	1.475	1.719	1.071	-	1.397	1.816	1.437	1.215	1.275	1.606	1.797
Books & newspapers			1.205				1.401			0.793		1.210				1.563					1.088		
Restaurants & hotels	1.521	1.863	-	-	1.656	1.626	-	1.540	1.618	1.227	1.510	-	1.568	1.972	1.573	-	1.757	2.042	1.838	1.949	1.704	-	1.309
Financial services	1.044	1.055	0.585	1.001	-	0.902	-	-	0.740	0.809	1.552	1.423	1.109	0.956	0.808	1.434	0.736	2.065	1.358	0.639	1.193	0.907	-
Other (std rated)	1.584	1.535	1.487	1.341	1.635	1.310	0.911	1.287	1.360	1.121	1.298	1.698	1.058	1.811	1.423	1.492	1.468	1.429	1.368	1.481	2.073	1.388	1.453
Other (red/ex)	0.862	1.350	1.956	0.931	1.702	1.844	1.901	0.849	1.230	1.015	0.931	1.223	1.966	2.070	1.251	1.750	0.927	2.490	1.976	0.710	1.475	0.684	

Notes. Results are the weighted means of the estimated expenditure elasticities for each household. Results are based on household expenditure microdata for 23 countries, using extended Working-Leser model as proposed by Creedy and Sleeman (2006). See text for further detail.

1. In Estonia, the "food: std-rated" grouping includes alcoholic beverages, and the "alcohol and tobacco" grouping only includes tobacco.
2. In the Slovak Republic, the "culture" grouping includes cultural expenditure plus newspapers and magazines, and the "books and newspapers" grouping only includes books.

Table 4.2. Uncompensated own-price elasticities

	AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST[1] (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	ITA (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK[2] (2010)	SWE (2010)	TUR (2010)
Food: std-rated	-0.285	-	-	-	-0.293	-	-0.513	-	-	-0.317	-	-0.425	-0.286	-0.374	-	-0.456	-	-0.407	-0.494	-	-0.438	-	-
Food: red-rated	-0.307	-0.361	-0.352	-0.371	-0.244	-0.342	-	-0.345	-0.491	-0.321	-0.316	-0.309	-0.246	-0.389	-0.304		-0.403	-0.331	-0.423	-0.398	-	-0.354	-0.447
Food: super red-rated	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-0.277	-0.338	-	-	-	
Alcohol and tobacco	-0.504	-0.662	-0.653	-0.384	-0.477	-0.360	-0.071	-0.578	-0.628	-0.593	-0.495	-0.591	-0.637	-0.564	-0.423	-0.594	-0.715	-0.688	-0.446	-0.414	-0.577	-0.690	-0.645
Clothing: std-rated	-0.954	-0.869	-0.856	-0.689	-0.690	-0.788	-1.100	-0.826	-0.525	-0.839	-0.921	-0.746	-0.863	-0.838	-0.653	-1.083	-0.777	-1.049	-0.792	-0.800	-0.927	-	-0.807
Clothing: red-rated	-	-	-	-	-	-	-	-	-	-0.649	-	-	-0.822	-	-0.764	-	-		-	-	-	-	-0.673
Housing rental	-0.298	-0.291	-	-0.371	-0.378	-0.488	-0.462	-0.496	-0.506	-	-0.481	-0.605	-0.546	-0.497	-0.526	-0.365	-0.345	-0.328	-0.472	-0.497	-0.402	-	-0.473
Domestic energy	-0.172	-0.259	-0.253	-0.268	-0.349	-0.283	-	-0.364	-0.291	-	-0.237	-0.337	-0.232	-0.365	-0.207	-0.321	-0.191	-	-0.339	-0.284	-0.355	-	-0.438
Housing services	-	-		-	-	-0.242	-			-	-					-	-	-0.368				-	
Household durables	-0.890	-1.030	-1.001	-0.917	-0.913	-0.767	-0.929	-0.737	-0.780	-1.013	-1.025	-0.889	-0.736	-	-0.829	-1.090	-0.898	-	-0.961	-0.954	-0.817	-1.031	-0.817
Household services	-0.649	-0.574	-0.303	-0.359	-0.354	-0.623	-	-0.268	-0.402	-0.389	-0.657	-0.629	-0.432	-0.550	-0.470	-0.539	-0.485	-0.512	-0.600	-0.347	-	-	-0.658
Pharmaceuticals	-0.537	-0.399	-0.561	-0.412	-0.578	-0.617	-0.604	-0.388	-0.406	-0.740	-	-0.462	-1.274	-0.466	-0.377	-0.651	-0.437	-0.453	-0.427	-0.606	-0.370	-	-0.291
Other healthcare	-0.961	-0.755	-0.874	-0.630	-	-0.894	-		-0.562		-0.819			-	-0.606	-	-0.956	-1.009	-0.931	-0.920	-	-	-0.725
Transport fuels	-0.579	-0.631	-	-0.664	-0.647	-0.687	-1.049	-0.753	-0.667	-0.628	-0.841	-0.955	-0.572	-0.587	-0.461	-	-0.741	-	-0.830	-0.767	-0.932	-0.509	-0.960
Passenger transport	-0.602	-0.828	-0.682	-0.350	-0.487	-0.614		-0.742	-0.714	-	-0.480		-0.940	-0.861	-0.615	-0.772	-0.664	-0.6869	-0.612	-0.606	-0.418		-0.489
Culture	-0.855	-0.855	-	-0.589	-0.656	-0.813	-	-0.466	-0.811	-	-0.915	-	-0.783	-0.906	-0.567	-	-0.742	-0.956	-0.762	-0.644	-0.673	-0.848	-0.946
Books & newspapers			-0.639				-0.741			-0.423		-0.641				-0.824					-0.573		
Restaurants & hotels	-0.818	-0.985	-	-0.717	-0.881	-0.879	-	-0.822	-0.865	-0.677	-0.820	-	-0.840	-1.039	-0.849	-	-0.927	-1.071	-0.978	-1.026	-0.904	-	-0.708
Financial services	-0.571	-0.579	-0.411	-0.539	-	-0.492	-	-	-0.426	-0.448	-0.821	-0.755	-0.606	-0.517	-0.444	-0.759	-0.446	-1.085	-0.721	-0.365	-0.630	-0.490	-
Other (std rated)	-0.872	-0.842	-0.856	-0.751	-0.879	-0.727	-0.630	-0.732	-0.744	-0.651	-0.714	-0.907	-0.589	-0.958	-0.787	-0.841	-0.797	-0.862	-0.743	-0.807	-1.064	-0.828	-0.793
Other (red/ex)	-0.493	-0.724	-1.027	-0.517	-0.923	-0.972	-1.004	-0.466	-0.662	-0.616	-0.517	-0.657	-1.031	-1.083	-0.673	-0.928	-0.515	-1.301	-1.038	-0.403	-0.785	-0.514	

Notes. Results are the weighted means of the estimated uncompensated own-price elasticities for each household. Results are based on household expenditure microdata for 23 countries, applying Frisch's (1959) result for directly additive utility functions as proposed by Creedy and Sleeman (2006). Frisch parameter = -1.9. See text for further detail.

1. In Estonia, the "food: std-rated" grouping includes alcoholic beverages, and the "alcohol and tobacco" grouping only includes tobacco.
2. In the Slovak Republic, the "culture" grouping includes cultural expenditure plus newspapers and magazines, and the "books and newspapers" grouping only includes books.

4.4. Conclusion

This chapter has introduced behavioural microsimulation models that have been constructed for 23 OECD countries based on cross-sectional household expenditure microdata. The chapter follows the empirical approach proposed by Creedy and Sleeman (2006), which itself draws on a result established for directly additive utility functions by Frisch (1959). This approach is based on the linear expenditure system (LES) and relates price elasticities to total expenditure elasticities, budget shares and the elasticity of the marginal utility of total expenditure (the “Frisch parameter”). As such, it requires only the estimation of expenditure elasticities and can therefore be undertaken using cross-sectional expenditure data without information on prices.

The behavioural models cover between eight and 18 different expenditure groups, with elasticities estimated separately for 11 different household types to allow for heterogeneity of preferences. Expenditure and price elasticity estimates are highly plausible. Average expenditure elasticities are positive, with food (including non-alcoholic beverages), housing rental, domestic energy and housing services generally found to be necessities. Clothing, cultural expenditure, and restaurants and hotels are almost always found to be luxuries.

By construction, the price elasticities follow a similar pattern to the expenditure elasticities with own-price elasticities roughly (negative) 50-60 percent of the value of the corresponding expenditure elasticity, although the (exogenous) choice of Frisch parameter impacts the magnitude of the relationship. Given this rough proportionality between expenditure and price elasticities, it is the necessities that are the least price responsive and luxuries that are the most price responsive. In almost all cases though, own-price elasticities are below one, though in many countries the luxury groups tend to be very close to (and occasionally slightly over) one.

The rough proportionality imposed between expenditure and price elasticities, together with the influence of the Frisch parameter, highlight the restrictiveness of the LES-based approach. The price elasticity estimates are driven far more by the structure of the model itself, than by the data as compared to typical demand system estimation using price variation for identification. As Creedy (1998b) argues, though, this is a reasonable trade-off to make for the ability to produce a large number of feasible elasticity estimates drawing only on cross-sectional household expenditure data. Furthermore, the similarity of simulation results from LES and QUAIDS models for New Zealand in Appendix 2 suggests the LES-based approach provides a reasonable estimate of behavioural responses to VAT rate changes.

Nevertheless, the restrictive assumptions underlying the price elasticity results means they should be considered with some caution.

The next two chapters use the behavioural models developed in this chapter to investigate the distributional impact of the reduced VAT rates in 23 OECD countries, and to examine whether the use of cash transfers would be a more effective way of achieving distributional goals.

CHAPTER 5. USING REDUCED VAT RATES TO SUPPORT POORER HOUSEHOLDS

5.1. Introduction

The results in Chapter 3 imply that reduced VAT rates have had a small progressive effect on average VAT burdens in many of the countries examined. However, because reduced rates do not differentiate between rich and poor consumers, they can be expected to be a relatively blunt instrument with which to target the poor. This chapter uses the behavioural microsimulation models developed in Chapter 4 to investigate further the distributional effects of reduced VAT rates and, in particular, how effective they are at providing support to poorer households.

To the extent that reduced rates are targeted at consumption items that make up a greater proportion of the expenditure of poor households than of rich households, reduced rates can be expected to have a progressive effect – i.e. they will give a greater relative tax reduction to the poor than to the rich. However, because richer households consume more in aggregate terms than poorer households, rich households can still be expected to gain more in aggregate terms from a reduced VAT rate. Furthermore, if a reduced rate is provided for goods or services that the rich consume proportionately more of than the poor, then that reduced VAT rate will actually have a regressive effect. In practice, the size of the tax reduction from a reduced VAT rate will depend on the consumption patterns of households – which are captured in the HBS data – and their responses to a change in the VAT rate – which are captured by the estimated behavioural elasticities.

To examine who benefits from reduced VAT rates, I simulate the removal of reduced rates in 23 OECD countries. These simulation results are then used to examine the revenue and welfare effects of a move in the opposite direction – i.e. the introduction of those reduced rates. Taken as a whole, reduced VAT rates are found to have a progressive impact in 21 out of 23 countries in terms of the tax expenditure (the change in tax revenue), and 20 out of 23 countries in terms of the welfare gain (as measured by the compensating variation). As anticipated, though, not only do rich households benefit from reduced rates, they benefit more in aggregate terms from reduced rates than poor households do. Furthermore, the progressivity leads to very little redistribution due to low average concession rates.

When looking at reduced rates on specific products, results are typically found to vary depending on the underlying policy rationale for introducing the reduced rate. Reduced rates specifically introduced to support the poor – such as reduced rates on food consumed at home and domestic utilities – are typically found to have a progressive impact. However, rich households still receive a larger aggregate benefit from these reduced VAT rates than poor households. Meanwhile, reduced VAT rates introduced to address social, cultural and other non-distributional goals often provide such a large aggregate benefit to rich households that the reduced rates have a regressive effect. For example, reduced rates on restaurants and hotels benefit the rich vastly more than the poor, both in aggregate and proportional terms, in all 15 countries in which they are applied. In each case, the low average concession rates mean minimal redistribution occurs.

Aggregate welfare gains are found to be greater than aggregate tax expenditures, and disproportionately so for richer households – reflecting their greater ability to adjust their consumption behaviour in response to price changes. Consequently, reduced VAT rates are shown to be even more poorly targeted, less progressive (or more regressive), and less redistributive when considered in terms of the welfare gain. A number of reduced VAT rates that produce a slightly progressive tax expenditure, produce a slightly regressive welfare gain.

Some caution needs to be taken with these results as the behavioural microsimulation models are based on the restrictive assumption of additive preferences. Furthermore, the modelling has required broad grouping so that highly specific expenditure types have not always been able to be separated out in the analysis. Nevertheless, the analysis has strong implications for VAT policy – though discussion of these implications is deferred until Chapter 8.

The chapter proceeds as follows: Section 5.2 briefly reviews the previous empirical literature examining the distributional effects of reduced VAT rates. Section 5.3 then outlines the simulation methodology. Section 5.4 presents the simulation results, first for all reduced VAT rates combined, and then individually. Section 5.5 provides some concluding comments.

5.2. Literature review

Several studies have examined the distributional effects of reduced VAT rates. These studies typically use microsimulation models to simulate either the introduction or removal of reduced VAT rates in order to assess who gains and loses from the reduced rates. Research has predominantly focused on the impact of either all reduced VAT rates, or of reduced rates applied to food and/or necessities. This section provides a summary of these studies.

An early study by Davis and Kay (1985) uses 1982 household expenditure microdata to simulate the removal of zero VAT rates and exemptions in the United Kingdom. Their analysis assumes that most exemptions had an effective pre-reform tax rate of 4% (due to the inability to claim input tax credits). They find that 63% of the benefit of zero rating and exemptions goes to households with above average income.

Caspersen and Metcalf (1994) use 1988 household expenditure microdata to simulate the introduction of a VAT in the United States. They find that zero-rating food, housing and medical care will reduce the regressivity (or increase the progressivity) of the VAT as compared to a single-rate VAT that is applied to all consumption expenditure. They add that using zero rates for redistribution will be somewhat inefficient, as they benefit both poor and rich households.

IFS (2011a), in their study of nine European countries (see Chapter 3 for additional details), simulate the removal of reduced VAT rates in each country. They find that richer households lose more than poorer households from the removal of reduced rates in aggregate terms but lose less as a proportion of expenditure. As such, they conclude reduced rates have a progressive effect, though they emphasise their poorly targeted nature. While they do not present results for individual reduced rates, they do note that a key reason for the progressive overall results is the application of reduced rates to the majority of food items in all nine countries. They also note that the zero rate for children's clothing in the United Kingdom, and reduced rate for domestic energy in Greece, Italy and the United Kingdom have a progressive impact, while reduced rates for most other goods are generally either distributionally neutral, or regressive.

Leahy et al. (2011) use 2005 household expenditure microdata to simulate the distributional impact of the VAT in Ireland. They find that removing the reduced VAT rates on food and children's clothing would have a regressive effect. More recently, the Irish Department of Finance (2018) find that Ireland's 9% reduced VAT rate – which applies to restaurant food, hotel accommodation and a range of cultural and recreational expenditure – provides a greater aggregate benefit to richer households than poorer households. Their analysis used both 2010 and 2016 household expenditure microdata.

Harris et al. (2018) simulate the removal of reduced VAT rates in four developing countries (Ethiopia, Ghana, Senegal and Zambia). They find that reduced VAT rates are broadly progressive in Ghana – with poorer households benefiting more than richer households from reduced rates as a proportion of expenditure. They find reduced rates to be slightly regressive in Ethiopia and Zambia, and find no clear trend in Senegal. However, in all four countries higher income households gained significantly more in aggregate terms from the presence of reduced rates.

An important limitation of the above studies is that they ignore behavioural responses when simulating the introduction or removal of reduced VAT rates. In contrast, Creedy (2001) for Australia, and Ball et al. (2016) for New Zealand, adopt a Linear Expenditure System (LES) based approach to account for behavioural responses and undertake welfare analysis of VAT reforms. Amongst other results, Creedy (2001) finds that the adoption of a system applying zero rates to necessities and higher rates to luxuries would be progressive – with higher proportionate welfare costs faced by higher income taxpayers. However, he also concluded that the redistributive ability of the VAT was weak. Ball et al. (2016) examine the welfare effects of zero-rating food in New Zealand's GST system. Based on 2010 microdata, they find that zero-rating food expenditure would produce a small amount of progressivity in the GST, but that better-off households would receive greater absolute welfare gains.

In addition to the non-behavioural analysis discussed above, IFS (2011a) also estimate a Quadratic Almost Ideal Demand System (QUAIDS) for five countries to examine the impact of the VAT on consumption patterns and consumer welfare – although welfare analysis is only possible for three of the countries due to modelling limitations. For these three countries (Belgium, Germany and the United Kingdom), they find broadly consistent results with their non-behavioural analysis: removal of reduced rates would result in greater welfare losses for richer households than poorer households in aggregate money-metric welfare terms, but smaller welfare losses when measured as a proportion of expenditure.

Cseres-Gergely et al. (2017) also estimate a QUAIDS model using Hungarian price and household expenditure data from 2003-2011. They find that a reduced VAT rate on food would provide larger monetary and welfare gains as a proportion of total expenditure to poorer households, but that richer households would still benefit significantly from the reform. As such, they conclude it would be a poorly targeted reform. Gaarder (2018) estimates a QUAIDS model for Norway using price and household expenditure data from 1991-2001, and finds that lowering the VAT rate on food would reduce inequality in consumer welfare.

Finally, preliminary research undertaken for this thesis (presented in Chapter 3 of OECD/KIPF, 2014, and in Thomas, 2015) examines in detail the impact of reduced VAT rates on different types of expenditure. However, neither study takes account of behavioural effects. OECD/KIPF (2014), uses microdata for 20 OECD countries from 2004-2013 to simulate the removal of reduced rates, while Thomas (2015) simulates the introduction of a European-style VAT rate structure in New Zealand using

2012-13 microdata. Both studies find significant variation in the distributional impact of reduced rates across expenditure types. Reduced rates typically introduced to achieve distributional goals – such as on food, water supply and energy products – are found to have a small progressive effect, but to be poorly targeted. Reduced rates typically introduced to address social, cultural and other non-distributional goals – such as reduced rates on books, restaurant food and hotel accommodation – are often found to be so poorly targeted that they have a regressive effect. The current chapter is, in broad terms, an extension of this analysis taking into account consumer behavioural responses.

5.3. Methodology

This chapter uses the behavioural microsimulation models described in Chapter 4 to investigate both the overall distributional impact of all reduced VAT rates present in each of the 23 OECD countries covered, as well as the impact of reduced VAT rates applicable to specific types of expenditure. By using the behavioural models, consumers' responses to price changes are able to be taken into account in the simulations.

To investigate the overall distributional impact of all reduced VAT rates, I simulate the imposition of the standard VAT rate on all the expenditure groupings in the behavioural microsimulation models that are subject to reduced, super-reduced, or zero VAT rates (referred to jointly as "reduced rates") and compare pre- and post-reform results. The distributional impact of specific expenditure groupings are examined by simulating the imposition of the standard VAT rate on just the expenditure grouping of interest.[78] However, analytical results are calculated as if the opposite was occurring – i.e. as if reduced VAT rates were being introduced, rather than removed. This allows the distributional impact of reduced rates to be presented directly as opposed to having to be inferred from results for the removal of reduced rates.

The analysis in this chapter focuses purely on reduced VAT rates and, as such, the simulations are not revenue-neutral. No attempt is made to account for wider implications of the reforms, such as the impact of consequent adjustments to public expenditure or other taxes. However, a range of revenue-neutral reform simulations are presented in Chapter 6.

[78] Calculations are also made for the total revenue effect of each reform, including the change in VAT paid on other goods. Results, however, are very similar to those for just the change in VAT paid on the particular good subject to the reduced rate. Results were also calculated for the change in VAT on the particular good of interest within a reform removing reduced rates on all goods. Results were again very similar, and do not alter the conclusions of the analysis. The results for a reform changing one rate only are focused on here because it enables welfare analysis to be undertaken also. It does, however, mean that the sum of the revenue change from each individual reduced rate does not add to the overall revenue change from all reduced rates as budget allocations are slightly different.

This chapter also does not examine the distributional impact of exemptions. As noted previously, for practical reasons the behavioural models treat exemptions as zero-rates. However, this overlooks the likely presence of some tax embedded in the supply chain (due to the inability to claim input tax credits for exempt goods). Modelling of these groupings consequently underestimates the amount of tax currently collected from exempt goods, and any simulations removing the exemptions would therefore overstate the size of the revenue change.

Simulation of the removal of all reduced rates therefore also excludes any groupings of exempt goods or any groupings that combine reduced rates with exempt goods. Any composite groupings that include categories subject to both reduced and standard rates are also excluded, but grouping of expenditure categories subject to a combination of different reduced rates are included. With the latter composite groupings, it is effectively being assumed that taxpayers continue to consume the constituent expenditure categories in the same proportions, thereby responding to the change in the average VAT rate attributed to the grouping. While imperfect, data limitations meant such composite groupings of reduced-rated goods were necessary to feasibly estimate the behavioural models.

To assess the distributional impact of the simulated reforms, two indicators are calculated for each household: the change in tax paid, and the money-metric welfare change as measured by the compensating variation (CV). The change in tax paid results can be interpreted as the "tax expenditure" from the provision of reduced rates, i.e. the tax revenue "spent" through concessionary tax treatment as compared to the benchmark of a single-rate VAT system. Unlike the tax expenditure results, the welfare change results also enable the distortionary impact of tax-induced changes in consumption patterns to be taken into account in the analysis. Welfare gains are presented as positive numbers to aid comparison with the tax expenditure results.[79]

The underlying tax expenditure and welfare change calculations are made per household and are then weighted up to the population using household survey weights. Average tax expenditure and welfare change results are presented across equivalised expenditure deciles, in both aggregate terms and as a proportion of total expenditure.[80] As in Chapter 3, the unit of analysis adopted is the individual, and equivalisation is undertaken using the parametric equivalence scale $m_i = \left(n_{a,i} + \theta n_{c,i}\right)^{\alpha}$ with $\theta = 0.5$ and $\alpha = 0.7$.

[79] Technically, a negative compensating variation reflects a welfare gain as it shows the amount of money that would need to be given to a household post-reform in order to maintain their pre-reform utility level. For presentational purposes, however, these welfare gains are presented as positive numbers.

[80] Results across income deciles are very similar to (and show the same patterns as) results across expenditure deciles, though they are slightly compressed.

To complement these decile averages, the set of summary indicators introduced in Chapter 3 are also presented: the Kakwani progressivity index, and two redistributive measures – the Reynolds-Smolensky index and the change in the Atkinson inequality index (evaluated at three levels of inequality aversion: $\varepsilon = 0.2, 0.7$ and 1.2). These summary indicators enable clearer judgements to be drawn on the overall distributional impact of reduced rates and for comparisons to be made that are not always possible from the analysis of simple decile averages – such as when non-monotonic patterns arise.

As suggested by Lambert (1985) for government expenditures, the negative of the standard Kakwani index for taxes is used to measure the progressivity of the tax expenditures from reduced VAT rates. As such, a progressive tax expenditure results in a positive Kakwani index, and consequently a positive Reynolds-Smolensky index. The same approach is adopted for the welfare change based calculations.

5.4. Simulation results

I first consider the overall effect of all reduced VAT rates before considering reduced rates on specific types of expenditure. The latter are examined in two groups defined by policy intent:

1. Reduced rates typically introduced in order to provide support for poorer households. This includes: food; children's clothing; domestic utilities; and pharmaceuticals.

2. Reduced rates introduced to support cultural, social and other policy goals. This includes: cultural and social expenditure; and restaurants and hotels.

5.4.1. All reduced rates

Figures 5.1 and 5.2 summarise the tax expenditure and welfare change results for all reduced VAT rates. Solid bars present the all-country simple average across expenditure deciles of the household average tax expenditure (Figure 5.1) and welfare gain (Figure 5.2). The lines present the same results, but as a percentage of household expenditure. Individual country results are presented in Tables 5.3 and 5.4 at the end of the chapter.

Considering first the tax expenditure results, Figure 5.1 shows a clear pattern with higher deciles benefiting from successively larger aggregate tax expenditures. This conclusion is supported when looking at the individual country results in Table 5.3. In every country, the top decile receives a tax expenditure that is more than double what the bottom decile receives. The difference is most explicit in Estonia and Latvia, where the top decile receives a tax expenditure that is more than 10 times the tax expenditure gained by the bottom decile. These results clearly illustrate the inability of reduced rates to target support to poorer households. Not only do richer households benefit from the presence of reduced

VAT rates, they benefit substantially more from them in aggregate terms due to their greater total expenditure levels.[81]

Figure 5.1 also shows that, despite their poor targeting, reduced rates as a whole generally do have a progressive impact – with higher deciles in most countries benefiting from successively smaller tax expenditures when measured as a proportion of total expenditure. That said, the individual country results in Table 5.3 show that the fall in proportional tax expenditure is not always monotonic. For example, France and the Netherlands have peaks in the middle deciles before falling at higher deciles, leaving some ambiguity in assessing whether or not the tax expenditure is progressive. Meanwhile, the Slovak Republic appears roughly proportional with minimal change in the proportional tax expenditure across deciles. Finally, the results for Estonia and Latvia suggest a slightly regressive impact, with proportionate tax expenditures tending to increase for richer households, though not for the very top deciles.

Turning to the welfare gain results, the patterns of results (in both Figure 5.2 and in Table 5.4) are almost entirely consistent with those for the tax expenditure. In all countries, richer households benefit more in aggregate welfare terms. Meanwhile, in most countries richer households tend to benefit less in proportionate terms. Latvia and Estonia are again the clearest exceptions with richer households tending to benefit more in proportionate terms. Ambiguous results occur in France, the Slovak Republic and the Netherlands where the proportionate welfare gain tends to peak in the middle of the distribution.

In all cases, the average welfare gains are slightly greater in magnitude than the average tax expenditures as the tax-induced behavioural change has an impact on welfare beyond its impact on tax paid. Furthermore, the difference increases for richer households – highlighting their greater ability to adjust behaviour in response to a price change. A consequence of this is that the fall in proportionate welfare gain at higher deciles tends to be slightly lower.

Figures 5.3 and 5.4 present the Kakwani and Reynolds-Smolensky index results for each country, calculated for the tax expenditure and welfare change, respectively. As noted in Chapter 3, through imposing additional value judgements, these summary indicators enable conclusions to be made regarding the distributional impact of the simulated reforms that are not always possible from the analysis of simple decile averages, such as when non-monotonic patterns arise across deciles.

[81] This conclusion also holds when measured across disposable income rather than expenditure deciles, though results at the upper and lower deciles are slightly compressed.

For the tax expenditure, the Kakwani index (measured on the horizontal axis of Figure 5.3) is found to be positive in 21 of 23 countries (including France, the Netherlands and the Slovak Republic), confirming the progressive effect of reduced rates as a whole in these countries. The regressivity of reduced rates in Estonia and Latvia is also confirmed, with both having negative Kakwani indices.

The most progressive results are in the United Kingdom, Germany, Switzerland and Poland with Kakwani indices between 0.1078 and 0.1632, while 15 of 23 countries have Kakwani indices greater than 0.05. These results are comparable in magnitude to progressivity results often found for personal income taxes. For example, as noted in Chapter 3, Joumard et al. (2012) found Kakwani indices of between 0.05 and 0.25 for personal income taxes (including employee social security contributions) in 27 of 30 OECD countries examined. More recently, Causa and Hermansen (2017) found Kakwani indices of between 0.1 and 0.25 for personal income taxes in 13 of 15 OECD countries examined. The progressivity results for the tax expenditure contrast with the progressivity results presented in Chapter 3 for VAT systems as a whole – which exhibit far less progressivity due to the dominant impact of the standard VAT rate. The least progressive tax expenditures are for the three countries producing non-monotonic patterns across expenditure deciles: France, the Netherlands, and the Slovak Republic, with Kakwani indices less than 0.035.

It follows logically that the 21 countries with a positive Kakwani index, also have a positive Reynolds-Smolensky redistribution index (measured on the vertical axis of Figure 5.3) – showing that inequality has fallen in these countries. Conversely the two countries with a negative Kakwani index (Estonia and Latvia) also have a negative Reynolds-Smolensky index showing inequality rising.[82] However, the significant degree of progressivity exhibited in many countries does not translate into a high degree of redistribution. This is because the overall magnitudes of the tax expenditures are typically low – with average tax expenditure rates ranging from 0.2% in the Slovak Republic to 4.3% in Poland.[83] Poland and the United Kingdom produce the greatest degree of redistribution with Reynolds-Smolensky indices of 0.0046 and 0.0045, respectively (equating to just a 1.7% and 1.4% reduction in inequality, respectively). This is extremely low compared to typical personal income tax results. For example, Joumard et al. (2012) and Causa and Hermansen (2017) found Reynolds-Smolensky indices greater than 0.01 for personal income taxes in 28 of 30 countries, and 14 of 15 countries, respectively.

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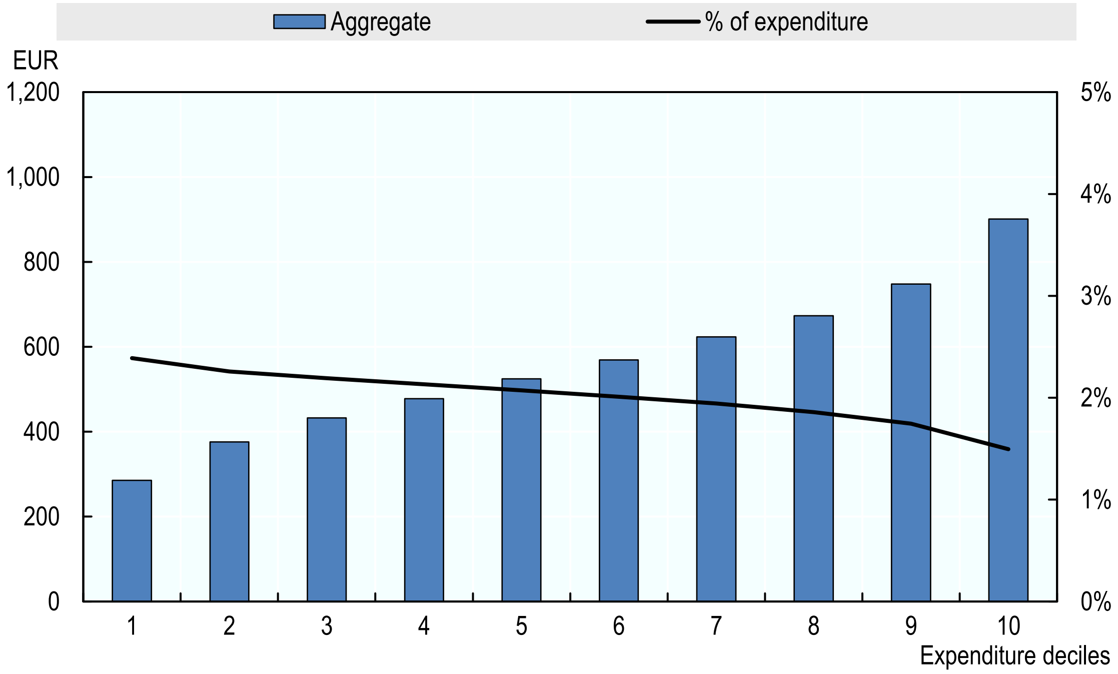
[82] Although this rounds down to zero for Estonia in Table 5.3 (which presents results to four decimal places). Similarly, the slightly positive value for the Slovak Republic rounds down to zero in Table 5.3.

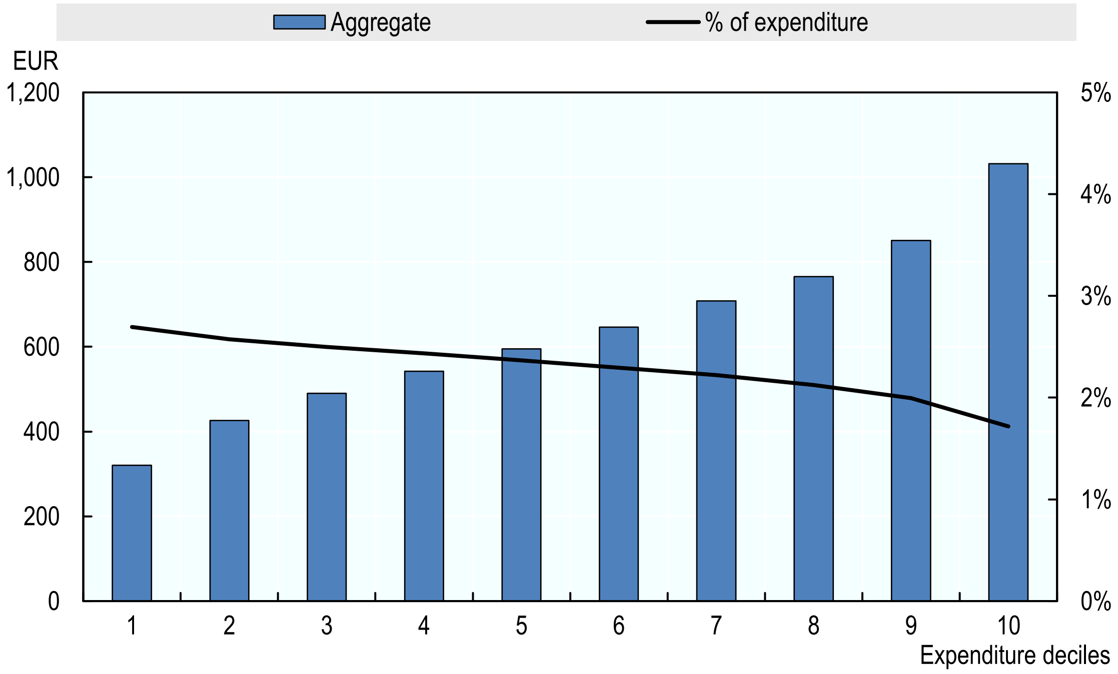
[83] Recall from chapter three that the Reynolds-Smolensky index can be decomposed into both a progressivity and average tax rate effect as follows: $\pi^{RS} = t/(1-t)\,\pi^{K}$. So a highly progressive tax (or tax expenditure) may still have minimal redistributive effect if the average tax rate $(t/(1-t))$ is low.

Figure 5.1. All-country average of average tax expenditure per household from all reduced rates



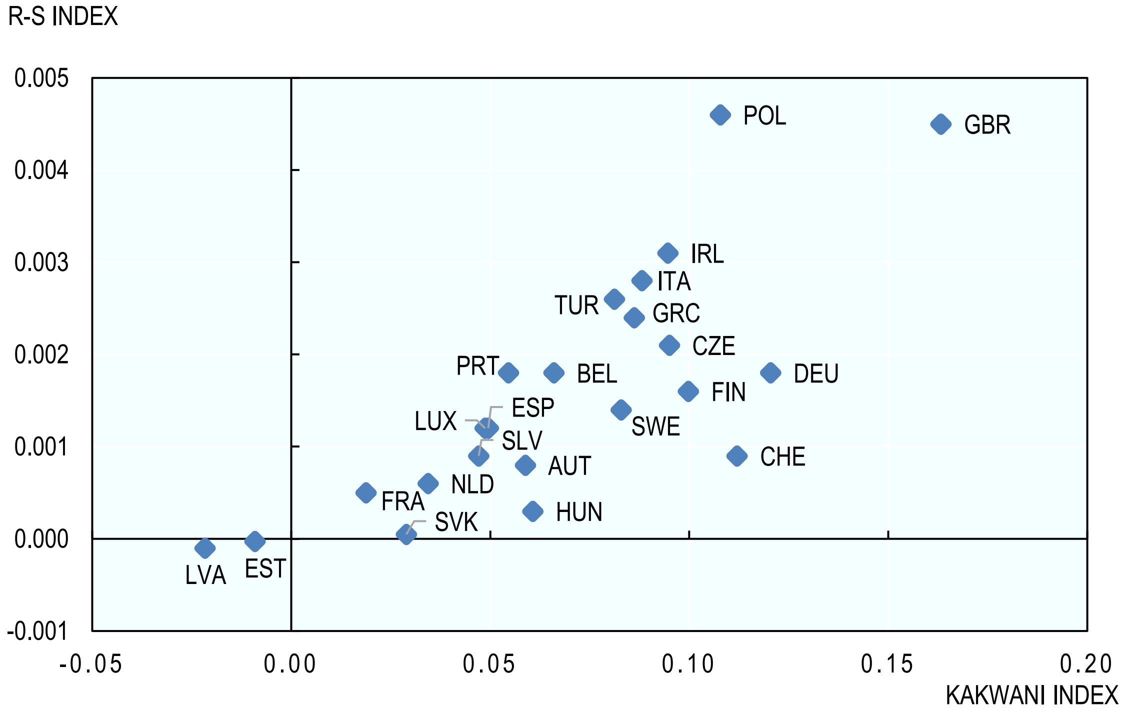
Notes. Results calculated using behavioural microsimulation models for 23 countries based on household expenditure survey microdata. "Aggregate" results present the simple mean across all countries of the within-country weighted mean of the tax expenditure per household. "% of expenditure" results present the simple mean across all countries of the within-country weighted mean of the tax expenditure as a percentage of total expenditure per household. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

Figure 5.2. All-country average of average welfare change per household from all reduced rates



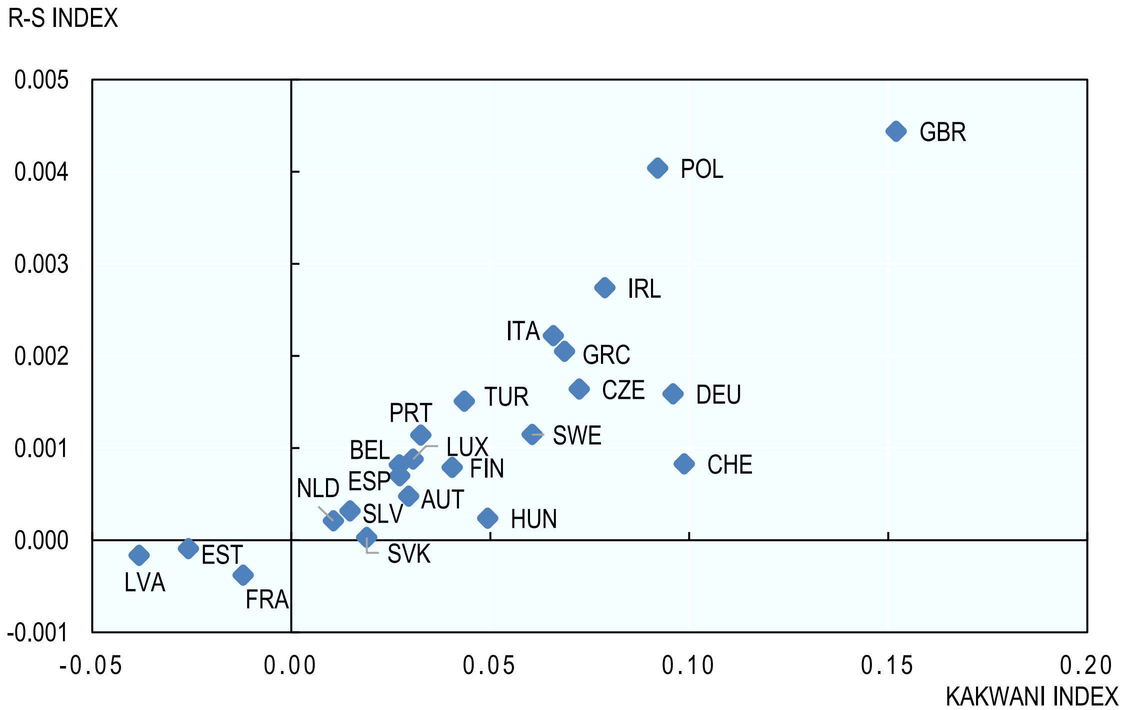
Notes. Results calculated using behavioural microsimulation models for 23 countries based on household expenditure survey microdata. "Aggregate" results present the simple mean across all countries of the within-country weighted mean of the (negative of the) compensating variation per household. "% of expenditure" results present the simple mean across all countries of the within-country weighted mean of the (negative of the) compensating variation as a percentage of total expenditure per household. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

Figure 5.3. Kakwani and Reynolds-Smolensky indices for tax expenditure from all reduced rates



Notes. Results calculated using behavioural microsimulation models for 23 countries based on household expenditure survey microdata. R-S index = Reynolds-Smolensky redistribution index; Kakwani index = Kakwani progressivity index. Results calculated using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

Figure 5.4. Kakwani and Reynolds-Smolensky indices for welfare change from all reduced rates



Notes. Results calculated using behavioural microsimulation models for 23 countries based on household expenditure survey microdata. R-S index = Reynolds-Smolensky redistribution index; Kakwani index = Kakwani progressivity index. Results calculated using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

How the small degree of redistribution is generated also varies across countries. For example, reduced VAT rates in Belgium and Germany produce the same degree of redistribution (Reynolds-Smolensky indices of 0.0018). However, Germany's tax expenditure is nearly twice as progressive as Belgium's (with a Kakwani index of 0.1204 vs 0.0660), while the average tax expenditure rate in Belgium is nearly twice that of Germany (2.7% vs 1.5%). Meanwhile, Switzerland has the third most progressive tax expenditure, but the fifth lowest average tax expenditure rate so that it only produced the 15th most redistribution. This is unsurprising given Switzerland's comparatively low standard VAT rate of 7.7%, which limits the potential size of any tax expenditure.

The lower progressivity of the welfare change results as compared to tax expenditure results is confirmed by the Kakwani index results in Figure 5.4 – which are slightly lower in every country. In Latvia and Estonia, Kakwani index results therefore indicate a greater degree of regressivity in the welfare change than in the tax expenditure. Meanwhile France, for which the tax expenditure was slightly progressive, is now seen to be slightly regressive in terms of the welfare change. The across-the-board reduced progressivity flows through into the redistributive effect, with lower Reynolds-Smolensky index results for all countries (including now a negative result for France).

As noted in Chapter 3, Gini-based measures (such as the Kakwani and Reynolds-Smolensky indices) are less responsive to changes at the tails as compared to the middle of the distribution. Atkinson inequality index results – which enable greater sensitivity to be applied to the bottom of the distribution – are therefore also calculated and included in Tables 5.3 and 5.4. The (change in) Atkinson index results confirm the Reynolds-Smolensky results, showing a very small reduction in inequality in the same 21 countries for the tax expenditure and 20 countries for the welfare change.[84] For greater levels of inequality aversion (where greater weight is given to the bottom tail of the distribution), the reduction in the Atkinson index is shown to increase, confirming that the bottom tail of the distribution is benefiting from the introduction of reduced VAT rates.

5.4.2. Reduced rates generally aimed at supporting the poor

This section examines the distributional impact of reduced rates on particular expenditure groupings where the policy rationale for their introduction is typically to provide support to the poor. The microsimulation models allow the following expenditure groupings to be separately examined: food and non-alcoholic beverages for home consumption; children's clothing; domestic utilities (energy, water, refuse and sewage); and pharmaceuticals.

[84] Some positive (change in) Atkinson index results round down to zero in Tables 5.3 and 5.4. The only negative results are for Estonia, Latvia (some of which also round down to zero) and France (in Table 5.4).

Food

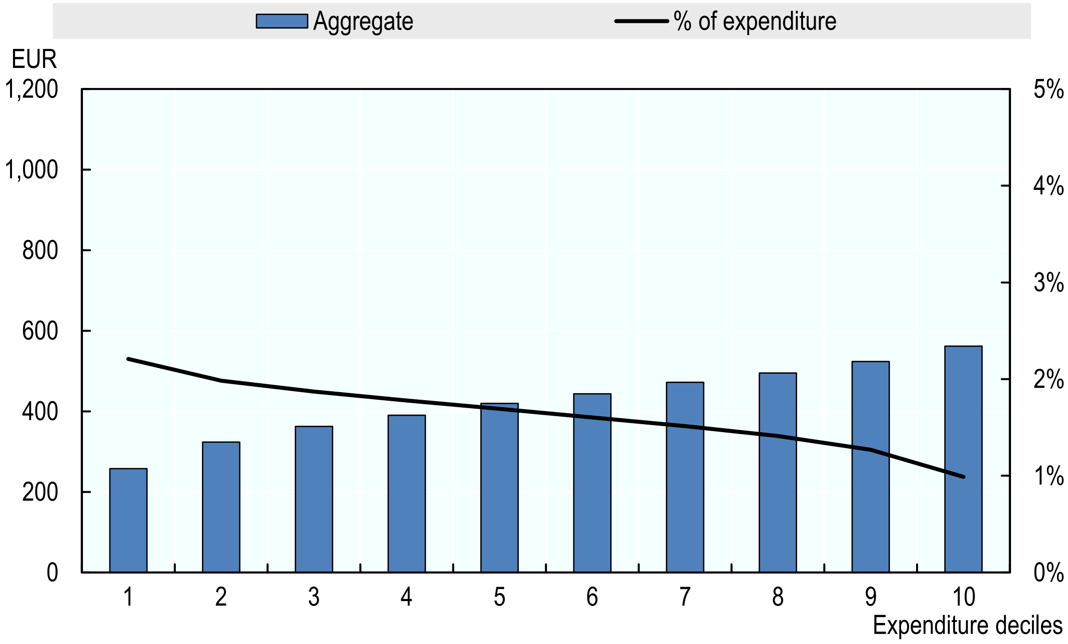
Food and non-alcoholic beverages for home consumption ("food" hereafter) are the most common expenditure type to be subject to a reduced rate. In 10 of the 23 countries examined, all food products are subject to a reduced (or super-reduced) rate, while another 11 provide a reduced rate for at least some food products, although the extent varies. For example, Hungary only provides a reduced rate for certain basic food types (bread, dairy, butter). Only two of the 23 countries (Estonia and the Slovak Republic) apply the standard rate to all food products. Latvia provides a reduced rate just for baby food, but this is unable to be separately examined below due to data limitations as specified in Chapter 4.

Figures 5.5 and 5.6 present the all-country averages of the tax expenditure and welfare change results from reduced VAT rates on food. Individual country results are presented in Tables 5.5 and 5.6 at the end of the chapter. Figures 5.5 and 5.6 show a similar pattern to that for all reduced rates, with higher deciles benefiting from successively larger tax expenditures and welfare changes, although the increases are significantly less marked than for all reduced rates. This is confirmed by the individual country results in Tables 5.5 and 5.6. The largest differences occur in France and the United Kingdom where the top decile receives more than three times the tax expenditure and welfare gain received by the bottom decile. The results show a clear progressive pattern for all 20 countries, with higher deciles benefiting from successively smaller proportional tax expenditures. As before, the welfare change results show increasingly larger aggregate gains for higher deciles than the tax expenditure results.

Figures 5.7 and 5.8 present the Kakwani and Reynolds-Smolensky index results. These results confirm the progressive patterns exhibited in Figures 5.5 and 5.6, with positive Kakwani indices in all counties. Furthermore, these are significantly higher than those for all reduced rates in almost every country. The redistributive effect is also positive in all countries. (This is also confirmed by the Atkinson index results in Tables 5.5 and 5.6.) Notably, in most countries, more redistribution occurs from the reduced rate on food than overall, although it is still minimal compared to typical income tax systems. Consistent with the slightly greater aggregate welfare change results, the Kakwani and Reynolds-Smolensky results show slightly less progressivity and redistribution for the welfare change than the tax expenditure.

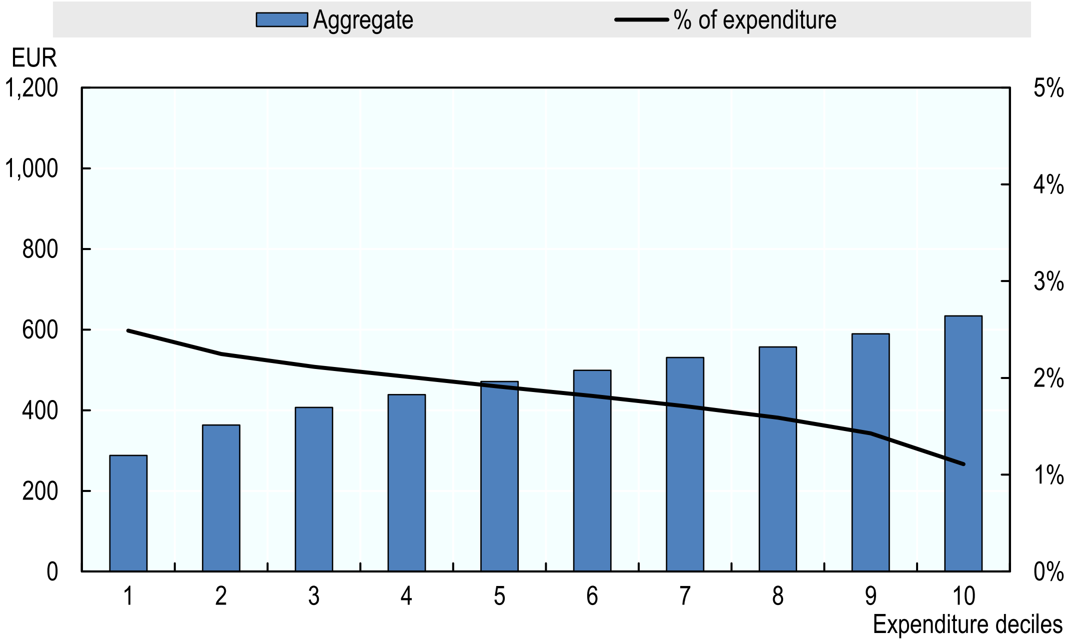
Overall, given the significant tax expenditures and welfare gains provided across the entire expenditure distribution, reduced rates for food are clearly not well targeted at poor households. However, they do have a progressive effect. Furthermore, comparison with the results for all reduced rates shows that reduced rates on food are a key part of most multi-rate VAT systems, providing the majority of support received by poor households. They are also clearly less poorly targeted than many other reduced rates given the smaller increases in the tax expenditure and welfare gain provided to higher decile households.

Figure 5.5. All-country average of average tax expenditure per household from reduced rates on food



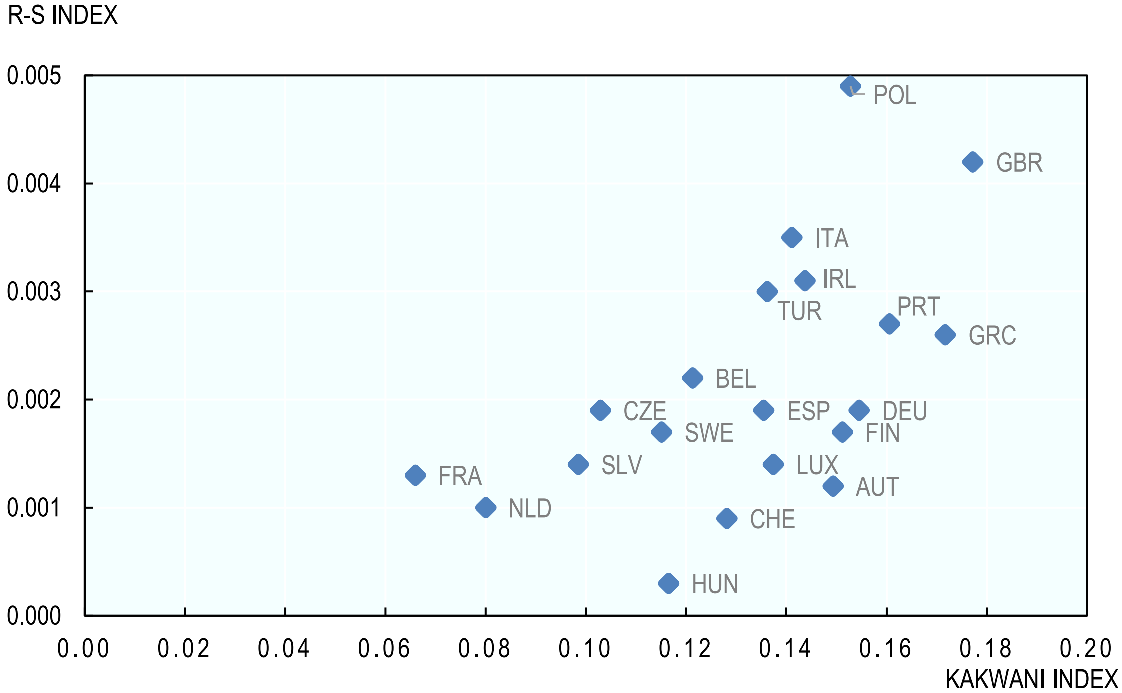
Notes. Results calculated using behavioural microsimulation models for 20 countries based on household expenditure survey microdata. "Aggregate" results present the simple mean across all countries of the within-country weighted mean of the tax expenditure per household. "% of expenditure" results present the simple mean across all countries of the within-country weighted mean of the tax expenditure as a percentage of total expenditure per household. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

Figure 5.6. All-country average of average welfare change per household from reduced rates on food



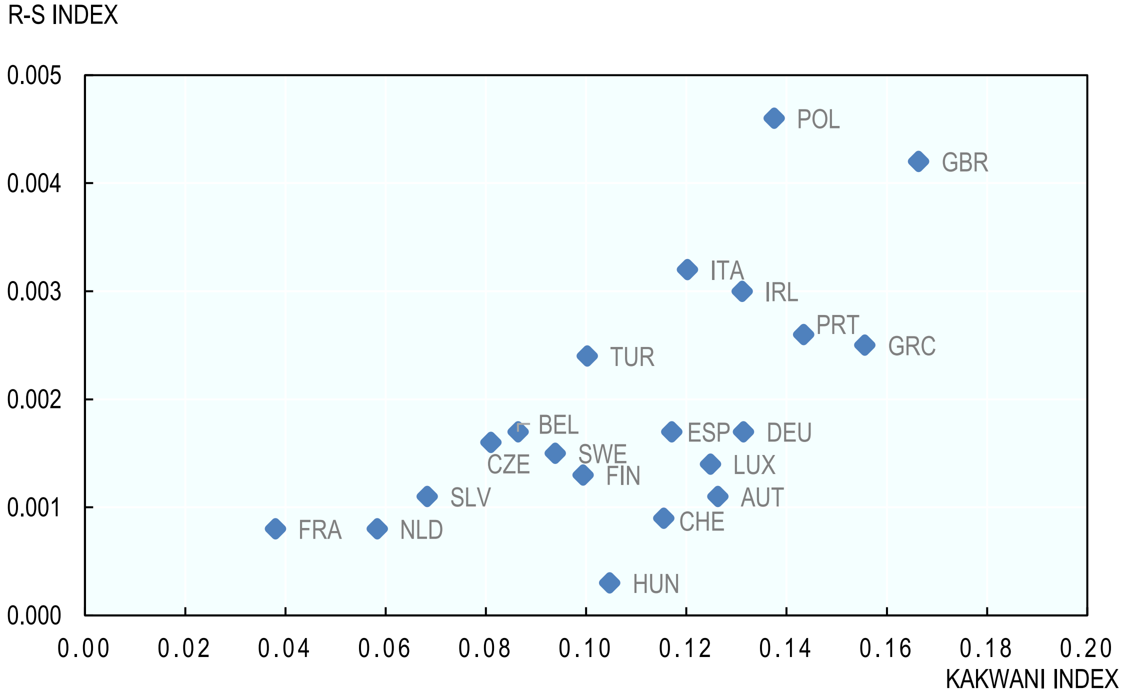
Notes. Results calculated using behavioural microsimulation models for 20 countries based on household expenditure survey microdata. "Aggregate" results present the simple mean across all countries of the within-country weighted mean of the (negative of the) compensating variation per household. "% of expenditure" results present the simple mean across all countries of the within-country weighted mean of the (negative of the) compensating variation as a percentage of total expenditure per household. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

Figure 5.7. Kakwani and Reynolds-Smolensky indices for tax expenditure from reduced rates on food



Notes. Results calculated using behavioural microsimulation models for 20 countries based on household expenditure survey microdata. R-S index = Reynolds-Smolensky redistribution index; Kakwani index = Kakwani progressivity index. Results calculated using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

Figure 5.8. Kakwani and Reynolds-Smolensky indices for welfare change from reduced rates on food



Notes. Results calculated using behavioural microsimulation models for 20 countries based on household expenditure survey microdata. R-S index = Reynolds-Smolensky redistribution index; Kakwani index = Kakwani progressivity index. Results calculated using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

Children's clothing

Figures 5.9 and 5.10 present the all-country averages of the tax expenditure and welfare change results for reduced VAT rates on children's clothing. Individual country results are presented in Tables 5.7 and 5.8 at the end of the chapter. The analysis covers four of the 23 countries (Ireland, Luxembourg, Turkey and the United Kingdom) that have reduced rates for children's clothing. One additional country – Poland – also applies a reduced rate for baby clothes, but the data limitations outlined in the previous chapter prevent this from being examined.

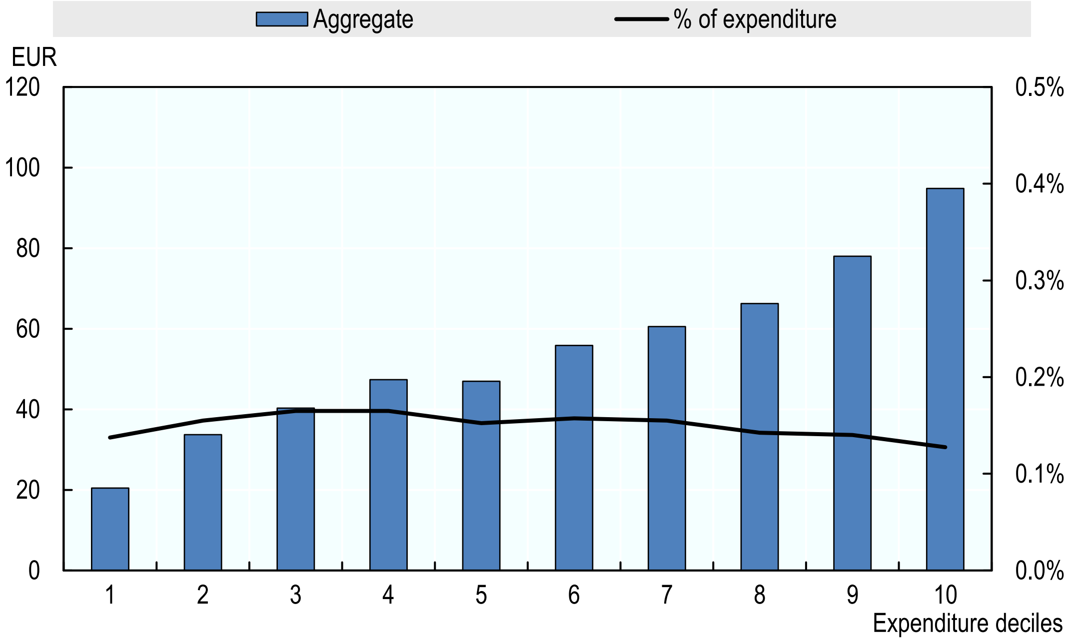
As with food, the results in Figures 5.9 and 5.10 (and Tables 5.7 and 5.8) again show higher deciles benefiting from successively larger tax expenditures and welfare gains, although the increases, as well as the overall magnitudes are far smaller than for food. As a proportion of expenditure, Figures 5.9 and 5.10 suggest that results tend to be slightly progressive overall. However, these averages mask significant variation across countries. While the results in Tables 5.7 and 5.8 for Turkey appear slightly progressive, the results for Ireland and the United Kingdom peak in the middle deciles before falling at higher deciles, and the results for Luxembourg cycle across deciles.

The ambiguous nature of the non-monotonic patterns shown in Tables 5.7 and 5.8 illustrate the benefit of the summary measures presented in Figures 5.11 and 5.12. The Kakwani index results for the tax expenditure show a very small degree of progressivity in all four countries. Unsurprisingly, though, given the minimal progressivity and low magnitude of the concessions, the Reynolds-Smolensky index results point to an extremely low degree of redistribution occurring.[85]

As before, the welfare change results show a greater aggregate gain for higher deciles than the tax expenditure results. As a consequence, the Kakwani index results in Figure 5.12 show the welfare effect of the reduced rate to be slightly regressive (and hence inequality increasing) in Ireland and Turkey. Additionally, for Ireland, the Atkinson index result for the tax expenditure at a high degree of inequality aversion (see Table 5.7) is inconsistent with the Reynolds-Smolensky index result, suggesting a small increase in inequality. Conclusions for Ireland and Turkey therefore depend on the choice of welfare metric as well as, in Ireland, on the underlying value judgement as to the degree of weight to be placed on the welfare of households in the lower tail of the distribution.

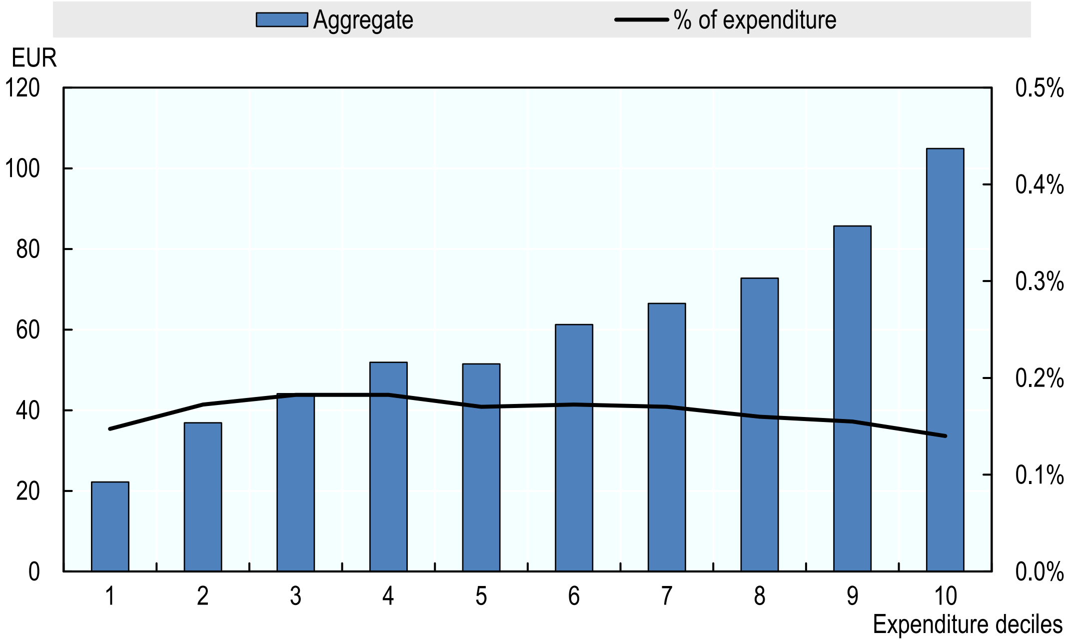
[85] Turkey also provides a reduced VAT rate for adult's clothing. In contrast to children's clothing, the results for adult's clothing in Turkey present a regressive picture (with Kakwani indices of -0.09 and -0.13 for the tax expenditure and welfare change, respectively).

Figure 5.9. All-country average of average tax expenditure per household from reduced rates on children's clothing



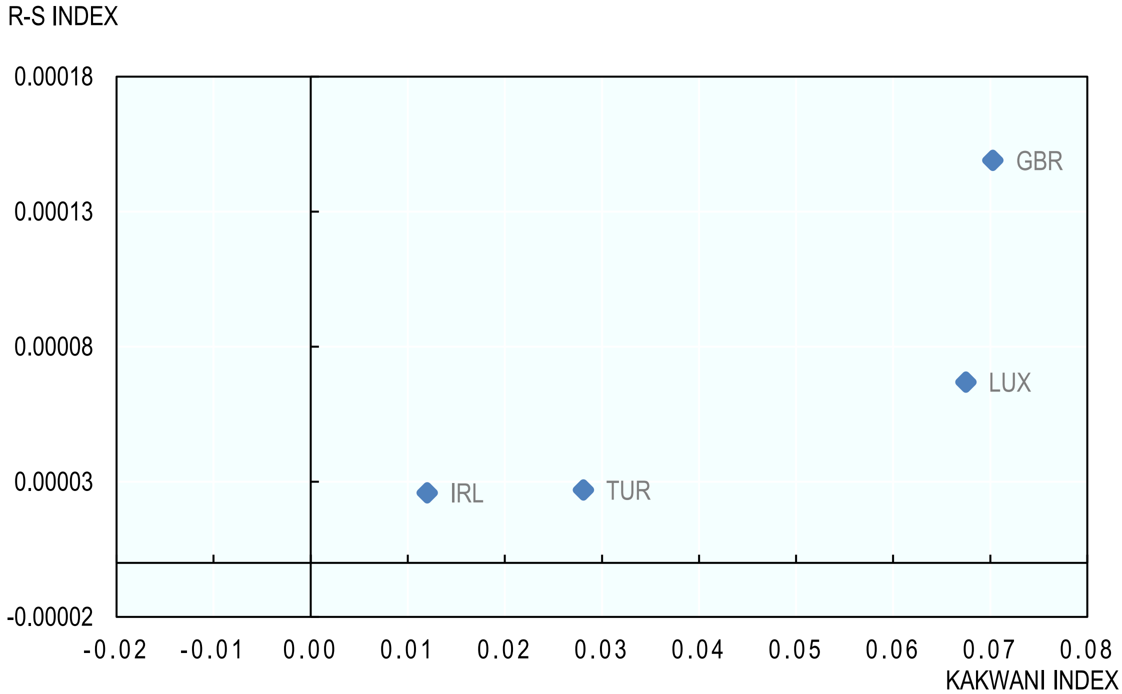
Notes. Results calculated using behavioural microsimulation models for four countries based on household expenditure survey microdata. "Aggregate" results present the simple mean across all countries of the within-country weighted mean of the tax expenditure per household. "% of expenditure" results present the simple mean across all countries of the within-country weighted mean of the tax expenditure as a percentage of total expenditure per household. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

Figure 5.10. All-country average of average welfare change per household from reduced rates on children's clothing



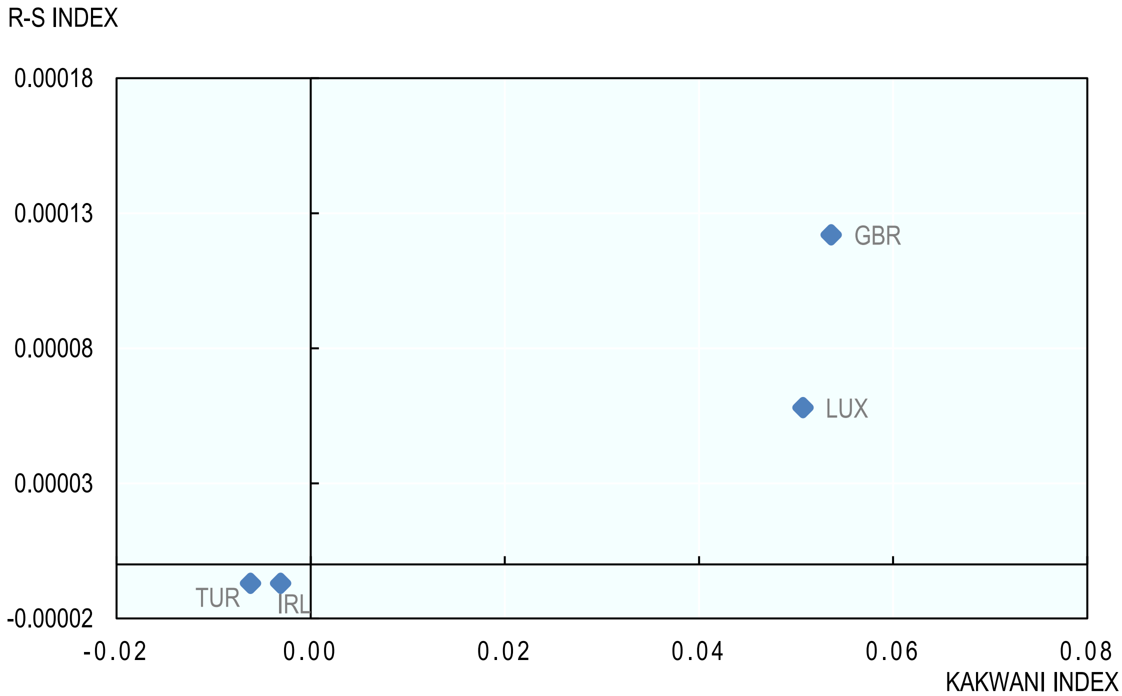
Notes. Results calculated using behavioural microsimulation models for four countries based on household expenditure survey microdata. "Aggregate" results present the simple mean across all countries of the within-country weighted mean of the (negative of the) compensating variation per household. "% of expenditure" results present the simple mean across all countries of the within-country weighted mean of the (negative of the) compensating variation as a percentage of total expenditure per household. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

Figure 5.11. Kakwani and Reynolds-Smolensky indices for tax expenditure from reduced rates on children's clothing



Notes. Results calculated using behavioural microsimulation models for four countries based on household expenditure survey microdata. R-S index = Reynolds-Smolensky redistribution index; Kakwani index = Kakwani progressivity index. Results calculated using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

Figure 5.12. Kakwani and Reynolds-Smolensky indices for welfare change from reduced rates on children's clothing



Notes. Results calculated using behavioural microsimulation models for four countries based on household expenditure survey microdata. R-S index = Reynolds-Smolensky redistribution index; Kakwani index = Kakwani progressivity index. Results calculated using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

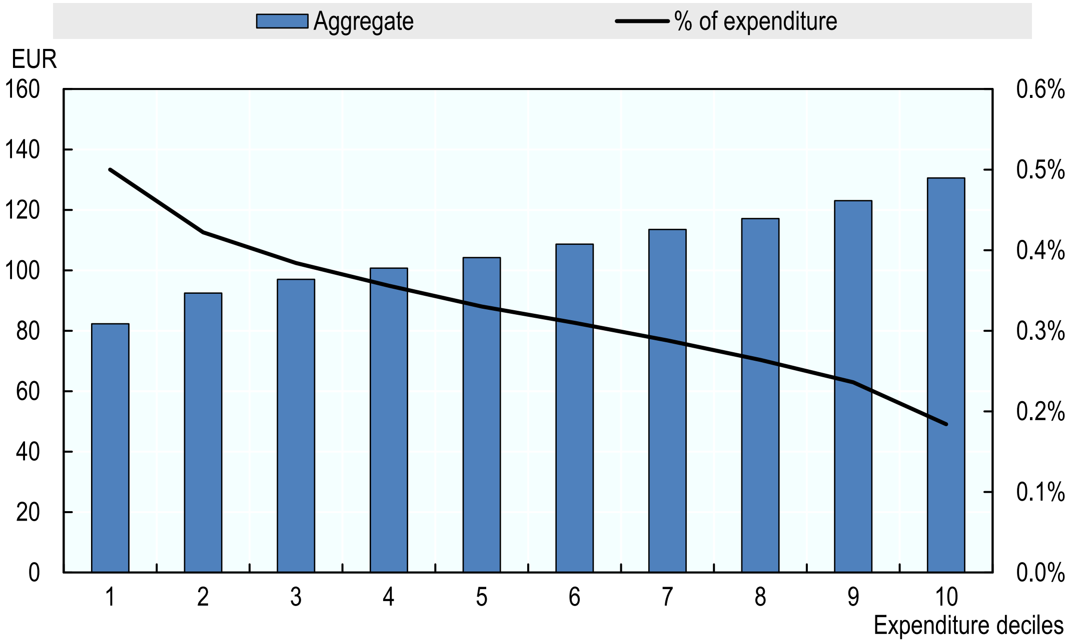
Domestic utilities (energy, water, refuse and sewage)

Figures 5.13 and 5.14 present the all-country averages of the tax expenditure and welfare change results for reduced VAT rates on domestic utilities. Individual country results are presented in Tables 5.9 and 5.10 at the end of the chapter. Domestic utilities are grouped in the behavioural models into domestic energy (predominantly electricity and gas) and housing services (water, refuse and sewage). The analysis covers five countries that have reduced rates for some or all utilities: Greece has reduced rates for domestic energy; Spain and Poland for housing services; and Ireland and Luxembourg for both. While several other countries also apply reduced rates for some domestic energy and/or housing services, as detailed in the previous chapter, data limitations prevent these from being separately examined.

Figures 5.13 and 5.14 again show higher deciles benefiting from successively larger tax expenditures and welfare gains, with the increases and the overall magnitudes again far smaller than for food. Unlike children's clothing, there is once again a clearly progressive pattern in each country. This is confirmed in Figures 5.15 and 5.16 by the Kakwani index results – which are of similar magnitude to the results for food, and significantly greater than for children's clothing. Given the smaller magnitude of the tax expenditure than for food, redistribution is minimal in all five countries.

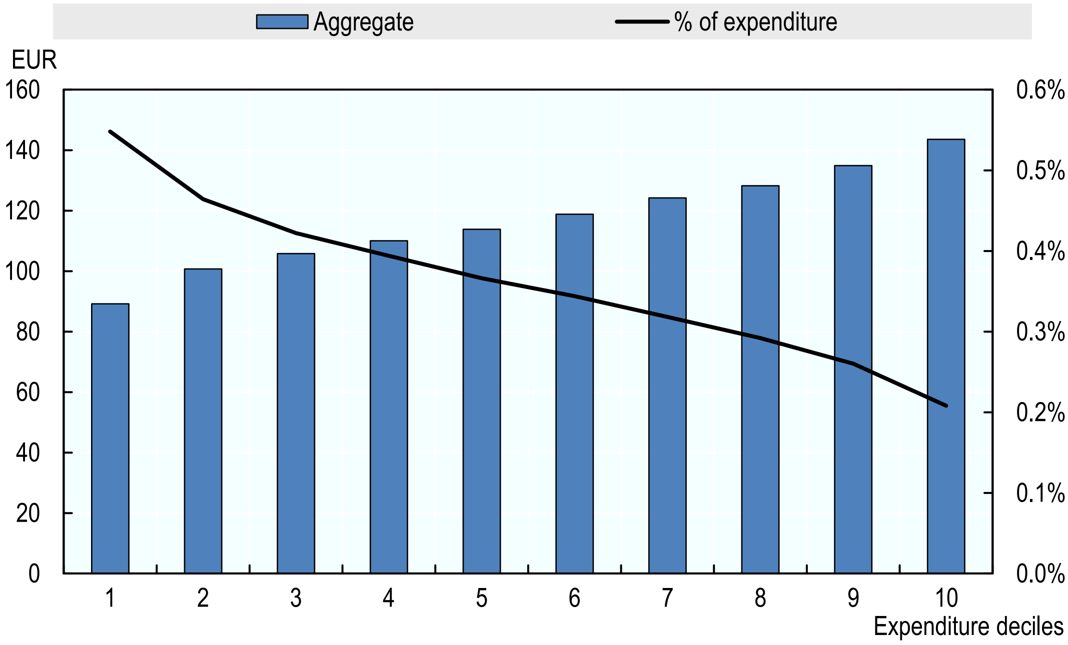
Once again, the welfare change results show slightly larger aggregate gains than the tax expenditure results, and hence slightly reduce progressivity. In Luxembourg, the higher magnitude of the welfare change leads to slightly greater redistribution than with the tax expenditure results, though again it is very low.

Figure 5.13. All-country average of average tax expenditure per household from reduced rates on domestic utilities



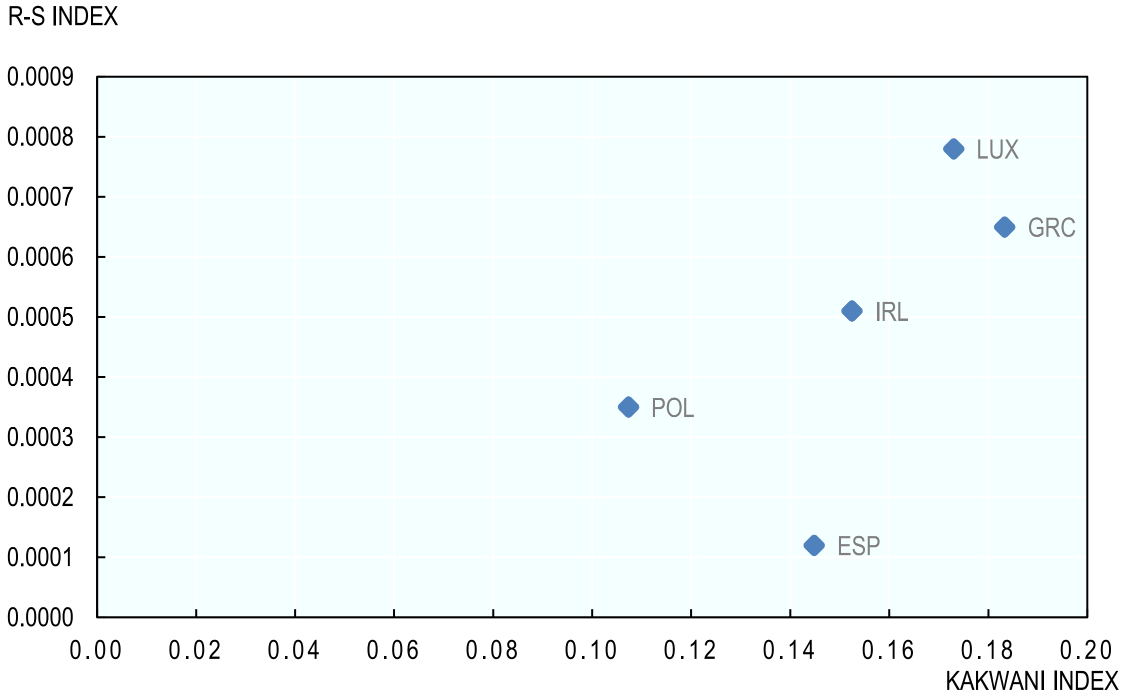
Notes. Results calculated using behavioural microsimulation models for five countries based on household expenditure survey microdata. "Aggregate" results present the simple mean across all countries of the within-country weighted mean of the tax expenditure per household. "% of expenditure" results present the simple mean across all countries of the within-country weighted mean of the tax expenditure as a percentage of total expenditure per household. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

Figure 5.14. All-country average of average welfare change per household from reduced rates on domestic utilities



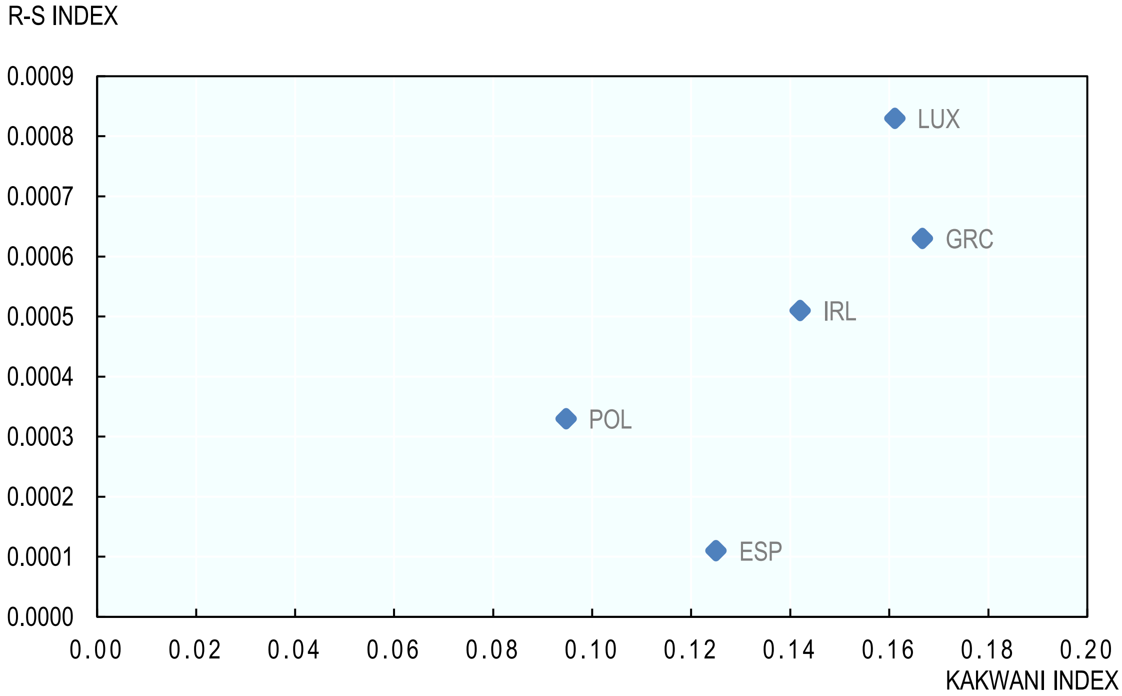
Notes. Results calculated using behavioural microsimulation models for five countries based on household expenditure survey microdata. "Aggregate" results present the simple mean across all countries of the within-country weighted mean of the (negative of the) compensating variation per household. "% of expenditure" results present the simple mean across all countries of the within-country weighted mean of the (negative of the) compensating variation as a percentage of total expenditure per household. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

Figure 5.15. Kakwani and Reynolds-Smolensky indices for tax expenditure from reduced rates on domestic utilities



Notes. Results calculated using behavioural microsimulation models for five countries based on household expenditure survey microdata. R-S index = Reynolds-Smolensky redistribution index; Kakwani index = Kakwani progressivity index. Results calculated using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

Figure 5.16. Kakwani and Reynolds-Smolensky indices for welfare change from reduced rates on domestic utilities



Notes. Results calculated using behavioural microsimulation models for five countries based on household expenditure survey microdata. R-S index = Reynolds-Smolensky redistribution index; Kakwani index = Kakwani progressivity index. Results calculated using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

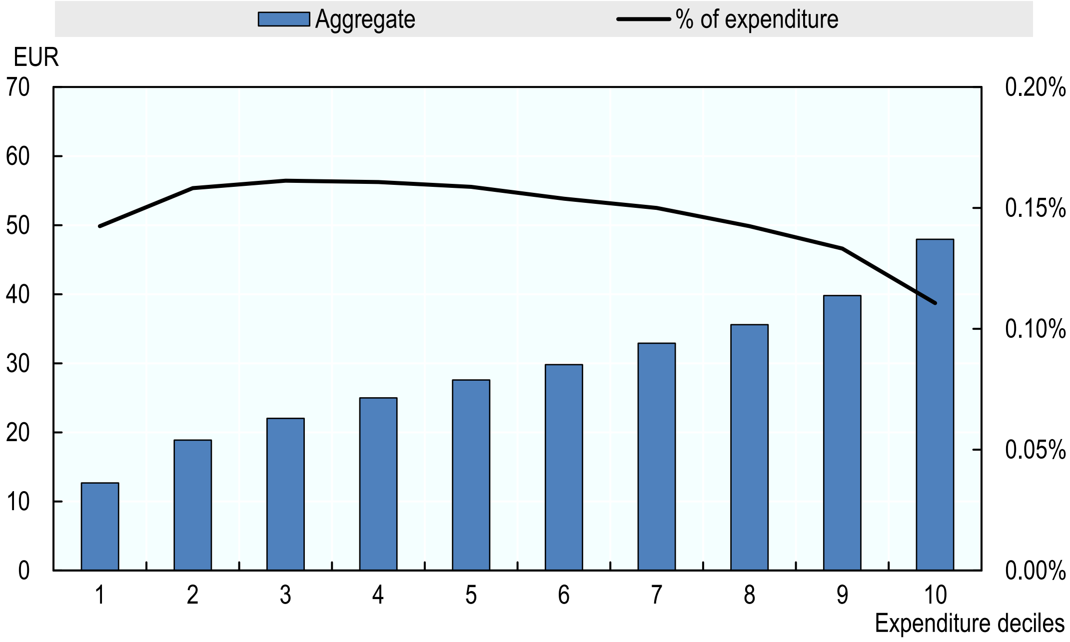
Pharmaceuticals

Figures 5.17 and 5.18 present the all-country averages of the tax expenditure and welfare change results for reduced VAT rates on pharmaceuticals. Individual country results are presented in Tables 5.11 and 5.12 at the end of the chapter. The analysis covers 16 countries that have reduced rates on pharmaceutical products. While several other countries also apply reduced rates for some pharmaceutical products, as detailed in the previous chapter data limitations prevent these from being separately examined.

Figures 5.17 and 5.18 again show higher deciles benefiting from successively larger tax expenditures and welfare gains, with the overall magnitudes again far smaller than for food. As a proportion of expenditure, results tend to peak around the fourth decile before exhibiting a progressive pattern at higher deciles. That said, there is considerable variation across countries. The Kakwani index results in Figure 5.19 confirm a small degree of overall progressivity for the tax expenditure in all but two countries – Spain and Slovenia. The typically small aggregate amounts and minimal progressivity, result in only minimal redistribution in all countries. In Latvia, while the Atkinson index results at low and medium degrees of inequality aversion are consistent with the Reynolds-Smolensky result (a very small reduction in inequality), at a high degree of inequality aversion the Atkinson index suggests a very small increase in inequality.

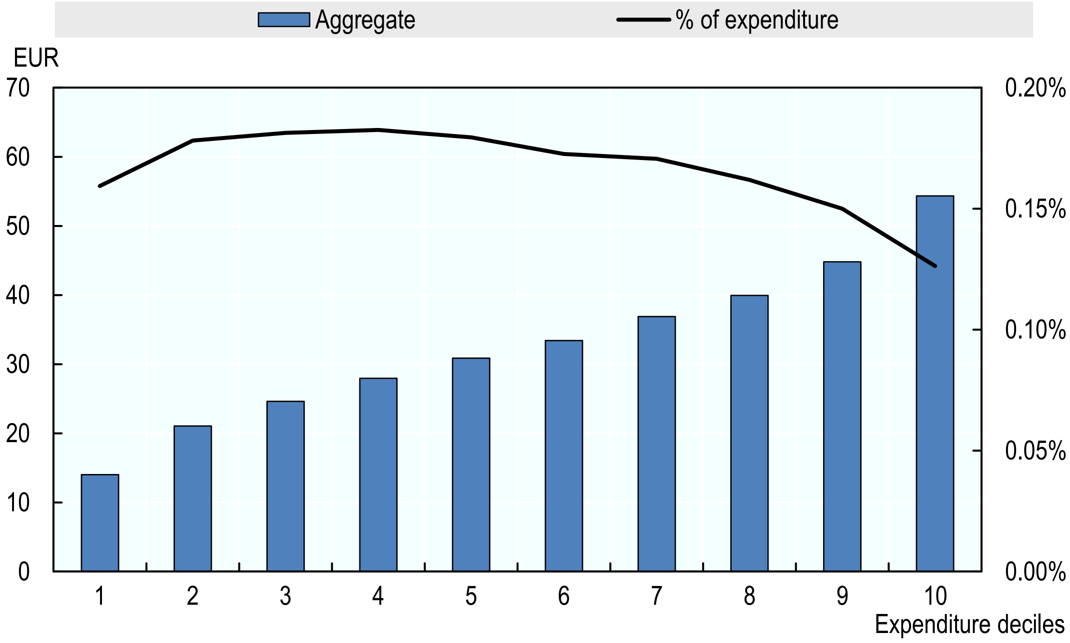
The welfare change results again show a greater aggregate gain for higher deciles than the tax expenditure results. As a consequence, the welfare effect of the reduced rate on pharmaceuticals is found in Figure 5.20 to be slightly regressive in three additional countries: Austria, Latvia and Switzerland. The typically small aggregate amounts and minimal progressivity, again, result in minimal redistribution.

Figure 5.17. All-country average of average tax expenditure per household from reduced rates on pharmaceuticals



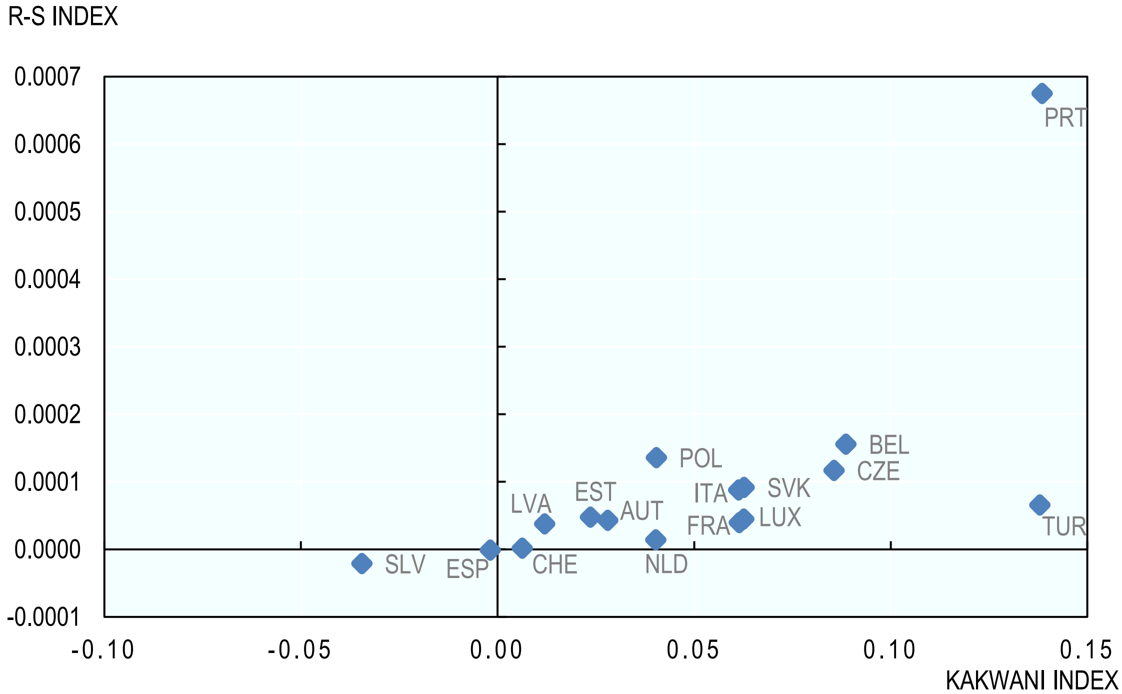
Notes. Results calculated using behavioural microsimulation models for 16 countries based on household expenditure survey microdata. "Aggregate" results present the simple mean across all countries of the within-country weighted mean of the tax expenditure per household. "% of expenditure" results present the simple mean across all countries of the within-country weighted mean of the tax expenditure as a percentage of total expenditure per household. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

Figure 5.18. All-country average of average welfare change per household from reduced rates on pharmaceuticals



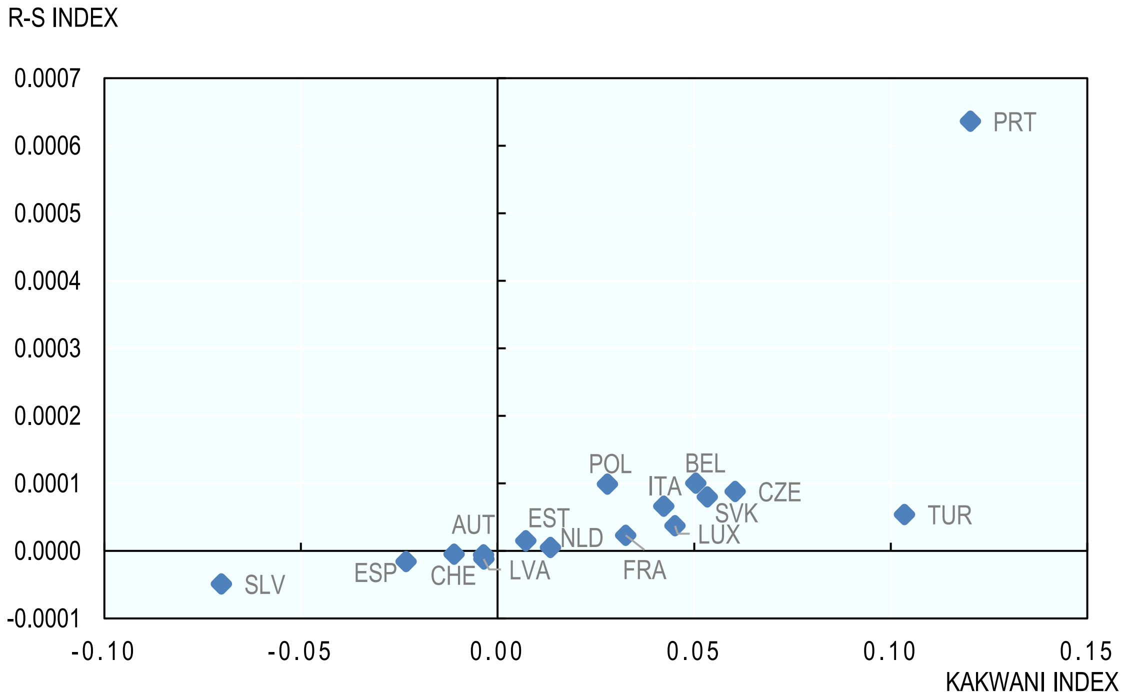
Notes. Results calculated using behavioural microsimulation models for 16 countries based on household expenditure survey microdata. "Aggregate" results present the simple mean across all countries of the within-country weighted mean of the (negative of the) compensating variation per household. "% of expenditure" results present the simple mean across all countries of the within-country weighted mean of the (negative of the) compensating variation as a percentage of total expenditure per household. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

Figure 5.19. Kakwani and Reynolds-Smolensky indices for tax expenditure from reduced rates on pharmaceuticals



Notes. Results calculated using behavioural microsimulation models for 16 countries based on household expenditure survey microdata. R-S index = Reynolds-Smolensky redistribution index; Kakwani index = Kakwani progressivity index. Results calculated using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

Figure 5.20. Kakwani and Reynolds-Smolensky indices for welfare change from reduced rates on pharmaceuticals



Notes. Results calculated using behavioural microsimulation models for 16 countries based on household expenditure survey microdata. R-S index = Reynolds-Smolensky redistribution index; Kakwani index = Kakwani progressivity index. Results calculated using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

5.4.3. Reduced rates introduced to support cultural, social and other policy goals

This section examines the distributional impact of reduced rates on particular expenditure groupings where the policy rationale for their introduction is to support cultural, social and other non-distributional policy goals. While not introduced specifically to support poorer households, these concessions may still have a significant distributional impact. In order to develop coherent economic policy, it is important to quantify the distributional effects of such concessions so that the impact on distributional goals can be weighed against the objectives of the concessions. The microsimulation model allows the following two expenditure groupings to be separately examined: cultural and social expenditure; and restaurants and hotels.

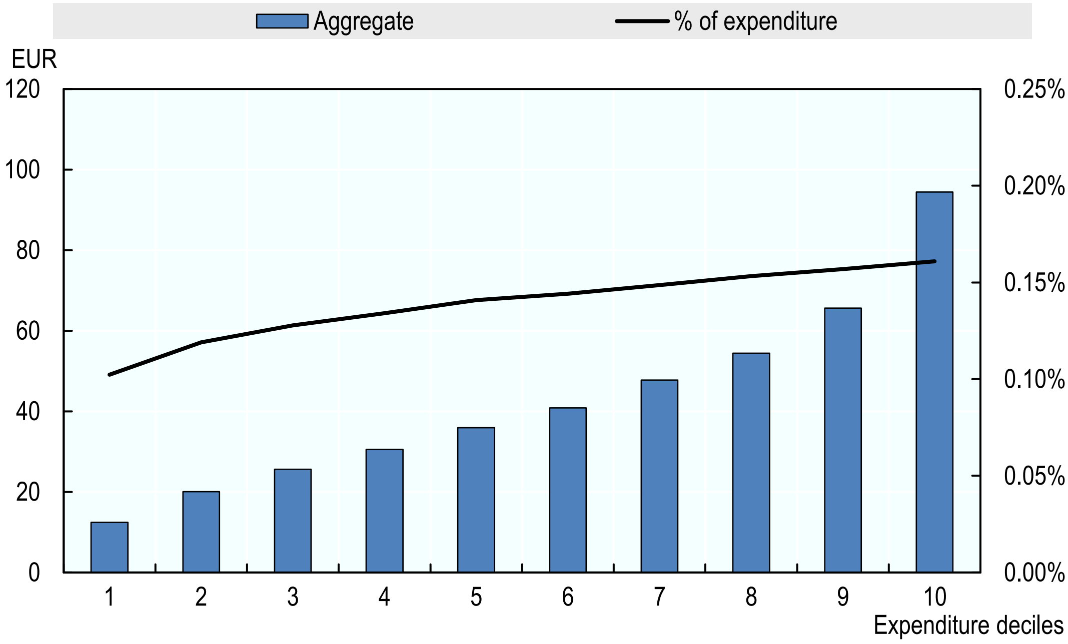
Cultural and social expenditure

Figures 5.21 and 5.22 present the all-country averages of the tax expenditure and welfare change results for reduced VAT rates on cultural and social expenditure (including: cinema, theatre and concerts; museums and zoos; books; and newspapers and magazines). Individual country results are presented in Tables 5.13 and 5.14 at the end of the chapter. All 23 countries have reduced rates for some cultural and social expenditure. The analysis here covers 22 of these 23 countries, with data limitations preventing the separate examination of this expenditure category for Switzerland.

Results are significantly different from the previous categories. Figures 5.21 and 5.22 show richer households not just benefiting more in aggregate terms than poorer households, but benefiting substantially more. The individual country results show that in many cases the difference is extreme. For example, in nine countries the top decile benefits from a tax expenditure and welfare gain more than 10 times as large as that received by the bottom decile. These large increases now result in a regressive pattern in most countries, with proportionate tax expenditures and welfare gains typically monotonically increasing across deciles. In contrast, Finland and the United Kingdom appear broadly progressive, while Luxembourg appears roughly proportional.

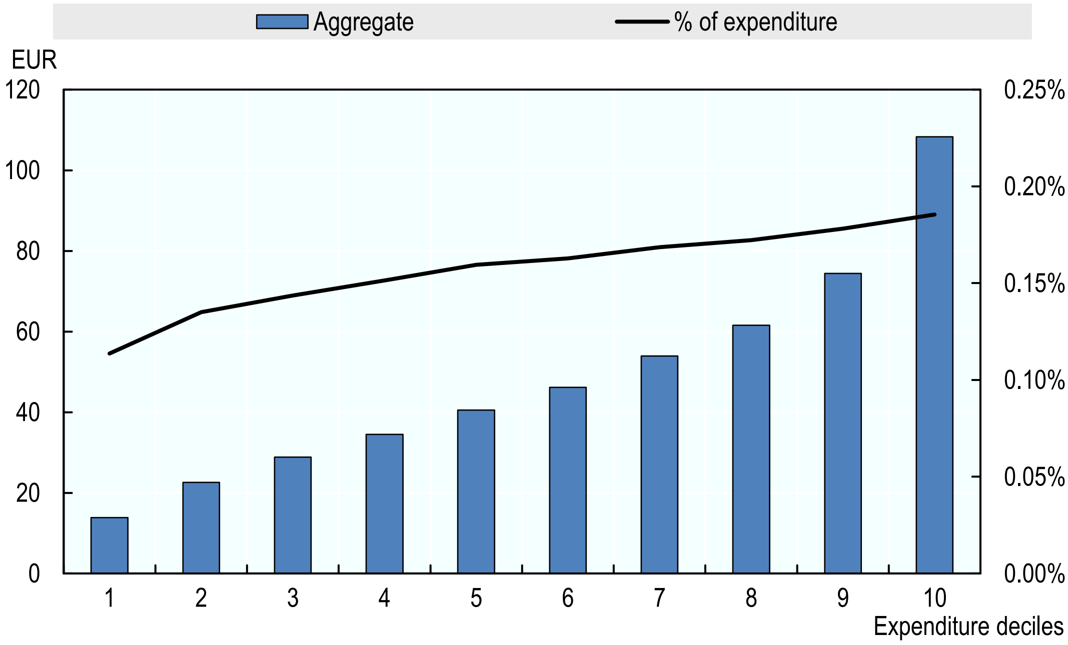
The Kakwani index results in Figure 5.23 confirm the progressivity of the tax expenditure in Finland and the United Kingdom, as well as Luxembourg, with the other 19 countries all regressive. Furthermore, the degree of regressivity in many cases is particularly significant, with nine countries having a Kakwani index greater (in absolute vale terms) than -0.10. The welfare change results again show a greater aggregate gain for higher deciles than the tax expenditure results. As a consequence, the welfare effect of the reduced rate is now also found to be slightly regressive in Luxembourg (Figure 5.24). The significant degree of regressivity in most countries does not lead to substantial increases in inequality though, due to the moderate size of the tax expenditure in most countries.

Figure 5.21. All-country average of average tax expenditure per household from reduced rates on cultural and social expenditure



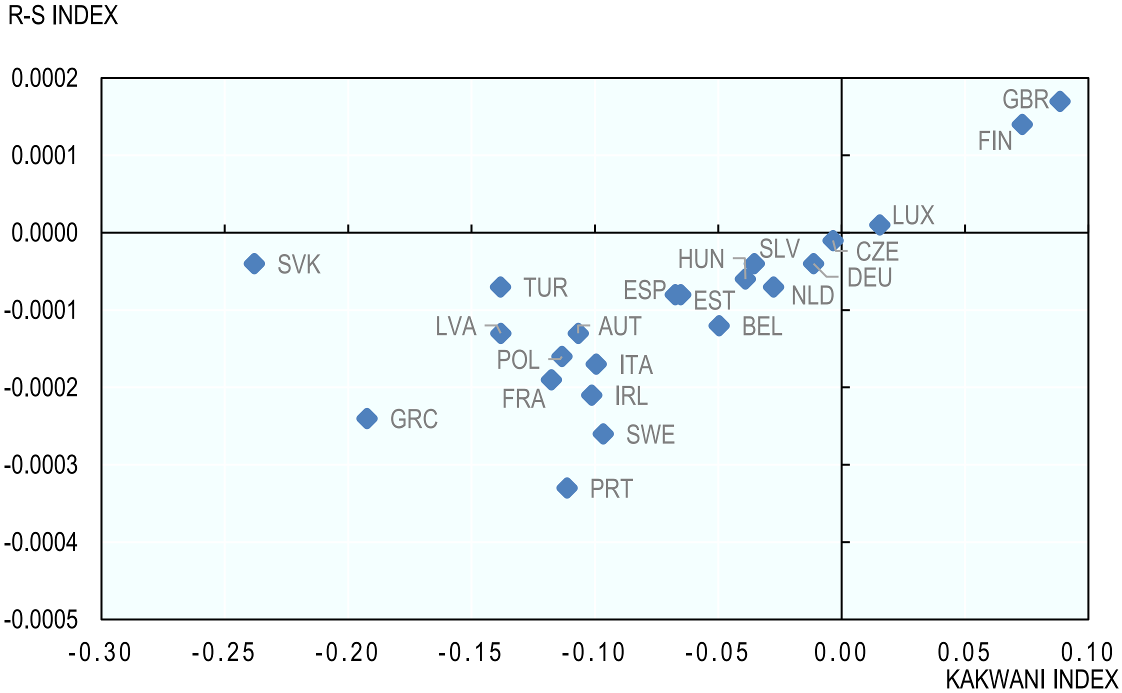
Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. "Aggregate" results present the simple mean across all countries of the within-country weighted mean of the tax expenditure per household. "% of expenditure" results present the simple mean across all countries of the within-country weighted mean of the tax expenditure as a percentage of total expenditure per household. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

Figure 5.22. All-country average of average welfare change per household from reduced rates on cultural and social expenditure



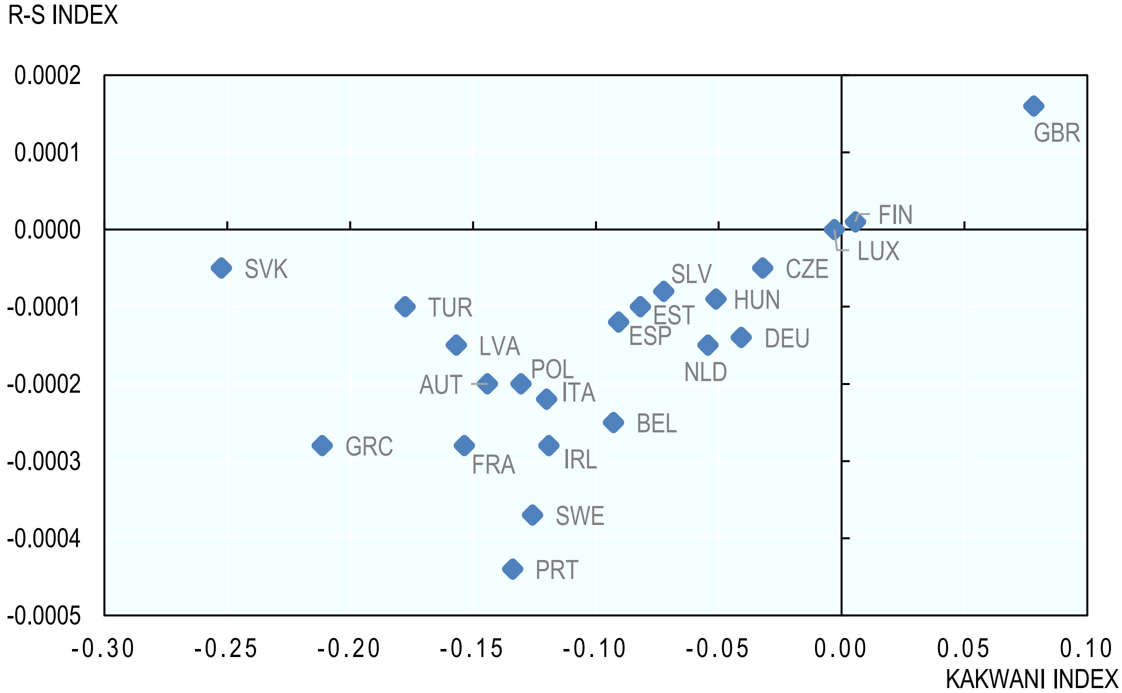
Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. "Aggregate" results present the simple mean across all countries of the within-country weighted mean of the (negative of the) compensating variation per household. "% of expenditure" results present the simple mean across all countries of the within-country weighted mean of the (negative of the) compensating variation as a percentage of total expenditure per household. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

Figure 5.23. Kakwani and Reynolds-Smolensky indices for tax expenditure from reduced rates on cultural and social expenditure



Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. R-S index = Reynolds-Smolensky redistribution index; Kakwani index = Kakwani progressivity index. Results calculated using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

Figure 5.24. Kakwani and Reynolds-Smolensky indices for welfare change from reduced rates on cultural and social expenditure



Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. R-S index = Reynolds-Smolensky redistribution index; Kakwani index = Kakwani progressivity index. Results calculated using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

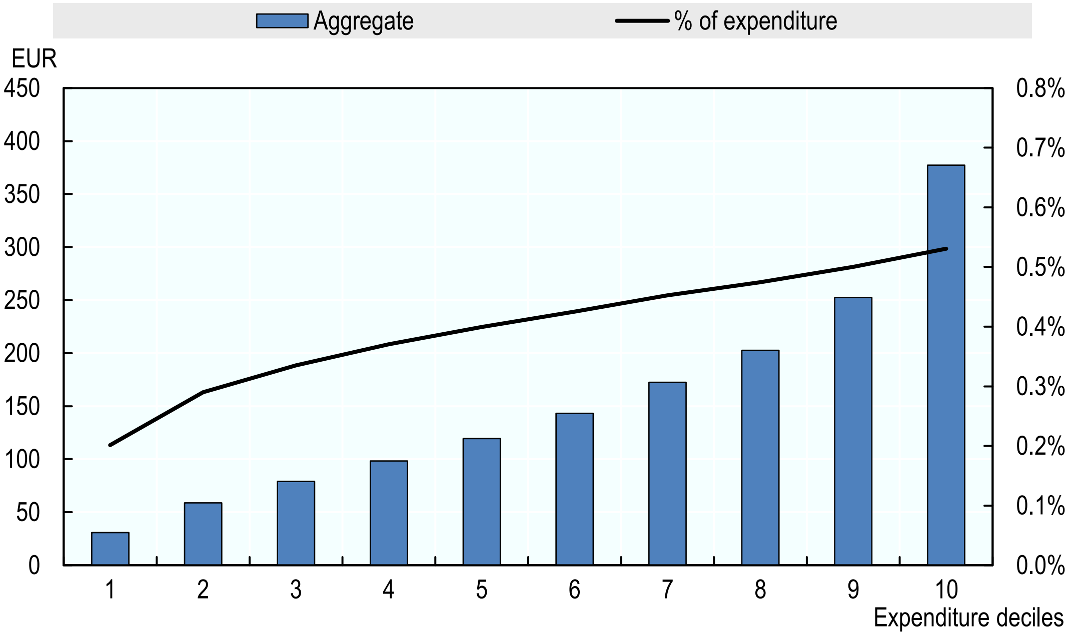
Restaurants and hotels

Figures 5.25 and 5.26 present the all-country averages of the tax expenditure and welfare change results for reduced VAT rates on restaurants (including canteens and cafeterias) and hotels (including other accommodation services, such as motels and "bed and breakfasts"). Individual country results are presented in Table 5.15 and 5.16 at the end of the chapter. The analysis covers 15 countries that have reduced rates for restaurants and hotels.

Results are even more extreme than those for cultural and social expenditure. Figures 5.25 and 5.26 show richer households again benefiting substantially more in aggregate terms than poorer households, but the aggregate tax expenditure and welfare gain amounts are now substantially larger. For example, the top decile in France benefits, on average, from a EUR 130 tax expenditure on cultural and social expenditure, whereas they benefit from a EUR 561 tax expenditure from restaurants and hotels.

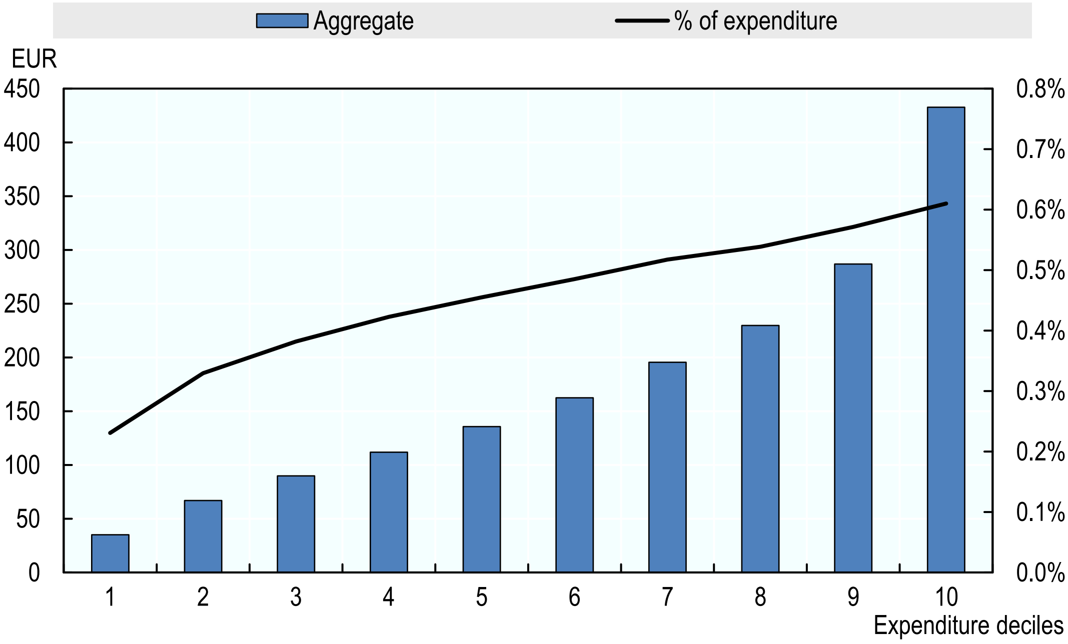
The results unsurprisingly show clearly regressive patterns in most countries, with higher deciles benefiting from successively larger proportional tax expenditures (though sometimes not for the top decile). The Kakwani index results in Figures 5.27 and 5.28 confirm the regressivity in every country. Additionally, in nine of 14 countries where comparison is possible, the reduced rate on restaurants and hotels is shown to be even more regressive than for cultural and social expenditure. Furthermore, the significantly larger aggregate tax expenditures and welfare gains result in a larger impact on inequality than for cultural and social expenditure. Nevertheless, as with all groups the overall redistributive effect is still small.

Figure 5.25. All-country average of average tax expenditure per household from reduced rates on restaurants and hotels



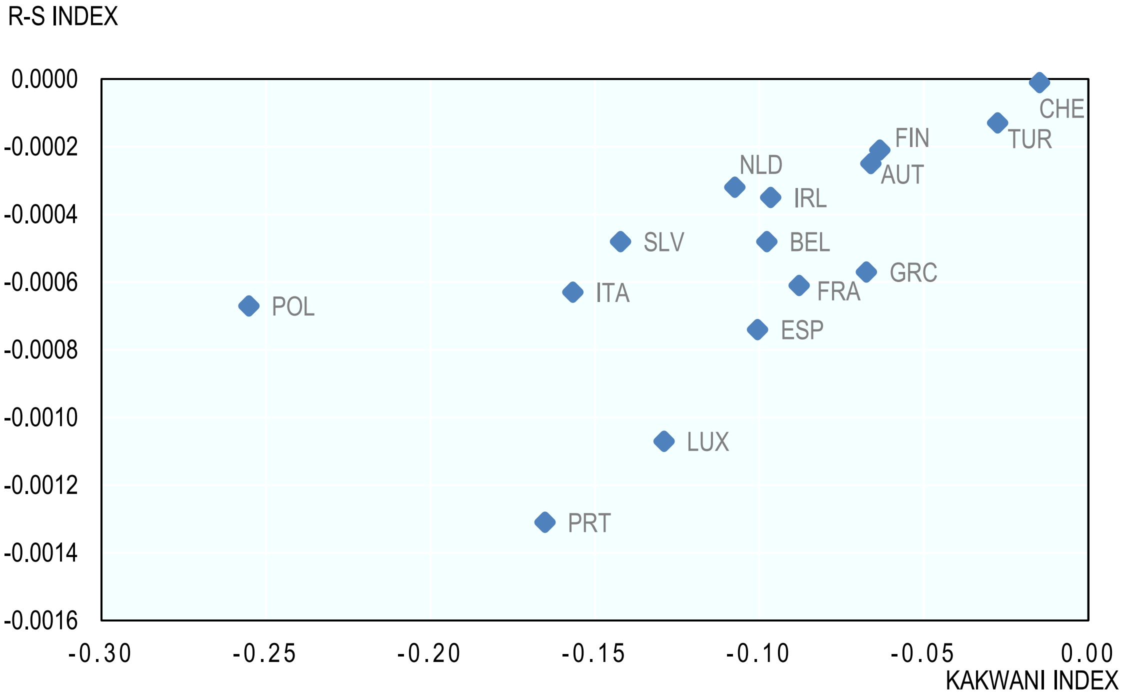
Notes. Results calculated using behavioural microsimulation models for 15 countries based on household expenditure survey microdata. "Aggregate" results present the simple mean across all countries of the within-country weighted mean of the tax expenditure per household. "% of expenditure" results present the simple mean across all countries of the within-country weighted mean of the tax expenditure as a percentage of total expenditure per household. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

Figure 5.26. All-country average of average welfare change per household from reduced rates on restaurants and hotels



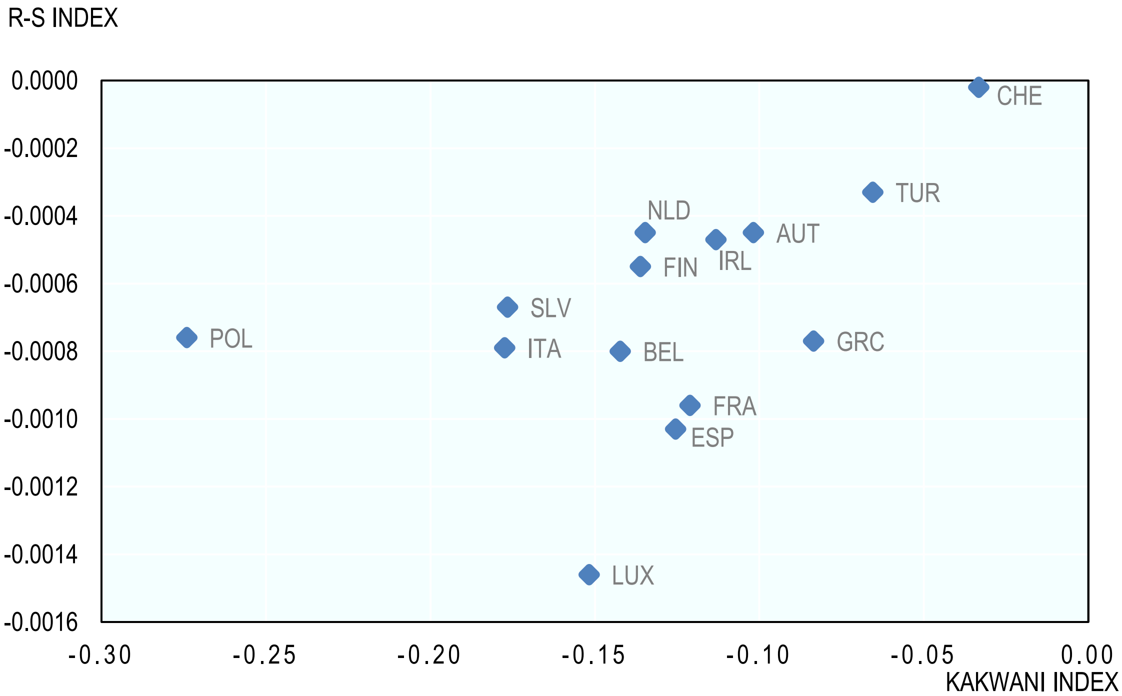
Notes. Results calculated using behavioural microsimulation models for 15 countries based on household expenditure survey microdata. "Aggregate" results present the simple mean across all countries of the within-country weighted mean of the (negative of the) compensating variation per household. "% of expenditure" results present the simple mean across all countries of the within-country weighted mean of the (negative of the) compensating variation as a percentage of total expenditure per household. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

Figure 5.27. Kakwani and Reynolds-Smolensky indices for tax expenditure from reduced rates on restaurants and hotels



Notes. Results calculated using behavioural microsimulation models for 15 countries based on household expenditure survey microdata. R-S index = Reynolds-Smolensky redistribution index; Kakwani index = Kakwani progressivity index. Results calculated using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

Figure 5.28. Kakwani and Reynolds-Smolensky indices for welfare change from reduced rates on restaurants and hotels



Notes. Results calculated using behavioural microsimulation models for 15 countries based on household expenditure survey microdata. R-S index = Reynolds-Smolensky redistribution index; Kakwani index = Kakwani progressivity index. Results calculated using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

5.4.4. Comparing results for different reduced rates

To provide an overall summary of how distributional impacts vary across different types of reduced VAT rates, Tables 5.1 and 5.2 present the all-country simple averages of the Kakwani and Reynolds-Smolensky indices, calculated for the tax expenditure and welfare gain, respectively. Each average is calculated only for the countries that have the particular reduced rate in place.

Table 5.1. All-country average of Kakwani and Reynolds-Smolensky indices for tax expenditure from different reduced rates

	Kakwani	Reynolds-Smolensky
Domestic utilities	0.152	0.00048
Food	0.132	0.00216
Pharmaceuticals	0.050	0.00009
Children’s clothing	0.044	0.00007
Cultural and social expenditure	-0.071	-0.00010
Restaurants and hotels	-0.104	-0.00052

Notes. Results calculated using microsimulation models for 23 countries based on household expenditure survey microdata. Results present the simple mean, across all countries that have the respective reduced VAT rate, of the Kakwani progressivity index and Reynolds-Smolensky redistribution index. Results calculated in relation to the tax expenditure, using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

Table 5.2. All-country average of Kakwani and Reynolds-Smolensky indices for welfare gain from different reduced rates

	Kakwani	Reynolds-Smolensky
Domestic utilities	0.138	0.00048
Food	0.110	0.00192
Pharmaceuticals	0.028	0.00007
Children’s clothing	0.024	0.00004
Cultural and social expenditure	-0.098	-0.00015
Restaurants and hotels	-0.135	-0.00075

Notes. Results calculated using microsimulation models for 23 countries based on household expenditure survey microdata. Results present the simple mean, across all countries that have the respective reduced VAT rate, of the Kakwani progressivity index and Reynolds-Smolensky redistribution index. Results calculated in relation to the (negative of the) compensating variation, using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

The results confirm that reduced VAT rates on domestic utilities (energy, water, refuse and sewage) and on food, are by far the most progressive types of reduced rates in OECD countries. In contrast, reduced rates on restaurants and hotels, and on cultural and social expenditure are the most regressive. While Reynolds-Smolensky indices are always low, the relative importance of reduced rates on food is shown by the substantially larger average Reynolds-Smolensky index for food than for any other expenditure group.

The disproportionately larger welfare gains received by richer households again reduce the degree of progressivity and redistribution when measured in terms of the welfare gain. That said, the average redistribution achieved by reduced rates on domestic utilities remains the same under either metric (as the progressivity and average concession rate effects cancel out).

5.5. Conclusion

This chapter has examined the effectiveness of reduced VAT rates as a policy instrument for supporting poorer households. It has utilised the behavioural microsimulation models developed in Chapter 4 to simulate the removal of reduced VAT rates in 23 OECD countries. These simulation results have then been used to examine the revenue and welfare effects of a move in the opposite direction – i.e. the introduction of those reduced rates. Aggregate and proportional tax expenditure (change in tax revenue) and welfare change (compensating variation) results are presented across equivalised expenditure deciles, along with standard summary measures of progressivity and redistribution.

Taken as a whole, reduced VAT rates are found to have a progressive impact in 21 of the 23 countries examined when measured by the tax expenditure, and 20 of 23 countries when measured by the welfare change. In a number of countries the tax expenditures and welfare gains from reduced VAT rates exhibit similar levels of progressivity to those found in many progressive personal income tax systems. Despite this progressivity, reduced VAT rates are shown to be a highly ineffective mechanism for targeting support to poorer households: as anticipated, not only do rich households benefit from reduced VAT rates, but they benefit more in aggregate terms than poor households do. This is further illustrated by the minimal degree of redistribution achieved by reduced rates, despite their significant progressivity.

Further analysis shows considerable variation in the distributional impact of reduced rates depending on the particular type of expenditure subject to the reduced rate. In most cases, results are found to vary depending on the underlying policy rationale for introducing the reduced VAT rate.

Reduced VAT rates that have been specifically introduced to support the poor – such as reduced rates on food consumed at home and domestic utilities – are typically found to have the desired progressive effect. For example, tax expenditure results show that reduced rates for food provide significantly greater financial support to the poor than the rich, as a proportion of expenditure, in every country in which they are applied. However, as with the overall results, these reduced VAT rates are still shown to be a very ineffective tool for targeting support to poor households: at best, rich households receive a similar aggregate benefit from a reduced VAT rate as do poor households; at worst, rich households benefit vastly more in aggregate terms than poor households. Furthermore, given the typically low average concession rates, the progressivity is found to result in only minimal redistribution.

In contrast, reduced VAT rates introduced to address cultural, social and other non-distributional goals often provide so large a benefit to rich households that the reduced rates actually have a regressive effect – benefiting the rich more both in aggregate and proportional terms. For example, reduced rates on restaurants and hotels benefit the rich vastly more than the poor, both in aggregate and proportional terms, in all countries in which they are applied. Similar regressive results, but of less absolute magnitude, are also found for reduced rates on cultural and social expenditure (including cinema, theatre, concerts, museums, zoos, books, newspapers and magazines). Once again, the low average concession rates mean that, despite the regressivity, there is minimal impact on redistribution.

The welfare change results paint an even bleaker picture than the tax expenditure results. Aggregate welfare gains are found to be greater than aggregate tax expenditures, and disproportionately so for richer households – reflecting their greater ability to adjust their consumption behaviour in response to price changes. Consequently, reduced VAT rates are shown to be even more poorly targeted, less progressive (or more regressive), and less redistributive. A number of reduced VAT rates that produce a slightly progressive tax expenditure, produce a slightly regressive welfare gain.

The "progressive, but poorly targeted" results for reduced VAT rates as a whole are consistent with previous evidence from smaller-scale studies of the overall distributional impact of reduced VAT rates – including the non-behavioural analysis for nine countries in IFS (2011a), as well behavioural analyses for Australia in Creedy (2001), and for Belgium, Germany and the United Kingdom in IFS (2011a). This chapter shows that these results are valid for a far wider range of countries, and when behavioural effects to the tax changes are accounted for. That said, results for Estonia and Latvia (and arguably France) show that in some cases the overall impact of reduced rates is not even progressive.

Similarly, the "progressive, but poorly targeted" results for reduced rates on necessities (such as food) are consistent with results from previous studies for Australia (Creedy, 2001), Hungary (Cseres-Gergely et al., 2017), Ireland (Leahy et al., 2011), New Zealand (Ball et al., 2016), Norway (Gaarder, 2018) and the United States (Caspersen and Metcalf, 1994). The significant variation found in results across other expenditure types is consistent with the non-behavioural analysis – of which this chapter is an extension – for 20 countries in OECD/KIPF (2014) and for New Zealand in Thomas (2015). The LES-based results of this chapter suggest that such variation is still present once behavioural responses to the tax changes are accounted for.

Some caution needs to be taken with these results as the behavioural microsimulation models are based on the restrictive assumption of additive preferences. Furthermore, the modelling has required broad expenditure groupings so that highly specific expenditure types have not always been able to be separated out in the analysis. For example, results are available for the combined group of restaurants and hotels (including other accommodation services), but not for restaurants, hotels or other accommodation services on their own.

Nevertheless, the results of this chapter provide strong *prima facie* support for theoretical arguments for a move towards a single-rate VAT system (with its consequent efficiency and compliance and administrative cost benefits). These arguments are, however, predicated on the view that redistribution can be better achieved through more direct mechanisms such as income-tested cash transfers to poor households. Before making definitive policy recommendations on the removal of reduced VAT rates it is therefore necessary to determine whether such an alternative mechanism is more effective than reduced VAT rates. This is the subject of the next chapter which examines the ability of cash transfers to compensate poor households for the removal of reduced VAT rates.

Table 5.3. Tax expenditure from all reduced rates

Change in VAT (in euros) across exp deciles	AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	ITA (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
1	242	483	264	112	260	335	5	271	372	254	369	26	775	482	790	6	311	264	247	229	9	293	160
2	336	656	346	153	328	442	10	375	535	394	489	29	965	620	999	12	389	313	371	308	12	352	214
3	379	767	390	177	375	517	12	458	631	492	560	31	1,082	698	1,095	16	460	339	424	353	13	425	246
4	427	872	418	181	407	579	15	506	700	545	630	33	1,194	789	1,184	21	517	354	508	381	14	445	272
5	463	954	466	203	440	636	19	554	809	623	706	35	1,238	864	1,292	23	576	370	581	419	15	471	305
6	519	1,021	488	210	467	702	21	640	887	645	800	36	1,385	933	1,418	28	590	392	619	448	16	502	328
7	553	1,087	519	222	501	772	26	666	1,011	731	900	40	1,483	1,012	1,581	31	651	406	749	484	17	537	364
8	583	1,166	530	230	538	857	30	728	1,115	797	980	42	1,596	1,113	1,730	37	677	438	823	521	19	539	398
9	641	1,290	564	252	587	975	37	816	1,265	823	1,121	45	1,733	1,228	1,957	43	727	477	1,004	567	21	568	458
10	771	1,440	583	261	618	1,229	55	908	1,735	910	1,370	60	1,922	1,500	2,453	72	855	557	1,402	707	26	679	605

Change in VAT (% of exp) across exp deciles	AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	ITA (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
1	1.51	2.77	1.01	2.47	1.87	2.60	0.20	2.02	2.75	4.15	3.34	0.53	4.26	3.87	2.94	0.18	1.77	5.25	3.53	1.99	0.15	1.92	3.86
2	1.48	2.81	0.96	2.29	1.77	2.49	0.26	1.82	2.73	3.72	3.18	0.47	3.78	3.65	2.75	0.29	1.74	4.85	3.39	1.97	0.15	1.85	3.56
3	1.44	2.78	0.92	2.20	1.70	2.43	0.26	1.76	2.73	3.47	3.07	0.44	3.60	3.49	2.65	0.34	1.82	4.63	3.32	1.93	0.15	1.81	3.46
4	1.42	2.77	0.88	2.15	1.64	2.39	0.28	1.68	2.72	3.29	2.98	0.43	3.38	3.37	2.61	0.39	1.83	4.47	3.25	1.91	0.15	1.73	3.35
5	1.38	2.66	0.83	2.04	1.58	2.35	0.30	1.63	2.74	3.09	2.88	0.41	3.29	3.26	2.49	0.38	1.79	4.33	3.20	1.90	0.15	1.69	3.28
6	1.34	2.63	0.79	1.97	1.51	2.29	0.28	1.58	2.71	2.91	2.79	0.40	3.12	3.16	2.47	0.39	1.76	4.16	3.11	1.87	0.15	1.63	3.19
7	1.31	2.58	0.75	1.90	1.45	2.22	0.30	1.49	2.69	2.73	2.68	0.39	3.02	3.04	2.39	0.38	1.75	3.98	3.05	1.81	0.15	1.57	3.09
8	1.24	2.48	0.71	1.82	1.37	2.17	0.28	1.40	2.64	2.46	2.53	0.38	2.87	2.92	2.33	0.37	1.69	3.77	2.91	1.78	0.15	1.49	3.00
9	1.17	2.34	0.65	1.68	1.25	2.08	0.27	1.29	2.55	2.18	2.36	0.37	2.65	2.75	2.23	0.36	1.63	3.49	2.81	1.68	0.14	1.37	2.83
10	1.06	1.90	0.52	1.37	0.93	1.90	0.27	1.07	2.46	1.55	2.01	0.35	2.32	2.27	2.11	0.35	1.43	2.83	2.51	1.49	0.13	1.18	2.38

	AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	ITA (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
Kakwani	0.0588	0.0660	0.1120	0.0950	0.1204	0.0495	-0.0091	0.0998	0.0188	0.1632	0.0862	0.0607	0.0946	0.0881	0.0487	-0.0217	0.0344	0.1078	0.0546	0.0471	0.0289	0.0829	0.0812
R-S	0.0008	0.0018	0.0009	0.0021	0.0018	0.0012	0.0000	0.0016	0.0005	0.0045	0.0024	0.0003	0.0031	0.0028	0.0012	-0.0001	0.0006	0.0046	0.0018	0.0009	0.0000	0.0014	0.0026
Δ Atkn ε=0.2	0.0001	0.0003	0.0001	0.0003	0.0003	0.0002	0.0000	0.0003	0.0001	0.0010	0.0005	0.0000	0.0005	0.0006	0.0002	0.0000	0.0001	0.0009	0.0004	0.0002	0.0000	0.0002	0.0007
Δ Atkn ε=0.7	0.0005	0.0010	0.0005	0.0009	0.0010	0.0007	0.0000	0.0010	0.0003	0.0032	0.0015	0.0002	0.0017	0.0019	0.0007	-0.0001	0.0003	0.0028	0.0012	0.0005	0.0000	0.0007	0.0020
Δ Atkn ε=1.2	0.0007	0.0014	0.0007	0.0015	0.0016	0.0011	-0.0001	0.0015	0.0004	0.0049	0.0023	0.0003	0.0028	0.0028	0.0012	-0.0002	0.0004	0.0042	0.0018	0.0007	0.0000	0.0011	0.0029

Notes. Results calculated using behavioural microsimulation models for 23 countries based on household expenditure survey microdata. Results in top panel present the weighted mean of the tax expenditure (change in VAT) per household. Results in middle panel present the weighted mean of the tax expenditure (change in VAT) as a percentage of total expenditure per household. All tax expenditure results are presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail. Results in bottom panel present the following summary indicators: Kakwani = Kakwani progressivity index; R-S = Reynolds-Smolensky redistribution index; Δ Atkn = change in Atkinson inequality index, with ε = degree of inequality aversion. Summary indicators are calculated in relation to the tax expenditure, using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

Table 5.4. Welfare gain from all reduced rates

		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	ITA (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
Welfare change (CV) across exp deciles	1	277	549	277	131	293	373	6	311	420	284	415	31	871	543	859	7	345	309	283	259	10	342	183
	2	388	754	365	179	370	493	11	436	605	443	557	34	1,091	703	1,093	14	440	366	429	351	13	412	245
	3	438	883	412	207	423	576	14	533	714	553	637	37	1,224	791	1,198	19	521	397	491	403	15	499	281
	4	494	1,004	441	212	459	646	17	590	793	612	716	39	1,352	896	1,297	24	585	415	588	436	16	524	311
	5	537	1,101	492	238	496	710	21	647	917	699	802	41	1,401	982	1,415	27	654	434	674	480	17	556	349
	6	603	1,179	515	246	526	784	24	748	1,006	724	908	43	1,569	1,061	1,555	33	669	459	718	513	19	593	375
	7	643	1,258	549	260	563	863	30	779	1,147	820	1,022	47	1,679	1,152	1,734	36	739	475	871	555	20	636	418
	8	679	1,351	560	270	605	959	35	852	1,267	892	1,111	50	1,808	1,269	1,899	43	768	512	958	598	22	639	455
	9	750	1,497	596	295	660	1,092	43	956	1,438	921	1,271	53	1,965	1,402	2,151	50	826	558	1,172	652	24	676	524
	10	916	1,685	617	306	695	1,383	63	1,073	1,982	1,011	1,554	70	2,192	1,724	2,708	86	987	654	1,656	818	30	819	695

		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	ITA (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
Welfare change (% of exp) across exp deciles	1	1.72	3.14	1.05	2.90	2.10	2.89	0.22	2.29	3.10	4.61	3.74	0.62	4.76	4.33	3.18	0.20	1.95	6.14	4.01	2.24	0.17	2.22	4.39
	2	1.71	3.22	1.02	2.68	1.99	2.77	0.30	2.10	3.08	4.18	3.62	0.55	4.27	4.13	3.01	0.33	1.97	5.68	3.92	2.24	0.17	2.16	4.07
	3	1.66	3.20	0.97	2.57	1.92	2.71	0.30	2.04	3.09	3.90	3.48	0.52	4.07	3.95	2.89	0.40	2.06	5.42	3.84	2.20	0.17	2.12	3.95
	4	1.64	3.19	0.93	2.52	1.85	2.67	0.32	1.96	3.08	3.70	3.39	0.50	3.82	3.83	2.86	0.45	2.07	5.23	3.76	2.18	0.17	2.03	3.83
	5	1.60	3.07	0.88	2.39	1.78	2.62	0.35	1.91	3.10	3.47	3.27	0.48	3.72	3.71	2.73	0.44	2.03	5.06	3.71	2.17	0.18	1.98	3.75
	6	1.56	3.03	0.84	2.31	1.71	2.56	0.33	1.85	3.07	3.26	3.17	0.47	3.53	3.58	2.70	0.45	1.99	4.86	3.60	2.14	0.18	1.92	3.65
	7	1.52	2.98	0.80	2.22	1.63	2.48	0.35	1.75	3.05	3.05	3.04	0.46	3.41	3.46	2.62	0.45	1.99	4.65	3.54	2.07	0.18	1.86	3.54
	8	1.45	2.88	0.75	2.14	1.54	2.42	0.33	1.64	2.99	2.75	2.86	0.45	3.25	3.33	2.55	0.43	1.92	4.41	3.38	2.04	0.17	1.76	3.44
	9	1.37	2.71	0.68	1.96	1.41	2.33	0.31	1.51	2.89	2.44	2.68	0.43	3.00	3.13	2.45	0.42	1.85	4.08	3.27	1.93	0.17	1.62	3.24
	10	1.25	2.23	0.55	1.61	1.05	2.13	0.32	1.26	2.80	1.72	2.27	0.41	2.64	2.60	2.32	0.41	1.64	3.32	2.95	1.72	0.15	1.42	2.73

		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	ITA (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
Kakwani		0.0295	0.0271	0.0987	0.0723	0.0959	0.0273	-0.0258	0.0404	-0.0121	0.1520	0.0687	0.0493	0.0788	0.0658	0.0306	-0.0383	0.0106	0.0920	0.0325	0.0147	0.0190	0.0606	0.0434
R-S		0.0005	0.0008	0.0008	0.0016	0.0016	0.0007	-0.0001	0.0008	-0.0004	0.0044	0.0021	0.0002	0.0027	0.0022	0.0009	-0.0002	0.0002	0.0040	0.0011	0.0003	0.0000	0.0012	0.0015
Δ Atkn	ε=0.2	0.0001	0.0001	0.0001	0.0002	0.0002	0.0001	0.0000	0.0001	-0.0002	0.0009	0.0004	0.0000	0.0004	0.0004	0.0001	0.0000	0.0000	0.0006	0.0002	0.0000	0.0000	0.0001	0.0003
	ε=0.7	0.0002	0.0002	0.0004	0.0008	0.0007	0.0002	-0.0001	0.0003	-0.0006	0.0029	0.0012	0.0001	0.0012	0.0012	0.0003	-0.0001	0.0001	0.0020	0.0007	0.0001	0.0001	0.0003	0.0008
	ε=1.2	0.0003	0.0002	0.0006	0.0013	0.0010	0.0002	-0.0001	0.0005	-0.0010	0.0045	0.0018	0.0001	0.0020	0.0019	0.0005	-0.0002	0.0002	0.0031	0.0011	0.0002	0.0001	0.0005	0.0013

Notes. Results calculated using behavioural microsimulation models for 23 countries based on household expenditure survey microdata. Results in top panel present the weighted mean of the compensating variation (CV) per household. Results in middle panel present the weighted mean of the CV as a percentage of total expenditure per household. All CV results are presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail. To aid comparison with the tax expenditure results, CV results are presented with positive values reflecting welfare gains. Results in bottom panel present the following summary indicators: Kakwani = Kakwani progressivity index; R-S = Reynolds-Smolensky redistribution index; Δ Atkn = change in Atkinson inequality index, with ε = degree of inequality aversion. Summary indicators are calculated in relation to the CV, using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

Table 5.5. Tax expenditure from reduced VAT rates on food

		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	ITA (2010)	LUX (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SWE (2010)	TUR (2010)
Change in VAT (in euros) across exp deciles	1	185	402	245	100	232	253	216	299	230	262	19	593	444	417	253	225	179	200	274	133
	2	229	505	316	136	282	312	291	410	348	319	21	707	548	493	297	260	250	258	320	168
	3	245	569	354	157	316	348	346	469	427	348	22	776	600	522	338	278	275	287	381	188
	4	264	629	377	160	339	376	371	510	474	377	23	830	661	543	370	286	317	305	394	203
	5	275	676	418	179	361	400	401	573	539	405	23	858	708	569	405	296	346	327	410	222
	6	300	706	434	185	378	423	451	614	553	443	24	937	748	592	408	308	357	343	433	235
	7	305	727	459	194	399	448	460	683	623	476	25	980	793	636	439	313	408	361	456	255
	8	309	761	465	200	422	475	495	736	679	496	26	1,029	846	662	452	330	426	378	450	272
	9	318	808	487	218	448	506	528	805	692	533	27	1,063	892	709	470	346	470	395	463	300
	10	323	832	486	220	445	543	526	1,026	738	567	32	1,068	973	761	515	361	509	450	514	351

		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	ITA (2010)	LUX (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SWE (2010)	TUR (2010)
Change in VAT (% of exp) across exp deciles	1	1.17	2.33	0.93	2.21	1.66	2.01	1.60	2.25	3.78	2.38	0.40	3.28	3.59	1.55	1.45	4.48	2.27	1.76	1.80	3.27
	2	1.00	2.16	0.88	2.02	1.51	1.79	1.40	2.12	3.31	2.09	0.34	2.78	3.24	1.36	1.33	4.04	2.14	1.66	1.68	2.84
	3	0.92	2.06	0.83	1.94	1.43	1.67	1.32	2.06	3.03	1.92	0.31	2.60	3.01	1.26	1.34	3.79	2.07	1.58	1.62	2.69
	4	0.87	1.99	0.79	1.89	1.36	1.58	1.22	2.01	2.88	1.80	0.29	2.37	2.84	1.19	1.31	3.60	1.96	1.54	1.53	2.54
	5	0.81	1.88	0.74	1.80	1.29	1.49	1.17	1.96	2.68	1.67	0.28	2.29	2.69	1.09	1.26	3.44	1.91	1.50	1.47	2.42
	6	0.77	1.81	0.70	1.73	1.22	1.40	1.11	1.90	2.50	1.56	0.26	2.12	2.55	1.02	1.22	3.25	1.79	1.45	1.41	2.32
	7	0.72	1.72	0.66	1.65	1.15	1.31	1.02	1.84	2.33	1.43	0.25	2.00	2.40	0.95	1.19	3.05	1.70	1.36	1.34	2.19
	8	0.65	1.61	0.62	1.58	1.07	1.21	0.94	1.76	2.10	1.29	0.24	1.86	2.24	0.89	1.13	2.82	1.61	1.30	1.24	2.08
	9	0.58	1.45	0.56	1.44	0.95	1.09	0.82	1.64	1.84	1.13	0.22	1.64	2.02	0.80	1.05	2.52	1.49	1.18	1.11	1.88
	10	0.45	1.10	0.43	1.16	0.67	0.87	0.62	1.49	1.26	0.85	0.19	1.31	1.52	0.66	0.86	1.86	1.18	0.96	0.90	1.44

		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	ITA (2010)	LUX (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SWE (2010)	TUR (2010)
Kakwani		0.1493	0.1213	0.1281	0.1029	0.1545	0.1355	0.1512	0.0660	0.1772	0.1717	0.1165	0.1437	0.1411	0.1374	0.0800	0.1528	0.1606	0.0985	0.1151	0.1362
R-S		0.0012	0.0022	0.0009	0.0019	0.0019	0.0019	0.0017	0.0013	0.0042	0.0026	0.0003	0.0031	0.0035	0.0014	0.0010	0.0049	0.0027	0.0014	0.0017	0.0030
Δ Atkn	ε=0.2	0.0002	0.0004	0.0001	0.0003	0.0003	0.0003	0.0003	0.0002	0.0009	0.0005	0.0001	0.0005	0.0007	0.0002	0.0001	0.0010	0.0006	0.0002	0.0002	0.0008
	ε=0.7	0.0007	0.0012	0.0005	0.0009	0.0010	0.0011	0.0010	0.0007	0.0030	0.0016	0.0002	0.0017	0.0023	0.0008	0.0005	0.0030	0.0019	0.0007	0.0008	0.0024
	ε=1.2	0.0011	0.0019	0.0008	0.0014	0.0016	0.0018	0.0016	0.0012	0.0046	0.0026	0.0003	0.0029	0.0036	0.0013	0.0007	0.0045	0.0029	0.0012	0.0013	0.0035

Notes. Results calculated using behavioural microsimulation models for 20 countries based on household expenditure survey microdata. Results in top panel present the weighted mean of the tax expenditure (change in VAT) per household. Results in middle panel present the weighted mean of the tax expenditure (change in VAT) as a percentage of total expenditure per household. All tax expenditure results are presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail. Results in bottom panel present the following summary indicators: Kakwani = Kakwani progressivity index; R-S = Reynolds-Smolensky redistribution index; Δ Atkn = change in Atkinson inequality index, with ε = degree of inequality aversion. Summary indicators are calculated in relation to the tax expenditure, using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

Table 5.6. Welfare gain from reduced VAT rates on food

Welfare change (CV) across exp deciles	AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	ITA (2010)	LUX (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SWE (2010)	TUR (2010)
1	211	452	257	117	260	279	246	334	256	289	23	656	495	446	279	261	202	225	319	150
2	263	572	334	159	317	344	336	458	391	357	24	785	614	530	333	302	283	292	374	190
3	281	646	374	183	355	383	400	524	478	389	26	861	672	560	379	322	312	325	447	213
4	304	714	398	187	381	414	430	570	530	421	27	922	741	584	415	332	359	345	463	230
5	316	769	441	210	406	440	465	641	602	452	28	952	794	612	455	343	392	371	483	251
6	346	804	458	216	424	466	523	687	619	495	28	1,041	840	636	459	357	405	390	511	266
7	352	830	485	227	447	493	533	764	697	531	30	1,087	891	684	494	363	462	410	540	288
8	357	870	490	234	472	522	574	824	759	553	31	1,141	952	712	508	382	483	429	534	307
9	369	925	514	254	501	557	612	901	773	593	32	1,178	1,004	764	530	401	533	449	552	339
10	377	956	514	258	497	597	613	1,153	820	630	38	1,184	1,098	821	589	419	577	514	619	397

Welfare change (% of exp) across exp deciles	AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	ITA (2010)	LUX (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SWE (2010)	TUR (2010)
1	1.32	2.60	0.97	2.58	1.86	2.21	1.80	2.51	4.19	2.63	0.47	3.61	3.99	1.66	1.58	5.19	2.88	1.97	2.07	3.68
2	1.15	2.45	0.92	2.37	1.70	1.97	1.61	2.37	3.71	2.33	0.40	3.09	3.62	1.46	1.48	4.68	2.58	1.88	1.96	3.21
3	1.06	2.34	0.88	2.27	1.60	1.83	1.52	2.30	3.39	2.14	0.37	2.88	3.37	1.35	1.50	4.39	2.42	1.79	1.89	3.04
4	1.00	2.26	0.83	2.21	1.52	1.74	1.42	2.24	3.22	2.01	0.35	2.63	3.19	1.28	1.47	4.17	2.28	1.75	1.80	2.87
5	0.93	2.14	0.78	2.10	1.45	1.64	1.35	2.20	3.00	1.86	0.33	2.54	3.02	1.17	1.42	3.98	2.15	1.70	1.72	2.74
6	0.89	2.06	0.74	2.02	1.37	1.54	1.29	2.13	2.80	1.74	0.31	2.35	2.86	1.10	1.37	3.76	2.02	1.64	1.65	2.62
7	0.83	1.96	0.70	1.93	1.29	1.44	1.18	2.06	2.61	1.59	0.30	2.22	2.70	1.03	1.33	3.53	1.88	1.55	1.58	2.47
8	0.75	1.84	0.65	1.85	1.19	1.33	1.09	1.97	2.34	1.44	0.28	2.06	2.52	0.95	1.27	3.26	1.70	1.48	1.46	2.35
9	0.67	1.66	0.59	1.69	1.06	1.20	0.96	1.84	2.06	1.26	0.26	1.81	2.27	0.86	1.18	2.91	1.49	1.34	1.32	2.12
10	0.52	1.26	0.46	1.36	0.75	0.96	0.72	1.68	1.41	0.95	0.22	1.44	1.71	0.71	0.98	2.16	1.07	1.10	1.09	1.63

	AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	ITA (2010)	LUX (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SWE (2010)	TUR (2010)
Kakwani	0.1263	0.0864	0.1155	0.0810	0.1314	0.1171	0.0994	0.0380	0.1663	0.1556	0.1047	0.1311	0.1202	0.1248	0.0583	0.1375	0.1434	0.0683	0.0938	0.1002
R-S	0.0011	0.0017	0.0009	0.0016	0.0017	0.0017	0.0013	0.0008	0.0042	0.0025	0.0003	0.0030	0.0032	0.0014	0.0008	0.0046	0.0026	0.0011	0.0015	0.0024
Δ Atkn ε=0.2	0.0002	0.0002	0.0001	0.0002	0.0002	0.0003	0.0002	0.0001	0.0009	0.0005	0.0000	0.0005	0.0006	0.0002	0.0001	0.0007	0.0005	0.0002	0.0002	0.0005
Δ Atkn ε=0.7	0.0006	0.0006	0.0004	0.0007	0.0007	0.0009	0.0005	0.0003	0.0029	0.0015	0.0001	0.0016	0.0019	0.0006	0.0002	0.0021	0.0017	0.0005	0.0005	0.0016
Δ Atkn ε=1.2	0.0010	0.0009	0.0006	0.0012	0.0011	0.0014	0.0008	0.0005	0.0044	0.0024	0.0002	0.0026	0.0030	0.0010	0.0002	0.0033	0.0026	0.0009	0.0008	0.0025

Notes. Results calculated using behavioural microsimulation models for 20 countries based on household expenditure survey microdata. Results in top panel present the weighted mean of the compensating variation (CV) per household. Results in middle panel present the weighted mean of the CV as a percentage of total expenditure per household. All CV results are presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail. To aid comparison with the tax expenditure results, CV results are presented with positive values reflecting welfare gains. Results in bottom panel present the following summary indicators: Kakwani = Kakwani progressivity index; R-S = Reynolds-Smolensky redistribution index; Δ Atkn = change in Atkinson inequality index, with ε = degree of inequality aversion. Summary indicators are calculated in relation to the CV, using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

Table 5.7. Tax expenditure from reduced VAT rates on children's clothing

Change in VAT (in euros) across exp deciles		GBR (2010)	IRL (2010)	LUX (2010)	TUR (2010)
	1	13	35	30	4
	2	25	56	47	6
	3	40	68	46	7
	4	42	83	57	8
	5	48	81	50	9
	6	54	93	67	9
	7	62	105	65	11
	8	65	116	73	12
	9	72	138	88	14
	10	97	160	100	22

Change in VAT (% of exp) across exp deciles		GBR (2010)	IRL (2010)	LUX (2010)	TUR (2010)
	1	0.18	0.17	0.10	0.10
	2	0.20	0.20	0.12	0.10
	3	0.25	0.21	0.10	0.10
	4	0.22	0.22	0.12	0.10
	5	0.22	0.20	0.09	0.10
	6	0.23	0.20	0.10	0.10
	7	0.22	0.21	0.09	0.10
	8	0.19	0.20	0.09	0.09
	9	0.18	0.20	0.09	0.09
	10	0.16	0.18	0.08	0.09

		GBR (2010)	IRL (2010)	LUX (2010)	TUR (2010)
Kakwani		0.070272	0.012003	0.067489	0.028076
R-S		0.000149	0.000026	0.000067	0.000027
Δ Atkn	ε=0.2	0.000033	0.000003	0.000012	0.000005
	ε=0.7	0.000089	0.000005	0.000037	0.000016
	ε=1.2	0.000110	-0.000002	0.000057	0.000025

Notes. Results calculated using behavioural microsimulation models for four countries based on household expenditure survey microdata. Results in top panel present the weighted mean of the tax expenditure (change in VAT) per household. Results in middle panel present the weighted mean of the tax expenditure (change in VAT) as a percentage of total expenditure per household. All tax expenditure results are presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail. Results in bottom panel present the following summary indicators: Kakwani = Kakwani progressivity index; R-S = Reynolds-Smolensky redistribution index; Δ Atkn = change in Atkinson inequality index, with ε = degree of inequality aversion. Summary indicators are calculated in relation to the tax expenditure, using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

Table 5.8. Welfare gain from reduced VAT rates on children's clothing

		GBR (2010)	IRL (2010)	LUX (2010)	TUR (2010)
Welfare change (CV) across exp deciles	1	14	38	32	5
	2	28	62	51	7
	3	44	75	49	8
	4	46	91	62	9
	5	53	89	54	10
	6	59	103	72	11
	7	68	115	70	12
	8	72	128	78	13
	9	80	152	96	15
	10	107	178	109	25

		GBR (2010)	IRL (2010)	LUX (2010)	TUR (2010)
Welfare change (% of exp) across exp deciles	1	0.19	0.18	0.11	0.11
	2	0.22	0.22	0.13	0.12
	3	0.28	0.23	0.11	0.11
	4	0.24	0.24	0.13	0.12
	5	0.24	0.22	0.10	0.12
	6	0.25	0.22	0.11	0.11
	7	0.24	0.23	0.10	0.11
	8	0.21	0.22	0.10	0.11
	9	0.20	0.22	0.10	0.10
	10	0.17	0.20	0.09	0.10

		GBR (2010)	IRL (2010)	LUX (2010)	TUR (2010)
Kakwani		0.05360	-0.00310	0.05070	-0.00620
R-S		0.00012	-0.00001	0.00006	-0.00001
Δ Atkn	ε=0.2	0.00003	0.00000	0.00001	-0.00001
	ε=0.7	0.00008	-0.00001	0.00003	-0.00003
	ε=1.2	0.00010	-0.00003	0.00005	-0.00004

Notes. Results calculated using behavioural microsimulation models for four countries based on household expenditure survey microdata. Results in top panel present the weighted mean of the compensating variation (CV) per household. Results in middle panel present the weighted mean of the CV as a percentage of total expenditure per household. All CV results are presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail. To aid comparison with the tax expenditure results, CV results are presented with positive values reflecting welfare gains. Results in bottom panel present the following summary indicators: Kakwani = Kakwani progressivity index; R-S = Reynolds-Smolensky redistribution index; Δ Atkn = change in Atkinson inequality index, with ε = degree of inequality aversion. Summary indicators are calculated in relation to the CV, using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

Table 5.9. Tax expenditure from reduced VAT rates on domestic utilities

Change in VAT (in euros) across exp deciles		ESP (2010)	GRC (2010)	IRL (2010)	LUX (2010)	POL (2010)
	1	17	66	95	214	19
	2	19	77	113	231	24
	3	20	81	119	239	26
	4	21	87	127	241	27
	5	22	93	129	248	29
	6	23	101	138	251	31
	7	24	108	143	261	32
	8	26	112	148	266	34
	9	28	121	154	276	37
	10	32	132	159	291	38

Change in VAT (% of exp) across exp deciles		ESP (2010)	GRC (2010)	IRL (2010)	LUX (2010)	POL (2010)
	1	0.14	0.63	0.54	0.82	0.37
	2	0.11	0.52	0.46	0.65	0.37
	3	0.10	0.46	0.41	0.59	0.36
	4	0.09	0.42	0.37	0.55	0.35
	5	0.08	0.39	0.35	0.49	0.34
	6	0.08	0.36	0.32	0.46	0.33
	7	0.07	0.33	0.30	0.42	0.32
	8	0.07	0.29	0.28	0.38	0.30
	9	0.06	0.26	0.25	0.33	0.28
	10	0.05	0.20	0.20	0.27	0.20

		ESP (2010)	GRC (2010)	IRL (2010)	LUX (2010)	POL (2010)
Kakwani		0.14480	0.18330	0.15248	0.17300	0.10730
R-S		0.00012	0.00065	0.00051	0.00078	0.00035
Δ Atkn	ε=0.2	0.00002	0.00012	0.00008	0.00014	0.00007
	ε=0.7	0.00007	0.00041	0.00028	0.00047	0.00022
	ε=1.2	0.00013	0.00066	0.00048	0.00078	0.00031

Notes. Results calculated using behavioural microsimulation models for five countries based on household expenditure survey microdata. Results in top panel present the weighted mean of the tax expenditure (change in VAT) per household. Results in middle panel present the weighted mean of the tax expenditure (change in VAT) as a percentage of total expenditure per household. All tax expenditure results are presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail. Results in bottom panel present the following summary indicators: Kakwani = Kakwani progressivity index; R-S = Reynolds-Smolensky redistribution index; Δ Atkn = change in Atkinson inequality index, with ε = degree of inequality aversion. Summary indicators are calculated in relation to the tax expenditure, using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

Table 5.10. Welfare gain from reduced VAT rates on domestic utilities

		ESP (2010)	GRC (2010)	IRL (2010)	LUX (2010)	POL (2010)
Welfare change (CV) across exp deciles	1	19	73	106	227	22
	2	20	85	125	246	27
	3	22	90	133	255	30
	4	23	97	141	258	31
	5	24	104	144	265	33
	6	25	112	153	269	35
	7	26	120	159	280	37
	8	28	125	165	285	39
	9	30	134	172	296	42
	10	36	148	178	313	44

		ESP (2010)	GRC (2010)	IRL (2010)	LUX (2010)	POL (2010)
Welfare change (% of exp) across exp deciles	1	0.16	0.68	0.60	0.87	0.43
	2	0.12	0.57	0.51	0.70	0.42
	3	0.11	0.50	0.46	0.63	0.41
	4	0.10	0.47	0.42	0.58	0.40
	5	0.09	0.43	0.39	0.53	0.39
	6	0.09	0.40	0.36	0.49	0.38
	7	0.08	0.36	0.34	0.44	0.37
	8	0.07	0.33	0.31	0.40	0.35
	9	0.07	0.29	0.27	0.35	0.32
	10	0.06	0.22	0.23	0.29	0.24

		ESP (2010)	GRC (2010)	IRL (2010)	LUX (2010)	POL (2010)
Kakwani		0.12500	0.16670	0.14198	0.16110	0.09470
R-S		0.00011	0.00063	0.00051	0.00083	0.00033
Δ Atkn	ε=0.2	0.00002	0.00012	0.00008	0.00016	0.00007
	ε=0.7	0.00008	0.00041	0.00027	0.00053	0.00021
	ε=1.2	0.00014	0.00068	0.00046	0.00088	0.00031

Notes. Results calculated using behavioural microsimulation models for five countries based on household expenditure survey microdata. Results in top panel present the weighted mean of the compensating variation (CV) per household. Results in middle panel present the weighted mean of the CV as a percentage of total expenditure per household. All CV results are presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail. To aid comparison with the tax expenditure results, CV results are presented with positive values reflecting welfare gains. Results in bottom panel present the following summary indicators: Kakwani = Kakwani progressivity index; R-S = Reynolds-Smolensky redistribution index; Δ Atkn = change in Atkinson inequality index, with ε = degree of inequality aversion. Summary indicators are calculated in relation to the CV, using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

Table 5.11. Tax expenditure from reduced VAT rates on pharmaceuticals

		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	ESP (2010)	EST (2010)	FRA (2011)	ITA (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	TUR (2010)
Change in VAT (in euros) across exp deciles	1	18	30	8	7	7	3	9	17	25	5	5	13	40	5	9	3
	2	31	44	13	9	11	6	13	25	30	10	7	19	63	8	11	4
	3	37	51	15	10	13	8	15	30	32	13	9	22	73	9	12	4
	4	43	57	17	11	15	10	17	34	34	17	10	24	83	11	13	4
	5	48	61	20	12	17	12	19	38	36	19	10	27	93	12	14	5
	6	52	65	22	13	19	13	20	42	38	22	11	29	97	13	15	5
	7	58	69	24	14	22	17	22	46	42	25	11	32	110	15	15	5
	8	61	73	27	14	24	19	24	51	45	29	12	35	117	16	16	6
	9	69	77	31	15	28	22	28	57	51	32	13	39	131	19	17	6
	10	83	82	39	17	36	31	34	67	68	50	15	45	145	26	20	8

		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	ESP (2010)	EST (2010)	FRA (2011)	ITA (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	TUR (2010)
Change in VAT (% of exp) across exp deciles	1	0.12	0.18	0.03	0.16	0.05	0.13	0.07	0.14	0.09	0.15	0.03	0.27	0.59	0.04	0.15	0.08
	2	0.14	0.20	0.04	0.14	0.06	0.18	0.07	0.15	0.08	0.24	0.04	0.31	0.63	0.05	0.14	0.06
	3	0.15	0.20	0.04	0.14	0.06	0.18	0.07	0.15	0.08	0.29	0.04	0.32	0.61	0.05	0.14	0.06
	4	0.15	0.19	0.04	0.14	0.06	0.19	0.07	0.15	0.07	0.33	0.04	0.33	0.57	0.05	0.14	0.05
	5	0.15	0.18	0.04	0.12	0.06	0.21	0.07	0.15	0.07	0.31	0.03	0.34	0.56	0.06	0.14	0.05
	6	0.14	0.17	0.04	0.12	0.06	0.19	0.06	0.15	0.07	0.31	0.04	0.34	0.52	0.06	0.14	0.05
	7	0.14	0.17	0.04	0.12	0.06	0.20	0.06	0.14	0.06	0.31	0.03	0.34	0.48	0.06	0.14	0.05
	8	0.14	0.16	0.04	0.12	0.06	0.18	0.06	0.14	0.06	0.29	0.03	0.33	0.44	0.06	0.13	0.04
	9	0.13	0.15	0.04	0.11	0.06	0.17	0.06	0.13	0.06	0.27	0.03	0.31	0.39	0.06	0.12	0.04
	10	0.12	0.11	0.03	0.09	0.06	0.16	0.05	0.10	0.06	0.25	0.03	0.24	0.28	0.06	0.10	0.03

		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	ESP (2010)	EST (2010)	FRA (2011)	ITA (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	TUR (2010)
Kakwani		0.028019	0.088615	0.006239	0.085563	-0.001848	0.023651	0.061437	0.061270	0.062653	0.012000	0.040237	0.040386	0.138511	-0.034521	0.062686	0.137921
R-S		0.000043	0.000156	0.000002	0.000117	-0.000001	0.000048	0.000040	0.000088	0.000045	0.000038	0.000014	0.000136	0.000675	-0.000021	0.000092	0.000066
Δ Atkn	ε=0.2	0.000008	0.000027	0.000000	0.000016	0.000000	0.000010	0.000007	0.000021	0.000007	0.000000	0.000002	0.000039	0.000146	-0.000003	0.000017	0.000016
	ε=0.7	0.000019	0.000079	0.000001	0.000053	-0.000003	0.000018	0.000023	0.000056	0.000026	0.000001	0.000006	0.000092	0.000443	-0.000011	0.000048	0.000051
	ε=1.2	0.000018	0.000114	0.000000	0.000087	-0.000009	0.000004	0.000037	0.000072	0.000046	0.000000	0.000008	0.000101	0.000640	-0.000019	0.000070	0.000080

Notes. Results calculated using behavioural microsimulation models for 16 countries based on household expenditure survey microdata. Results in top panel present the weighted mean of the tax expenditure (change in VAT) per household. Results in middle panel present the weighted mean of the tax expenditure (change in VAT) as a percentage of total expenditure per household. All tax expenditure results are presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail. Results in bottom panel present the following summary indicators: Kakwani = Kakwani progressivity index; R-S = Reynolds-Smolensky redistribution index; Δ Atkn = change in Atkinson inequality index, with ε = degree of inequality aversion. Summary indicators are calculated in relation to the tax expenditure, using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

Table 5.12. Welfare gain from reduced VAT rates on pharmaceuticals

		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	ESP (2010)	EST (2010)	FRA (2011)	ITA (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	TUR (2010)
Welfare change (CV) across exp deciles	1	20	33	9	8	7	4	10	19	26	6	5	15	44	5	10	3
	2	34	50	13	10	11	7	14	28	32	12	8	22	70	9	13	4
	3	41	58	16	12	14	9	16	33	34	16	10	25	82	10	14	4
	4	48	65	18	13	17	11	18	38	36	20	11	28	93	12	15	5
	5	53	69	21	14	19	14	20	43	38	22	11	31	105	14	16	5
	6	58	74	23	15	21	15	22	47	41	26	12	34	109	15	17	5
	7	66	79	26	16	24	19	24	52	45	29	12	37	124	17	18	6
	8	69	82	28	17	27	22	27	57	49	33	14	41	131	19	19	6
	9	78	88	33	18	31	26	30	64	55	37	14	45	148	22	20	7
	10	96	94	41	20	40	36	37	76	74	59	17	53	165	30	24	9

		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	ESP (2010)	EST (2010)	FRA (2011)	ITA (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	TUR (2010)
Welfare change (% of exp) across exp deciles	1	0.13	0.20	0.03	0.18	0.05	0.15	0.08	0.15	0.10	0.17	0.03	0.31	0.66	0.05	0.17	0.09
	2	0.16	0.22	0.04	0.17	0.06	0.20	0.08	0.17	0.09	0.28	0.04	0.35	0.70	0.06	0.16	0.07
	3	0.16	0.22	0.04	0.16	0.07	0.20	0.07	0.17	0.08	0.33	0.04	0.37	0.69	0.06	0.17	0.07
	4	0.17	0.21	0.04	0.16	0.07	0.22	0.07	0.17	0.08	0.38	0.04	0.38	0.65	0.06	0.16	0.06
	5	0.17	0.20	0.04	0.14	0.07	0.24	0.07	0.17	0.07	0.36	0.04	0.39	0.63	0.06	0.16	0.06
	6	0.16	0.20	0.04	0.14	0.07	0.21	0.07	0.16	0.07	0.36	0.04	0.39	0.58	0.06	0.16	0.05
	7	0.16	0.19	0.04	0.14	0.07	0.23	0.07	0.16	0.07	0.36	0.04	0.39	0.54	0.06	0.16	0.05
	8	0.15	0.18	0.04	0.14	0.07	0.21	0.06	0.15	0.07	0.34	0.04	0.37	0.50	0.07	0.15	0.05
	9	0.15	0.17	0.04	0.12	0.07	0.19	0.06	0.15	0.06	0.32	0.03	0.35	0.44	0.07	0.14	0.04
	10	0.14	0.13	0.04	0.11	0.06	0.18	0.05	0.12	0.06	0.29	0.03	0.28	0.32	0.06	0.12	0.03

		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	ESP (2010)	EST (2010)	FRA (2011)	ITA (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	TUR (2010)
Kakwani		-0.003599	0.050400	-0.011096	0.060445	-0.023313	0.007159	0.032609	0.042269	0.045140	-0.003526	0.013422	0.027904	0.120221	-0.070219	0.053306	0.103515
R-S		-0.000006	0.000100	-0.000005	0.000088	-0.000016	0.000015	0.000023	0.000066	0.000037	-0.000012	0.000005	0.000099	0.000636	-0.000049	0.000080	0.000054
Δ Atkn	ε=0.2	-0.000002	0.000024	-0.000001	0.000021	-0.000003	0.000028	0.000005	0.000019	0.000007	-0.000001	0.000006	0.000054	0.000176	-0.000002	0.000024	0.000012
	ε=0.7	-0.000013	0.000077	-0.000003	0.000076	-0.000015	0.000096	0.000016	0.000059	0.000024	-0.000029	0.000021	0.000182	0.000575	-0.000007	0.000085	0.000042
	ε=1.2	-0.000032	0.000119	-0.000007	0.000135	-0.000030	0.000150	0.000028	0.000092	0.000042	-0.000095	0.000035	0.000306	0.000905	-0.000010	0.000143	0.000072

Notes. Results calculated using behavioural microsimulation models for 16 countries based on household expenditure survey microdata. Results in top panel present the weighted mean of the compensating variation (CV) per household. Results in middle panel present the weighted mean of the CV as a percentage of total expenditure per household. All CV results are presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail. To aid comparison with the tax expenditure results, CV results are presented with positive values reflecting welfare gains. Results in bottom panel present the following summary indicators: Kakwani = Kakwani progressivity index; R-S = Reynolds-Smolensky redistribution index; Δ Atkn = change in Atkinson inequality index, with ε = degree of inequality aversion. Summary indicators are calculated in relation to the CV, using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

Table 5.13. Tax expenditure from reduced VAT rates on cultural and social expenditure

Change in VAT (in euros) across exp deciles	AUT (2009)	BEL (2010)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	ITA (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
1	9	21	5	30	10	2	33	8	12	3	7	24	9	24	1	29	4	14	8	0	20	1
2	17	41	8	47	17	3	42	18	22	9	8	36	18	33	2	45	6	22	13	1	32	2
3	22	56	10	59	22	4	48	24	27	13	10	48	25	40	3	57	8	26	15	1	44	2
4	27	68	11	69	26	5	54	31	33	17	11	60	33	41	4	68	9	34	17	1	52	3
5	32	79	12	80	30	6	60	39	39	22	12	66	41	49	5	80	10	42	19	2	63	4
6	38	89	14	90	35	7	70	45	42	30	13	83	48	51	6	81	12	48	21	2	71	4
7	43	99	15	103	41	10	74	55	49	38	15	99	56	60	7	97	13	65	24	2	83	6
8	49	111	17	118	48	12	82	64	56	47	16	119	67	64	9	100	16	77	26	3	91	7
9	60	132	20	141	58	15	96	79	61	63	18	149	82	74	11	108	21	108	31	3	106	9
10	92	162	24	175	83	23	122	130	76	115	28	209	127	92	23	131	34	199	44	6	167	17

Change in VAT (% of exp) across exp deciles	AUT (2009)	BEL (2010)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	ITA (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
1	0.06	0.11	0.12	0.22	0.07	0.06	0.26	0.06	0.21	0.02	0.13	0.13	0.06	0.08	0.03	0.16	0.07	0.19	0.07	0.00	0.12	0.02
2	0.07	0.17	0.12	0.26	0.09	0.08	0.21	0.10	0.22	0.05	0.13	0.14	0.10	0.09	0.04	0.20	0.09	0.18	0.08	0.00	0.17	0.03
3	0.08	0.20	0.13	0.28	0.10	0.08	0.20	0.11	0.20	0.06	0.13	0.15	0.12	0.09	0.06	0.22	0.10	0.19	0.08	0.01	0.19	0.03
4	0.09	0.21	0.13	0.29	0.10	0.09	0.19	0.12	0.21	0.07	0.13	0.16	0.13	0.09	0.06	0.24	0.11	0.20	0.09	0.01	0.20	0.03
5	0.09	0.22	0.13	0.29	0.11	0.10	0.18	0.14	0.20	0.08	0.14	0.17	0.14	0.09	0.07	0.25	0.11	0.22	0.09	0.01	0.23	0.04
6	0.10	0.23	0.13	0.30	0.11	0.10	0.18	0.14	0.19	0.10	0.13	0.18	0.15	0.09	0.07	0.24	0.12	0.23	0.09	0.02	0.23	0.04
7	0.10	0.23	0.13	0.30	0.11	0.11	0.17	0.15	0.19	0.11	0.14	0.19	0.16	0.09	0.08	0.25	0.12	0.25	0.09	0.02	0.24	0.04
8	0.11	0.24	0.13	0.31	0.12	0.11	0.16	0.16	0.18	0.12	0.14	0.21	0.17	0.08	0.08	0.25	0.13	0.26	0.09	0.02	0.25	0.05
9	0.11	0.24	0.13	0.31	0.12	0.11	0.16	0.16	0.17	0.13	0.15	0.22	0.18	0.08	0.09	0.24	0.14	0.29	0.09	0.02	0.26	0.05
10	0.13	0.22	0.12	0.27	0.12	0.12	0.14	0.19	0.13	0.16	0.16	0.24	0.18	0.08	0.10	0.22	0.16	0.34	0.09	0.03	0.28	0.06

	AUT (2009)	BEL (2010)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	ITA (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
Kakwani	-0.10680	-0.04970	-0.00350	-0.01140	-0.06750	-0.06520	0.07320	-0.11760	0.08850	-0.19240	-0.03900	-0.10130	-0.09950	0.01540	-0.13820	-0.02760	-0.11340	-0.11130	-0.03540	-0.23810	-0.09670	-0.13830
R-S	-0.00013	-0.00012	-0.00001	-0.00004	-0.00008	-0.00008	0.00014	-0.00019	0.00017	-0.00024	-0.00006	-0.00021	-0.00017	0.00001	-0.00013	-0.00007	-0.00016	-0.00033	-0.00004	-0.00004	-0.00026	-0.00007
Δ Atkn ε=0.2	-0.00002	-0.00001	0.00000	0.00000	-0.00001	-0.00002	0.00002	-0.00003	0.00004	-0.00005	-0.00001	-0.00003	-0.00003	0.00000	-0.00003	-0.00001	-0.00003	-0.00007	-0.00001	-0.00001	-0.00004	-0.00002
Δ Atkn ε=0.7	-0.00007	-0.00006	0.00000	-0.00001	-0.00005	-0.00006	0.00009	-0.00012	0.00011	-0.00015	-0.00003	-0.00011	-0.00011	0.00001	-0.00009	-0.00003	-0.00009	-0.00022	-0.00002	-0.00002	-0.00012	-0.00006
Δ Atkn ε=1.2	-0.00012	-0.00013	-0.00001	-0.00004	-0.00009	-0.00010	0.00016	-0.00019	0.00016	-0.00023	-0.00005	-0.00018	-0.00019	0.00001	-0.00014	-0.00006	-0.00015	-0.00033	-0.00003	-0.00003	-0.00021	-0.00008

Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. Results in top panel present the weighted mean of the tax expenditure (change in VAT) per household. Results in middle panel present the weighted mean of the tax expenditure (change in VAT) as a percentage of total expenditure per household. All tax expenditure results are presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail. Results in bottom panel present the following summary indicators: Kakwani = Kakwani progressivity index; R-S = Reynolds-Smolensky redistribution index; Δ Atkn = change in Atkinson inequality index, with ε = degree of inequality aversion. Summary indicators are calculated in relation to the tax expenditure, using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

Table 5.14. Welfare gain from reduced VAT rates on cultural and social expenditure

Welfare change (CV) across exp deciles	AUT (2009)	BEL (2010)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	ITA (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
1	10	24	6	33	11	2	37	9	13	4	8	27	10	26	1	32	5	15	9	0	23	1
2	20	46	10	53	18	4	48	20	24	10	10	41	21	36	2	50	7	25	14	1	37	2
3	25	62	12	67	24	5	55	27	30	15	11	55	28	43	3	64	9	29	17	1	51	3
4	31	76	12	78	28	6	61	34	36	19	12	70	37	44	4	77	10	39	19	1	60	3
5	36	88	14	90	33	7	69	43	43	25	14	76	45	53	5	90	12	47	22	2	72	4
6	44	100	16	102	39	9	81	50	46	33	15	96	53	55	7	91	14	54	24	2	82	5
7	50	111	17	116	45	11	85	61	54	43	17	114	62	64	8	109	15	74	27	3	96	6
8	57	125	19	133	53	13	94	71	62	53	19	137	75	69	10	112	19	88	30	3	105	7
9	70	149	23	158	64	17	112	87	68	71	21	173	92	79	13	121	24	123	35	4	123	10
10	110	185	28	198	92	27	142	145	85	129	33	245	143	99	27	150	39	231	50	7	200	19

Welfare change (% of exp) across exp deciles	AUT (2009)	BEL (2010)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	ITA (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
1	0.06	0.12	0.13	0.24	0.08	0.07	0.29	0.07	0.22	0.03	0.15	0.14	0.06	0.09	0.04	0.18	0.08	0.21	0.08	0.00	0.14	0.02
2	0.09	0.19	0.14	0.29	0.09	0.09	0.24	0.11	0.24	0.06	0.15	0.16	0.11	0.09	0.05	0.23	0.10	0.21	0.09	0.01	0.20	0.03
3	0.10	0.22	0.15	0.31	0.11	0.10	0.22	0.12	0.22	0.07	0.15	0.17	0.13	0.10	0.06	0.25	0.11	0.22	0.09	0.01	0.22	0.03
4	0.10	0.24	0.15	0.32	0.11	0.10	0.21	0.14	0.23	0.08	0.15	0.19	0.15	0.09	0.07	0.27	0.12	0.23	0.10	0.01	0.23	0.04
5	0.11	0.25	0.14	0.33	0.12	0.11	0.21	0.15	0.22	0.09	0.16	0.20	0.16	0.10	0.08	0.28	0.13	0.25	0.10	0.02	0.26	0.04
6	0.11	0.25	0.15	0.34	0.12	0.11	0.21	0.16	0.21	0.11	0.15	0.21	0.17	0.09	0.09	0.27	0.13	0.26	0.10	0.02	0.27	0.05
7	0.12	0.26	0.15	0.34	0.12	0.12	0.20	0.17	0.21	0.12	0.16	0.22	0.18	0.09	0.09	0.28	0.14	0.29	0.10	0.02	0.28	0.05
8	0.12	0.27	0.15	0.34	0.13	0.12	0.19	0.17	0.20	0.13	0.16	0.24	0.19	0.09	0.10	0.28	0.15	0.30	0.10	0.02	0.29	0.05
9	0.13	0.27	0.15	0.35	0.13	0.12	0.18	0.18	0.19	0.15	0.17	0.25	0.20	0.09	0.10	0.27	0.17	0.33	0.11	0.02	0.30	0.06
10	0.15	0.25	0.14	0.30	0.14	0.14	0.17	0.21	0.14	0.18	0.19	0.28	0.20	0.09	0.12	0.25	0.19	0.39	0.11	0.03	0.34	0.07

	AUT (2009)	BEL (2010)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	ITA (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
Kakwani	-0.14410	-0.09280	-0.03210	-0.04080	-0.09080	-0.08190	0.00560	-0.15350	0.07820	-0.21140	-0.05120	-0.11920	-0.12010	-0.00290	-0.15680	-0.05440	-0.13050	-0.13390	-0.07240	-0.25240	-0.12580	-0.17760
R-S	-0.00020	-0.00025	-0.00005	-0.00014	-0.00012	-0.00010	0.00001	-0.00028	0.00016	-0.00028	-0.00009	-0.00028	-0.00022	0.00000	-0.00015	-0.00015	-0.00020	-0.00044	-0.00008	-0.00005	-0.00037	-0.00010
Δ Atkn ε=0.2	-0.00003	-0.00004	-0.00001	-0.00001	-0.00003	-0.00001	0.00001	-0.00004	0.00004	-0.00006	-0.00002	-0.00004	-0.00005	-0.00001	-0.00002	-0.00003	-0.00004	-0.00011	-0.00001	-0.00001	-0.00005	-0.00002
Δ Atkn ε=0.7	-0.00011	-0.00013	-0.00002	-0.00004	-0.00010	-0.00003	0.00006	-0.00013	0.00011	-0.00019	-0.00008	-0.00014	-0.00018	-0.00002	-0.00007	-0.00009	-0.00013	-0.00034	-0.00002	-0.00002	-0.00016	-0.00008
Δ Atkn ε=1.2	-0.00017	-0.00023	-0.00003	-0.00007	-0.00017	-0.00005	0.00012	-0.00020	0.00015	-0.00030	-0.00012	-0.00023	-0.00029	-0.00004	-0.00010	-0.00015	-0.00021	-0.00051	-0.00003	-0.00004	-0.00026	-0.00012

Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. Results in top panel present the weighted mean of the compensating variation (CV) per household. Results in middle panel present the weighted mean of the CV as a percentage of total expenditure per household. All CV results are presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail. To aid comparison with the tax expenditure results, CV results are presented with positive values reflecting welfare gains. Results in bottom panel present the following summary indicators: Kakwani = Kakwani progressivity index; R-S = Reynolds-Smolensky redistribution index; Δ Atkn = change in Atkinson inequality index, with ε = degree of inequality aversion. Summary indicators are calculated in relation to the CV, using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

Table 5.15. Tax expenditure from reduced VAT rates on restaurants and hotels

		AUT (2009)	BEL (2010)	CHE (2011)	ESP (2010)	FIN (2012)	FRA (2011)	GRC (2010)	IRL (2010)	ITA (2010)	LUX (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	TUR (2010)
Change in VAT (in euros) across exp deciles	1	30	32	11	50	23	57	42	36	15	91	24	5	17	17	12
	2	61	71	17	88	44	98	90	63	33	177	42	6	41	31	22
	3	78	97	21	119	66	128	124	82	48	229	59	8	55	44	28
	4	95	125	24	145	84	148	156	106	66	282	71	10	80	51	33
	5	112	146	29	173	95	185	192	117	84	355	85	12	106	63	40
	6	132	170	32	207	122	215	234	148	103	435	93	16	124	72	45
	7	150	201	36	244	135	259	287	172	126	535	108	20	175	87	52
	8	167	232	40	292	155	301	334	201	157	639	118	27	214	104	59
	9	197	284	47	364	196	365	415	246	207	780	141	39	307	126	73
	10	277	377	59	546	265	561	567	344	347	1165	198	84	566	192	110

		AUT (2009)	BEL (2010)	CHE (2011)	ESP (2010)	FIN (2012)	FRA (2011)	GRC (2010)	IRL (2010)	ITA (2010)	LUX (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	TUR (2010)
Change in VAT (% of exp) across exp deciles	1	0.18	0.17	0.04	0.34	0.17	0.38	0.34	0.18	0.10	0.31	0.13	0.10	0.21	0.12	0.25
	2	0.27	0.29	0.05	0.46	0.21	0.46	0.56	0.24	0.18	0.48	0.19	0.10	0.34	0.18	0.34
	3	0.30	0.35	0.05	0.53	0.25	0.51	0.66	0.26	0.23	0.55	0.23	0.11	0.41	0.22	0.37
	4	0.32	0.40	0.05	0.58	0.28	0.54	0.72	0.29	0.27	0.62	0.25	0.12	0.49	0.23	0.40
	5	0.33	0.41	0.05	0.62	0.29	0.60	0.77	0.30	0.30	0.68	0.26	0.14	0.56	0.27	0.41
	6	0.34	0.44	0.05	0.66	0.30	0.63	0.80	0.33	0.33	0.76	0.27	0.16	0.61	0.28	0.42
	7	0.35	0.48	0.05	0.69	0.31	0.66	0.84	0.34	0.36	0.80	0.29	0.19	0.69	0.31	0.43
	8	0.36	0.50	0.05	0.73	0.30	0.68	0.85	0.36	0.40	0.85	0.29	0.23	0.74	0.34	0.44
	9	0.36	0.52	0.05	0.76	0.31	0.71	0.86	0.37	0.44	0.88	0.32	0.28	0.84	0.36	0.44
	10	0.37	0.50	0.05	0.81	0.31	0.75	0.81	0.41	0.48	0.98	0.32	0.40	0.97	0.38	0.42

		AUT (2009)	BEL (2010)	CHE (2011)	ESP (2010)	FIN (2012)	FRA (2011)	GRC (2010)	IRL (2010)	ITA (2010)	LUX (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	TUR (2010)
Kakwani		-0.06610	-0.09780	-0.01490	-0.10060	-0.06340	-0.08790	-0.06750	-0.09660	-0.15670	-0.12900	-0.10750	-0.25520	-0.16520	-0.14220	-0.02760
R-S		-0.00025	-0.00048	-0.00001	-0.00074	-0.00021	-0.00061	-0.00057	-0.00035	-0.00063	-0.00107	-0.00032	-0.00067	-0.00131	-0.00048	-0.00013
Δ Atkn	ε=0.2	-0.00004	-0.00006	0.00000	-0.00013	-0.00004	-0.00011	-0.00010	-0.00006	-0.00012	-0.00019	-0.00004	-0.00013	-0.00028	-0.00007	-0.00002
	ε=0.7	-0.00016	-0.00025	-0.00001	-0.00045	-0.00013	-0.00037	-0.00037	-0.00019	-0.00040	-0.00063	-0.00014	-0.00038	-0.00091	-0.00024	-0.00011
	ε=1.2	-0.00027	-0.00044	-0.00001	-0.00074	-0.00022	-0.00061	-0.00067	-0.00032	-0.00065	-0.00104	-0.00024	-0.00057	-0.00143	-0.00040	-0.00023

Notes. Results calculated using behavioural microsimulation models for 15 countries based on household expenditure survey microdata. Results in top panel present the weighted mean of the tax expenditure (change in VAT) per household. Results in middle panel present the weighted mean of the tax expenditure (change in VAT) as a percentage of total expenditure per household. All tax expenditure results are presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail. Results in bottom panel present the following summary indicators: Kakwani = Kakwani progressivity index; R-S = Reynolds-Smolensky redistribution index; Δ Atkn = change in Atkinson inequality index, with ε = degree of inequality aversion. Summary indicators are calculated in relation to the tax expenditure, using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

Table 5.16. Welfare gain from reduced VAT rates on restaurants and hotels

		AUT (2009)	BEL (2010)	CHE (2011)	ESP (2010)	FIN (2012)	FRA (2011)	GRC (2010)	IRL (2010)	ITA (2010)	LUX (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	TUR (2010)
Welfare change (CV) across exp deciles	1	35	38	11	56	27	65	48	43	18	100	27	6	20	19	14
	2	71	83	18	98	51	110	103	74	39	194	48	7	48	36	25
	3	91	114	22	132	77	144	142	95	56	251	67	9	65	50	31
	4	110	145	25	162	98	167	177	123	76	309	80	12	95	58	38
	5	130	170	30	193	112	208	218	136	97	388	96	14	126	72	45
	6	153	197	34	231	143	242	266	172	118	476	105	18	147	83	50
	7	174	234	38	272	158	292	326	199	145	585	122	22	207	100	59
	8	195	269	42	326	182	338	378	233	181	700	133	31	252	119	67
	9	232	331	49	407	231	411	470	285	238	855	159	44	363	144	83
	10	332	446	63	615	316	635	646	403	402	1284	228	99	677	223	125

		AUT (2009)	BEL (2010)	CHE (2011)	ESP (2010)	FIN (2012)	FRA (2011)	GRC (2010)	IRL (2010)	ITA (2010)	LUX (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	TUR (2010)
Welfare change (% of exp) across exp deciles	1	0.21	0.20	0.04	0.39	0.19	0.43	0.39	0.21	0.12	0.34	0.15	0.12	0.25	0.14	0.28
	2	0.31	0.34	0.05	0.52	0.25	0.51	0.64	0.28	0.21	0.52	0.21	0.11	0.40	0.20	0.39
	3	0.35	0.41	0.05	0.59	0.29	0.58	0.75	0.31	0.26	0.60	0.26	0.12	0.49	0.25	0.42
	4	0.37	0.46	0.06	0.65	0.33	0.61	0.82	0.33	0.31	0.68	0.28	0.14	0.58	0.27	0.45
	5	0.38	0.48	0.06	0.69	0.34	0.67	0.87	0.35	0.35	0.75	0.29	0.16	0.66	0.30	0.47
	6	0.39	0.51	0.06	0.74	0.35	0.70	0.91	0.38	0.38	0.83	0.31	0.19	0.72	0.33	0.48
	7	0.41	0.56	0.06	0.77	0.36	0.74	0.96	0.40	0.42	0.88	0.33	0.22	0.81	0.35	0.49
	8	0.41	0.58	0.06	0.81	0.36	0.77	0.96	0.41	0.46	0.93	0.33	0.26	0.87	0.38	0.49
	9	0.42	0.60	0.06	0.85	0.37	0.80	0.98	0.43	0.51	0.97	0.36	0.32	0.99	0.41	0.50
	10	0.44	0.59	0.06	0.91	0.36	0.85	0.92	0.48	0.56	1.08	0.37	0.46	1.16	0.44	0.47

		AUT (2009)	BEL (2010)	CHE (2011)	ESP (2010)	FIN (2012)	FRA (2011)	GRC (2010)	IRL (2010)	ITA (2010)	LUX (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	TUR (2010)
Kakwani		-0.10180	-0.14230	-0.03330	-0.12550	-0.13620	-0.12110	-0.08360	-0.11320	-0.17750	-0.15180	-0.13470	-0.27410	-0.18550	-0.17660	-0.06560
R-S		-0.00045	-0.00080	-0.00002	-0.00103	-0.00055	-0.00096	-0.00077	-0.00047	-0.00079	-0.00146	-0.00045	-0.00076	-0.00168	-0.00067	-0.00033
Δ Atkn	ε=0.2	-0.00008	-0.00011	0.00000	-0.00022	-0.00008	-0.00026	-0.00015	-0.00007	-0.00018	-0.00025	-0.00006	-0.00012	-0.00039	-0.00013	-0.00008
	ε=0.7	-0.00025	-0.00037	0.00000	-0.00073	-0.00027	-0.00084	-0.00055	-0.00025	-0.00056	-0.00080	-0.00021	-0.00035	-0.00122	-0.00042	-0.00029
	ε=1.2	-0.00042	-0.00062	0.00000	-0.00119	-0.00044	-0.00134	-0.00095	-0.00041	-0.00088	-0.00128	-0.00035	-0.00051	-0.00186	-0.00068	-0.00048

Notes. Results calculated using behavioural microsimulation models for 15 countries based on household expenditure survey microdata. Results in top panel present the weighted mean of the compensating variation (CV) per household. Results in middle panel present the weighted mean of the CV as a percentage of total expenditure per household. All CV results are presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail. To aid comparison with the tax expenditure results, CV results are presented with positive values reflecting welfare gains. Results in bottom panel present the following summary indicators: Kakwani = Kakwani progressivity index; R-S = Reynolds-Smolensky redistribution index; Δ Atkn = change in Atkinson inequality index, with ε = degree of inequality aversion. Summary indicators are calculated in relation to the CV, using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

CHAPTER 6. REPLACING REDUCED VAT RATES WITH CASH TRANSFERS

6.1. Introduction

Chapter 5 showed that reduced VAT rates are an ineffective policy instrument for targeting support to poorer households. However, if no better instrument is available to provide the desired level of support to poorer households then reduced VAT rates may remain an appropriate policy tool. This chapter uses the behavioural microsimulation models developed in Chapter 4 to examine whether a cash transfer would be a more effective tool for supporting the poor than reduced VAT rates.

Theoretically, a targeted cash transfer (whether implemented through the tax or benefit system[86]) should provide better targeted support to poor households because the targeting mechanism can exclude some households, whereas – as shown in the last chapter – a reduced VAT rate will benefit all taxpayers, including the rich. Furthermore, all OECD countries already have some type of targeted cash transfer system in place – meaning it would be administratively feasible to adjust these systems to compensate targeted households for the removal of reduced VAT rates. This contrasts with many developing countries that do not yet have the administrative capacity to implement an effective targeted cash transfer system.

To examine whether a cash transfer will, in practice, better support the poor than reduced VAT rates, I simulate, for 22 OECD countries, a set of three revenue-neutral reforms that replace reduced VAT rates with stylised cash transfers, and examine the resulting financial and welfare gains and losses for different households.

Analysis of the impact of such reforms poses some measurement challenges as the VAT increase resulting from the removal of reduced VAT rates depends on expenditure, while the size of an income-tested cash transfer depends on income. Presenting results across income rather than expenditure deciles will accurately reflect the ability of an income-tested cash transfer to target low-income households. However, it will overstate the long-term impact of the removal of reduced VAT rates on low-income

[86] Cash transfers are defined broadly as any transfer made to individuals or households by government, whether implemented through the tax system (e.g. as a tax credit) or through the benefit system.

households as compared to higher income households due, as was highlighted in Chapter 3, to the distorting impact of savings behaviour. In contrast, presenting results across expenditure deciles will more accurately reflect the long-term impact of the VAT increase, but will imperfectly portray the ability of an income-tested cash transfer to target low-income households. Given the imperfect nature of each approach, financial and welfare gain results are presented across both income and expenditure deciles. In addition, the expenditure-based summary indicators of redistribution and poverty that were introduced in Chapter 3 are also presented.

Despite the measurement difficulties, simulation results confirm that an income-tested cash transfer will better target support to the poor than reduced VAT rates in all 22 countries. The introduction of a stylised income-tested cash transfer is found to more than fully compensate households, on average, in the bottom 2-4 income and expenditure deciles for the removal of all reduced VAT rates, with households in higher deciles losing from the reform. Welfare gain results are found to be similar. Reynolds-Smolensky and Atkinson index results also show a clear reduction in inequality following such a reform, while Foster-Greer-Thorbecke (FGT) poverty index results show a clear reduction in poverty.

However, the simulation results also show that it is difficult for an income-tested cash transfer to fully compensate absolutely all poor households for the removal of reduced VAT rates. For example, on average across the 22 countries, 4.6% of bottom income decile households and 24.3% of bottom expenditure decile households are actually found to be worse off following the reform. That said, it may be misleading to consider many of these taxpayers as poor: many of the bottom income decile households that lose from the reform are actually found to be in higher expenditure deciles, while the vast majority of bottom expenditure decile households that lose from the reform are found to be in higher income deciles. Furthermore, the number of losers in each country is likely to be exacerbated by the design of the cash transfer. While the transfer is modelled based on household income, size and composition, in practice more precise targeting is likely to be achieved by basing it on family income and by making additional adjustments, such as for the age of children and regional housing costs.

While income-testing enables a cash transfer to be highly targeted at the poor, it also increases the marginal effective tax rates (METRs) faced by households earning income within the “phase-out” region of the cash transfer, increasing work disincentives. However, the second simulation results show that even a universal cash transfer – which would have no impact on METRs – would still better target poor households than reduced VAT rates. On average, the introduction of a universal cash transfer is found to fully compensate households in the bottom 5-7 income and expenditure deciles, depending on the country, for the removal of all reduced VAT rates. The welfare gain results show similar targeting. Again Reynolds-Smolensky and Atkinson index results show a reduction in inequality following such a reform, though significantly less than with an income-tested cash transfer, while FGT poverty index results show a small reduction in poverty.

Despite the superiority of cash transfers as a tool to support the poor, public perception of the regressivity of the VAT is likely to make it difficult from a political perspective to remove all reduced VAT rates. However, the third reform shows that even a restricted reform that excludes food would still provide a considerable improvement in the targeting of support to poorer households. On average, the replacement of all reduced VAT rates except those on food with the stylised income-tested cash transfer provides a financial gain to just the bottom 2-4 income and expenditure deciles, depending on the country. The average financial gain amounts are however substantially lower than in the full reform, as significantly less revenue is redistributed due to the exclusion of food. The welfare gain results are again found to be similar. Reynolds-Smolensky and Atkinson index results show a reduction in inequality similar to that achieved with the universal cash transfer, while the FGT poverty index results show a similarly small reduction in poverty.

Overall, the three reforms show the clear superiority of a cash transfer over reduced VAT rates as a tool for supporting the poor. The fact that even a universal cash transfer provides better targeting of the poor is a particular indictment on the use of reduced VAT rates. These findings, taken together with those of Chapter 5, have strong implications for VAT policy. However, discussion of these implictions is left for Chapter 8.

The chapter proceeds as follows: Section 6.2 summarises previous empirical literature examining the use of cash transfers to replace reduced VAT rates. Section 6.3 outlines the simulation methodology. Section 6.4 then presents the simulation results. Section 6.5 provides some concluding comments.

6.2. Literature review

While theory (see Chapter 2) clearly predicts that targeted cash transfers will be a superior instrument for providing support to poorer households than reduced VAT rates, there have been relatively few empirical studies on the topic. This section reviews the small number of empirical studies that have compared the use of reduced VAT rates with cash transfers (defined broadly) in developed countries, as well as several recent studies that have begun to examine the issue in developing countries. These studies generally use microsimulation models to simulate reforms that remove reduced VAT rates and introduce new, or extend existing, cash transfer programs. With two exceptions (Cseres-Gergely, 2017, and Van Oordt, 2018), these studies do not take account of behavioural responses to the removal of reduced VAT rates.

Davis and Kay (1985) use 1982 household expenditure microdata for the United Kingdom to simulate a reform that uses the revenue generated from removing zero rates and exemptions to increase income tax thresholds, the child benefit and pensions. Their analysis assumes that most exemptions had an effective pre-reform tax rate of 4% (due to the inability to claim input tax credits). They find that most lower income household types gain from such a reform and that most higher income households lose. As such, they conclude that "distributional objectives of differential commodity taxation can be more effectively achieved by more direct measures." (p14).

Brashares et al. (1988) simulate the introduction of a VAT in the United States using 1982 household expenditure microdata. They compare various potential methods of lowering the burden of the VAT on low-income households, including zero-rating certain necessities (food, medicines and utilities), and the provision of income-tested cash transfers.[87] They find that income-tested cash transfers will benefit poor households far more than zero-rating necessities.

Crawford et al. (2010), use 2006 household expenditure microdata for the United Kingdom to simulate a reform that removes zero and reduced VAT rates and uses part of the revenue gain to increase income support payments and tax credits. They find that such a reform can, on average, fully compensate poorer households for the removal of the reduced rates while generating additional revenue to fund other government expenditure priorities. Mirrlees et al. (2011), which draws on the analysis in Crawford et al. (2010), presents an additional more complex simulation that spends the revenue from removing zero and reduced VAT rates on direct tax cuts and benefit increases. They find that carefully designed reform can compensate poorer households, on average, for the VAT increase without increasing work disincentives, while increasing overall welfare through removing distortions to consumption decisions.

Cseres-Gergely et al. (2017) simulate for Hungary the introduction of a range of potential policy measures to help poorer households, including the introduction of a reduced VAT rate on food, an income transfer to the unemployed, government regulation of utility prices, and subsidies for home production activities. Unlike the above studies, they account for behavioural responses to price changes through the estimation of a Quadratic Almost Ideal Demand System (QUAIDS), utilising Hungarian price and household expenditure data from 2003-2011. They find that the income transfer to the

[87] They refer to "reimbursements" or "credits", noting these could be implemented through the tax system or paid out separately.

unemployed would be the most well targeted at poorer households, whereas the reduced VAT rate for food would provide significant gains to both poor and rich households (as was noted in Chapter 5).[88]

Harris et al. (2018) model the VAT in four developing countries (Ethiopia, Ghana, Senegal and Zambia), drawing on household expenditure microdata from 2011-2016. In their model they also estimate pre-reform VAT burdens on exempted goods using input-output tables. For each country, they simulate removing reduced VAT rates and exemptions and using either 100% or 75% of the revenue to fund the introduction of a universal benefit. Despite the lack of targeting of the universal benefit, they find such a reform would provide significant gains for poor households in all four countries. They also find that existing cash transfer programs are better targeted at poor households in three of the four countries, but that upscaling these programs would not be a suitable way to compensate for a base-broadening VAT reform due to program-specific coverage and targeting limitations.

Van Oordt (2018) uses South African data from 2010-11 to simulate a range of reforms removing zero-rates on food products and increasing existing social grants. As with Cseres-Gergely et al. (2017), he accounts for behavioural responses to price changes through the estimation of a QUAIDS model. For revenue-neutral reforms, he finds a strong redistributive effect, with low- and middle-income households benefiting from the reforms, and high-income households losing. However, results are less clear when only part of the revenue raised is used to fund increases in social grants. Where the reform removes zero-rates on food consumed disproportionately by richer households, a positive redistributive effect is still found. However, where the reform removes zero-rated food consumed disproportionately by poorer households, a negative redistributive effect can result, in part due to the imperfect targeting of the social grants.

Gcabo et al. (2019) consider similar reforms for South Africa, using 2014-15 household expenditure microdata. In contrast to Van Oordt (2018), they consider using the revenue raised from removing reduced VAT rates to fund the introduction of new social benefits rather than increasing existing ones. They do not take account of behavioural responses in their simulations. They find that the combination of a single VAT rate and an expanded set of social benefits would reduce both poverty and inequality.

[88] Abramovsky et al. (2015) also develop a QUAIDS model which they use to examine the distributional effects of Mexico's 2010 VAT reform. While they do not directly compare the impact of reduced VAT rates with cash transfers, their simulations of alternatives to the 2010 reform (which involved a one percentage point increase in the standard VAT rate in place of a previously proposed new 2% broad-based consumption tax) implicitly suggest that cash transfers would better target poorer households than reduced VAT rates.

The last three studies highlight that the ability of a government to effectively administer a targeted cash transfer program is of critical importance if it is to replace a system of poorly targeted reduced VAT rates. While this is unlikely to be a problem in OECD countries, it clearly remains an important issue for developing and emerging economies.

6.3. Methodology

This chapter uses the behavioural microsimulation models described in Chapter 4 to simulate three revenue-neutral reforms. First, the removal of all reduced VAT rates (i.e. increasing these rates to the standard VAT rate applicable in each country), and replacement with an income-tested cash transfer. Second, the removal of all reduced rates, and replacement with a universal cash transfer. Third, the removal of all reduced rates excluding reduced rates on food and non-alcoholic beverages for home consumption ("food" hereafter), and replacement with an income-tested cash transfer.

The analysis covers 22 of the 23 countries for which behavioural microsimulation models have been built. Italy is excluded from the analysis because income data necessary to model the income-tested cash transfer is not available in the Italian household expenditure microdata.

As in Chapter 5, simulation of the removal of all reduced rates excludes expenditure groupings of exempt goods, groupings that combine expenditure subject to reduced rates with exempt goods, and groupings that combine expenditure subject to both reduced and standard rates. Expenditure categories subject to a combination of different reduced rates are included under the assumption that taxpayers continue to consume the constituent expenditure categories in the same proportions, thereby responding to the change in the average VAT rate attributed to the grouping.

A stylised cash transfer design is adopted for the simulations as opposed to attempting to model an extended version of the cash transfer systems already in place in each country. The universal cash transfer is modelled as a fixed cash amount that is then adjusted to take account of household composition by multiplying it by the equivalent size of the household (as defined by the parametric equivalence scale utilised in previous chapters: $m_i = \left(n_{a,i} + \theta n_{c,i}\right)^{\alpha}$ with $\theta = 0.5$ and $\alpha = 0.7$). The income-tested cash transfer follows the same design, but is withdrawn at a rate of 20% of every currency unit of income above 50% of average household income. In both cases, the size of the pre-adjustment fixed amount is determined following an iterative process to ensure revenue neutrality – i.e. the total fiscal cost of the cash transfer equals the revenue gain from removing the reduced VAT rates. In these calculations, it is assumed that the cash transfer is fully consumed and subject to VAT in accordance with the estimated post-reform budget shares.

The stylised cash transfer design is not expected to be the exact design that a country would adopt because targeting objectives and administrative factors vary from country to country. For example, the families or individuals a government wishes to target will vary from country to country, as will other factors affecting the targeting such as the underlying income distribution and the ability to target based on broader factors than just household income. In particular, for a given fiscal cost, trade-offs must be made regarding the rate of withdrawal and the range of incomes that will be subject to the higher marginal effective tax rates that result from the targeting. Furthermore, while countries in practice target based on either family or individual income, the available data restricts the modelling in this chapter to the use of household income. This can have a significant impact on the analysis in countries where it is more common for more than one family to reside in the same house.

More generally, the revenue neutrality of the reform should only be considered approximate. As discussed in Chapter 3, the microsimulation models underestimate total VAT revenue, and hence are likely to underestimate the revenue gain from increasing the reduced VAT rates. As such, the available revenue to fund the cash transfer may in practice be higher. This suggests that the results can be treated as a lower bound on the gain from a shift from reduced VAT rates to targeted cash transfers.

Following the approach in Chapter 5, two indicators are calculated for each household: the financial gain or loss from the reform (calculated as the cash transfer received minus the increase in VAT paid), and the money-metric welfare gain or loss (calculated as the cash transfer received minus the compensating variation). Average financial and welfare gain/loss results are presented across both income and expenditure deciles. To gain additional insight on the reforms, the proportion of winners and losers in each decile from each reform is also calculated. As in previous chapters, the underlying calculations are made per household and are then weighted up to the population using household survey weights. As before, the unit of analysis adopted is the individual, and equivalisation is undertaken using the above noted parametric equivalence scale.

The two summary measures of redistribution introduced in Chapter 3 – the Reynolds Smolensky index and the change in the Atkinson inequality index – are also presented to summarise the impact of the reforms as a whole on inequality, while the three Foster-Greer-Thorbecke (FGT) indices are presented to examine their impact on poverty.

6.4. Simulation results

This section presents the simulation results for the three reforms. Results are first presented across income and expenditure deciles for each reform. The summary measures of redistribution and poverty are then presented together for all three reforms. While the text typically refers to the gains and losses of households, recall that, as the unit of analysis is the individual, each decile has the same number of individuals in it, not households.

6.4.1. Reform 1

Figures 6.1-6.4 summarise the results of the decile-based analysis for reform 1. The solid bars in each figure present the all-country average of the average financial gain (Figures 6.1 and 6.2) and welfare gain (Figures 6.3 and 6.4) per household from each reform, across income and expenditure deciles, respectively. The dotted lines present the all-country average of the proportion of losers from the reform in each decile. Individual country results are presented in Tables 6.1 and 6.2 at the end of the chapter.

The financial gain results in Figures 6.1 and 6.2 show that an income-tested cash transfer more effectively targets support to poor households than reduced VAT rates. On average across the 22 countries, the replacement of reduced VAT rates with the stylised income-tested cash transfer provides a financial gain to just the bottom three income deciles and bottom four expenditure deciles. This is because the size of the cash transfer received falls with income, while the increase in VAT rises with income (indirectly via increased expenditure). As such, the VAT increase outweighs the cash transfer at higher income levels. Individual country results in Table 6.1 show only a small degree of variation with the bottom 2-4 deciles benefiting from the reform, depending on the country (with the exception of Turkey where the fifth income and expenditure decile also benefits slightly, and Ireland and Portugal where the fifth expenditure decile benefits).

The welfare gain results in Figures 6.3 and 6.4 also show just the bottom three income deciles and four expenditure deciles gaining from the reform, on average. However, the gains are slightly smaller, and losses larger, than those in Figures 6.1 and 6.2. This is due to the greater welfare loss, as opposed to financial loss, from the removal of the reduced VAT rates. As noted in the previous chapter, this, in turn, is due to the additional impact of the tax-induced behavioural change on welfare. Again, there is only a small degree of variation in the individual country results (Table 6.2), with the bottom 2-4 deciles benefiting from the reform, depending on the country (with the exception of Turkey where the fifth income decile also benefits to a very small degree).

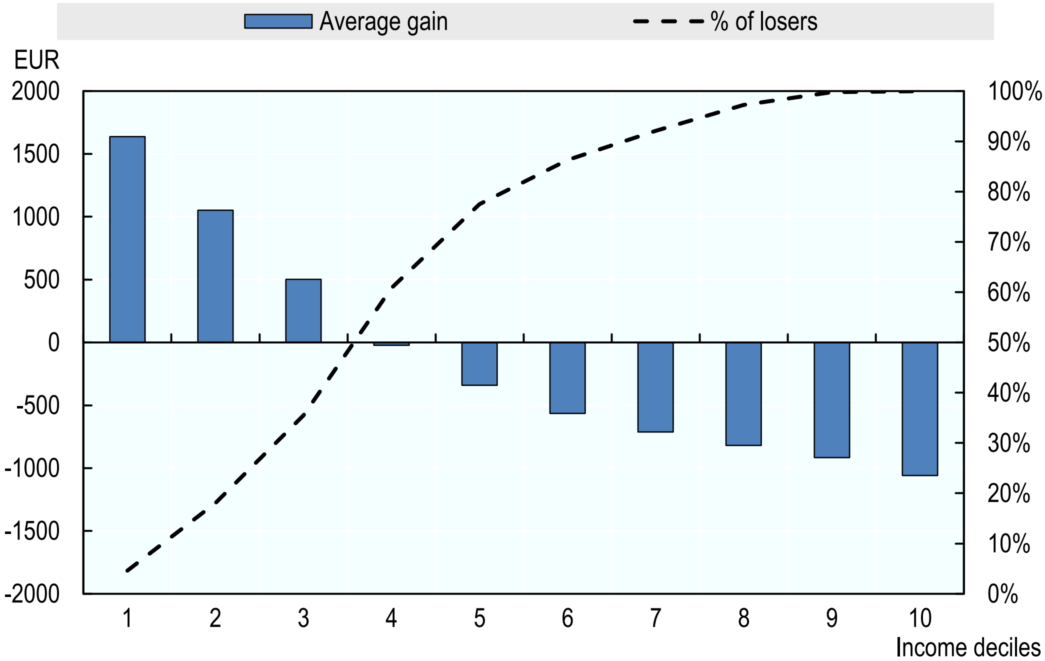
An important caveat to these results is that they present the average effects for each decile. As consumption patterns determine the exact impact on each household of the removal of reduced VAT rates, and household size and composition (in addition to income) adjust the cash transfer, the overall impact of the reform does vary to a degree across households within each decile. The dotted lines in Figures 6.1 and 6.2 show, for example, that 4.6% of bottom income decile households and 24.3% of bottom expenditure decile households actually lose from the reform, on average, across the 22 countries. Additionally, 3.8% of top expenditure decile households gain from the reform, although the income-testing ensures that no top income decile households gain from the reform.

These 22-country averages hide significant variation in the number of losers across countries. Table 6.1 shows that there are no losers in the bottom income decile in 12 countries, and 2% or less losers in a further three countries.[89] The main outlier is the Slovak Republic – where 34% of the bottom income decile lose from the reform. However, this result is due to the minimal use of reduced rates in the Slovak Republic, the removal of which funds only a very small cash transfer which is often unable to compensate households that spend a significant proportion of their total expenditure on previously reduced-rated goods. The proportion of losers in the bottom expenditure decile ranges from 3% in Turkey, to 57% and 58% in the Slovak Republic and Estonia (in both cases driven by the low size of the cash transfers).

The presence of losers in the bottom income and expenditure deciles is partially due to the measurement difficulties associated with the analysis of VAT reform based on cross-sectional data. Specifically, while presenting results across income deciles accurately reflects the ability of an income-tested cash transfer to target low-income households, it overstates the long-term impact of the removal of reduced VAT rates on low-income households as compared to higher income households. As was illustrated in Chapter 3, this is because low-income households tend to be net borrowers – thereby increasing the VAT they pay relative to their current income – whereas high-income households tend to be net savers. In contrast, presenting results across expenditure deciles more accurately reflects the long-term impact of the VAT increase by removing the misleading influence of savings behaviour. However, it imperfectly portrays the ability of an income-tested cash transfer to target low-income households because the income and expenditure distributions are imperfectly aligned.[90]

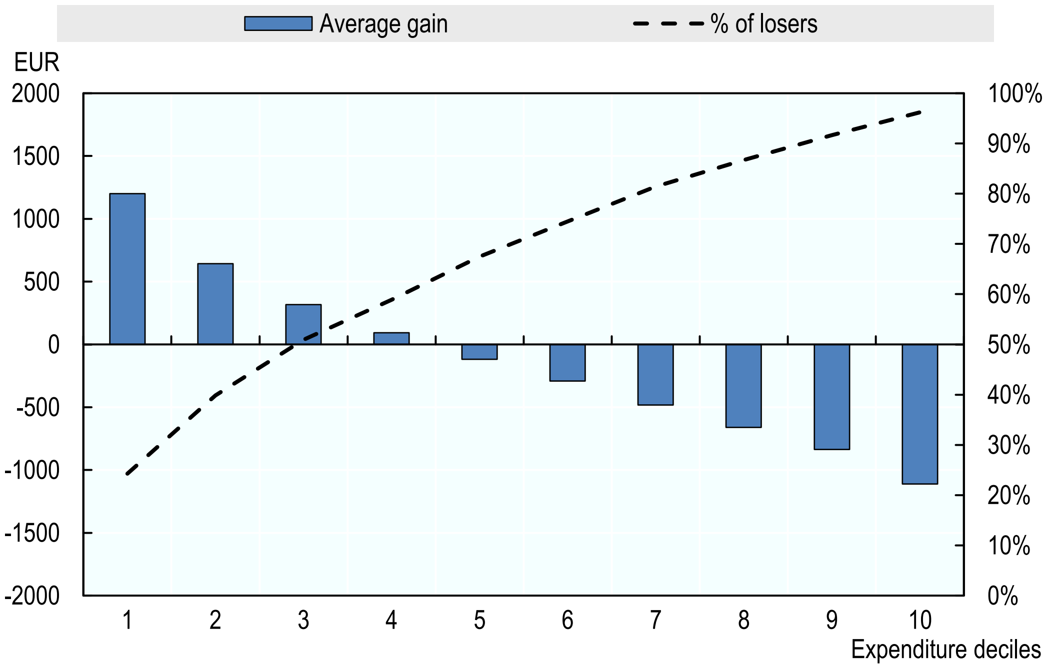
[89] In three of these countries (Germany, France and Poland) the number of losers is positive, but rounds down to zero in Table 6.1.
[90] Recall from Chapter 3 that only 42% of individuals in the bottom expenditure decile are also in the bottom income decile (on average across 25 countries). More generally, 72% of individuals in a particular expenditure decile are within (plus or minus) two deciles of the same income decile (on average across 25 countries).

Figure 6.1. All-country average financial gain or loss across income deciles from reform 1



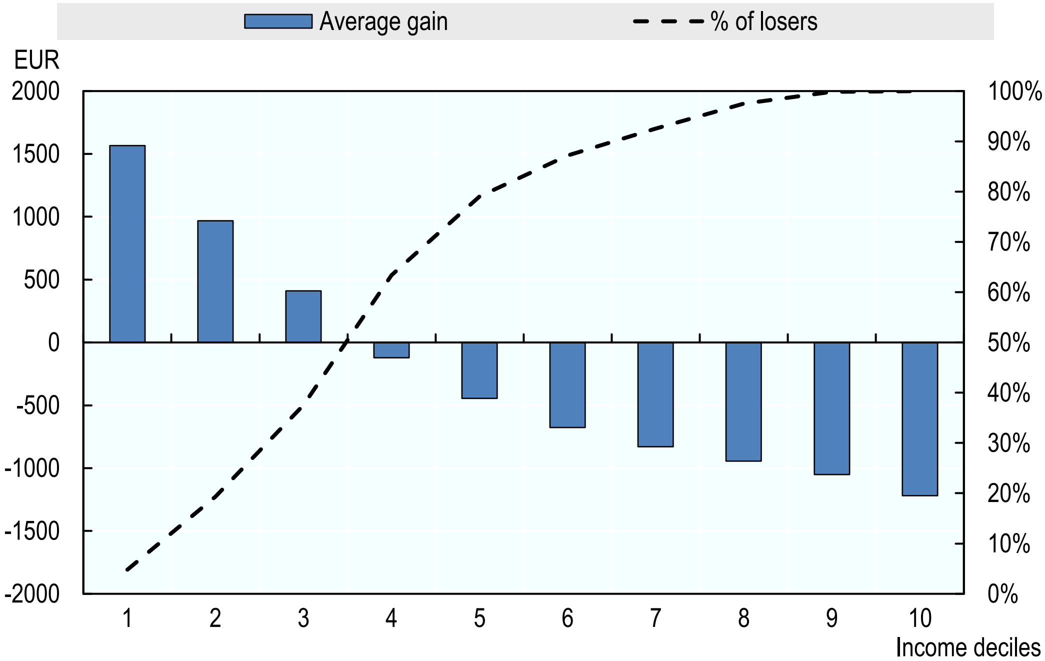
Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. "Average gain" results present the simple mean across all countries of the within-country weighted mean of the financial gain from the reform per household. The financial gain is calculated as cash transfer received minus increase in VAT paid. "% of losers" results present the simple mean across all countries of the percentage of individuals in each country that suffer a financial loss from the reform. Results presented across equivalised income deciles, with the individual as unit of analysis. See text for further detail.

Figure 6.2. All-country average financial gain or loss across expenditure deciles from reform 1



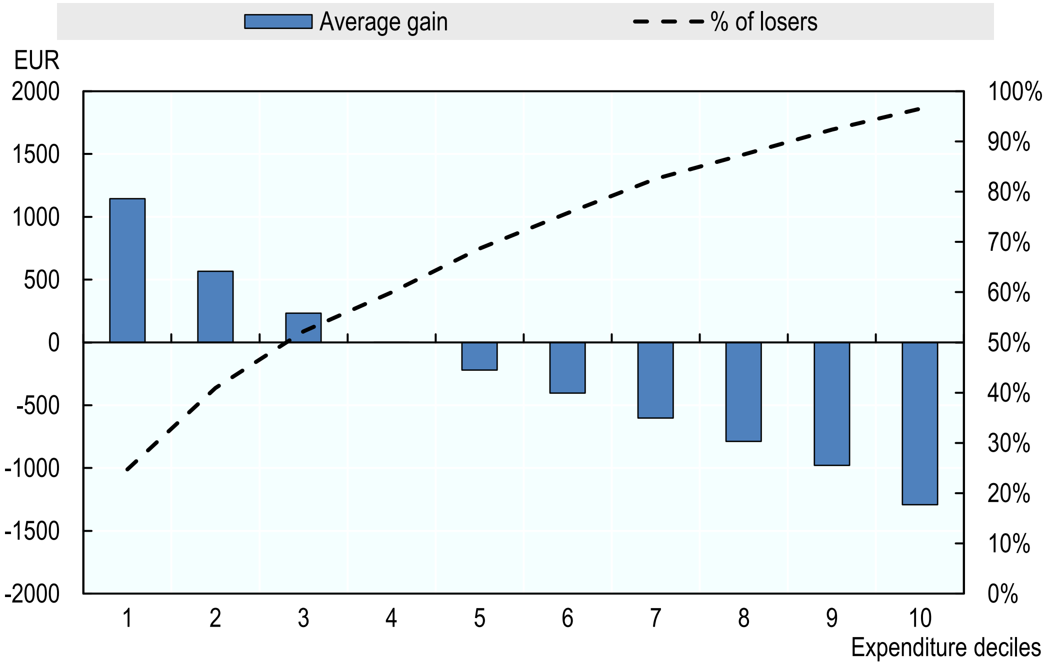
Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. "Average gain" results present the simple mean across all countries of the within-country weighted mean of the financial gain from the reform per household. The financial gain is calculated as cash transfer received minus increase in VAT paid. "% of losers" results present the simple mean across all countries of the percentage of individuals in each country that suffer a financial loss from the reform. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

Figure 6.3. All-country average welfare gain or loss across income deciles from reform 1



Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. "Average gain" results present the simple mean across all countries of the within-country weighted mean of the money-metric welfare gain from the reform per household. The welfare gain is calculated as cash transfer received minus compensating variation. "% of losers" results present the simple mean across all countries of the percentage of individuals in each country that suffer a welfare loss from the reform. Results presented across equivalised income deciles, with the individual as unit of analysis. See text for further detail.

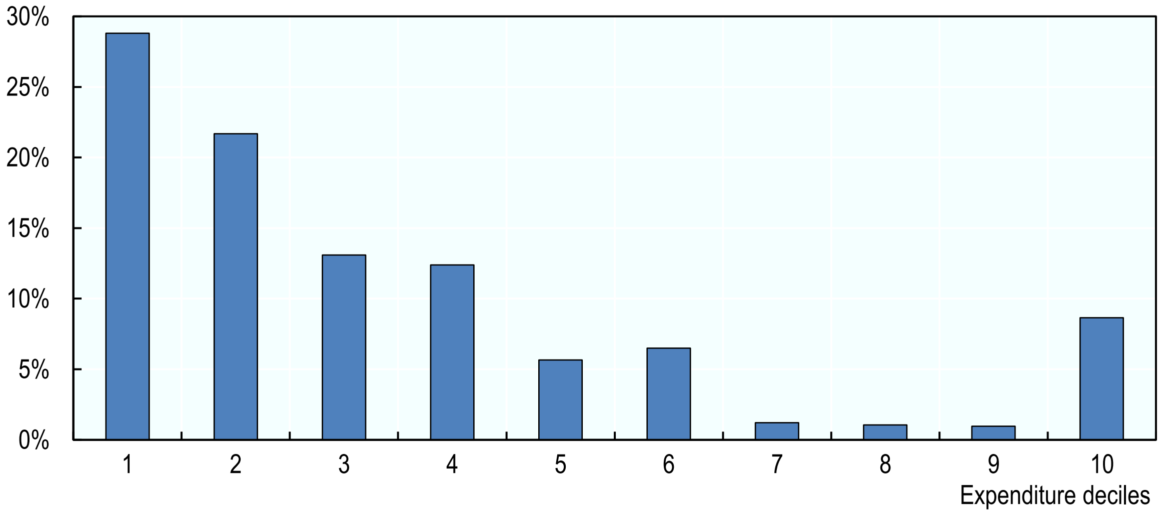
Figure 6.4. All-country average welfare gain or loss across expenditure deciles from reform 1



Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. "Average gain" results present the simple mean across all countries of the within-country weighted mean of the money-metric welfare gain from the reform per household. The welfare gain is calculated as cash transfer received minus compensating variation. "% of losers" results present the simple mean across all countries of the percentage of individuals in each country that suffer a welfare loss from the reform. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

Consider the small number of losers in the bottom income decile. Figure 6.5 shows that, on average across the 13 countries with losers in the bottom income decile, 50% of the losers in the bottom income decile are in the third or higher expenditure deciles, and therefore face a disproportionate increase in VAT due to their higher current spending levels. If these households are long-term poor then the analysis overstates the long-term impact of the reform because these households will need to lower their expenditure levels in future years, thereby lowering their VAT burden. Meanwhile, other low-income high-spending households are not long-term poor, but instead are engaging in some degree of consumption smoothing, and therefore are unlikely to be of particular concern to policy makers.[91]

Figure 6.5. Distribution of losers in bottom income decile across expenditure deciles (average across countries)



Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. Results show the conditional mean across countries of the distribution across expenditure deciles of "losers" in the bottom income decile in each country, for countries where the number of such losers is greater than zero (13 countries). A "loser" is defined as an individual in a household that suffers a financial loss, where the financial gain/loss is calculated as cash transfer received minus increase in VAT paid. Deciles are based on equivalised income/expenditure, with the individual as unit of analysis. See text for further detail.

Of more concern in these 13 countries are the 28.8% of bottom income decile (losing) households that are also in the bottom expenditure decile.[92] However, further examination of these households shows that they are disproportionately households with more than two adults. Many such households will comprise more than one family, and so family income-based targeting is likely to be able to ensure these households do not lose from the reform. Indeed, further simulations providing an additional credit for

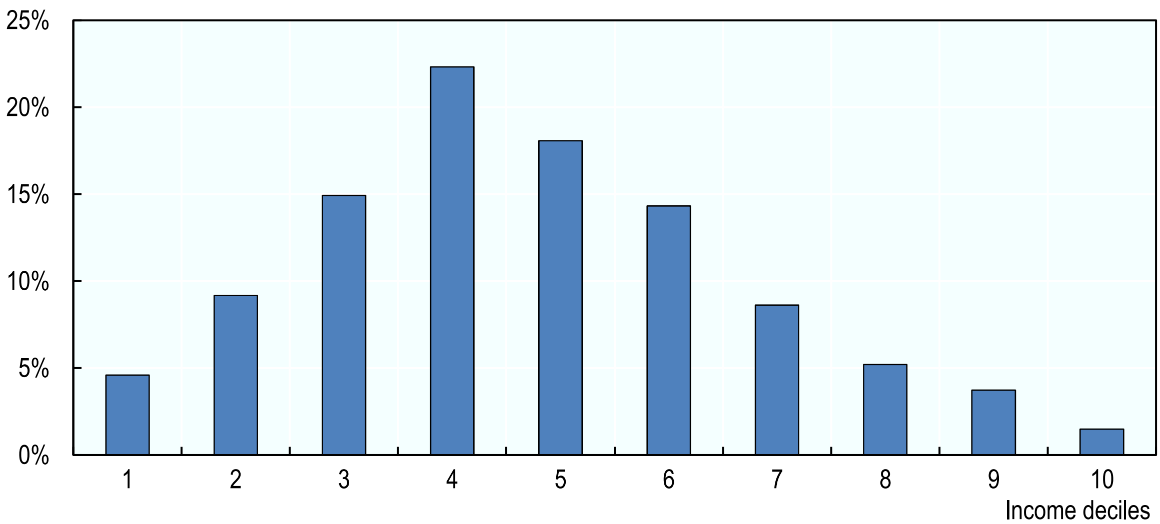
[91] In nine of the 13 countries with a non-zero number of bottom income decile losers, data are also available on the activity status of the household head. On average across the nine countries, 31% of these households have a household head who is either a student, retired, or self-employed (including agriculture). This suggests they are only short-term low-income households who are currently borrowing against future income, drawing down savings, or, in the case of the self-employed, subject to variable earnings and either borrowing or drawing down savings to fund current spending.

[92] Actually, such losers are only present in 8 of the 13 countries.

low-income households with more than two adults (as a proxy for family-based targeting) are able to eliminate any losers from households in both the bottom income and expenditure decile in every country excluding the Slovak Republic.

Turning to the higher number of losers in the bottom expenditure decile, these are typically households that are spending less than they earn. As such, they are subject to the withdrawal of the cash transfer and so lose out from the reform. This can be seen in Figure 6.6, which shows that, on average across all countries, the losers in the bottom expenditure decile are predominantly in the middle of the income distribution. Given their higher current income levels, these households are likely to be of less concern to policy makers.

Figure 6.6. Distribution of losers in bottom expenditure decile across income deciles (average across countries)



Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. Results show the simple mean across all countries of the distribution across income deciles of “losers” in the bottom expenditure decile in each country. A “loser” is defined as an individual in a household that suffers a financial loss, where the financial gain/loss is calculated as cash transfer received minus increase in VAT paid. Deciles are based on equivalised income/expenditure, with the individual as unit of analysis. See text for further detail.

More generally, the number of losers from the simulation results can be thought of as a worst-case scenario for each country. In addition to being able to target based on family income rather than household income, countries will, in practice, also be able to further minimise the number of losers in the bottom deciles by targeting based on a wider range of criteria than is possible in this study – such as by making adjustments for the age of children and regional housing costs.

Even taking account of these measurement difficulties, there may still be some households that lose out from the reform despite being in the targeted group. For example, two otherwise identical households that receive the exact same cash transfer will face different VAT increases if their consumption preferences for standard-rated vs reduced-rated goods differ. Consequently, one may win from the reform and the other lose. Nevertheless, as Mirrlees et al. (2011) note, it is difficult to justify the provision of a taste-based concession – as effectively occurs with a reduced VAT rate – as compared to a cash transfer which instead provides support based on income and family characteristics.

6.4.2. Reform 2

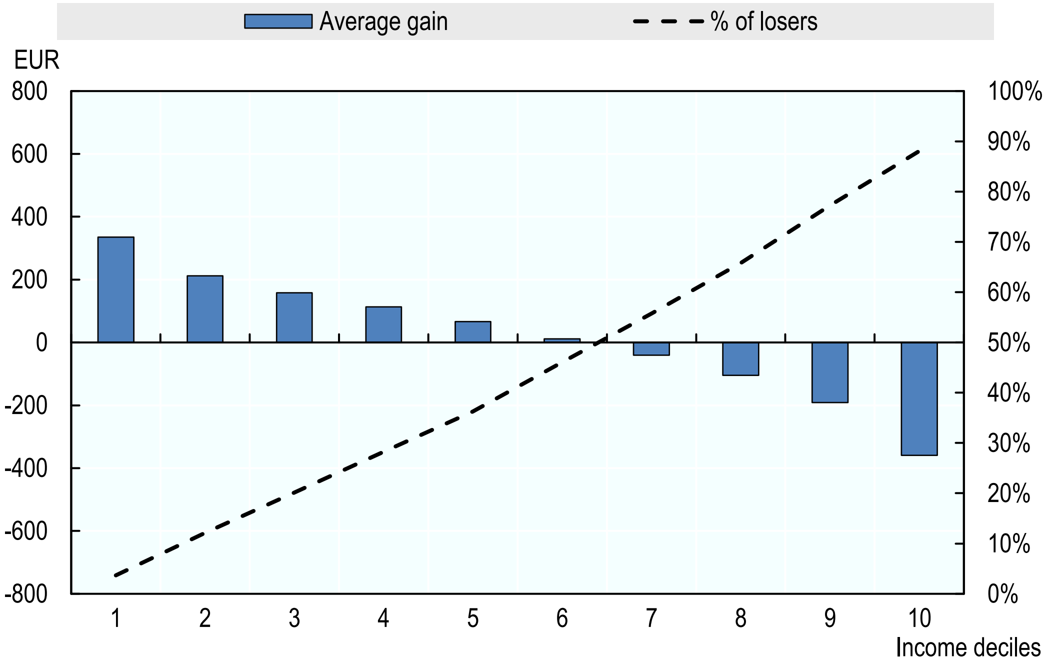
Reform 2 replaces all reduced VAT rates with a universal cash transfer rather than an income-tested cash transfer. Figures 6.7-6.10 present the all-country average results of the decile-based analysis for reform 2. Individual country results are presented in Tables 6.3 and 6.4 at the end of the chapter.

The results show that even an entirely untargeted cash transfer will still more effectively target support to poor households than reduced VAT rates. On average, the replacement of reduced VAT rates with a universal cash transfer provides a financial gain to the bottom six income and expenditure deciles. This is because the (mostly) low aggregate levels of expenditure on reduced-rated goods by households in these deciles means the increase in VAT paid from the removal of the reduced rates is outweighed by the cash transfer received. In contrast, the higher levels of aggregate expenditure on reduced-rated goods in the top four income and expenditure deciles means that the VAT increase outweighs the cash transfer. Individual country results show only small variation, with gains to the bottom 5-7 deciles (and the eighth income decile in the Slovak Republic). The welfare gain results show slightly tighter targeting of poorer households, with the reform providing a welfare gain to just the bottom four income and expenditure deciles, on average, though with some variation across countries.

As with reform 1, the average gains mask variation within deciles. The dotted lines in Figure 6.8 show that all bottom expenditure decile households gain from the reform as their low expenditure levels mean the increase in VAT is always outweighed by the universal cash transfer. However, Figure 6.7 shows a small number of higher-spending low-income households do face a significant enough loss from the increase in VAT rates that this outweighs the universal cash transfer. Additionally, a small number of high income and high expenditure households gain from the reform.

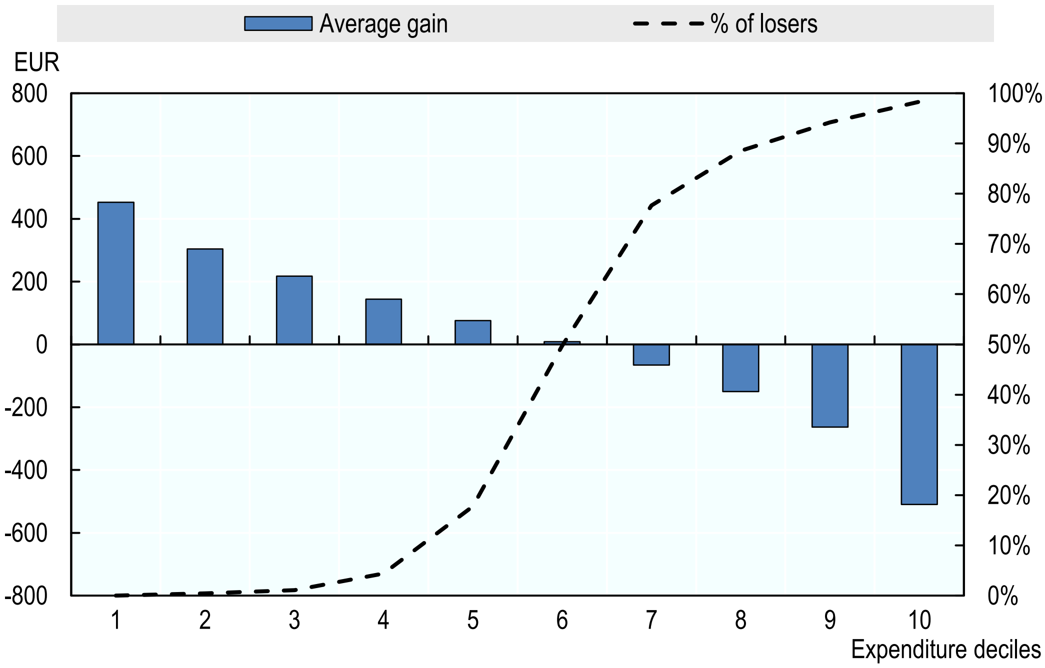
Once again, though, the small number of low-income households facing a loss from the reform are not necessarily poor in a lifetime sense, and hence not necessarily those of particular concern to policy makers. As Figure 6.11 shows, on average the losers in the bottom income decile are households in the middle or higher expenditure deciles. No households that feature in both the bottom income and expenditure decile lose from the reform.

Figure 6.7. All-country average financial gain or loss across income deciles from reform 2



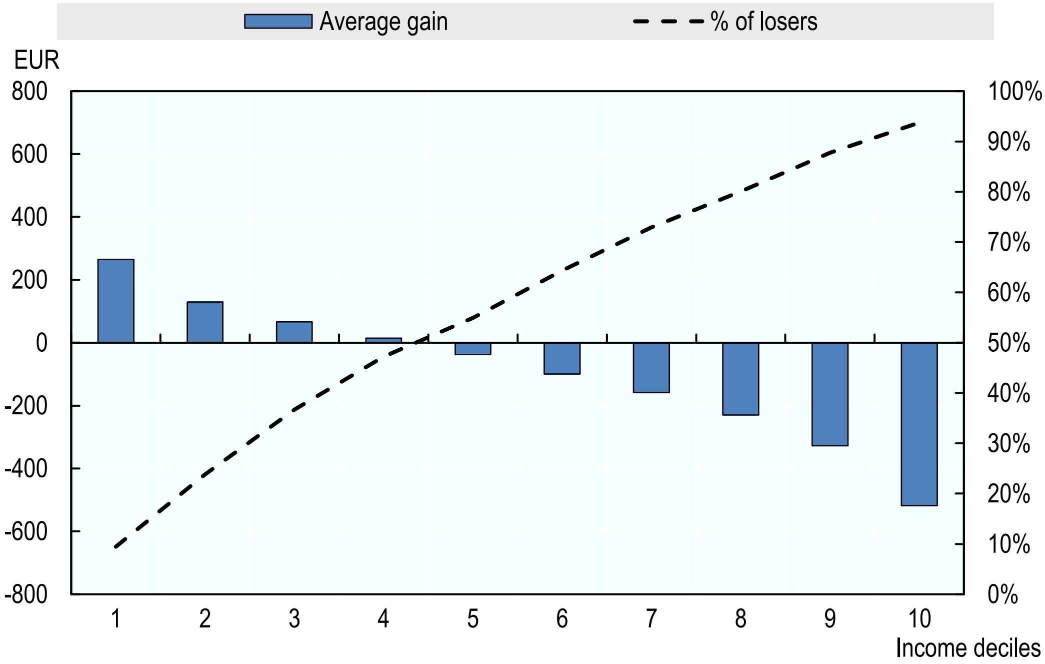
Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. "Average gain" results present the simple mean across all countries of the within-country weighted mean of the financial gain from the reform per household. The financial gain is calculated as cash transfer received minus increase in VAT paid. "% of losers" results present the simple mean across all countries of the percentage of individuals in each country that suffer a financial loss from the reform. Results presented across equivalised income deciles, with the individual as unit of analysis. See text for further detail.

Figure 6.8. All-country average financial gain or loss across expenditure deciles from reform 2



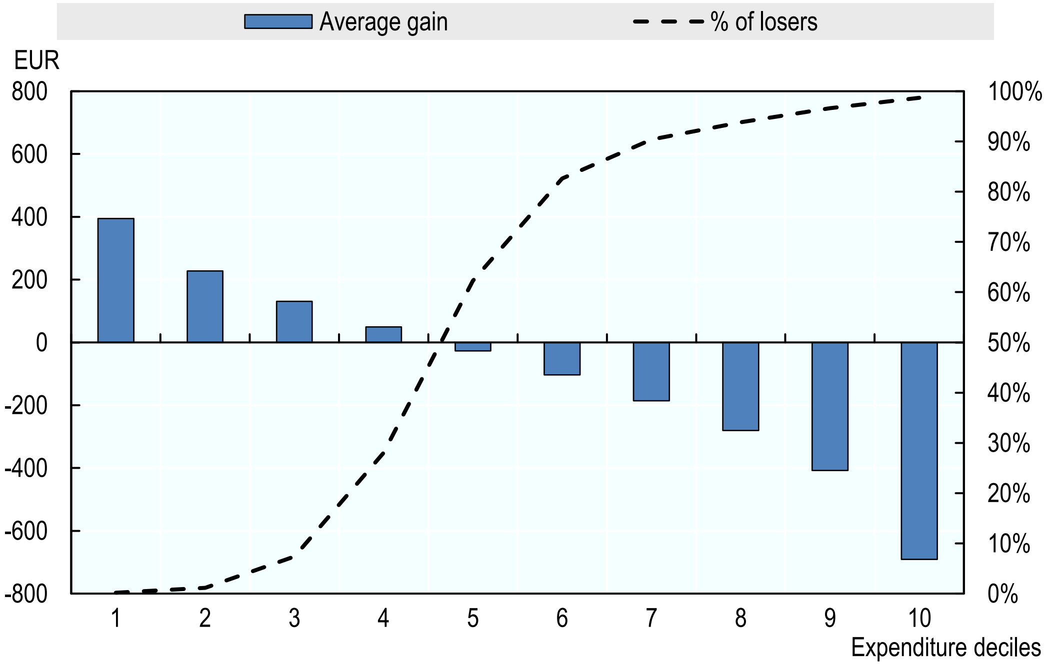
Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. "Average gain" results present the simple mean across all countries of the within-country weighted mean of the financial gain from the reform per household. The financial gain is calculated as cash transfer received minus increase in VAT paid. "% of losers" results present the simple mean across all countries of the percentage of individuals in each country that suffer a financial loss from the reform. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

Figure 6.9. All-country average welfare gain or loss across income deciles from reform 2



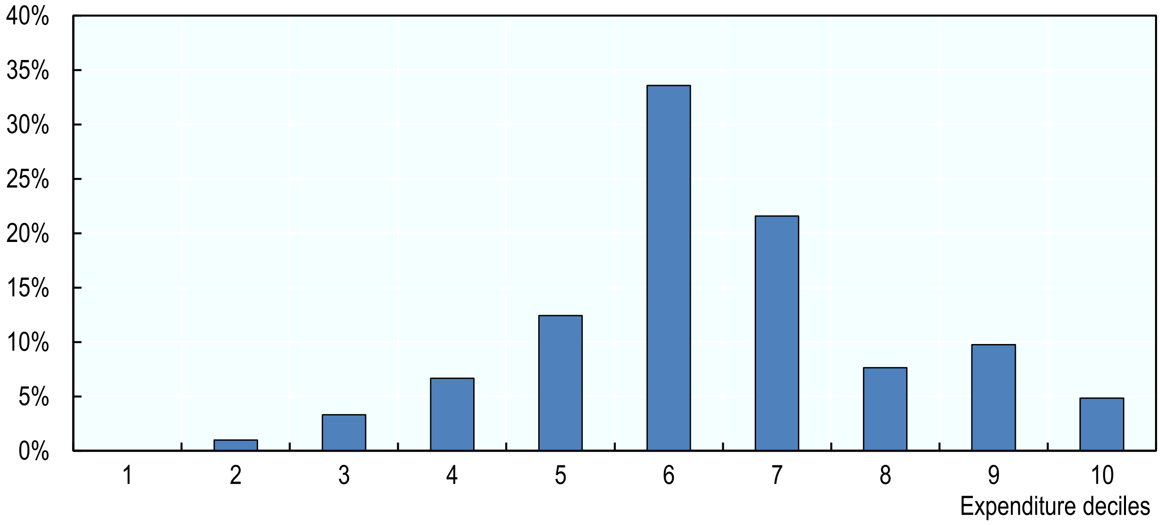
Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. "Average gain" results present the simple mean across all countries of the within-country weighted mean of the money-metric welfare gain from the reform per household. The welfare gain is calculated as cash transfer received minus compensating variation. "% of losers" results present the simple mean across all countries of the percentage of individuals in each country that suffer a welfare loss from the reform. Results presented across equivalised income deciles, with the individual as unit of analysis. See text for further detail.

Figure 6.10. All-country average welfare gain or loss across expenditure deciles from reform 2



Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. "Average gain" results present the simple mean across all countries of the within-country weighted mean of the money-metric welfare gain from the reform per household. The welfare gain is calculated as cash transfer received minus compensating variation. "% of losers" results present the simple mean across all countries of the percentage of individuals in each country that suffer a welfare loss from the reform. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

Figure 6.11. Distribution of losers in bottom income decile across expenditure deciles (average across countries)



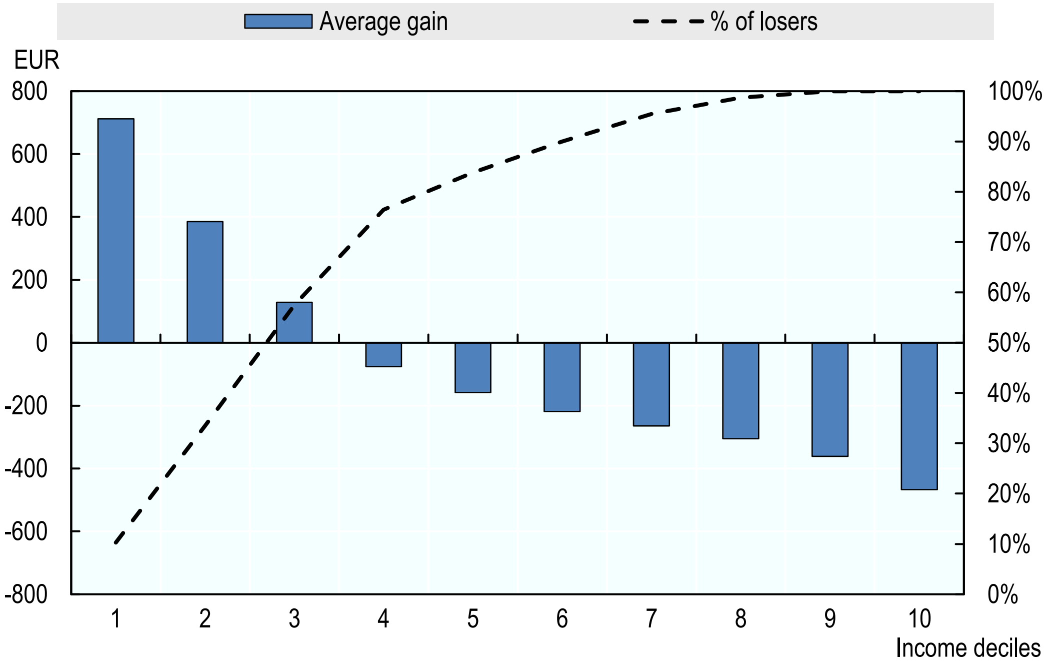
Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. Results show the conditional mean across countries of the distribution across expenditure deciles of "losers" in the bottom income decile in each country, for countries where the number of such losers is greater than zero (21 countries). A "loser" is defined as an individual in a household that suffers a financial loss, where the financial gain/loss is calculated as cash transfer received minus increase in VAT paid. Deciles are based on equivalised income/expenditure, with the individual as unit of analysis. See text for further detail.

6.4.3. Reform 3

Reform 3 removes all reduced rates excluding reduced rates on food, and replaces them with an income-tested cash transfer. Figures 6.12-6.15 present the all-country average results of the decile-based analysis for reform 3. Individual country results are presented in Tables 6.5 and 6.6 at the end of the chapter.

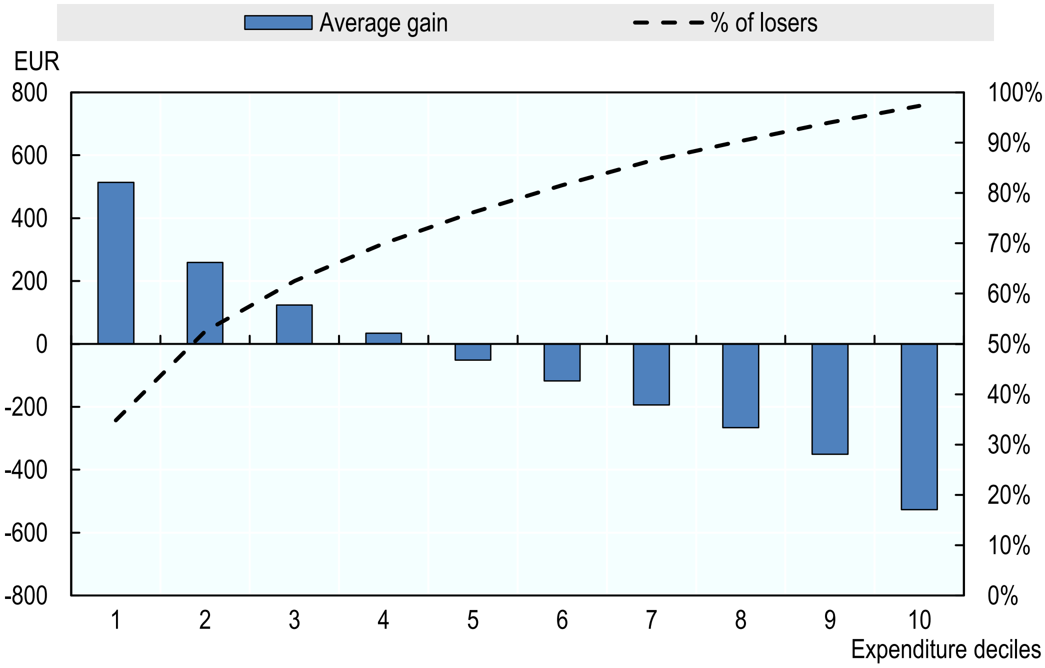
The results show that a considerable improvement in the targeting of support to poorer households can still be achieved even in a more restricted reform that excludes food. On average, the replacement of all reduced VAT rates except those on food with the stylised income-tested cash transfer provides a financial gain to just the bottom three income deciles and bottom four expenditure deciles. The average financial gain amounts are now substantially lower than in reform 1, as significantly less revenue is being redistributed due to the exclusion of food. The welfare gain results show very similar targeting, with the reform providing a welfare gain to just the bottom three income deciles and four expenditure deciles, on average. Under either metric there is little variation in targeting across countries, with between 2-4 deciles gaining from the reform (with the exceptions of Portugal and Turkey where the fifth expenditure decile receives a small financial gain, on average).

Figure 6.12. All-country average financial gain or loss across income deciles from reform 3



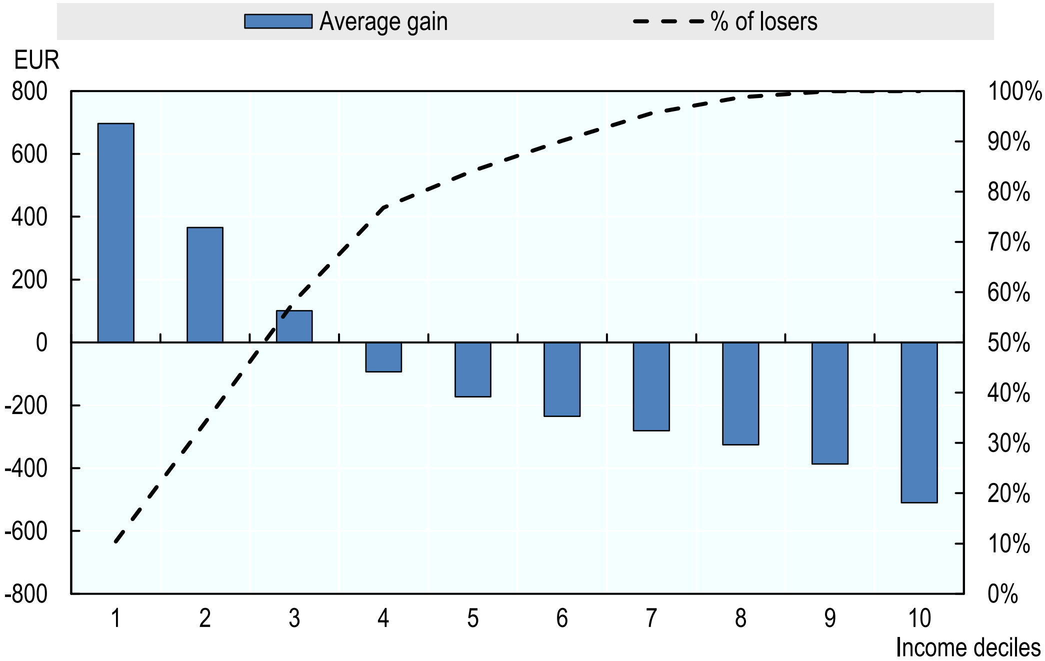
Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. "Average gain" results present the simple mean across all countries of the within-country weighted mean of the financial gain from the reform per household. The financial gain is calculated as cash transfer received minus increase in VAT paid. "% of losers" results present the simple mean across all countries of the percentage of individuals in each country that suffer a financial loss from the reform. Results presented across equivalised income deciles, with the individual as unit of analysis. See text for further detail.

Figure 6.13. All-country average financial gain or loss across expenditure deciles from reform 3



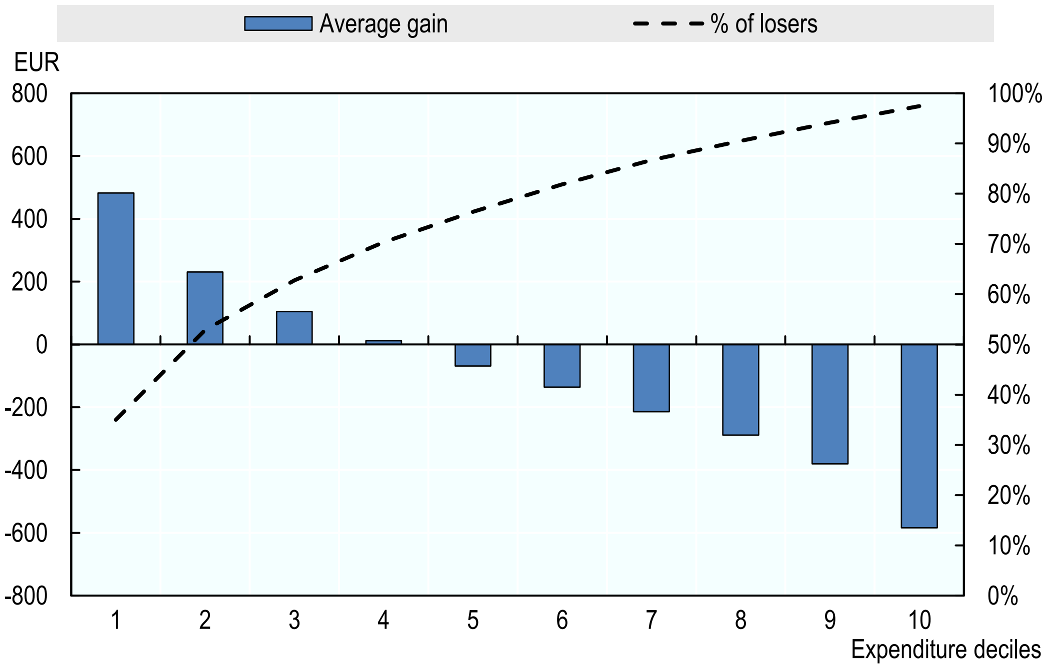
Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. "Average gain" results present the simple mean across all countries of the within-country weighted mean of the financial gain from the reform per household. The financial gain is calculated as cash transfer received minus increase in VAT paid. "% of losers" results present the simple mean across all countries of the percentage of individuals in each country that suffer a financial loss from the reform. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

Figure 6.14. All-country average welfare gain or loss across income deciles from reform 3



Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. "Average gain" results present the simple mean across all countries of the within-country weighted mean of the money-metric welfare gain from the reform per household. The welfare gain is calculated as cash transfer received minus compensating variation. "% of losers" results present the simple mean across all countries of the percentage of individuals in each country that suffer a welfare loss from the reform. Results presented across equivalised income deciles, with the individual as unit of analysis. See text for further detail.

Figure 6.15. All-country average welfare gain or loss across expenditure deciles from reform 3



Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. "Average gain" results present the simple mean across all countries of the within-country weighted mean of the money-metric welfare gain from the reform per household. The welfare gain is calculated as cash transfer received minus compensating variation. "% of losers" results present the simple mean across all countries of the percentage of individuals in each country that suffer a welfare loss from the reform. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

While there is still a low number of losers from the reform in the bottom income decile, there is now a greater number of losers in the second and third deciles as the smaller size of the cash transfer is less able to cover the variability of the VAT increases across households. There are also now a significant number of losers in the bottom expenditure decile. However, from a political economy perspective, the greater number of losers is likely to be more acceptable to policy makers than in reform 1 given that the reduced rate on food remains in place.

6.4.4. Redistribution

This section complements the decile average results above by presenting the two summary measures of redistribution introduced in Chapter 3. As in previous chapters, the indices are calculated using expenditure as the welfare metric. As such, while they will accurately portray the long-term impact of the VAT reform, they will only imperfectly account for the ability of an income-tested cash transfer to target low-income households. Consequently, they can be considered as showing the minimum impact on inequality that the reforms will have.

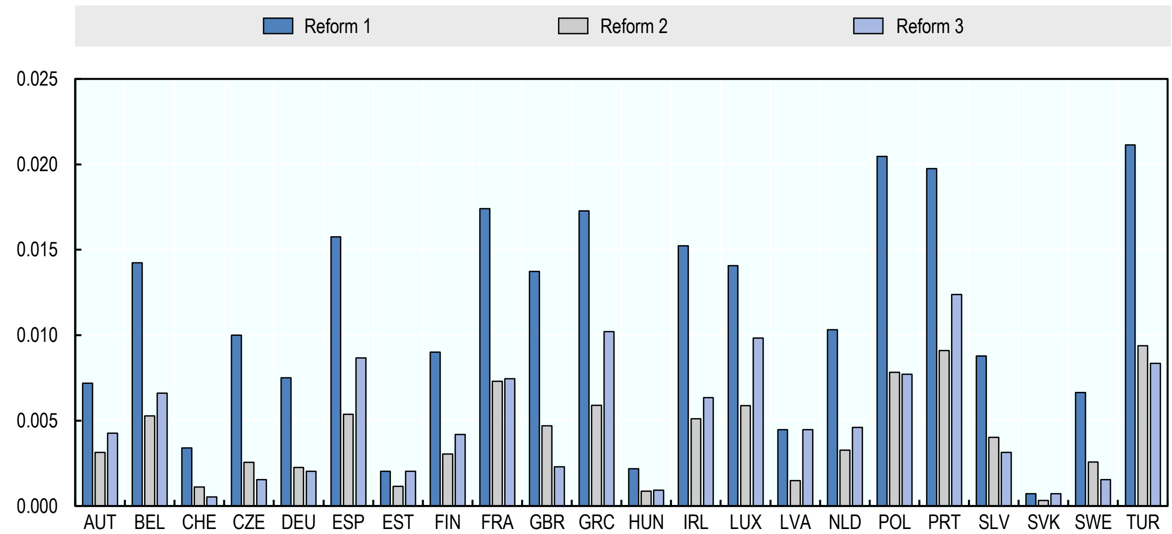
Figure 6.16 presents Reynolds-Smolensky index results for the three reforms.[93] The results show that all three reforms reduce inequality, with reform 1 having by far the greatest impact in every country (excluding the three countries – Estonia, the Slovak Republic and Latvia[94] – that have no reduced rate on food, where reform 1 and 3 are consequently identical). In most countries, reform 1 produces more than twice the reduction in inequality produced by reform 2 or 3. The greatest degree of redistribution occurs in countries that apply reduced rates to a very wide range of products – Belgium, France, Greece, Ireland, Luxembourg, Poland, Portugal, Spain, Turkey, and the United Kingdom. At the other end of the scale, countries with a small total tax expenditure from reduced rates – Estonia, Hungary, Latvia, the Slovak Republic and Switzerland – produce very little redistribution. Results for the welfare change (presented in Tables 6.2, 6.4 and 6.6) are very similar to those for the financial change.[95]

As noted in Chapter 3, Gini-based measures such as the Reynolds-Smolensky index are less responsive to changes at the tails as compared to the middle of the distribution. Atkinson inequality index results – which enable greater sensitivity to be applied to the bottom of the distribution – are therefore also calculated. Figure 6.17 presents (change in) Atkinson index results for the three reforms for a high

[93] The Reynolds-Smolensky index compares the dispersion from equality of pre-reform net (VAT-exclusive) expenditure to the dispersion from equality of post-reform net expenditure plus the cash transfer.
[94] Recall that Latvia applies a reduced rate to baby food, but this expenditure category is too small to be separately included in the behavioural models.
[95] While results for the welfare change are very similar to those for the financial change, they are not directly comparable. This is because they are based on money-metric utility calculated based on gross (VAT-inclusive) expenditure whereas the financial change results are based on net (VAT-exclusive) expenditure.

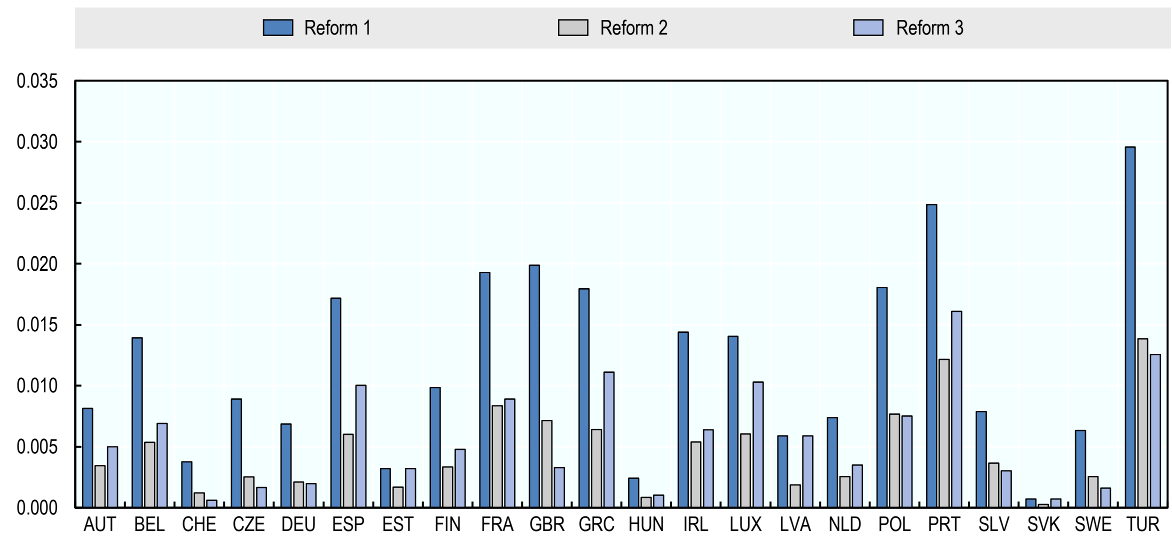
degree of inequality aversion (ε = 1.2), thereby giving considerable weight to the bottom of the distribution (results for lower levels of inequality aversion are presented in Tables 6.1-6.6 at the end of the chapter). These results are consistent with the Reynolds-Smolensky results showing a reduction in inequality in all countries for all three reforms, and a substantially greater reduction for reform 1 than reforms 2 or 3. Again countries with the largest tax expenditures have the greatest reductions in inequality. Results for the welfare change are again very similar to those for the financial change.

Figure 6.16. Reynolds-Smolensky index results for each reform



Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. Results present Reynolds-Smolensky redistribution index for each reform. Results calculated in relation to the financial gain/loss, using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate redistribution.

Figure 6.17. Change in Atkinson inequality index for each reform (ε = 1.2)



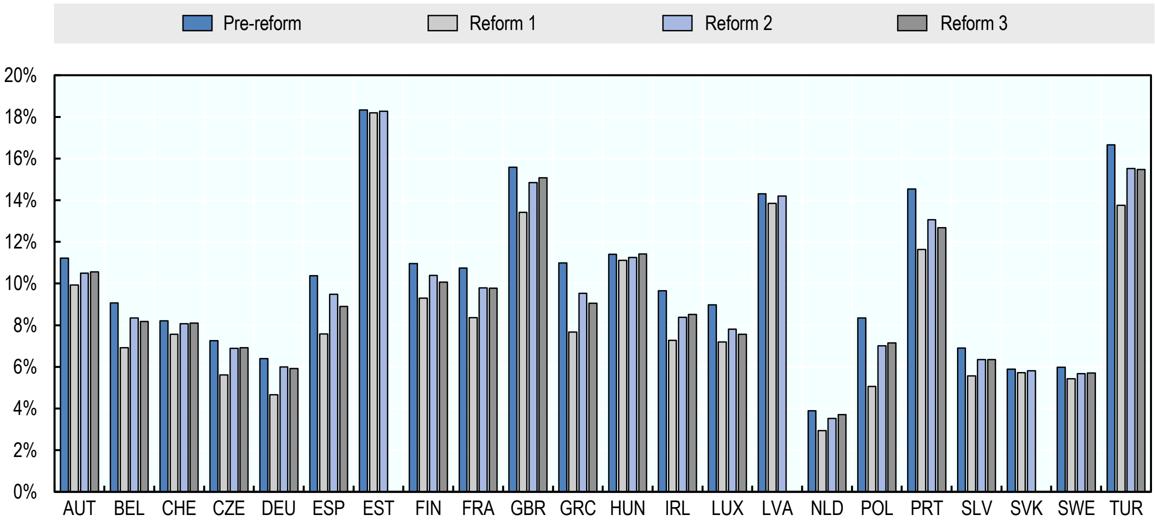
Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. Results present the change in Atkinson inequality index for each reform, with degree of inequality aversion, ε = 1.2. Results calculated in relation to the financial gain/loss, using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate redistribution.

6.4.5. Poverty

In addition to their overall redistributive effect, all three reforms are also found to reduce poverty. This is the case under all three of the Foster-Greer-Thorbecke (FGT) poverty measures that were introduced in Chapter 3. Figure 6.18 presents results for the poverty headcount using net expenditure as the welfare metric[96], while results for all three indices are presented in Table 6.7. To be consistent with Chapter 3, the poverty line is set equal to 50% of median gross expenditure.[97]

Figure 6.18. Poverty headcount results for each reform

Poverty line = 50% of median gross expenditure



Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. Results present pre- and post-reform poverty headcounts, expressed as percentages, for a poverty line equal to 50% of median gross expenditure. Results calculated using equivalised expenditure, with the individual as unit of analysis. See text for further detail.

Unsurprisingly, Figure 6.18 shows that reform 1 has the greatest impact on poverty in every country, reducing the poverty headcount by, on average, 17.5% (or 1.7 percentage points). The greatest proportionate reductions in the poverty headcount are in Greece, Poland and Spain. These countries all apply a large number of reduced VAT rates, so the revenue available for the cash transfer is significant. The smallest changes are in the four countries with the most limited use of reduced VAT rates – Estonia, Hungary, Latvia and the Slovak Republic. While less targeted, even reforms 2 and 3 still reduce poverty as compared to the pre-reform level in every country (with the one exception of reform 3 for Hungary – where the poverty headcount increases by 0.01 percentage points). This further confirms the greater ability of cash transfers to support the poor as compared to reduced VAT rates.

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[96] Pre-reform net (VAT-exclusive) expenditure is compared to post reform net expenditure plus the cash transfer. Results are similar using "income less VAT paid plus cash transfer" as the welfare metric – although, as noted in Chapter 3, such an income-based approach would exaggerate the long-term impact of VAT at the bottom of the income distribution.

[97] Poverty headcounts for pre-reform net expenditure are similar though not identical to those for net expenditure presented in Chapter 3 for most countries due to the slightly varying datasets that arise due to the removal of some observations in the behavioural modelling.

The poverty gap and squared poverty gap index results presented in Table 6.7 follow a similar pattern to the poverty headcount results, with all reforms (including reform 3 for Hungary) reducing these broader indicators of poverty, and with the greatest reduction again for reform 1. The reductions are in fact proportionately greater for the poverty gap than the poverty headcount for all three reforms in every country except the Slovak Republic, and even greater still for the squared poverty gap index. These results highlight that a cash transfer can even more successfully reduce the intensity of poverty and the degree of inequality amongst those in poverty.

6.5. Conclusion

This chapter has used the behavioural microsimulation models developed in Chapter 4 to examine whether a cash transfer would be a more effective tool for providing support to the poor than reduced VAT rates. Three reforms have been simulated for 22 OECD countries: the replacement of all reduced rates with a stylised income-tested cash transfer; the replacement of all reduced rates with a universal cash transfer; and the replacement of all reduced rates except those on food with a stylised income-tested cash transfer.

As anticipated, an income-tested cash transfer is shown to far more effectively target poor households than reduced VAT rates. The introduction of a stylised income-tested cash transfer is found to more than fully compensate households, on average, in the bottom 2-4 income and expenditure deciles, depending on the country, for the removal of all reduced VAT rates. Higher income and expenditure deciles lose, on average, from the reform for two reasons. They typically face a higher VAT increase than poorer households due to their greater consumption of previously reduced-rated goods, and they receive less or no cash transfer due to its income-based targeting. Welfare gain results are found to be similar. Reynolds-Smolensky and Atkinson index results also show a clear reduction in inequality following such a reform, while FGT index results show a clear reduction in poverty.

However, the simulation results also show that it is difficult for an income-tested cash transfer to fully compensate absolutely all poor households for the removal of reduced VAT rates. For example, on average across the 22 countries, 4.6% of bottom income decile households and 24.3% of bottom expenditure decile households are actually found to be worse off following the reform. That said, it may be misleading to consider many of these taxpayers as poor: many of the bottom income decile households that lose from the reform are actually found to be in higher expenditure deciles, while the vast majority of bottom expenditure decile households that lose from the reform are found to be in higher income deciles.

The presence of losers in the bottom income and expenditure deciles is partially due to the measurement difficulties associated with the analysis of VAT reform based on cross-sectional data. Specifically, presenting results across income deciles accurately reflects the ability of an income-tested cash transfer to target low-income households, but overstates the long-term impact of the removal of reduced VAT rates on low-income households as compared to higher income households due to the distorting impact of savings behaviour. In contrast, while presenting results across expenditure deciles more accurately reflects the long-term impact of the VAT increase, it imperfectly portrays the ability of an income-tested cash transfer to target low-income households.

It is possible to ensure that all households that feature in both the bottom income and bottom expenditure decile gain from the reform in 21 of 22 countries, although some countries require an adjustment to the basic stylised cash transfer providing greater support to households with three or more adults. This highlights a limitation of the modelling: the data only allow targeting to be based on household income whereas more precise targeting can be achieved using family income. In addition to targeting based on family income, countries can in practice further minimise the number of losers in the bottom deciles by targeting based on a wider range of criteria than is possible in this study, such as by making adjustments for the age of children and regional housing costs. Overall, while a small number of poor households may still lose out from such a reform, those that receive support will now be determined by income and family characteristics as opposed to consumption tastes, and many households will be lifted out of poverty as revenue previously transferred to richer households will now be transferred to the poor.

While income-testing enables a cash transfer to be highly targeted at the poor, it also increases the marginal effective tax rates (METRs) faced by households earning income within the "phase-out" region of the cash transfer. Careful design of the income-testing mechanism – taking into account the entire tax-benefit system – is therefore necessary to minimise the impact on work incentives. In some cases, for example where METRs are already high, the additional negative impact on work incentives may not be considered justified by policy makers. However, additional simulation results show that even a universal cash transfer – which would have no impact on METRs – would still better target poor households than reduced VAT rates.

On average, the introduction of a universal cash transfer is found to fully compensate households in only the bottom 5-7 income and expenditure deciles, depending on the country, for the removal of all reduced VAT rates. The welfare gain results are found to be similar. Again Reynolds-Smolensky and Atkinson index results show a reduction in inequality following such a reform, though significantly less than with an income-tested cash transfer, while FGT poverty index results show a small reduction in poverty. Additionally concerns about losers are minimised with such a reform. In 21 of 22 countries, there are no losers in the bottom three expenditure deciles – as they simply do not spend enough to face a significant increase in VAT. Meanwhile, the small number of losers in low income deciles are found to be in either middle or higher expenditure deciles – suggesting that they are unlikely to be long-term poor.

Despite the superiority of cash transfers as a tool to support the poor, public perception of the regressivity of the VAT is likely to make it difficult from a political perspective to remove reduced VAT rates. This is likely to be particularly the case in some countries for the reduced rate on food given the significant benefit it provides poorer households. As such, it may be more politically feasible – at least in the short run – to exclude the reduced rate on food from the reform. However, even such a restricted reform is still shown to provide a considerable improvement in the targeting of support to poorer households.

On average, the replacement of all reduced VAT rates except those on food with the stylised income-tested cash transfer provides a financial gain to just the bottom 2-4 income and expenditure deciles, depending on the country. The average financial gain amounts are however substantially lower than in the full reform, as significantly less revenue is redistributed due to the exclusion of food. The welfare gain results are again found to be similar. Reynolds-Smolensky and Atkinson index results show a reduction in inequality similar to that achieved with the universal cash transfer, as do the FGT index results for poverty. While there are a greater number of losers in bottom deciles than in the previous reforms, this is likely to be more acceptable to policy makers given that the reduced rate on food remains in place. METRs will increase, as in the full reform due to the income-based targeting, and so once again careful country-specific design of the cash transfer would be necessary to minimise any employment effects.

Overall, the results for the three reforms show the clear superiority of cash transfers over reduced VAT rates as a tool for supporting the poor. The fact that even a universal cash transfer provides better targeting of the poor is a particular indictment on the use of reduced VAT rates. The results are consistent with the conclusions of previous non-behavioural analysis for the United Kingdom and the United States, as well as recent behavioural analysis for Hungary and South Africa. The analysis in this chapter shows that the superiority of targeted cash transfers applies more broadly across OECD countries, including once behavioural responses to the tax changes are accounted for. These findings, taken together with those of Chapter 5, have strong implications for VAT policy. However, discussion of these implictions is left for Chapter 8.

Table 6.1. Financial gain/loss results for reform 1

Financial gain/loss (in euros) across income deciles	AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
1	1,325	2,176	1,256	404	869	1,779	70	1,078	2,052	1,185	1,586	100	2,193	4,006	107	1,204	806	1,275	953	47	968	844
2	382	1,202	403	159	576	1,200	21	619	1,298	913	1,220	23	1,735	3,412	45	556	512	952	577	3	508	623
3	26	433	-88	50	105	587	6	45	640	382	735	-1	1,023	1,852	11	97	291	634	226	1	-8	423
4	-235	-316	-306	-74	-215	84	-4	-270	-47	-124	143	-21	339	-695	0	-158	88	253	-99	-10	-265	247
5	-347	-605	-355	-162	-324	-292	-13	-456	-403	-381	-244	-27	-475	-1,360	-14	-333	-88	-68	-290	-12	-370	56
6	-354	-888	-340	-179	-361	-536	-16	-526	-710	-591	-652	-26	-1,198	-1,326	-25	-453	-228	-419	-389	-13	-423	-142
7	-466	-926	-431	-207	-468	-727	-26	-629	-856	-664	-764	-28	-1,400	-1,515	-26	-566	-323	-646	-459	-15	-462	-278
8	-518	-1,105	-507	-215	-533	-747	-27	-663	-1,042	-752	-911	-41	-1,459	-1,676	-33	-662	-387	-737	-494	-18	-528	-369
9	-557	-1,226	-503	-227	-575	-893	-33	-760	-1,186	-770	-1,059	-46	-1,612	-1,831	-42	-715	-445	-890	-541	-20	-533	-421
10	-634	-1,281	-534	-247	-610	-1,110	-44	-865	-1,501	-766	-1,262	-55	-1,685	-1,935	-62	-791	-517	-1,285	-651	-23	-628	-571
Winners / losers:																						
Decile 1	98/2	100/0	94/6	96/4	100/0	100/0	84/16	95/5	100/0	100/0	100/0	80/20	100/0	100/0	91/9	99/1	100/0	100/0	100/0	66/34	98/2	100/0
Decile 10	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100

Financial gain/loss (in euros) across expenditure deciles	AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
1	808	1,806	637	289	671	1,455	29	714	1,571	852	1,297	62	1,535	2,821	75	837	607	1,042	559	30	522	784
2	219	747	241	78	308	876	26	406	861	500	929	18	1,017	1,188	31	375	349	612	264	3	211	530
3	86	254	21	3	64	520	12	6	447	251	561	4	501	555	24	169	199	433	84	-2	-11	332
4	-49	-185	-26	-1	-87	203	8	-51	127	2	202	-11	239	220	7	-61	85	261	-1	-5	-114	191
5	-135	-394	-235	-100	-210	-72	-3	-296	-169	-175	-17	-17	24	-131	-1	-246	-16	12	-110	-6	-189	42
6	-259	-628	-262	-126	-296	-309	-6	-417	-376	-283	-345	-21	-507	-235	-13	-313	-106	-127	-212	-12	-319	-49
7	-380	-804	-350	-169	-382	-514	-16	-526	-604	-538	-634	-28	-880	-680	-18	-486	-191	-322	-312	-11	-375	-163
8	-422	-915	-411	-195	-457	-714	-26	-634	-862	-616	-807	-33	-1,183	-1,227	-32	-573	-295	-572	-352	-15	-387	-282
9	-545	-1,091	-484	-230	-542	-900	-35	-763	-1,087	-703	-1,028	-39	-1,472	-1,447	-40	-685	-394	-900	-439	-17	-445	-391
10	-695	-1,323	-536	-248	-604	-1,200	-55	-866	-1,665	-859	-1,353	-58	-1,812	-2,136	-72	-834	-530	-1,367	-647	-24	-632	-583
Winners / losers:																						
Decile 1	69/31	89/11	58/42	77/23	84/16	92/8	42/58	76/24	86/14	82/18	93/7	55/45	85/15	72/28	68/32	81/19	88/12	91/9	73/27	43/57	66/34	97/3
Decile 10	7/93	7/93	4/96	3/97	2/98	2/98	0/100	4/96	4/96	5/95	1/99	2/98	4/96	8/92	1/99	3/97	3/97	3/97	7/93	3/97	5/95	3/97

	AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
R-S	0.0071	0.0142	0.0034	0.0100	0.0075	0.0157	0.00204	0.0090	0.0174	0.0137	0.0173	0.0022	0.0153	0.0141	0.0045	0.0103	0.0205	0.0200	0.0088	0.0007	0.0067	0.0211
Δ Atkn ε=0.2	0.0011	0.0019	0.0005	0.0012	0.0011	0.0025	0.00044	0.0013	0.0027	0.0027	0.0028	0.0003	0.0022	0.0021	0.0006	0.0011	0.0029	0.0037	0.0012	0.0001	0.0009	0.0045
Δ Atkn ε=0.7	0.0042	0.0072	0.0020	0.0047	0.0039	0.0092	0.00166	0.0049	0.0099	0.0108	0.0100	0.0013	0.0080	0.0075	0.0022	0.0039	0.0101	0.0133	0.0043	0.0004	0.0033	0.0166
Δ Atkn ε=1.2	0.0078	0.0132	0.0038	0.0089	0.0069	0.0167	0.00320	0.0089	0.0182	0.0199	0.0174	0.0024	0.0144	0.0134	0.0040	0.0068	0.0174	0.0237	0.0077	0.0007	0.0063	0.0296

Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. Results in top panel present: the weighted mean of the financial gain/loss from the reform per household across equivalised income deciles; and the percentage of individuals that gain and lose, respectively, from the reform in the bottom and top equivalised income deciles ("Winners/losers"). Results in middle panel present: the weighted mean of the financial gain/loss from the reform per household across equivalised expenditure deciles; and the percentage of individuals that gain and lose, respectively, from the reform in the bottom and top equivalised expenditure deciles ("Winners/losers"). Results in bottom panel present the following summary indicators: R-S = Reynolds-Smolensky redistribution index; Δ Atkn = change in Atkinson inequality index, with ε = degree of inequality aversion. Summary indicators are calculated in relation to the financial gain/loss, using equivalised variables. Positive results indicate redistribution. The financial gain/loss is calculated as the cash transfer received minus the increase in VAT paid as a result of removing all reduced VAT rates. In all panels, the individual is the unit of analysis. See text for further detail.

Table 6.2. Welfare gain/loss results for reform 1

		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
Welfare gain/loss across income deciles	1	1,273	2,103	1,239	380	836	1,730	69	1,029	1,984	1,142	1,520	95	2,072	3,926	105	1,156	755	1,220	916	46	913	818
	2	318	1,097	382	131	533	1,141	19	556	1,218	854	1,150	18	1,609	3,307	42	500	455	883	529	1	446	589
	3	-42	310	-113	20	56	521	4	-38	549	315	652	-7	869	1,729	8	32	232	558	174	-1	-82	385
	4	-310	-460	-332	-106	-268	13	-7	-357	-149	-195	48	-26	180	-821	-4	-223	26	167	-156	-12	-351	205
	5	-424	-752	-381	-198	-381	-368	-16	-558	-511	-451	-339	-33	-644	-1,501	-18	-408	-152	-162	-350	-15	-460	12
	6	-438	-1,058	-367	-216	-421	-617	-20	-631	-832	-673	-761	-33	-1,397	-1,466	-30	-533	-294	-523	-454	-16	-518	-191
	7	-555	-1,094	-459	-245	-531	-819	-31	-742	-989	-748	-876	-35	-1,599	-1,669	-31	-651	-392	-766	-530	-18	-559	-329
	8	-610	-1,289	-536	-253	-600	-843	-31	-777	-1,189	-841	-1,037	-49	-1,662	-1,840	-39	-752	-460	-865	-570	-21	-629	-426
	9	-651	-1,425	-532	-267	-646	-1,001	-38	-892	-1,348	-861	-1,201	-54	-1,829	-2,015	-48	-823	-524	-1,038	-621	-23	-633	-482
	10	-749	-1,493	-564	-289	-685	-1,248	-51	-1,019	-1,714	-855	-1,433	-66	-1,917	-2,128	-73	-902	-608	-1,516	-754	-27	-754	-656
Winners / losers:																							
Decile 1		98/2	100/0	92/8	95/5	99/1	100/0	84/16	95/5	100/0	100/0	100/0	79/21	100/0	100/0	91/9	99/1	100/0	100/0	100/0	66/34	98/2	100/0
Decile 10		0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100

		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
Welfare gain/loss across expenditure deciles	1	772	1,739	624	269	638	1,417	28	674	1,523	822	1,251	58	1,438	2,752	74	803	562	1,006	529	29	473	761
	2	167	649	222	52	265	825	24	345	791	451	862	13	891	1,095	29	324	296	554	221	1	151	500
	3	26	138	-1	-27	16	460	10	-69	364	190	484	-1	359	452	22	108	141	367	33	-4	-85	296
	4	-116	-318	-50	-32	-139	136	6	-136	35	-65	116	-17	81	108	4	-129	24	180	-56	-7	-193	152
	5	-208	-540	-261	-135	-266	-147	-5	-389	-277	-251	-113	-23	-138	-254	-5	-324	-79	-81	-170	-9	-273	-2
	6	-342	-786	-289	-162	-355	-392	-9	-526	-495	-361	-453	-27	-692	-372	-17	-392	-173	-226	-278	-14	-410	-97
	7	-470	-974	-379	-207	-445	-605	-20	-638	-742	-626	-756	-35	-1,077	-833	-23	-574	-260	-444	-383	-14	-474	-216
	8	-518	-1,100	-441	-234	-524	-815	-30	-759	-1,012	-711	-938	-40	-1,396	-1,397	-38	-664	-370	-707	-428	-18	-488	-340
	9	-654	-1,299	-516	-273	-615	-1,017	-41	-904	-1,259	-800	-1,178	-47	-1,704	-1,642	-47	-784	-475	-1,068	-524	-20	-553	-457
	10	-840	-1,569	-570	-293	-681	-1,353	-63	-1,031	-1,912	-961	-1,537	-69	-2,082	-2,392	-85	-965	-628	-1,621	-758	-29	-773	-673
Winners / losers:																							
Decile 1		68/32	90/10	58/42	77/23	84/16	92/8	42/58	78/22	88/12	81/19	93/7	55/45	86/14	72/28	72/28	81/19	88/12	93/7	74/26	43/57	66/34	97/3
Decile 10		7/93	7/93	4/96	3/97	2/98	2/98	0/100	4/96	4/96	4/96	1/99	2/98	4/96	9/91	1/99	3/97	3/97	2/98	7/93	3/97	5/95	3/97

		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
R-S		0.0069	0.0140	0.0034	0.0085	0.0071	0.0156	0.00184	0.0094	0.0176	0.0127	0.0161	0.0019	0.0140	0.0151	0.0040	0.0099	0.0177	0.0189	0.0085	0.0006	0.0064	0.0202
Δ Atkn	ε=0.2	0.0010	0.0018	0.0005	0.0010	0.0010	0.0023	0.00038	0.0012	0.0025	0.0024	0.0025	0.0003	0.0019	0.0022	0.0005	0.0010	0.0025	0.0034	0.0011	0.0001	0.0008	0.0041
	ε=0.7	0.0038	0.0066	0.0019	0.0038	0.0035	0.0087	0.00146	0.0044	0.0094	0.0094	0.0089	0.0011	0.0070	0.0079	0.0019	0.0035	0.0087	0.0122	0.0039	0.0003	0.0031	0.0150
	ε=1.2	0.0070	0.0122	0.0035	0.0073	0.0062	0.0157	0.00281	0.0079	0.0171	0.0181	0.0157	0.0020	0.0126	0.0139	0.0035	0.0063	0.0150	0.0217	0.0069	0.0006	0.0058	0.0269

Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. Results in top panel present: the weighted mean of the welfare gain/loss from the reform per household across equivalised income deciles; and the percentage of individuals that gain and lose, respectively, from the reform in the bottom and top equivalised income deciles ("Winners/losers"). Results in middle panel present: the weighted mean of the welfare gain/loss from the reform per household across equivalised expenditure deciles; and the percentage of individuals that gain and lose, respectively, from the reform in the bottom and top equivalised expenditure deciles ("Winners/losers"). Results in bottom panel present the following summary indicators: R-S = Reynolds-Smolensky redistribution index; Δ Atkn = change in Atkinson inequality index, with ε = degree of inequality aversion. Summary indicators are calculated in relation to the welfare gain/loss, using equivalised variables. Positive results indicate redistribution. The welfare gain/loss is calculated as the cash transfer received minus the compensating variation from removing all reduced VAT rates. In all panels, the individual is the unit of analysis. See text for further detail.

Table 6.3. Financial gain/loss results for reform 2

Financial gain/loss (in euros) across income deciles		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
	1	218	502	139	53	135	374	18	200	471	187	341	17	332	601	31	198	192	367	158	9	127	296
	2	136	272	91	26	93	235	14	145	309	130	231	11	249	290	21	128	120	234	106	6	90	205
	3	97	169	58	15	62	162	9	93	204	66	151	8	227	357	15	83	88	202	88	4	63	143
	4	55	74	40	13	37	100	6	66	154	31	91	5	181	364	10	82	60	176	63	2	36	91
	5	47	26	18	4	16	47	6	3	79	40	62	3	97	230	7	25	38	117	54	2	4	59
	6	1	-92	-3	-4	-10	0	5	-6	-4	-31	2	1	-59	151	3	4	15	38	28	2	-9	29
	7	-27	-94	-29	-9	-37	-76	0	-60	-78	-68	-49	-2	-71	-42	5	-27	-10	-42	-17	1	-35	-13
	8	-55	-166	-52	-18	-69	-131	-1	-86	-197	-118	-154	-5	-189	-203	2	-87	-39	-115	-46	0	-57	-51
	9	-86	-259	-72	-31	-114	-235	-5	-175	-320	-149	-268	-9	-327	-400	-8	-182	-82	-231	-84	-2	-80	-104
	10	-202	-332	-120	-48	-175	-462	-18	-280	-666	-194	-493	-20	-471	-690	-27	-264	-157	-618	-211	-6	-160	-281
Winners / losers:																							
Decile 1		93/7	99/1	91/9	95/5	98/2	99/1	96/4	97/3	98/2	92/8	99/1	99/1	92/8	96/4	98/2	96/4	99/1	100/0	96/4	91/9	93/7	100/0
Decile 10		16/84	19/81	9/91	9/91	5/95	8/92	23/77	10/90	12/88	13/87	4/96	9/91	7/93	9/91	26/74	8/92	9/91	9/91	15/85	26/74	12/88	5/95

Financial gain/loss (in euros) across expenditure deciles		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
	1	318	617	224	74	172	434	22	263	610	307	403	21	598	926	34	278	235	485	250	11	219	339
	2	215	351	136	43	119	289	17	194	414	208	296	14	391	687	24	179	155	350	173	8	129	226
	3	152	230	92	29	82	210	15	140	296	140	216	10	278	526	19	114	112	260	131	6	83	154
	4	99	133	45	13	50	137	11	88	193	67	144	7	188	359	13	72	77	192	91	4	49	107
	5	53	60	14	5	19	66	7	38	91	15	75	4	52	227	11	38	43	112	49	3	13	66
	6	6	-29	-18	-4	-12	-1	5	-27	2	-43	-3	1	-29	54	7	-9	13	44	8	2	-19	29
	7	-46	-113	-49	-16	-46	-73	0	-69	-105	-111	-87	-2	-147	-108	2	-69	-20	-56	-29	0	-51	-15
	8	-98	-209	-82	-29	-87	-170	-4	-126	-233	-164	-187	-6	-274	-304	-2	-114	-60	-160	-81	-1	-79	-70
	9	-173	-349	-124	-43	-140	-298	-10	-224	-403	-225	-327	-11	-405	-570	-10	-187	-110	-342	-142	-4	-123	-139
	10	-342	-591	-169	-68	-218	-580	-29	-377	-913	-301	-612	-27	-685	-1,139	-38	-343	-220	-757	-313	-9	-244	-323
Winners / losers:																							
Decile 1		100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0
Decile 10		0/100	0/100	1/99	0/100	0/100	1/99	7/93	2/98	2/98	6/94	0/100	0/100	0/100	0/100	7/93	2/98	0/100	0/100	2/98	3/97	0/100	1/99

		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
R-S		0.0033	0.0057	0.0011	0.0026	0.0023	0.0056	0.00114	0.0036	0.0079	0.0046	0.0061	0.0009	0.0051	0.0063	0.0023	0.0036	0.0083	0.0095	0.0042	0.0003	0.0026	0.0094
Δ Atkn	ε=0.2	0.0005	0.0008	0.0002	0.0004	0.0003	0.0009	0.00025	0.0005	0.0013	0.0010	0.0011	0.0001	0.0008	0.0010	0.0003	0.0004	0.0013	0.0019	0.0006	0.0000	0.0004	0.0022
	ε=0.7	0.0019	0.0030	0.0007	0.0013	0.0012	0.0034	0.00092	0.0019	0.0047	0.0041	0.0037	0.0005	0.0030	0.0035	0.0011	0.0015	0.0045	0.0069	0.0021	0.0002	0.0014	0.0078
	ε=1.2	0.0034	0.0054	0.0012	0.0025	0.0021	0.0060	0.00169	0.0033	0.0084	0.0071	0.0064	0.0008	0.0054	0.0060	0.0019	0.0025	0.0077	0.0122	0.0037	0.0003	0.0025	0.0138

Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. Results in top panel present: the weighted mean of the financial gain/loss from the reform per household across equivalised income deciles; and the percentage of individuals that gain and lose, respectively, from the reform in the bottom and top equivalised income deciles ("Winners/losers"). Results in middle panel present: the weighted mean of the financial gain/loss from the reform per household across equivalised expenditure deciles; and the percentage of individuals that gain and lose, respectively, from the reform in the bottom and top equivalised expenditure deciles ("Winners/losers"). Results in bottom panel present the following summary indicators: R-S = Reynolds-Smolensky redistribution index; Δ Atkn = change in Atkinson inequality index, with ε = degree of inequality aversion. Summary indicators are calculated in relation to the financial gain/loss, using equivalised variables. Positive results indicate redistribution. The financial gain/loss is calculated as the cash transfer received minus the increase in VAT paid as a result of removing all reduced VAT rates. In all panels, the individual is the unit of analysis. See text for further detail.

Table 6.4. Welfare gain/loss results for reform 2

		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
Welfare gain/loss across income deciles	1	166	429	122	30	103	324	17	151	403	143	275	13	211	520	30	150	141	312	121	7	72	270
	2	71	167	69	-2	51	177	13	81	229	71	161	6	122	185	19	72	63	166	58	4	27	171
	3	29	46	34	-15	13	95	7	10	113	-1	68	3	73	235	12	19	29	126	35	2	-11	105
	4	-20	-70	15	-19	-16	29	3	-20	52	-40	-3	0	21	237	7	17	-2	90	7	0	-50	50
	5	-31	-121	-8	-31	-41	-29	3	-100	-30	-30	-33	-3	-72	90	3	-50	-25	23	-7	0	-87	15
	6	-83	-262	-29	-40	-69	-81	1	-111	-126	-112	-107	-6	-259	11	-2	-76	-51	-67	-37	-1	-104	-19
	7	-117	-262	-57	-47	-100	-168	-5	-173	-211	-152	-161	-9	-270	-196	0	-112	-79	-162	-89	-2	-132	-64
	8	-147	-349	-81	-56	-135	-226	-5	-199	-344	-207	-281	-12	-392	-367	-3	-177	-112	-243	-122	-3	-157	-107
	9	-180	-459	-100	-70	-185	-342	-10	-307	-482	-239	-410	-17	-544	-584	-15	-289	-160	-380	-165	-5	-180	-166
	10	-317	-545	-151	-91	-251	-600	-25	-435	-879	-282	-664	-30	-703	-882	-39	-375	-248	-849	-313	-9	-286	-366
Winners / losers:																							
Decile 1		85/15	97/3	86/14	79/21	95/5	98/2	95/5	90/10	95/5	85/15	97/3	95/5	79/21	93/7	98/2	85/15	95/5	95/5	87/13	85/15	79/21	99/1
Decile 10		9/91	7/93	6/94	3/97	2/98	5/95	17/83	5/95	6/94	9/91	3/97	2/98	2/98	3/97	18/82	1/99	4/96	4/96	8/92	15/85	5/95	2/98

		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
Welfare gain/loss across expenditure deciles	1	283	550	212	55	140	396	21	224	562	277	357	16	502	856	33	244	190	449	220	10	170	316
	2	163	253	117	16	76	238	16	133	344	158	228	9	265	594	22	128	101	292	130	6	69	195
	3	93	114	70	-1	34	150	13	65	212	79	139	5	136	423	16	54	54	193	80	4	9	118
	4	32	0	22	-18	-2	70	9	3	100	0	57	1	30	246	10	4	16	111	37	2	-30	68
	5	-21	-87	-12	-30	-37	-8	4	-55	-17	-60	-21	-2	-111	104	7	-40	-20	19	-11	0	-71	22
	6	-77	-187	-45	-40	-71	-83	2	-135	-116	-121	-111	-5	-214	-82	2	-88	-54	-56	-58	-1	-110	-18
	7	-136	-284	-78	-54	-109	-164	-4	-182	-241	-198	-209	-9	-344	-262	-3	-157	-90	-178	-100	-3	-150	-68
	8	-194	-393	-112	-69	-154	-271	-9	-250	-385	-258	-319	-14	-487	-473	-8	-205	-135	-295	-158	-4	-179	-128
	9	-282	-556	-156	-86	-213	-415	-16	-365	-575	-322	-477	-19	-638	-764	-17	-285	-191	-510	-226	-7	-231	-206
	10	-486	-836	-203	-113	-295	-734	-38	-542	-1,160	-402	-796	-38	-955	-1,394	-52	-474	-318	-1,011	-425	-14	-385	-412
Winners / losers:																							
Decile 1		100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	100/0	97/0	100/0	100/0	100/0	96/4	100/0	100/0
Decile 10		0/100	0/100	1/99	0/100	0/100	0/100	2/98	0/100	1/99	5/95	0/100	0/100	0/100	0/100	4/82	0/101	0/100	0/100	1/99	1/99	0/100	0/100

		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
R-S		0.0033	0.0056	0.0011	0.0021	0.0020	0.0055	0.00105	0.0038	0.0082	0.0040	0.0056	0.0007	0.0046	0.0067	0.0021	0.0036	0.0067	0.0089	0.0042	0.0003	0.0024	0.0090
Δ Atkn	ε=0.2	0.0005	0.0007	0.0002	0.0003	0.0003	0.0009	0.00022	0.0005	0.0013	0.0008	0.0009	0.0001	0.0007	0.0010	0.0003	0.0004	0.0010	0.0018	0.0006	0.0000	0.0003	0.0020
	ε=0.7	0.0018	0.0027	0.0007	0.0010	0.0010	0.0032	0.00082	0.0017	0.0045	0.0033	0.0033	0.0004	0.0026	0.0036	0.0010	0.0014	0.0036	0.0063	0.0020	0.0001	0.0012	0.0071
	ε=1.2	0.0032	0.0049	0.0012	0.0020	0.0018	0.0056	0.00151	0.0030	0.0080	0.0066	0.0056	0.0007	0.0047	0.0061	0.0017	0.0024	0.0062	0.0111	0.0034	0.0002	0.0023	0.0125

Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. Results in top panel present: the weighted mean of the welfare gain/loss from the reform per household across equivalised income deciles; and the percentage of individuals that gain and lose, respectively, from the reform in the bottom and top equivalised income deciles ("Winners/losers"). Results in middle panel present: the weighted mean of the welfare gain/loss from the reform per household across equivalised expenditure deciles; and the percentage of individuals that gain and lose, respectively, from the reform in the bottom and top equivalised expenditure deciles ("Winners/losers"). Results in bottom panel present the following summary indicators: R-S = Reynolds-Smolensky redistribution index; Δ Atkn = change in Atkinson inequality index, with ε = degree of inequality aversion. Summary indicators are calculated in relation to the welfare gain/loss, using equivalised variables. Positive results indicate redistribution. The welfare gain/loss is calculated as the cash transfer received minus the compensating variation from removing all reduced VAT rates. In all panels, the individual is the unit of analysis. See text for further detail.

Table 6.5. Financial gain/loss results for reform 3

Financial gain/loss (in euros) across income deciles	AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
1	664	940	175	65	227	1,002	70	415	814	223	972	37	1,008	2,636	107	442	318	796	323	47	174	354
2	134	372	53	8	126	562	21	204	375	105	703	8	676	2,194	45	155	129	559	103	3	74	230
3	-5	60	-22	-9	-6	157	6	45	110	-1	284	-1	174	1,050	11	11	33	298	20	1	-14	137
4	-118	-172	-27	-16	-39	-42	-4	-270	-108	-58	-55	-6	-93	-450	0	-79	-18	66	-61	-10	-27	56
5	-129	-212	-34	-19	-53	-178	-13	-456	-166	-60	-181	-9	-266	-781	-14	-108	-47	-93	-81	-12	-47	-10
6	-143	-283	-34	-20	-71	-242	-16	-526	-219	-88	-339	-9	-483	-765	-25	-137	-72	-238	-96	-13	-65	-70
7	-216	-326	-59	-28	-102	-311	-26	-629	-293	-105	-357	-11	-492	-919	-26	-196	-82	-318	-124	-15	-80	-97
8	-260	-404	-64	-29	-115	-346	-27	-663	-381	-115	-460	-16	-536	-1,039	-33	-226	-97	-367	-143	-18	-88	-122
9	-273	-457	-67	-31	-133	-431	-33	-760	-429	-119	-557	-18	-623	-1,171	-42	-252	-127	-471	-158	-20	-95	-144
10	-348	-507	-81	-37	-164	-610	-44	-865	-597	-138	-732	-25	-700	-1,311	-62	-312	-174	-806	-222	-23	-133	-239
Winners / losers:																						
Decile 1	86/14	96/4	80/20	70/30	94/6	99/1	84/16	92/8	96/4	100/0	100/0	66/34	99/1	100/0	91/9	83/17	97/3	100/0	95/5	66/34	79/21	100/0
Decile 10	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100

Financial gain/loss (in euros) across expenditure deciles	AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
1	426	731	92	47	173	777	29	714	572	138	756	24	588	1,830	75	308	209	604	169	30	107	304
2	126	261	38	6	78	436	26	406	284	76	529	7	350	822	31	126	102	356	79	3	47	196
3	69	99	10	-1	22	245	12	6	135	23	302	2	206	410	24	61	51	246	16	-2	16	114
4	-16	-67	4	-9	-12	81	8	-51	31	-14	95	-4	49	193	7	-21	17	159	-4	-5	-5	61
5	-62	-133	-20	-16	-38	-58	-3	-296	-76	-36	-46	-6	-22	-21	-1	-75	-14	5	-34	-6	-28	11
6	-132	-204	-28	-18	-59	-167	-6	-417	-140	-56	-208	-7	-217	-117	-13	-117	-37	-55	-63	-12	-52	-26
7	-183	-296	-40	-24	-81	-255	-16	-526	-239	-93	-349	-10	-355	-411	-18	-181	-61	-175	-92	-11	-63	-65
8	-215	-350	-55	-27	-104	-351	-26	-634	-330	-102	-425	-13	-465	-773	-32	-205	-88	-308	-111	-15	-69	-102
9	-288	-433	-69	-33	-133	-459	-35	-763	-426	-123	-564	-16	-625	-958	-40	-256	-120	-510	-150	-17	-92	-147
10	-416	-595	-93	-41	-173	-688	-55	-866	-706	-170	-804	-27	-845	-1,529	-72	-338	-197	-892	-249	-24	-162	-252
Winners / losers:																						
Decile 1	59/41	75/25	46/54	52/48	73/27	85/15	42/58	65/35	75/25	68/32	88/12	45/55	70/30	70/30	68/32	63/37	70/30	82/18	54/46	43/57	54/46	88/12
Decile 10	6/94	4/96	3/97	1/99	1/99	1/99	0/100	4/96	3/97	2/98	1/99	1/99	3/97	7/93	1/99	2/98	2/98	2/98	5/95	3/97	3/97	3/97

	AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
R-S	0.0042	0.0066	0.0005	0.0015	0.0020	0.0087	0.00204	0.0042	0.0075	0.0023	0.0102	0.0009	0.0064	0.0098	0.0045	0.0046	0.0077	0.0121	0.0031	0.0007	0.0015	0.0083
Δ Atkn ε=0.2	0.0007	0.0009	0.0001	0.0002	0.0003	0.0014	0.00044	0.0006	0.0011	0.0005	0.0016	0.0002	0.0010	0.0015	0.0006	0.0004	0.0011	0.0023	0.0004	0.0001	0.0002	0.0019
Δ Atkn ε=0.7	0.0025	0.0033	0.0003	0.0008	0.0011	0.0051	0.00166	0.0021	0.0041	0.0021	0.0060	0.0006	0.0035	0.0054	0.0022	0.0016	0.0038	0.0083	0.0016	0.0004	0.0008	0.0070
Δ Atkn ε=1.2	0.0046	0.0061	0.0006	0.0016	0.0020	0.0094	0.00320	0.0038	0.0075	0.0033	0.0105	0.0010	0.0064	0.0096	0.0040	0.0028	0.0066	0.0147	0.0028	0.0007	0.0016	0.0126

Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. Results in top panel present: the weighted mean of the financial gain/loss from the reform per household across equivalised income deciles; and the percentage of individuals that gain and lose, respectively, from the reform in the bottom and top equivalised income deciles ("Winners/losers"). Results in middle panel present: the weighted mean of the financial gain/loss from the reform per household across equivalised expenditure deciles; and the percentage of individuals that gain and lose, respectively, from the reform in the bottom and top equivalised expenditure deciles ("Winners/losers"). Results in bottom panel present the following summary indicators: R-S = Reynolds-Smolensky redistribution index; Δ Atkn = change in Atkinson inequality index, with ε = degree of inequality aversion. Summary indicators are calculated in relation to the financial gain/loss, using equivalised variables. Positive results indicate redistribution. The financial gain/loss is calculated as the cash transfer received minus the increase in VAT paid as a result of removing all reduced VAT rates (except on food). In all panels, the individual is the unit of analysis. See text for further detail.

Table 6.6. Welfare gain/loss results for reform 3

		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
Welfare gain/loss across income deciles	1	648	924	174	63	223	987	69	403	797	218	949	36	972	2,596	105	430	311	778	317	46	169	349
	2	111	346	51	5	120	543	19	187	354	99	677	7	636	2,136	42	140	120	533	94	1	68	222
	3	-31	25	-25	-12	-14	133	4	-70	85	-9	251	-3	123	983	8	-7	22	268	9	-1	-22	128
	4	-148	-216	-29	-20	-48	-68	-7	-93	-136	-67	-95	-8	-146	-518	-4	-97	-30	31	-73	-12	-36	46
	5	-161	-257	-37	-23	-63	-207	-16	-147	-197	-69	-222	-11	-325	-859	-18	-130	-59	-134	-95	-15	-59	-22
	6	-181	-338	-37	-25	-83	-275	-20	-194	-256	-99	-389	-11	-559	-844	-30	-160	-85	-285	-112	-16	-77	-84
	7	-256	-381	-62	-33	-115	-350	-31	-241	-334	-116	-409	-13	-567	-1,010	-31	-223	-97	-376	-143	-18	-94	-112
	8	-303	-467	-67	-34	-129	-389	-31	-258	-429	-127	-523	-18	-616	-1,139	-39	-255	-113	-432	-164	-21	-103	-139
	9	-319	-530	-71	-36	-149	-482	-38	-318	-483	-132	-632	-21	-715	-1,286	-48	-288	-148	-552	-181	-23	-110	-164
	10	-413	-592	-86	-44	-185	-687	-51	-411	-676	-152	-834	-29	-808	-1,440	-73	-355	-204	-958	-258	-27	-158	-273
Winners / losers:																							
Decile 1		86/14	96/4	80/20	70/30	94/6	99/1	84/16	92/8	96/4	100/0	100/0	66/34	99/1	100/0	91/9	83/17	97/3	100/0	95/5	66/34	79/21	100/0
Decile 10		0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100	0/100

		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
Welfare gain/loss across expenditure deciles	1	418	720	92	45	169	767	28	255	562	136	742	23	564	1,798	74	301	203	594	165	29	104	300
	2	110	237	36	4	72	421	24	141	268	71	505	6	314	776	29	114	94	337	71	1	42	190
	3	48	68	8	-5	14	226	10	5	114	16	273	1	162	357	22	45	41	222	6	-4	10	106
	4	-41	-104	2	-13	-21	58	6	-32	7	-22	61	-5	-3	134	4	-40	7	128	-16	-7	-13	51
	5	-91	-176	-23	-20	-48	-86	-5	-110	-106	-44	-87	-8	-77	-89	-5	-98	-26	-34	-48	-9	-38	-1
	6	-167	-253	-31	-23	-70	-199	-9	-162	-175	-66	-257	-9	-282	-195	-17	-141	-50	-98	-78	-14	-63	-38
	7	-223	-352	-43	-29	-94	-293	-20	-207	-281	-105	-407	-12	-429	-501	-23	-209	-76	-233	-110	-14	-76	-80
	8	-260	-413	-58	-32	-118	-397	-30	-255	-379	-115	-490	-15	-549	-876	-38	-235	-105	-375	-132	-18	-83	-119
	9	-342	-510	-73	-39	-151	-516	-41	-331	-485	-137	-644	-19	-725	-1,080	-47	-290	-141	-602	-176	-20	-109	-169
	10	-503	-702	-98	-48	-196	-776	-63	-446	-802	-188	-917	-32	-983	-1,706	-85	-390	-231	-1,064	-291	-29	-195	-289
Winners / losers:																							
Decile 1		59/41	75/25	46/54	52/48	73/27	85/15	42/58	64/36	74/26	68/32	88/12	45/55	69/31	70/30	68/32	63/37	70/30	82/18	54/46	43/57	53/47	88/12
Decile 10		6/94	4/96	3/97	1/99	1/99	1/99	0/100	4/96	3/97	2/98	1/99	1/99	2/98	7/93	1/99	2/98	2/98	1/99	5/95	3/97	3/97	2/98

		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
R-S		0.0043	0.0068	0.0006	0.0014	0.0020	0.0089	0.00184	0.0046	0.0078	0.0024	0.0099	0.0009	0.0062	0.0108	0.0040	0.0046	0.0072	0.0120	0.0032	0.0006	0.0016	0.0083
Δ Atkn	ε=0.2	0.0006	0.0009	0.0001	0.0002	0.0003	0.0014	0.00038	0.0005	0.0011	0.0005	0.0015	0.0001	0.0009	0.0016	0.0005	0.0004	0.0010	0.0022	0.0004	0.0001	0.0002	0.0018
	ε=0.7	0.0024	0.0032	0.0003	0.0007	0.0011	0.0050	0.00146	0.0020	0.0040	0.0019	0.0056	0.0005	0.0033	0.0058	0.0019	0.0015	0.0036	0.0080	0.0015	0.0003	0.0008	0.0066
	ε=1.2	0.0043	0.0058	0.0006	0.0014	0.0019	0.0091	0.00281	0.0035	0.0073	0.0037	0.0099	0.0009	0.0060	0.0102	0.0035	0.0027	0.0062	0.0141	0.0026	0.0006	0.0015	0.0120

Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. Results in top panel present: the weighted mean of the welfare gain/loss from the reform per household across equivalised income deciles; and the percentage of individuals that gain and lose, respectively, from the reform in the bottom and top equivalised income deciles ("Winners/losers"). Results in middle panel present: the weighted mean of the welfare gain/loss from the reform per household across equivalised expenditure deciles; and the percentage of individuals that gain and lose, respectively, from the reform in the bottom and top equivalised expenditure deciles ("Winners/losers"). Results in bottom panel present the following summary indicators: R-S = Reynolds-Smolensky redistribution index; Δ Atkn = change in Atkinson inequality index, with ε = degree of inequality aversion. Summary indicators are calculated in relation to the welfare gain/loss, using equivalised variables. Positive results indicate redistribution. The welfare gain/loss is calculated as the cash transfer received minus the compensating variation from removing all reduced VAT rates (except on food). In all panels, the individual is the unit of analysis. See text for further detail.

Table 6.7. Poverty index results

		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
Poverty headcount	Pre-reform	11.22	9.07	8.22	7.26	6.39	10.37	18.34	10.96	10.74	15.58	10.99	11.41	9.65	8.98	14.31	3.89	8.35	14.53	6.91	5.89	5.98	16.65
	Reform 1	9.93	6.91	7.56	5.61	4.66	7.57	18.20	9.30	8.35	13.42	7.66	11.11	7.26	7.19	13.84	2.94	5.05	11.63	5.56	5.71	5.42	13.75
	Reform 2	10.50	8.34	8.08	6.88	6.00	9.48	18.27	10.39	9.80	14.84	9.53	11.25	8.38	7.81	14.20	3.52	7.02	13.07	6.35	5.81	5.68	15.52
	Reform 3	10.56	8.18	8.09	6.92	5.92	8.90	0.00	10.07	9.77	15.07	9.06	11.42	8.51	7.56	0.00	3.70	7.15	12.67	6.35	0.00	5.71	15.47

		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
Poverty gap	Pre-reform	2.24	1.91	1.49	1.47	0.82	2.15	4.87	2.14	2.56	4.23	1.91	2.17	1.82	1.57	3.51	0.57	1.38	3.69	1.11	0.96	1.06	4.78
	Reform 1	1.79	1.15	1.29	0.99	0.49	1.31	4.70	1.64	1.65	3.00	1.02	2.01	1.18	0.86	3.28	0.35	0.63	2.44	0.76	0.91	0.82	3.08
	Reform 2	2.07	1.64	1.43	1.35	0.73	1.87	4.78	1.96	2.18	3.79	1.59	2.13	1.57	1.31	3.40	0.49	1.03	3.08	0.97	0.95	0.96	4.04
	Reform 3	1.98	1.57	1.46	1.37	0.72	1.66	0.00	1.93	2.18	3.99	1.35	2.11	1.53	1.06	0.00	0.47	1.05	2.91	0.99	0.00	1.00	4.06

		AUT (2009)	BEL (2010)	CHE (2011)	CZE (2010)	DEU (2008)	ESP (2010)	EST (2010)	FIN (2012)	FRA (2011)	GBR (2010)	GRC (2010)	HUN (2010)	IRL (2010)	LUX (2010)	LVA (2010)	NLD (2004)	POL (2010)	PRT (2011)	SLV (2010)	SVK (2010)	SWE (2010)	TUR (2010)
Poverty intensity	Pre-reform	0.72	0.59	0.41	0.51	0.17	0.72	1.97	0.67	0.95	1.71	0.52	0.64	0.60	0.43	1.30	0.14	0.36	1.44	0.30	0.25	0.35	1.99
	Reform 1	0.52	0.28	0.33	0.31	0.09	0.37	1.87	0.46	0.52	1.01	0.22	0.57	0.33	0.17	1.17	0.07	0.13	0.81	0.17	0.24	0.25	1.05
	Reform 2	0.64	0.46	0.39	0.45	0.14	0.60	1.92	0.59	0.76	1.44	0.40	0.62	0.49	0.33	1.25	0.11	0.24	1.11	0.25	0.25	0.31	1.54
	Reform 3	0.60	0.43	0.40	0.47	0.14	0.51	0.00	0.58	0.76	1.56	0.32	0.61	0.47	0.24	0.00	0.11	0.25	1.04	0.25	0.00	0.33	1.56

Notes. Results calculated using behavioural microsimulation models for 22 countries based on household expenditure survey microdata. Poverty line = 50% of median gross expenditure. Poverty indices are expressed as percentages. Results calculated using equivalised expenditure, with the individual as unit of analysis. See text for further detail.

CHAPTER 7. WHO WOULD WIN FROM A MULTI-RATE GST IN NEW ZEALAND: EVIDENCE FROM A QUAIDS MODEL

7.1. Introduction

New Zealand's goods and services tax (GST) is often highlighted as an example of best practice design of a value-added tax system.[98] Its broad-based, single-rate structure minimises compliance and administrative costs, avoids distortions to consumption decisions, and raises significant revenue despite a moderate rate of 15%. In contrast, most other OECD countries have adopted multi-rate systems that apply reduced rates to a selection of goods and services. A key motivation for such concessionary rates has been to target support to the poor. This chapter investigates who would benefit from the introduction of reduced GST rates in New Zealand and, in particular, whether reduced GST rates would be a more effective way of providing support to poorer households than New Zealand's current income-tested tax credit approach.

As the introduction of reduced GST rates will alter the relative prices of goods and services, it is important to account for the resulting changes in consumption patterns as these will affect post-reform revenue and welfare. This is achieved through the estimation of a Quadratic Almost Ideal Demand System (QUAIDS) for New Zealand. As the QUAIDS model is based on consumer demand theory and imposes restrictions consistent with utility maximisation, it also allows money-metric welfare measures to be estimated. The modelling is based on household expenditure microdata from the four most recent Household Economic Surveys (HES) and corresponding Consumer Price Index (CPI) price data, both provided by Statistics New Zealand.[99]

The QUAIDS model developed by Banks et al. (1997) is the quadratic extension of the Almost Ideal (AI) demand system of Deaton and Muellbauer (1980a). The QUAIDS model provides greater flexibility than the AI model, allowing a good to be a necessity at one expenditure level and a luxury at another expenditure level. Estimation of the QUAIDS model has substantial data requirements beyond

[98] See, for example, Cnossen (2002).

[99] Access to the New Zealand Household Economic Survey data used in this study was provided by Statistics New Zealand under conditions designed to give effect to the security and confidentiality provisions of the Statistics Act 1975. The results presented in the study are the work of the author, not Statistics New Zealand.

those of the AI model, and hence a QUAIDS model has not previously been estimated using New Zealand data. However, the availability of price data at a regional level corresponding to the four most recent years of the HES now provides sufficient price variation to feasibly estimate the model for New Zealand. This chapter therefore provides the first estimates of a QUAIDS model based on New Zealand data.

The estimated QUAIDS model covers nine non-durable expenditure groups. Expenditure and price elasticity estimates are highly plausible. All expenditure elasticities are positive, with the "food and non-alcoholic beverages", "transport fuels", and "household utilities, communication and education" expenditure groups found to be necessities. The "clothing and footwear", "recreation and culture", and "transport (excluding transport fuels)" groups were clear luxuries. The "food and non-alcoholic beverages" and "recreation and culture" groups were the least price responsive, while the general "personal expenditure" and "household utilities, communication and education" expenditure groups were the most price-responsive.

The QUAIDS model is used to examine two reforms. The first reform considers the introduction of reduced GST rates on two of the nine non-durable expenditure groups from the QUAIDS model: "food and beverages" and "recreation and culture". These groupings include all food (including restaurant food), newspapers, books, magazines, cinema, theatre, concerts, hotels and other accommodation services. As such, the reform covers eight of the 11 most common expenditure groups taxed at reduced rates in OECD countries (see Figure 2.1).

Both tax and welfare change results (presented across income and expenditure deciles) show that the introduction of reduced rates on these expenditure groups will have a small progressive effect – providing greater support to poorer households when measured as a proportion of their total spending. However, richer households are shown to gain considerably more in absolute terms – highlighting the poorly targeted nature of the GST as a tool for supporting poorer households. Results are also found to differ between the two expenditure groupings. While the reduced rate on food largely mimics the overall results (and indeed drives them due to its greater budget share), the reduced rate on recreation and culture actually has a regressive effect. Kakwani, Reynolds-Smolensky and Atkinson index results confirm these findings.

The second reform simulates the removal of a simplified version of the income-tested family tax credit and replacement with reduced GST rates on the same two expenditure groups as above. The reduced GST rates are set to ensure revenue neutrality. Both tax and welfare change results (across deciles) show that, on average, poorer households lose from the reform, while richer households gain. The very poorest households with children are found to be particularly hard hit as they previously received the maximum possible tax credit amounts, and the small gain from the reduced GST rates is nowhere near enough to compensate them for the loss of the tax credit. Reynolds-Smolensky and Atkinson index results confirm that the reform increases inequality, while FGT poverty index results show the reform also increases poverty.

The overall "progressive, but poorly targeted" result for reduced GST rates in New Zealand is consistent with the general findings for 23 OECD countries in Chapter 5, and with the previous studies highlighted in that chapter. Similarly, the "progressive, but poorly targeted" result for the reduced rate on food and beverages is consistent with the finding for food in New Zealand by Ball et al. (2016). More generally, the variation in results between the two expenditure groupings highlights that the impact of a reform can vary significantly depending on the type of expenditure subject to a reduced rate. This is again consistent with the findings in Chapter 5, with the previous studies highlighted in that chapter, and with the non-behavioural analysis for New Zealand in Thomas (2015). The QUAIDS-based results of this chapter suggest that such variation is still present in New Zealand once behavioural responses to the tax changes are accounted for.

The results also clearly confirm that the family tax credit is a far superior mechanism for providing support to poorer households than reduced GST rates. This is consistent with the findings for cash transfers more generally in Chapter 6, and with the previous studies for OECD countries highlighted in that chapter. It is clear that New Zealand should maintain its current approach of a broad-based single-rate GST and income-tested tax credits.

The chapter proceeds as follows: Section 7.2 provides a literature review on demand system modelling with specific emphasis on previous modelling with New Zealand data; Section 7.3 discusses the methodological approach adopted to estimate the QUAIDS model, including the data used; Section 7.4 presents the results of the QUAIDS model; Section 7.5 presents the simulation results; and Section 7.6 concludes.

7.2. Literature review

The first full demand system to be estimated was the linear expenditure system (LES) by Stone (1954), who algebraically imposed the theoretical restrictions of adding-up, homogeneity and symmetry on a general linear functional form. The LES functional form is, however, quite restrictive: for example, it excludes the possibility of inferior goods or of complements. Subsequent research has therefore investigated less restrictive functional forms. Important models that have been developed include the Rotterdam model (Thiel, 1965; Barten, 1966) and the translog model (Christensen et al., 1975). However, the most popular model has been the Almost Ideal (AI) model of Deaton and Muellbauer (1980a), and its quadratic extension (QUAIDS) by Banks et al. (1997). In particular, whereas previous models impose a linear relationship between budget shares and the log of total expenditure, the QUAIDS model allows for a non-linear relationship – thereby allowing a good to be a necessity at one level of income and a luxury at another.

There have been a large number of applications of the AI and QUAIDS models since their introduction, though limitations in data availability – as has been the case in New Zealand – have tended to limit such studies to a small range of countries. However, as availability of expenditure microdata and disaggregated price data has increased, so too has the feasibility of QUAIDS modelling. In particular, the analysis of indirect tax reforms has motivated the estimation of QUAIDS models in a number of countries in the last few years, including: Van Oordt (2018) for South Africa, Bover et al. (2017) for Spain; Cseres-Gergely et al. (2017) for Hungary; Abramovsky et al. (2015) for Mexico; Jansky (2014) for the Czech Republic; and IFS (2011a) which included five separate case studies covering Belgium, France, Germany, Spain, and the United Kingdom. Meanwhile, several recent studies have been motivated by food policy issues (including taxation), and have therefore limited their models to food expenditure. These include: Caro, Smith-Taillie et al. (2017) for Chile; Caro, Ng et al. (2017) for Colombia; and de Agostini (2014) for the United Kingdom. Other papers have focused purely on demand behaviour, such as Gostkowski (2018) for Poland.

There are a number of commonalities in the methodological approaches adopted by these recent studies. The majority of studies exclude durable goods from their analyses.[100] This is to remove the potentially distorting impact of large one-off purchases that: (1) would only be partially captured in the fixed coverage period of a household survey; and (2) do not reflect actual consumption (which is instead spread over the life of the durable). In most cases, the standard QUAIDS model is also extended to incorporate demographic variables following the translating approach of Pollak and Wales (1978) which incorporates demographics as taste-shifters within the intercept term of the demand equations. Price variation has been maximised by using multiple years of household expenditure survey and price data and, where possible, by obtaining regional and monthly/quarterly breakdowns of these data. Estimation typically follows an iterated seemingly unrelated regression approach, with most studies instrumenting for the potential endogeneity of total expenditure using disposable income.

[100] Van Oordt (2018), Gostkowski (2018) and some of the case studies in IFS (2011a) include durable goods. Abramovsky et al. (2015) only exclude large durables such as house and vehicle purchases.

Given the significant data requirements for demand system modelling, the New Zealand-specific literature in this area is sparse. Given the even greater demands of the QUAIDS model, no QUAIDS modelling has previously been undertaken in New Zealand. That said, several AI and Rotterdam models have been estimated.

Michelini (1999) uses semi-aggregated annual household expenditure data from 1983-84 to 1991-92 to estimate an AI model for New Zealand covering six expenditure groups. To aid estimation, the linearised version of the model is adopted (using the Stone price index instead of the translog price aggregator of the full AI model). Housing is excluded from the model, but other durables are included. Michelini finds plausible estimates of own-price and total expenditure elasticities, with two of the six expenditure groups – food and "household operational expenditure" – found to be necessities. These two groups are also found to be highly price inelastic. Other expenditure groups are also price inelastic, with the exception of clothing which was highly elastic.

In two similar papers, Khaled and Lattimore (2006, 2008) estimate Rotterdam demand models focusing, respectively, on the clothing sector and the housing sector in New Zealand. In both cases they rely on Household Economic Survey (HES) expenditure microdata from 1981 to 2004 and Consumer Price Index (CPI) price data and follow a two-step budgeting process whereby total expenditure is first allocated across six broad expenditure groups, and then expenditure is allocated within those groups. Among their six broad expenditure groups, they find, in both papers, housing and transport to be luxury goods, and the other groups to be necessities. Frisch own-price elasticities showed all groups to be inelastic, except clothing – mirroring the findings of Michelini (1999).

In their 2006 paper, Khaled and Lattimore break the clothing expenditure category into eight sub-groups and find demand to also be elastic amongst clothing types, together with significant cross-price effects. In their 2008 paper, they break housing expenditure into rented and owner-occupied housing (estimating the price they need for owner-occupied housing following a user cost of capital approach). In their conditional model of housing demand, they find owner-occupied housing to be a luxury and rental housing to be a necessity. They find very small cross-price effects on housing demand.

Most recently, Ni Mhurchu et al. (2013) estimate a linearised AI model for food expenditure in New Zealand. They use 2006-07 and 2009-10 HES microdata together with highly disaggregated Food Price Index (FPI) data. The FPI data was available on a monthly basis across 15 regions which could be matched to the six regions in the HES data, thereby providing substantial price variation. The estimated model was extended to include demographic variables and covered 24 food groups. Given this large disaggregation of food expenditure, and hence large number of observations with zero expenditure for particular categories, they address potential censoring bias by applying a Heckman two-step procedure. They find significant variation in own-price elasticities ranging from -0.44 to -1.78, while cross-price estimates are typically (but not always) small. They also estimate the model on several ethnic and income subsets of the data finding that own-price elasticities tend to be stronger (i.e. more negative) for lower as compared to higher income quintiles, and for Maori as compared to non-Maori.

Finally, two other papers that were discussed in Chapter 5 are of particular relevance here given their focus on New Zealand's GST rate structure. Ball et al. (2016) examine the welfare effects of zero-rating food in New Zealand's GST system. They incorporate demand responses into their microsimulation analysis following the LES-based approach that has also been adopted in Chapter 4 of this thesis. Based on 2009-10 HES microdata, they find that zero-rating food expenditure produces a small amount of progressivity in the GST, measured as the change in equivalent variation as a proportion of total expenditure, but that better off households receive greater absolute welfare gains. Under a revenue neutral reform, the welfare gain to poorer households remains positive but richer households who spend a greater proportion of their expenditure on standard rated goods are made worse off. Redistribution is also found to occur from high spending households without children towards lower spending households with children and to older households.

Thomas (2015) uses a non-behavioural microsimulation model to simulate (holding quantity constant) the introduction in New Zealand of a European-style VAT rate structure including zero rates for a large number of expenditure items. It draws on 2012-13 HES microdata. Results suggest that such a reform would provide greater support to poorer households when measured as a proportion of total spending, but that richer households would gain considerably more in absolute terms. Results were also found to differ depending on the particular reduced rate, with some reduced rates (such as on books) providing a greater benefit to richer households both proportionately and in absolute terms. The current chapter is, in part, an extension of this analysis taking into account consumer behavioural responses.

7.3. Methodology

7.3.1. The Quadratic Almost Ideal Demand System

The Quadratic Almost Ideal Demand System (QUAIDS) was developed by Banks et al. (1997) as an extension of the Almost Ideal Demand System (AI) of Deaton and Muellbauer (1980a). The AI model is derived from a specific class of preferences – price-independent generalised logarithmic (Muellbauer, 1976) (PIGLOG) – that permit aggregation over consumers. PIGLOG preferences produce a demand function that is linear in prices and log expenditure. Banks et al. (1997), however, observe that the addition of a quadratic term in log expenditure will often provide a better fit for their long time series of British data. They show that an indirect utility function of the following form will produce such a demand function:

$$\ln V = \left[\left(\frac{\ln m - \ln a(p)}{b(p)}\right)^{-1} + \lambda(p)\right]^{-1} \tag{1}$$

where V is indirect utility, m is total expenditure, and $\ln a(p)$, $b(p)$ and $\lambda(p)$ are differentiable functions defined as:

$$\ln a(p) = \alpha_0 + \sum_{i=1}^{N} \alpha_i \ln p_i + \frac{1}{2}\sum_{i=1}^{N}\sum_{j=1}^{N} \gamma_{ij} \ln p_i \ln p_j \tag{2}$$

$$b(p) = \prod_{i=1}^{N} p_i^{\beta_i} \tag{3}$$

$$\lambda(p) = \sum_{i=1}^{N} \lambda_i \ln p_i \tag{4}$$

Equations (2) and (3), respectively, are the translog price aggregator and Cobb-Douglas price aggregator functions of the AI model.[101] Substituting equations (2)-(4) into (1), differentiating with respect to p_i and m and then applying Roy's identity, gives the budget share equations of the QUAIDS model[102]:

$$w_i = \alpha_i + \sum_{j=1}^{N} \gamma_{ij} \ln(p_j) + \beta_i \ln\left(\frac{m}{a(p)}\right) + \frac{\lambda_i}{b(p)}\left[\ln\left(\frac{m}{a(p)}\right)\right]^2 \tag{5}$$

Setting $\lambda_i = 0$ in equation (5) would result in the AI specification, and enables easy testing of the empirical relevance of the quadratic term. To be consistent with utility maximisation, demand theory implies the following constraints:

Adding up: $\sum_{i=1}^{N} \alpha_i = 1$; $\sum_{i=1}^{N} \beta_i = 0$; $\sum_{i=1}^{N} \gamma_{ij} = 0$ for all j ; $\sum_{i=1}^{N} \lambda_i = 0$

Homogeneity: $\sum_{j=1}^{N} \gamma_{ij} = 0$

Symmetry: $\gamma_{ij} = \gamma_{ji}$

[101] As specified in Banks et al. (1997). The original specification in Deaton and Muellbauer (1980a) varies slightly. Note that setting $\lambda(p)$=0 reduces equation 1 to the indirect utility function of the AI model.

[102] Alternatively, one could rearrange for the expenditure function and apply Sheppard's lemma, as in the original derivation of the AI budget share equations in Deaton and Muellbauer (1980a,b).

These constraints can be imposed during estimation. A fourth requirement of demand theory – negativity – cannot be imposed, but can be tested for.

Expenditure and price elasticities can be obtained from equation (5). Following the concise presentation in Banks et al. (1997), first differentiate equation (5) with respect to $\ln m$ and $\ln p_j$:

$$\mu_i \equiv \frac{\partial w_i}{\partial \ln m} = \beta_i + \frac{2\lambda_i}{b(p)}\left[\ln\left(\frac{m}{a(p)}\right)\right] \tag{6}$$

$$\mu_{ij} \equiv \frac{\partial w_i}{\partial \ln p_j} = \gamma_{ij} - \mu_i\left(\alpha_j + \sum_{k=1}^{N}\gamma_{jk}\ln(p_k)\right) - \frac{\lambda_i\beta_j}{b(p)}\left[\ln\left(\frac{m}{a(p)}\right)\right]^2 \tag{7}$$

The expenditure elasticities are then $e_i = \mu_i/w_i + 1$, while uncompensated price elasticities are $e_{ij}^u = \mu_{ij}/w_i - \delta_{ij}$, where δ_{ij} is the Kronecker delta ($\delta_{ij} = 1$ if $i = j$, and zero otherwise). Compensated elasticities can of course be calculated using the slutsky equation ($e_{ij}^c = e_{ij}^u + e_i w_j$). Unlike the original AI model, the QUAIDS model enables a good to be a necessity at one expenditure level and a luxury at another expenditure level. This can be seen from the expenditure elasticity: for a positive β_i and negative λ_i, the expenditure elasticity will be greater than unity at low expenditure levels, but will fall as expenditure increases eventually falling below unity.

A key benefit of demand system modelling is the ability to carry out welfare analysis. To calculate the welfare change of a reform, the compensating or equivalent variation can be calculated from the expenditure function. The compensating variation (CV) can be calculated as:

$$CV = E(u^0, p^1) - E(u^0, p^0) \tag{8}$$

$$= e^{\ln a(p^1) + b(p^1)\{(1/\ln u^0)\lambda(p^1)\}^{-1}} - e^{\ln a(p^0) + b(p^0)\{(1/\ln u^0)\lambda(p^0)\}^{-1}} \tag{9}$$

where p^0 and p^1 are pre- and post-reform prices, respectively, and u^0 is pre-reform utility. Pre-reform utility is calculated from the indirect utility function using pre-reform prices.

As equation 5 shows, the QUAIDS model explains demand for each good in terms of prices of all goods and total expenditure. Implicit in the inclusion of total expenditure rather than income in the model is intertemporal separability – i.e. that the decision on how to allocate total expenditure in the current period can be made separately from the decision on how to allocate expenditure across periods (through borrowing and saving). As some degree of aggregation of goods is required, it also assumes separability of preferences between the broad expenditure groups modelled. Additionally, the model assumes separability of consumption and labour supply decisions, and that no externalities exist. These last two assumptions, in particular, are restrictive and should be borne in mind when using the model.

7.3.2. Data

Estimation of the QUAIDS model requires data on both household expenditure and prices. Expenditure data are obtained from the Household Economic Survey (HES). The HES is a sample survey of household expenditure and income conducted once every three years. HES data was made available by Statistics New Zealand for the six most recent surveys (2000-01, 2003-04, 2006-07, 2009-10, 2012-13 and 2015-16). Each survey covers approximately 3000 households (different households each year) resulting in a total possible sample size of 18,190 households. The HES breaks expenditure into almost 2000 different categories, and also contains a range of demographic variables. While there have been some minor variations in categorisation at a detailed level across the six HES surveys, these disappear on aggregation into broader categories.

Price data are taken from Statistics New Zealand's publicly available Consumer Price Index (CPI) series. National level price data are available for more than 100 different expenditure categories from 1999 onwards. Additionally, regional price data are publicly available for 12 expenditure categories, but only from 2006 onwards. These data are provided separately for five regions: Auckland, Wellington, the rest of the North Island, Christchurch, and the rest of the South Island. The available categories in both the national and regional price data follow the same classification system as the HES data – making matching the datasets a relatively simple process. All price data are available on a quarterly basis and can be matched to the HES data based on the month of survey response.

The QUAIDS model was initially estimated with two different matched datasets: first with all six available HES surveys matched to national price data for each quarter (18,190 observations); second with the four most recent HES surveys matched to regional price data for each quarter (12,266 observations). Unfortunately, the degree of price variation available from the larger national price dataset[103] proved insufficient for identification, and so only the smaller regional price dataset is utilised in the analysis in this paper.[104]

[103] 24 different sets of prices (6 years x 4 quarters) vs 80 (4 years x 4 quarters x 5 regions).

[104] Modelling was attempted for a range of expenditure groupings and compositions using the larger dataset, with group prices initially calculated as averages of the prices of the constituent expenditure items weighted by their average population within-group expenditure shares. Following IFS (2011a), attempts were made to increase price variation by calculating group average prices based on the within-group expenditure shares of each household, so that the average price varied depending on each household's actual consumption pattern. However, this approach

While there is a large gain in terms of price variation with the use of the regional price data, it comes with two clear costs. First, the sample size is reduced by around one third. Second, very little flexibility is provided regarding the choice of expenditure groupings to be used in the analysis.

The limited number of groupings available is not a significant issue because it would in any case be necessary to limit the number of expenditure groups to feasibly estimate the QUAIDS model due to the large number of parameters that must be estimated. However, the restricted choice of composition of those categories is a significant limitation as ideally expenditure would be grouped in a way that best matches the policy reforms to be simulated (while at the same time grouping similar goods together to conform as closely as possible with the separability assumption[105]).

An additional problem also faced by studies in this area is the impact of infrequently purchased durable goods on the analysis. Ideally, the consumption benefit from a durable good would be apportioned across its useful life, and so only the component "consumed" in the year of the survey would be taken account of in the analysis. However, the HES only reports the actual purchase of durable goods – meaning either a large or zero expenditure amount is reported depending on whether these infrequent purchases are made during the survey period. This can significantly distort the analysis and hence – as noted above – the typical approach adopted in recent studies has been to exclude durables. Inclusion of durables poses similar problems in the current analysis and hence durables are also excluded from the QUAIDS model here.[106] However, for the policy simulations in Section 7.5, durables are included as an additional expenditure category – with their demand unaffected by the price changes to non-durables. This effectively assumes separability of durable and non-durable consumption decisions. That is, households are assumed to first decide how much of their total expenditure to spend on durables vs non-durables, before then considering how to allocate their non-durable expenditure.

As part of the durables category, expenditure on rented housing is also excluded. While actual rental expenditure is included in the HES data, imputed rental expenditure from homeowners is not. As such, inclusion of rental expenditure would have resulted in only a partial inclusion of total housing consumption, with the absence of imputed rental expenditure potentially biasing results. While beyond the scope of this paper, a potential future extension of this work would be to estimate imputed rental

risks conflating quality variation with price variation resulting in spurious relationships. This was indeed the case here, leading, for example, to positive price elasticities for some expenditure groupings.

[105] Expenditure groupings can be justified on the basis of weak separability which requires that preferences for goods within a particular group can be described independently of the quantities in other groups (Deaton and Muellbauer, 1980b).

[106] Including durables for either of the two datasets led to clearly spurious results, including several positive own-price elasticities.

expenditure and to include both this estimate, and the reported actual rental expenditure, in the modelling.[107]

Regional price data were available for the following broad expenditure categories: food and beverages; alcohol and tobacco; clothing and footwear; housing and household utilities; household contents and services; health; transport; recreation and culture; miscellaneous goods and services. Additionally, regional prices were separately available for petrol (which is part of the wider transport category) and for actual rentals for housing and purchase of housing (which are both part of the wider housing and household utilities category). While these classifications match largely with the classifications in the HES, they entirely miss two HES expenditure groups: communications and education.

From these 12 partially overlapping categories, those that entirely or predominantly contain durables are excluded: housing and household utilities; household contents and services; actual rentals for housing; and purchase of housing. While the "household contents and services" category contains, on average, 80.4% durables, removing the "housing and household utilities" category is more problematic as household utilities (comprising household energy and property rates) make up on average 8.5% of total consumption reported in the HES. Exclusion of the communications and education categories is also problematic as they make up on average another 5.4% of total consumption in the HES. As such, these three categories are included in the modelling based on just national price data.

Separate inclusion of these three extra categories was not feasible due to the more limited price variation in the national price data. They are instead combined into one additional category and the necessary price variation is obtained by calculating an average price for the category weighted by each household's expenditure. While this approach poses some risk of conflating quality effects with price effects, it is the only means available to include the additional expenditure in the model. Sensitivity analysis shows that the inclusion of this additional category only has a small impact on the elasticity estimates for the categories that are based on regional price data, and hence any risks are judged to be outweighed by the benefit of being able to include an extra 13.9% of total household expenditure in the model.

[107] Imputed rental expenditure of homeowners is estimated by a number of national statistics agencies in their household expenditure surveys, following a range of different methodologies. One possibility would be to base estimation of imputed rental on factors such as region, house size and property rates paid to local councils and reported in the HES (such an approach was undertaken, for example, for the United Kingdom by Brewer and O'Dea, 2012).

The final expenditure groupings are as follows:

1. Food and beverages (including restaurant food)
2. Alcohol and tobacco
3. Clothing and footwear
4. Healthcare
5. Transport (excluding transport fuels)
6. Transport fuels
7. Recreation and culture
8. Other personal expenditure
9. Household utilities, communication and education

There are several additional compromises that are made in order to obtain the above expenditure groupings. Petrol, diesel and LPG are included in the "transport fuels" category, but the petrol price is used to proxy the average price for the category as it is the only one available on a regional basis. These three transport fuels, as well as vehicle purchases, are consequently excluded from the broader transport category. However, as no further breakdown is available in the regional price data, the average price of the transport category cannot be adjusted. As such, it still incorporates the prices of transport fuels and vehicle purchases in its calculation. This is of some concern as transport fuels and vehicle purchases comprise on average 28.7% and 33.4%, respectively, of the total transport category, and hence can be expected to have a strong influence on the average price of the category.

Similarly, three durable goods categories are removed from the wider "recreation and culture" grouping, but the average regional price for the whole category is used.[108] This presents a similar concern as these durables constitute on average 40.0% of the "recreation and culture" grouping.

7.3.3. Estimation

To estimate the QUAIDS model I follow the iterated linear least squares approach proposed by Blundell and Robin (1999), utilising the *aidsills* Stata program developed by Lecocq and Robin (2015). This approach takes advantage of the fact that the QUAIDS demand system is linear in all parameters conditional on the price indices, and so standard linear estimation techniques can be utilised.

[108] The three excluded categories are "audio-visual and computing equipment", "major recreational and cultural equipment" and "other recreational equipment and supplies".

An iterative process is followed. First, the two price indices, $a(p)$ and $b(p)$, are fixed (with the Stone price index and 1 used, respectively, as their initial values[109]). With these fixed values, the budget share equations are then estimated using the seemingly unrelated regressions (SUR) approach – which adjusts the variance- covariance matrix for correlation of the error terms across equations[110]. Using the resulting parameter estimates, the two price indices are then re-calculated and the budget share equations are re-estimated. This process is then repeated until the parameter estimates converge to more than four decimal places. Blundell and Robin (1999) show that this process produces consistent and asymptotically normal parameter estimates.

To avoid singularity (as the dependent variables of all the equations sum to one), the last equation is dropped during estimation, with its parameter estimates being recovered via the adding-up constraints (and thereby automatically imposing additivity). Homogeneity is imposed by including the first *N*-1 prices as relative prices using the *N*th price as the reference price, and then removing the *N*th price as an explanatory variable.[111] Symmetry is then imposed via linear restrictions on the parameters.[112]

As is common in the literature, I extend the QUAIDS model to incorporate demographic variables following the "translating" approach of Pollak and Wales (1978) in which demographic variables enter as taste-shifters through the intercept term in the budget share equations.[113] Specifically, α_i is replaced by α_i^Z, in both equations (2) and (5), where:

$$\alpha_i^Z = \alpha_i + \sum_{k=1}^{K} \alpha_{ik} z_k \quad (10)$$

[109] These are the most commonly applied initial values used in the literature. The Stone price index is calculated as the average price weighted by the mean budget shares: $\sum \bar{w}_i p_i$.
[110] As Lecocq and Robin (2015) note, OLS and SUR would produce identical parameter estimates as the right hand variables in each budget share equation are identical.
[111] Following estimation, absolute price effects are then recovered from the relative price effects.
[112] Symmetry is only imposed following the iterative process. Lecocq and Robin (2015) note that imposing symmetry during each iteration produces almost identical results but increases the number of estimations that do not converge.
[113] This approach has been adopted in a range of recent studies, including: Cseres-Gergely (2017), Abramovsky et al. (2015), Jansky (2014) and IFS (2011a), and in the *aidsills* program of Lecocq and Robin (2015). There are however a range of ways to include demographic effects (Pollak and Wales, 1981). For example, Poi (2012) applies the demographic scaling approach of Ray (1983) in his *quaids* Stata program. The scaling approach is arguably more flexible than the translating approach, but the translating approach maintains the conditional linearity of the demand system thereby increasing computational ease and speed. For comparison, I apply both Lecocq and Robin's (2015) *aidsills* program and Poi's (2012) *quaids* program to model the demand system with the same 11 demographic variables (but without instrumenting total expenditure in either case) and find very similar results. I prefer the *aidsills* program as it enables potential endogeneity in total expenditure to be instrumented for and is computationally faster.

and z_k is a set of K demographic variables. This allows the budget shares to vary depending on the demographic variables while maintaining the conditional linearity of the model. A further adding-up condition must also be included to ensure consistency with demand theory and enable welfare analysis:

$$\sum_{i=1}^{N} \alpha_{ik} = 0.$$

The demographic variables included are:

- The adult equivalent size of the household.[114]
- The number of adults in the household.
- The number of children in the household.
- The age of the household reference person.[115]
- The gender of the household reference person (set to 1 if male; zero otherwise).
- A regional dummy (set to 1 if the household lives in Auckland; zero otherwise).
- An ethnicity dummy (set to 1 if the household reference person is of European/pakeha descent; zero otherwise).
- A tertiary education dummy (set to 1 if the household reference person's highest qualification is at tertiary level; zero otherwise).
- A secondary education dummy (set to 1 if the household reference person's highest qualification is at secondary level; zero otherwise).
- A full-time employment dummy (set to 1 if at least one adult in the household is in full-time employment; zero otherwise).
- A time variable specifying the quarter during which the HES questionnaire was completed (between 1 (Q3 2006) and 40 (Q2 2016)).

Another common issue in demand system estimation is the potential endogeneity of the total expenditure variable.[116] Specifically, the error term may be correlated with the total expenditure variable if, for example, tastes and total expenditure are both affected by the same shocks. To address this concern I instrument for total expenditure using disposable income. This approach was adopted by Banks et al. (1997) in their original empirical illustration of the QUAIDS model and subsequently by various authors including the recent studies by Cseres-Gergely et al. (2017), Abramovsky et al. (2015), and Jansky (2014). It is included as a key feature of Lecocq and Robin's (2015) *aidsills* Stata program

[114] The adult equivalent size is calculated using the parametric equivalence scale presented in Section 7.5.
[115] The reference person is normally determined by who takes responsibility for answering the questionnaire.
[116] In studies that use unit values (expenditure divided by quantity from household expenditure survey data) rather than separate price data, endogeneity can also be a problem as quality effects captured in the unit values may be correlated with the error term. As argued by Jansky (2014), the use of CPI price data – as used here – mitigates such concerns.

and I therefore follow their approach, which includes all price and demographic variables, together with log disposable income, as independent variables in the first stage regressions.[117]

7.4. QUAIDS results

7.4.1. Expenditure and own-price elasticities

The expenditure and own-price elasticity estimates (evaluated at the means of all the variables) from the QUAIDS model are presented in Table 7.1. As expected, all expenditure elasticities are positive. Three expenditure groupings are found to be necessities, with elasticity values less than unity: food and beverages; transport fuels; and household utilities, communications and education. This broadly conforms with ex ante expectations of typical necessity goods. That said, within the latter group, education may not necessarily be expected to be a necessity given that roughly half of this category in the HES data constitutes either private primary and secondary education expenditure or tertiary education expenditure. The influence of education expenditure on the results may therefore have been outweighed by the necessity nature of household utility and communication expenditure. The empirical need to group these three expenditure categories together (as only annual price data was available for them) means that this potential problem was unavoidable.

The remaining expenditure groupings can be classified as luxuries, with expenditure elasticities in excess of unity. These include goods typically thought of as luxuries such as: clothing and footwear; recreation and culture, and other personal expenditure. In contrast to transport fuels, the general transport category is also a luxury. The elasticity estimates for alcohol and tobacco and for healthcare are the closest to unity (in fact, alcohol and tobacco is not statistically significantly different from unity).

Table 7.1. Budget shares, expenditure and own-price elasticities

	Observed shares	Predicted shares	Expenditure elasticity	Uncompensated price elasticity	Compensated price elasticity
1. Food and non-alcoholic beverages	0.291	0.292	0.776***	-0.566**	-0.333
2. Alcohol and tobacco	0.045	0.045	1.144***	-0.951	-0.898
3. Clothing and footwear	0.040	0.040	1.668***	-0.632	-0.568
4. Healthcare	0.040	0.040	1.161***	-0.711	-0.666
5. Transport (excluding transport fuels)	0.076	0.076	1.485***	-1.474	-1.368
6. Transport fuels	0.069	0.069	0.789***	-0.613*	-0.555
7. Recreation and culture	0.073	0.073	1.486***	-0.535	-0.430
8. Other non-durable personal expenditure	0.145	0.145	1.393***	-2.339*	-2.137
9. Household utilities, communication and education	0.221	0.221	0.618***	-1.612***	-1.479***

Notes. Elasticity estimates from Quadratic Almost Ideal Demand System, evaluated at the means of the variables.
* $p<0.05$, ** $p<0.01$, *** $p<0.001$

[117] The instrumental variable (two-stage least squares) procedure has two stages: in the first stage, log total expenditure is regressed on the instrumental variable (log disposable income) and the price and demographic variables; in the second stage, the demand equations are estimated with the error term from the first stage regression added as an additional explanatory variable. As two-stage least squares is combined with SUR, the process becomes equivalent to three-stage least squares regression.

Comparison of results with other studies can be difficult as the composition of expenditure groupings tends to vary across studies. However, a number of results are broadly comparable. Food is unsurprisingly found to be a necessity in virtually all recent QUAIDS studies.[118] Most recent studies also find household utilities to be necessities and clothing and footwear to be luxuries (e.g. Bover et al., 2017, for Spain; Cseres-Gergely et al., 2017, for Hungary; Jansky, 2014, for the Czech Republic). Results for other expenditure groupings tend to be more mixed. The previous AI and Rotterdam model studies of New Zealand by Michelini (1999) and Khaled and Lattimore (2006, 2008) present consistent expenditure elasticity results for food and transport. However, they find clothing to be a necessity rather than a luxury. Those papers were based on data predominantly from the 1980s and 1990s, suggesting that, as living standards have continued to rise, a greater component of clothing consumption now appears to be of a luxury nature.

As expected, all own-price elasticities are negative. The least responsive groupings are: food and beverages; and recreation and culture. While the food and beverages grouping would be expected to be relatively unresponsive to price changes, the elasticity, at -0.566, is less inelastic than might be expected – certainly in comparison to recent studies in other countries (for example, Bover et al., 2017, find an uncompensated own-price elasticity of -0.109 for Spain; Cseres-Gergely et al., 2017, find an elasticity of -0.32 for Hungary; Jansky, 2014, finds an elasticity of -0.311 for the Czech Republic[119]). For New Zealand, Michelini (1999) and Khaled and Lattimore (2006, 2008) find food to be more inelastic than found here. These studies typically restrict their food categories to food purchased for home consumption, excluding restaurant food – which may be expected to be more price responsive. The inclusion of restaurant food within the broader food category here is therefore likely to explain the slightly higher elasticity estimate. Ideally, restaurant food would have been separated in the modelling here also, but this was not possible due to the limited price data available.

The comparatively inelastic result for recreation and culture may also hide some greater price responsiveness for some of its components. Recreation and culture is a wide grouping, including recreational expenditure such as books, magazines and newspapers; cultural activities such as cinema, theatre and concerts; and a range of accommodation services. Expenditure such as on hotel accommodation, or cinema, theatre and concert tickets may be expected to be more price responsive,

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[118] The case study for the United Kingdom in IFS (2011a) found an expenditure elasticity of 0.25 for food subject to the zero VAT rate, but an expenditure elasticity of 1.15 for their standard-rated food and drink category which included restaurant food, takeaways and alcohol.

[119] Food own-price elasticity estimates vary considerably across the case studies included in IFS (2011a), with estimates of: -0.11 for the United Kingdom; -0.23 for Belgium; -0.43 for Germany; -0.74 for France; and -0.92 for Spain. The latter is a surprisingly large result, particularly in light of the more recent analysis of Bover et al., 2017.

but it is not possible to separate out these components due to the limited price data available. Comparison with other studies is difficult for such an amalgamated grouping. That said, the IFS (2011a) case studies for Belgium, France, Germany, Spain and the UK have broadly similar "leisure" groupings, finding widely varying elasticity estimates of -0.21, -1.2, -1.68, -1.07 and -0.50, respectively. Meanwhile, Bover et al. (2017) find an elasticity of -2.253 for their "leisure and culture" grouping for Spain, and Abramovsky et al. (2015) find an elasticity of -2.09 for "leisure and hotel services" in Mexico.

Another grouping issue arises with alcohol and tobacco which is found to be slightly inelastic. Tobacco – given its addictive qualities – may be expected to be less price responsive than alcohol, but it was not possible to separate the two in the analysis. That said, Bover et al. (2017) – who are able to separate the two categories in their Spanish data – find similar price elasticities of -0.933 and -0.833 for alcohol and tobacco, respectively.

The most price-responsive grouping is "other personal expenditure", while the "household utilities, communication and education" grouping and the transport grouping are also elastic. The influence of private education on the second grouping may explain to some extent the elastic result. Again, comparison with results for similar groupings in other countries are difficult to make, but where it is possible, results tend to vary significantly (for example, own-price elasticity estimates for the transport categories in the IFS, 2011a, case studies for Belgium and Germany are -0.22 and -0.41; -0.76 for "cars and transport" in France, and -1.02 for "private transport" in the United Kingdom). In contrast to the general transport grouping, transport fuels are found to be inelastic (a similar finding was made by Bover et al., 2017, for Spain). This is unsurprising given New Zealand's high dependence on private transport.[120] In their New Zealand studies, Michelini (1999) and Khaled and Lattimore (2006, 2008) include a single broad transport grouping that includes transport fuels, and each find demand to be inelastic.

While expenditure elasticities are all statistically significantly different from zero, the majority of own-price elasticities are not. This is a consequence of the limited price variation. The "household utilities, communication and education" grouping, which increased price variation using household-specific expenditure weights, is statistically significant. But, as mentioned, a greater reliance on this source of price variation carried with it the risk of conflation of quality effects with price effects.

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[120] New Zealand had the seventh highest rate of passenger vehicle ownership out of 171 countries considered in World Bank (2011)

Uncompensated own-price elasticities are higher (in absolute value terms) than compensated own-price elasticities. This is because the income effect – which is captured only in the uncompensated elasticities – reinforces the price effect, thereby increasing responsiveness to a price change.

7.4.2. Cross-price elasticities

Cross-price elasticities (evaluated, again, at the means of all the variables) are presented in Tables 7.2 and 7.3. In general, groupings are far less responsive to changes in other prices than their own. However, there are a number of expenditure group pairings with large cross-price elasticities and where at least one is statistically significantly different from zero (although, in general, results again tend not to be statistically significant). For example, the results show "recreation and culture" and "clothing and footwear" to be strong complements, with large negative cross-price elasticities, meaning that increases in the price of one will strongly reduce consumption of the other.

Transport and healthcare are also shown to be strong complements (with large negative cross-price elasticities), whereas transport fuels and healthcare are substitutes (with large positive cross-price elasticities). Transport and other personal expenditure are substitutes, while transport fuels and other personal expenditure are complements. Transport and transport fuels are unsurprisingly substitutes, though estimates are not statistically significant. Transport and food are also complements, while clothing and other personal expenditure are substitutes.

In general, patterns are very similar for both compensated and uncompensated elasticities. However, both the other personal expenditure and clothing groupings are complements with the "household utilities, communication and education" group in Table 7.2, but substitutes according to Table 7.3. The difference in signs between the uncompensated and compensated elasticity results highlights the impact of the income effect on the results (which is only captured in the uncompensated results).

Overall, the magnitude of some of the cross-price elasticity estimates, and the general lack of statistical significance of these as well as the majority of own-price elasticity estimates, casts some doubt on their reliability. This is particularly the case in light of the limited price variation available in the data and highlights the need for some caution in interpreting the results.

Table 7.2. Uncompensated cross-price elasticities

	1. Food and non-alcoholic beverages	2. Alcohol and tobacco	3. Clothing and footwear	4. Healthcare	5. Transport (excluding transport fuels)	6. Transport fuels	7. Recreation and culture	8. Other non-durable personal expenditure	9. Household utilities, comms & education
1. Food and non-alcoholic beverages	-0.566**	0.027	0.034	0.091	-0.316	-0.094	0.109	-0.245	0.183***
2. Alcohol and tobacco	0.062	-0.951	-0.067	0.212	0.083	-0.141	0.227	-0.658	0.089
3. Clothing and footwear	0.004	-0.106	-0.632	0.114	-1.151	-0.244	-2.594	3.080	-0.139
4. Healthcare	0.589	0.253	0.130	-0.711	-3.400*	1.109*	0.473	0.113	0.284
5. Transport (excluding transport fuels)	-1.528*	0.038	-0.601	-1.853	-1.474	0.690	-0.504	3.397	0.351***
6. Transport fuels	-0.385	-0.072	-0.092	0.597	0.720	-0.613*	-0.090	-1.247	0.393***
7. Recreation and culture	0.248	0.133	-1.379*	0.246	-0.510	-0.145	-0.535	0.148	0.308***
8. Other non-durable personal expenditure	-0.689*	-0.222	0.813*	0.021	1.682**	-0.678**	0.079	-2.339*	-0.061
9. Household utilities, communication and education	0.302	0.044	0.015	0.072	0.179	0.148	0.163	0.072	-1.612***

Notes. Elasticity estimates from Quadratic Almost Ideal Demand System, evaluated at the means of the variables.
* p<0.05, ** p<0.01, *** p<0.001

Table 7.3. Compensated cross-price elasticities

	1. Food and non-alcoholic beverages	2. Alcohol and tobacco	3. Clothing and footwear	4. Healthcare	5. Transport (excluding transport fuels)	6. Transport fuels	7. Recreation and culture	8. Other non-durable personal expenditure	9. Household utilities, comms & education
1. Food and non-alcoholic beverages	-0.333	0.063	0.064	0.122	-0.260	-0.037	0.164	-0.132	0.350***
2. Alcohol and tobacco	0.404	-0.898	-0.023	0.257	0.165	-0.057	0.308	-0.492	0.335*
3. Clothing and footwear	0.503	-0.029	-0.568	0.179	-1.031	-0.121	-2.475	3.323	0.220
4. Healthcare	0.936	0.307	0.174	-0.666	-3.317*	1.195*	0.555	0.282	0.534***
5. Transport (excluding transport fuels)	-1.084	0.107	-0.545	-1.796	-1.368	0.800*	-0.399	3.613	0.670***
6. Transport fuels	-0.149	-0.036	-0.062	0.628	0.777	-0.555	-0.034	-1.132	0.563***
7. Recreation and culture	0.692	0.202	-1.322*	0.304	-0.404	-0.035	-0.430	0.365	0.628***
8. Other non-durable personal expenditure	-0.272	-0.157	0.866*	0.075	1.782***	-0.575**	0.178	-2.137	0.239***
9. Household utilities, communication and education	0.486	0.072	0.039	0.096	0.223	0.193	0.207	0.162	-1.479***

Notes. Elasticity estimates from Quadratic Almost Ideal Demand System, evaluated at the means of the variables.
* p<0.05, ** p<0.01, *** p<0.001

7.5. Simulated reforms

In contrast to New Zealand's "broad-base single-rate" GST structure, most other OECD countries – as illustrated in previous chapters – have multi-rate systems that apply reduced rates to a selection of goods and services. The most common reason for these concessionary rates is to provide support to poorer households – hence a significant number of OECD countries apply reduced rates to food and other items that typically make up a greater proportion of poorer households' total budgets. That said, reduced rates are often also introduced to support social, cultural and employment-related goals.

This section uses the estimated QUAIDS model to investigate the distributional effects of a move to a multi-rate GST system in New Zealand and, in particular, whether the introduction of reduced GST rates is a more effective way of providing support to poorer households than the current use of targeted tax credits. By using the QUAIDS model, the behavioural responses induced by the consequent price changes are taken into account. While the demand system was estimated using data from the four most recent household economic surveys, the simulations in this section are based on just the most recent data available (2015-16).

Two reform scenarios are considered. The first reform examines who benefits from reduced rates. This reform scenario simply introduces reduced GST rates of 7.5% on two of the nine non-durable expenditure groups from the QUAIDS model: "food and beverages" and "recreation and culture". These groupings include all food (including restaurant food), newspapers, books, magazines, cinema, theatre, concerts, hotels and other accommodation services. As such, the reform covers eight of the 11 most common expenditure groups to be taxed at reduced rates in OECD countries (see Figure 2.1).[121] The standard GST rate on other expenditure remains unchanged at 15%, so the reform is revenue negative.

It would also have been informative to separately examine the effects of a reduced GST rate on different types of food, for example, food consumed in the home vs food consumed outside the home (e.g. restaurant food), and on different types of recreation and cultural activities. However, the available groupings of the QUAIDS model preclude this.

The second reform examines whether reduced GST rates would better support the poor than existing income-tested support. New Zealand's current approach is to apply a broad-based single-rate GST and rely on income-targeted cash transfer payments to provide support to poorer households. The Working for Families (WFF) tax credit package is a prime example. The largest component of this package is the

[121] The exceptions being pharmaceuticals, water supply and passenger transport.

family tax credit which provides income-tested support to families with children. The second reform simulates the removal of a simplified version of the family tax credit and replacement with reduced GST rates on the same two expenditure groupings as above. To ensure revenue neutrality, the reform requires a reduction in the GST rate on the two expenditure groupings from 15% to 10.46%. In the revenue-neutral calculation, it is assumed that expenditure (and hence GST revenue) is reduced by the lost amount of the tax credit (proportionately with the post-reform budget shares).

In 2015-16, the family tax credit had a relatively complicated design, with the amounts payable depending on both the number and age of children, and with higher amounts provided for the first child and for older children.[122] The simplified version modelled in this chapter provides NZD 4,822 for the first child under 16 and NZD 3,351 for the second and subsequent children (under 16), with the amount withdrawn at 21.25 cents for every dollar of household income above NZD 36,350. The simplified credit is intended as illustrative, and will underestimate eligibility for the family tax credit. In addition to the simplified payment structure, the income testing is also based on household income, whereas the targeting of the WFF package is based on family income. As noted in Chapter 6, this may have a particular impact on eligibility of families living in large households (that comprise more than one family).

More generally, the revenue neutrality of the reform should only be considered approximate. As discussed in Chapter 3, the microsimulation model underestimates total GST revenue, and hence is likely to underestimate the revenue cost of reducing GST rates. As such, for a given revenue gain from removal of the modelled tax credit (as opposed to the actual family tax credit), the benefit to households from the reduced GST rates can be expected to be lower than that modelled (as the actual revenue-neutral reduced GST rate may be slightly higher than that modelled). This suggests that the results can be treated as an upper bound of the gain (or lower bound of any loss) from a shift from a targeted child tax credit to reduced GST rates.

For the first reform, two indicators are calculated for each household: the change in tax paid, and the money-metric welfare change as measured by the compensating variation (CV). For the second reform, two analogous indicators are calculated: the financial gain or loss from the reform (calculated as the

[122] In 2015-16, the family tax credit provided an amount of NZD 5,303 for the eldest child if aged 16-18 or NZD 4,822 if younger than 16. A further amount was paid per additional child as follows: NZD 4,745 if aged 16-18; NZD 3,822 if aged 13-15; and NZD 3,351 if younger than 13. The total credit amount (including other amounts provided under the WFF package) was withdrawn at a rate of 21.25 cents for every dollar of family income above NZD 36,350. The credit was refundable, so that if it exceeded tax due the unutilised amount was paid out to the family. Note that subsequent reforms have simplified the payment structure as of 2017. The modelling effectively assumes the first child in the family is aged under 16, and the second and subsequent children are aged under 13.

reduction in GST paid minus the cash transfer lost), and the money-metric welfare gain or loss (calculated as the negative of the compensating variation minus the cash transfer lost). While the CV can be calculated directly from the demand system (as per equation (9)), the demand system must be incorporated into a consumption tax microsimulation model to calculate the change in tax paid and the cash transfer.

The QUAIDS model provides the basic input into the microsimulation model in the form of the predicted pre- and post-reform budget shares for the nine non-durable expenditure groups for each household. Total expenditure is assumed to remain unchanged, so it is only the budget shares that change. The predicted pre-reform budget shares are used rather than the actual budget shares from the microdata to avoid "ascribing deviations from the model to effects of the tax reform" (Capéau et al., 2014, p242). Post-reform budget shares are calculated under the assumption that the tax rate changes are fully passed on to the consumer in prices (this is also assumed for the CV calculations).[123] In addition to the nine non-durable expenditure groups, two durable expenditure groups (taxed and non-taxed durables) are included in the microsimulation model, with durable expenditure assumed to remain constant across all scenarios.

The microsimulation model allocates the applicable pre- and post-reform GST rates to the 11 expenditure groupings and then calculates the tax paid in each scenario. GST rates for the pre-reform scenario are those for the 2015-16 tax year. Despite the restricted number of expenditure groupings in the QUAIDS model, there is minimal loss of precision in modelling the pre-reform GST rate structure thanks to its broad-based design. Where multiple rates do apply within an expenditure grouping, a weighted GST rate is applied based on the average expenditure proportions in the sample. The most significant example is the "other personal expenditure" grouping which includes exempted financial services.[124]

The underlying tax, CV and cash transfer calculations are made per household and are then weighted up to the population using household survey weights. Average results are presented across equivalised disposable income and expenditure deciles. In each case, results are presented for the entire population and separately for both winners and losers from each reform (although in the case of reform 1, where tax rates only fall, there are only winners). As in previous chapters, the unit of analysis adopted is the

[123] This is a standard assumption in the empirical literature. See Chapter 3 for further discussion.

[124] As in previous chapters, for practical reasons exemptions are treated as zero-rates. This overlooks the likely presence of some tax embedded in the supply chain (due to the inability to claim input tax credits for exempt goods). The model consequently underestimates the amount of tax currently collected from exempt goods. See Chapter 3 for further discussion.

individual, and equivalisation is undertaken using the parametric equivalence scale $m_i = (n_{a,i} + \theta n_{c,i})^{\alpha}$ with $\theta = 0.5$ and $\alpha = 0.7$.

To complement these decile averages, the set of summary indicators introduced in Chapter 3 are also presented: the Kakwani progressivity index; two redistributive measures – the Reynolds-Smolensky index and the change in the Atkinson inequality index (evaluated at three levels of inequality aversion: $\varepsilon = 0.2, 0.7$ and 1.2); and the three Foster-Greer-Thorbecke (FGT) poverty indices.

7.5.1. Reform 1

Tables 7.4 and 7.5 present results for reform 1 measured in terms of the change in tax paid, across equivalised disposable income and expenditure deciles, respectively.[125] As the reform only involves a reduction in tax rates, there are no losers from the reform. Considering first the results measured as a percentage of expenditure, reform 1 is shown to benefit the poor proportionately more than the rich, across both income and expenditure deciles.[126] This is because poorer households spend a greater proportion of their total expenditure on reduced-rated goods than richer households do.

However, looking at the average gain amounts shows that the rich benefit substantially more than the poor in absolute dollar terms. Indeed, the average gains of the top income and expenditure deciles are around three and six-and-a-half times the gains of the bottom deciles. These results are driven by the fact that richer households simply spend more in absolute terms than the poor, and thereby save more tax from the reduction in the GST rates. This illustrates the poorly targeted nature of the GST system as a tool for supporting poorer households.

The results (and patterns of results) across both income and expenditure deciles are very similar. However, the income decile results are slightly more compressed – with higher gains at bottom deciles and lower gains at top deciles. This is due to savings patterns. Bottom income decile households tend to be net borrowers, spending comparatively more than bottom expenditure decile households, and thereby benefiting more from the reduction in GST rates. Meanwhile, top income decile households tend to be net savers, spending comparatively less than top expenditure decile households, so benefiting less from the rate reduction.

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[125] Note that some minor variation occurs in the estimated number of individuals within each decile due to the need to allocate unweighted household observations that overlap the boundary between two deciles into one.

[126] When distinguishing between "poor" and "rich" based on data for a single year, a case can be made for ranking by either expenditure or income. As such, results are presented across both income and expenditure deciles. However, proportional results, whether across income or expenditure deciles, are calculated as a percentage of expenditure to avoid the misleading impact of savings behaviour. See Chapter 3 for further discussion.

Table 7.4. Gain/loss in dollar terms from reform 1 across income deciles

Income decile	Total: Number of individuals	Total: Average gain or loss	Total: % of expenditure	Winners: Number of individuals	Winners: Average gain	Winners: % of expenditure	Losers: Number of individuals	Losers: Average loss	Losers: % of expenditure
1	450,000	601	2.038%	450,000	601	2.038%	0	-	-
2	449,000	609	1.934%	449,000	609	1.934%	0	-	-
3	450,000	832	2.040%	450,000	832	2.040%	0	-	-
4	448,000	828	1.950%	448,000	828	1.950%	0	-	-
5	450,000	967	1.983%	450,000	967	1.983%	0	-	-
6	450,000	1,041	1.836%	450,000	1,041	1.836%	0	-	-
7	448,000	1,097	1.835%	448,000	1,097	1.835%	0	-	-
8	450,000	1,179	1.856%	450,000	1,179	1.856%	0	-	-
9	448,000	1,257	1.759%	448,000	1,257	1.759%	0	-	-
10	448,000	1,795	1.687%	448,000	1,795	1.687%	0	-	-

Notes. Results calculated using behavioural microsimulation model based on HES microdata. Number of individuals rounded to the nearest thousand to comply with HES confidentiality rules. "Average gain or loss" results present the weighted mean of the financial gain per household. "% of expenditure" results present the weighted mean of the financial gain as a percentage of total expenditure per household. Results presented across equivalised income deciles, with the individual as unit of analysis. See text for further detail.

Table 7.5. Gain/loss in dollar terms from reform 1 across expenditure deciles

Expenditure decile	Total: Number of individuals	Total: Average gain or loss	Total: % of expenditure	Winners: Number of individuals	Winners: Average gain	Winners: % of expenditure	Losers: Number of individuals	Losers: Average loss	Losers: % of expenditure
1	449,000	320	2.104%	449,000	320	2.104%	0	-	-
2	449,000	534	2.057%	449,000	534	2.057%	0	-	-
3	453,000	647	2.023%	453,000	647	2.023%	0	-	-
4	447,000	787	1.998%	447,000	787	1.998%	0	-	-
5	448,000	888	1.940%	448,000	888	1.940%	0	-	-
6	449,000	1,042	1.934%	449,000	1,042	1.934%	0	-	-
7	449,000	1,114	1.858%	449,000	1,114	1.858%	0	-	-
8	449,000	1,279	1.782%	449,000	1,279	1.782%	0	-	-
9	451,000	1,500	1.725%	451,000	1,500	1.725%	0	-	-
10	446,000	2,099	1.496%	446,000	2,099	1.496%	0	-	-

Notes. Results calculated using behavioural microsimulation model based on HES microdata. Number of individuals rounded to the nearest thousand to comply with HES confidentiality rules. "Average gain or loss" results present the weighted mean of the financial gain per household. "% of expenditure" results present the weighted mean of the financial gain as a percentage of total expenditure per household. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

Tables 7.6 and 7.7 present results for reform 1 measured in terms of the compensating variation (CV) across equivalised disposable income and expenditure deciles. As in Chapter 5, welfare gains are presented as positive numbers to aid comparison with the dollar gain (change in tax paid) results.[127] A similar pattern is found in these results as in the tax change results in Tables 7.4 and 7.5. The welfare gains to poorer households are proportionately greater than for richer households, whereas the aggregate welfare gains are greater for richer households. The welfare gains are always slightly greater in magnitude than the change in tax results. As highlighted in previous chapters, this is due to the additional impact of the tax-induced behavioural change on welfare. Furthermore, the difference increases for richer households – highlighting their greater ability to adjust behaviour in response to a price change. Results are again more compressed across income as compared to expenditure deciles.

[127] Technically, a negative compensating variation reflects a welfare gain as it shows the amount of money that would need to be given to a household post-reform in order to maintain their pre-reform utility level. For presentational purposes, however, these welfare gains are presented as positive numbers.

Table 7.6. Gain/loss in money metric welfare terms from reform 1 across income deciles

	Total			Winners			Losers		
Income decile	Number of individuals	Average CV	% of expenditure	Number of individuals	Average CV	% of expenditure	Number of individuals	Average CV	% of expenditure
1	450,000	662	2.279%	450,000	662	2.279%	0	-	-
2	449,000	672	2.177%	449,000	672	2.177%	0	-	-
3	450,000	917	2.279%	450,000	917	2.279%	0	-	-
4	448,000	920	2.193%	448,000	920	2.193%	0	-	-
5	450,000	1,072	2.222%	450,000	1,072	2.222%	0	-	-
6	450,000	1,152	2.050%	450,000	1,152	2.050%	0	-	-
7	448,000	1,214	2.048%	448,000	1,214	2.048%	0	-	-
8	450,000	1,306	2.075%	450,000	1,306	2.075%	0	-	-
9	448,000	1,394	1.975%	448,000	1,394	1.975%	0	-	-
10	448,000	1,978	1.881%	448,000	1,978	1.881%	0	-	-

Notes. Results calculated using behavioural microsimulation model based on HES microdata. Number of individuals rounded to the nearest thousand to comply with HES confidentiality rules. “Average CV” results present the weighted mean of the compensating variation (CV) per household. “% of expenditure” results present the weighted mean of the CV as a percentage of total expenditure per household. To aid comparison with the dollar gain results, CV results are presented with positive values reflecting welfare gains. Results presented across equivalised income deciles, with the individual as unit of analysis. See text for further detail.

Table 7.7. Gain/loss in money metric welfare terms from reform 1 across expenditure deciles

	Total			Winners			Losers		
Expenditure decile	Number of individuals	Average CV	% of expenditure	Number of individuals	Average CV	% of expenditure	Number of individuals	Average CV	% of expenditure
1	449,000	371	2.465%	449,000	371	2.465%	0	-	-
2	449,000	606	2.338%	449,000	606	2.338%	0	-	-
3	453,000	729	2.282%	453,000	729	2.282%	0	-	-
4	447,000	882	2.241%	447,000	882	2.241%	0	-	-
5	448,000	989	2.164%	448,000	989	2.164%	0	-	-
6	449,000	1,159	2.151%	449,000	1,159	2.151%	0	-	-
7	449,000	1,236	2.063%	449,000	1,236	2.063%	0	-	-
8	449,000	1,412	1.967%	449,000	1,412	1.967%	0	-	-
9	451,000	1,642	1.889%	451,000	1,642	1.889%	0	-	-
10	446,000	2,264	1.618%	446,000	2,264	1.618%	0	-	-

Notes. Results calculated using behavioural microsimulation model based on HES microdata. Number of individuals rounded to the nearest thousand to comply with HES confidentiality rules. “Average CV” results present the weighted mean of the compensating variation (CV) per household. “% of expenditure” results present the weighted mean of the CV as a percentage of total expenditure per household. To aid comparison with the dollar gain results, CV results are presented with positive values reflecting welfare gains. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

Tables 7.8-7.11 provide additional detail on this reform by presenting results separately for the two expenditure groups subject to reduced rates. The change in tax results in Tables 7.8 and 7.9 show that the reduced rate on food and beverages provides a greater proportional benefit to poorer households than richer households, but a greater aggregate benefit to richer households. In contrast, the reduced rate on recreation and culture provides a greater benefit to richer households both in aggregate and proportional terms. That is, while the reduced rate on food and beverages has a small progressive effect, the reduced rate on recreation and culture has a regressive effect. Overall, though, the significantly greater budget share devoted to food and beverages means that the progressive impact of the reduced rate on food and beverages outweighs the regressive impact of the reduced rate on recreation and culture.[128]

Table 7.8. Gain/loss in dollar terms from reform 1 for different expenditure groups across income deciles

	Total			Food and non-alcoholic beverages			Recreation and cultural activities		
Income decile	Number of individuals	Average gain	% of expenditure	Number of individuals	Average gain	% of expenditure	Number of individuals	Average gain	% of expenditure
1	450,000	605	2.057%	450,000	512	1.778%	450,000	93	0.278%
2	449,000	613	1.953%	449,000	502	1.632%	449,000	111	0.321%
3	450,000	838	2.056%	450,000	681	1.713%	450,000	157	0.343%
4	448,000	834	1.965%	448,000	675	1.635%	448,000	159	0.330%
5	450,000	974	1.998%	450,000	777	1.636%	450,000	197	0.361%
6	450,000	1,048	1.850%	450,000	822	1.483%	450,000	225	0.367%
7	448,000	1,105	1.849%	448,000	847	1.455%	448,000	258	0.394%
8	450,000	1,187	1.870%	450,000	892	1.442%	450,000	295	0.428%
9	448,000	1,265	1.772%	448,000	916	1.338%	448,000	349	0.434%
10	448,000	1,805	1.698%	448,000	1,203	1.182%	448,000	603	0.516%

Notes. Results calculated using behavioural microsimulation model based on HES microdata. Number of individuals rounded to the nearest thousand to comply with HES confidentiality rules. "Average gain" results present the weighted mean of the financial gain per household. "% of expenditure" results present the weighted mean of the financial gain as a percentage of total expenditure per household. Results presented across equivalised income deciles, with the individual as unit of analysis. See text for further detail.

Table 7.9. Gain/loss in dollar terms from reform 1 for different expenditure groups across expenditure deciles

	Total			Food and non-alcoholic beverages			Recreation and cultural activities		
Expenditure decile	Number of individuals	Average gain	% of expenditure	Number of individuals	Average gain	% of expenditure	Number of individuals	Average gain	% of expenditure
1	449,000	324	2.128%	449,000	292	1.919%	449,000	32	0.209%
2	449,000	538	2.075%	449,000	470	1.804%	449,000	68	0.271%
3	453,000	652	2.040%	453,000	549	1.714%	453,000	102	0.326%
4	447,000	793	2.013%	447,000	656	1.662%	447,000	137	0.352%
5	448,000	894	1.955%	448,000	723	1.582%	448,000	171	0.373%
6	449,000	1,049	1.947%	449,000	835	1.548%	449,000	214	0.400%
7	449,000	1,121	1.871%	449,000	869	1.451%	449,000	252	0.420%
8	449,000	1,287	1.794%	449,000	976	1.359%	449,000	311	0.435%
9	451,000	1,509	1.736%	451,000	1,092	1.259%	451,000	418	0.478%
10	446,000	2,111	1.505%	446,000	1,367	0.997%	446,000	744	0.508%

Notes. Results calculated using behavioural microsimulation model based on HES microdata. Number of individuals rounded to the nearest thousand to comply with HES confidentiality rules. "Average gain" results present the weighted mean of the financial gain per household. "% of expenditure" results present the weighted mean of the financial gain as a percentage of total expenditure per household. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

The welfare change results in Tables 7.10 and 7.11 show the same pattern of results, though the welfare changes are once again always slightly greater in magnitude than the change in tax results. As before, all results are more compressed across income deciles compared to expenditure deciles.

[128] The total gains reported in Tables 7.8 and 7.9 from reduced rates on food/beverages and recreation/culture are slightly different to those presented for the overall reform in Tables 7.4 and 7.5. This is because the simulations for Tables 7.8 and 7.9 are undertaken separately for each expenditure group (thereby enabling welfare results to also be calculated). Additionally, the overall reform results in Table 7.4 and 7.5 capture some additional revenue generated as a result of a shift in some consumption away from reduced-rated goods towards standard-rated goods in response to the change in relative prices. Minimal difference occurs if results are calculated for each expenditure group under the combined reform, and does not change the conclusions of the analysis in any way.

Table 7.10. Gain/loss in money metric welfare terms from reform 1 for different expenditure groups across income deciles

	Total			Food and non-alcoholic beverages			Recreation and cultural activities		
Income decile	Number of individuals	Average CV	% of expenditure	Number of individuals	Average CV	% of expenditure	Number of individuals	Average CV	% of expenditure
1	450,000	667	2.298%	450,000	561	1.982%	450,000	106	0.315%
2	449,000	678	2.196%	449,000	552	1.835%	449,000	126	0.361%
3	450,000	924	2.297%	450,000	746	1.910%	450,000	178	0.387%
4	448,000	927	2.210%	448,000	747	1.839%	448,000	180	0.371%
5	450,000	1,080	2.240%	450,000	858	1.833%	450,000	222	0.407%
6	450,000	1,161	2.067%	450,000	906	1.653%	450,000	255	0.414%
7	448,000	1,224	2.065%	448,000	933	1.622%	448,000	291	0.443%
8	450,000	1,317	2.092%	450,000	985	1.611%	450,000	332	0.481%
9	448,000	1,405	1.991%	448,000	1,012	1.504%	448,000	393	0.487%
10	448,000	1,993	1.895%	448,000	1,315	1.316%	448,000	678	0.579%

Notes. Results calculated using behavioural microsimulation model based on HES microdata. Number of individuals rounded to the nearest thousand to comply with HES confidentiality rules. "Average CV" results present the weighted mean of the compensating variation (CV) per household. "% of expenditure" results present the weighted mean of the CV as a percentage of total expenditure per household. To aid comparison with the dollar gain results, CV results are presented with positive values reflecting welfare gains. Results presented across equivalised income deciles, with the individual as unit of analysis. See text for further detail.

Table 7.11. Gain/loss in money metric welfare terms from reform 1 for different expenditure groups across expenditure deciles

	Total			Food and non-alcoholic beverages			Recreation and cultural activities		
Expenditure decile	Number of individuals	Average CV	% of expenditure	Number of individuals	Average CV	% of expenditure	Number of individuals	Average CV	% of expenditure
1	449,000	374	2.485%	449,000	339	2.256%	449,000	35	0.229%
2	449,000	610	2.356%	449,000	534	2.052%	449,000	76	0.304%
3	453,000	735	2.301%	453,000	620	1.935%	453,000	115	0.366%
4	447,000	889	2.259%	447,000	736	1.863%	447,000	154	0.396%
5	448,000	997	2.181%	448,000	803	1.760%	448,000	193	0.421%
6	449,000	1,168	2.168%	449,000	927	1.718%	449,000	241	0.451%
7	449,000	1,246	2.079%	449,000	963	1.606%	449,000	284	0.474%
8	449,000	1,424	1.983%	449,000	1,072	1.492%	449,000	351	0.491%
9	451,000	1,655	1.905%	451,000	1,183	1.365%	451,000	472	0.540%
10	446,000	2,281	1.631%	446,000	1,441	1.056%	446,000	840	0.574%

Notes. Results calculated using behavioural microsimulation model based on HES microdata. Number of individuals rounded to the nearest thousand to comply with HES confidentiality rules. "Average CV" results present the weighted mean of the compensating variation (CV) per household. "% of expenditure" results present the weighted mean of the CV as a percentage of total expenditure per household. To aid comparison with the dollar gain results, CV results are presented with positive values reflecting welfare gains. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

The above findings are confirmed by the progressivity and redistribution metrics presented in Tables 7.12 and 7.13.[129] Kakwani progressivity index results – both for the tax and welfare change – show that the overall tax expenditure from the reduced GST rates is progressive, and driven by the progressivity of the reduced rate on food and beverages. Meanwhile, the reduced rate on recreation and culture is regressive. The Reynolds-Smolensky redistribution index results show that the overall reform has a positive redistributive impact, reducing inequality. The (change in) Atkinson inequality index results

[129] As in Chapter 5, I follow Lambert (1985) and use the negative of the Kakwani index for taxes to measure the progressivity of the tax expenditure from reduced GST rates. As such, a progressive tax expenditure results in a positive Kakwani index, and consequently a positive Reynolds-Smolensky index. The same approach is adopted for the welfare change based calculations.

support this finding. Furthermore, the (change in) Atkinson index results are greater at higher inequality aversion levels, pointing to a clear positive impact at the bottom of the expenditure distribution. The results also confirm that the reduced rate on food and beverages reduces inequality, while the reduced rate on recreation and culture increases inequality.

Comparing the magnitudes of the tax and welfare change results shows the welfare change results to be less progressive (and more regressive in the case of recreation and culture) than the tax results. This is consistent with the disproportionately greater welfare gains than tax reductions for richer households found in the decile results above. The overall welfare change results also show slightly less redistribution than the change in tax results, although the redistributive impact of the reduced rate on food is slightly greater as a result of the higher aggregate concession amounts.

More generally, the magnitudes of the results suggest that, while the reduced rates produce a moderate degree of progressivity overall (and comparable to some income tax systems), the degree of redistribution achieved is very low.[130] The degree of redistribution could be increased by lowering the GST rate further from 7.5% to zero. However, as the results for 23 countries in Chapter 5 show, the degree of redistribution would remain vastly lower than that achievable through the personal income tax.

Table 7.12. Progressivity and redistribution metrics for reform 1 in financial terms

		Total	Food and non-alcoholic beverages	Recreation and cultural activities
Kakwani		0.0575	0.1069	-0.0956
R-S		0.0011	0.0016	-0.0005
Δ Atkn	ε=0.2	0.0003	0.0004	-0.0001
	ε=0.7	0.0008	0.0012	-0.0004
	ε=1.2	0.0012	0.0018	-0.0006

Notes. Results calculated using behavioural microsimulation model based on HES microdata. Kakwani = Kakwani progressivity index; R-S = Reynolds-Smolensky redistribution index; Δ Atkn = change in Atkinson inequality index, with ε = degree of inequality aversion. Results calculated in relation to the financial gain, using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

Table 7.13. Progressivity and redistribution metrics for reform 1 in money metric welfare terms

		Total	Food and non-alcoholic beverages	Recreation and cultural activities
Kakwani		0.0350	0.0916	-0.1375
R-S		0.0009	0.0017	-0.0008
Δ Atkn	ε=0.2	0.0002	0.0004	-0.0002
	ε=0.7	0.0006	0.0012	-0.0006
	ε=1.2	0.0009	0.0019	-0.0009

Notes. Results calculated using behavioural microsimulation model based on HES microdata. Kakwani = Kakwani progressivity index; R-S = Reynolds-Smolensky redistribution index; Δ Atkn = change in Atkinson inequality index, with ε = degree of inequality aversion. Results calculated in relation to the compensating variation, using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

[130] Recall from Chapter 3 that Joumard et al. (2012) and Causa and Hermansen (2017) found Kakwani indices of between 0.05 and 0.25, and 0.1 and 0.25, for personal income taxes in 27 of 30, and 13 of 15, OECD countries, respectively. They found Reynolds-Smolensky indices greater than 0.01 for personal income taxes in 28 of 30 countries, and 14 of 15 countries.

7.5.2. Reform 2

Tables 7.14 and 7.15 present results for reform 2 measured in terms of the average financial gain or loss, across equivalised disposable income and expenditure deciles, respectively. Results are presented in total, and separately for the winners and losers from the reform. The overall results show that, on average, poor households lose from the reform, while rich households gain. This illustrates that the income-tested family tax credit is far better targeted at poorer households than the reduced GST rates that have replaced the credit in this reform.

On average, households in the bottom four income deciles and five expenditure deciles lose from the reform, while higher decile households gain. Households in the bottom income and expenditure deciles are shown to be particularly hard hit by the reform. On average, households in the bottom and second income decile face a loss equal to 9% and 14% of (non-housing) expenditure. Meanwhile, bottom expenditure decile households face a loss equal to 23% of (non-housing) expenditure.[131]

The separate results for winners and losers provide further nuance. In the very bottom income and expenditure deciles, around 64% and 58% of individuals actually gain from the reform. This is driven by the eligibility conditions for the family tax credit. As the simplified credit is only available for families with children aged under 16, other households gain from the reform (they benefit from the reduced GST rates, but have no tax credit to lose).[132] Meanwhile, households with children in the bottom income and expenditure deciles lose significantly from the reform because they previously received the maximum possible credit amounts, and the small gain from the reduced GST rates is nowhere near enough to compensate for the loss of the tax credit. The result is most extreme for the bottom expenditure decile where losers from the reform face an average loss equal to 56% of (non-housing) expenditure.

[131] A significant number of households in the bottom expenditure decile feature in the second income decile, resulting in higher losses measured as a percentage of expenditure in the second income decile than in the bottom income decile (though less in aggregate terms).

[132] Additionally, a small number of bottom expenditure decile households with children aged under 16 have income levels high enough to restrict their eligibility to the family tax credit.

Table 7.14. **Gain/loss in dollar terms from reform 2 across income deciles**

	Total			Winners			Losers		
Income decile	Number of individuals	Average gain or loss	% of expenditure	Number of individuals	Average gain	% of expenditure	Number of individuals	Average loss	% of expenditure
1	450,000	-1,994	-9.216%	287,000	269	0.977%	162,000	-6,000	-27.259%
2	449,000	-1,767	-14.088%	301,000	304	0.921%	147,000	-5,999	-44.762%
3	450,000	-1,252	-6.087%	271,000	435	0.966%	178,000	-3,815	-16.806%
4	448,000	-424	-2.949%	329,000	414	0.901%	119,000	-2,738	-13.576%
5	450,000	327	0.280%	427,000	476	0.963%	23,000	[supr]	[supr]
6	450,000	478	0.786%	438,000	520	0.905%	12,000	[supr]	[supr]
7	448,000	541	0.905%	448,000	541	0.905%	0	-	-
8	450,000	582	0.916%	450,000	582	0.916%	0	-	-
9	448,000	621	0.868%	448,000	621	0.868%	0	-	-
10	448,000	888	0.834%	448,000	888	0.834%	0	-	-

Notes. Results calculated using behavioural microsimulation model based on HES microdata. Number of individuals rounded to the nearest thousand, and results based on less than 30 observations suppressed, to comply with HES confidentiality rules. "Average gain or loss" results present the weighted mean of the financial gain/loss per household. "% of expenditure" results present the weighted mean of the financial gain/loss as a percentage of total expenditure per household. Financial gain/loss calculated as the reduction in GST paid minus the cash transfer lost. Results presented across equivalised income deciles, with the individual as unit of analysis. See text for further detail.

Table 7.15. Gain/loss in dollar terms from reform 2 across expenditure deciles

	Total			Winners			Losers		
Expenditure decile	Number of individuals	Average gain or loss	% of expenditure	Number of individuals	Average gain	% of expenditure	Number of individuals	Average loss	% of expenditure
1	449,000	-2,330	-23.000%	260,000	155	1.000%	189,000	-5,735	-55.893%
2	449,000	-1,211	-4.713%	320,000	243	0.990%	129,000	-4,832	-18.911%
3	453,000	-683	-2.117%	329,000	302	0.967%	124,000	-3,307	-10.335%
4	447,000	-336	-0.809%	380,000	381	0.974%	67,000	-4,400	-10.920%
5	448,000	-107	-0.190%	396,000	427	0.939%	52,000	-4,215	-8.861%
6	449,000	239	0.437%	419,000	510	0.950%	30,000	[supr]	[supr]
7	449,000	346	0.585%	428,000	545	0.912%	21,000	[supr]	[supr]
8	449,000	410	0.582%	428,000	625	0.875%	22,000	[supr]	[supr]
9	451,000	709	0.817%	446,000	740	0.852%	5,000	[supr]	[supr]
10	446,000	967	0.673%	440,000	1,040	0.738%	6,000	[supr]	[supr]

Notes. Results calculated using behavioural microsimulation model based on HES microdata. Number of individuals rounded to the nearest thousand, and results based on less than 30 observations suppressed, to comply with HES confidentiality rules. "Average gain or loss" results present the weighted mean of the financial gain/loss per household. "% of expenditure" results present the weighted mean of the financial gain/loss as a percentage of total expenditure per household. Financial gain/loss calculated as the reduction in GST paid minus the cash transfer lost. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

In contrast, there are no losers in the top four income deciles, and very few losers in higher expenditure deciles. This highlights the effectiveness of the income-based targeting of the family tax credit. As high income households were not eligible for the family tax credit, they only gain from the reform due to the reduced GST rates.[133] Furthermore, as shown in reform 1, the gain from the reduced rate increases in aggregate terms for richer households. Meanwhile, the small number of losers in higher expenditure deciles are households that feature in lower income deciles so still have some reduced eligibility to the family tax credit.

[133] A small number of large households in higher deciles still benefit from a reduced family tax credit amount, but the loss of this reduced amount is outweighed by the gain from the reduced GST rates.

The welfare change results presented in Tables 7.16 and 7.17 show a very similar pattern to the financial change results in Tables 7.14 and 7.15, with the bottom four income deciles and five expenditure deciles again losing from the reform, on average. The magnitudes of the welfare change results are always slightly more positive (smaller losses, larger gains) than the financial change results. This is because the welfare gain from introducing the reduced GST rates is larger than the reduction in tax paid (as it also takes account of the behavioural response), while the loss of the tax credit remains constant.

Table 7.16. Gain/loss in money metric welfare terms from reform 2 across income deciles

	Total			Winners			Losers		
Income decile	Number of individuals	Average gain or loss	% of expenditure	Number of individuals	Average gain	% of expenditure	Number of individuals	Average loss	% of expenditure
1	450,000	-1,937	-9.005%	287,000	321	1.181%	162,000	-5,935	-27.036%
2	449,000	-1,709	-13.880%	301,000	362	1.114%	147,000	-5,940	-44.525%
3	450,000	-1,173	-5.878%	271,000	517	1.166%	178,000	-3,741	-16.582%
4	448,000	-342	-2.741%	329,000	499	1.102%	119,000	-2,664	-13.346%
5	450,000	421	0.487%	428,000	570	1.165%	22,000	[supr]	[supr]
6	450,000	578	0.973%	438,000	621	1.092%	12,000	[supr]	[supr]
7	448,000	647	1.091%	448,000	647	1.091%	0	-	-
8	450,000	696	1.106%	450,000	696	1.106%	0	-	-
9	448,000	743	1.052%	448,000	743	1.052%	0	-	-
10	448,000	1,054	1.002%	448,000	1,054	1.002%	0	-	-

Notes. Results calculated using behavioural microsimulation model based on HES microdata. Number of individuals rounded to the nearest thousand, and results based on less than 30 observations suppressed, to comply with HES confidentiality rules. "Average gain or loss" results present the weighted mean of the welfare gain/loss per household. "% of expenditure" results present the weighted mean of the welfare gain/loss as a percentage of total expenditure per household. Welfare gain/loss calculated as the negative of the compensating variation minus the cash transfer lost. Results presented across equivalised income deciles, with the individual as unit of analysis. See text for further detail.

Table 7.17. Gain/loss in money metric welfare terms from reform 2 across expenditure deciles

	Total			Winners			Losers		
Expenditure decile	Number of individuals	Average gain or loss	% of expenditure	Number of individuals	Average gain	% of expenditure	Number of individuals	Average loss	% of expenditure
1	449,000	-2,289	-22.723%	260,000	196	1.275%	189,000	-5,696	-55.611%
2	449,000	-1,151	-4.481%	320,000	301	1.223%	129,000	-4,765	-18.679%
3	453,000	-613	-1.897%	329,000	370	1.187%	124,000	-3,234	-10.117%
4	447,000	-254	-0.599%	380,000	463	1.186%	67,000	-4,320	-10.725%
5	448,000	-18	0.006%	396,000	517	1.136%	52,000	-4,127	-8.672%
6	449,000	342	0.630%	419,000	615	1.144%	30,000	[supr]	[supr]
7	449,000	455	0.767%	429,000	653	1.092%	20,000	[supr]	[supr]
8	449,000	531	0.751%	428,000	747	1.044%	22,000	[supr]	[supr]
9	451,000	843	0.972%	446,000	875	1.007%	5,000	[supr]	[supr]
10	446,000	1,135	0.795%	440,000	1,209	0.861%	6,000	[supr]	[supr]

Notes. Results calculated using behavioural microsimulation model based on HES microdata. Number of individuals rounded to the nearest thousand, and results based on less than 30 observations suppressed, to comply with HES confidentiality rules. "Average gain or loss" results present the weighted mean of the welfare gain/loss per household. "% of expenditure" results present the weighted mean of the welfare gain/loss as a percentage of total expenditure per household. Welfare gain/loss calculated as the negative of the compensating variation minus the cash transfer lost. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

The above findings are confirmed by the redistribution metrics presented in Table 7.18. The negative Reynolds-Smolensky redistribution index results – for both the financial and welfare change – show that the reform has a negative redistributive impact, increasing inequality. The (change in) Atkinson inequality index results support this finding. Furthermore, the (change in) Atkinson index results are greater (in absolute value terms) at higher inequality aversion levels, pointing to a clear negative impact at the bottom of the expenditure distribution. The magnitudes of the redistributive effect are also now more significant than in reform 1. The Reynolds-Smolensky results are around 10 times the size (though opposite in effect) to the levels of reform 1, matching the levels of some personal income tax systems.[134] Atkinson results are even greater relative to those of reform 1.

Table 7.18. Redistribution metrics for reform 2

		Financial change	Welfare change
R-S		-0.0120	-0.0135
Δ Atkn	ε=0.2	-0.0024	-0.0027
	ε=0.7	-0.0112	-0.0126
	ε=1.2	-0.0264	-0.0299

Notes. Results calculated using behavioural microsimulation model based on HES microdata. R-S = Reynolds-Smolensky redistribution index; Δ Atkn = change in Atkinson inequality index, with ε = degree of inequality aversion. Results calculated using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate redistribution.

The welfare change results show a larger increase in inequality than the financial change results. This is the case for both the Reynolds-Smolensky and Atkinson index results. As with reform 1, this is because the aggregate welfare changes are slightly larger than the financial changes, and disproportionately so for richer households.

Finally, Table 7.19 presents poverty index results for reform 2. Recall from Chapter 3 that the size of the poverty index results for New Zealand are inflated due to the exclusion of housing expenditure.[135] Nevertheless, the pre- and post-reform differences show an increase in poverty as a result of the reform, whether measured by the poverty headcount index, poverty gap index or squared poverty gap index. These results show that not only does the reform increase the incidence of poverty, it increases its intensity and the degree of inequality amongst the poor.

[134] Recall again from Chapter 3 that Joumard et al. (2012) and Causa and Hermansen (2017) found Reynolds-Smolensky indices greater than 0.01 for personal income taxes in 28 of 30 countries, and 14 of 15 countries, respectively.

[135] Note that the results for the pre-reform scenario are different from the net expenditure results for New Zealand in Chapter 3. This is because the HES sample used for the QUAIDS model (see Section 7.3) in this chapter is slightly smaller than the full sample used in the non-behavioural model in Chapter 3.

Table 7.19. Poverty indices for reform 2

Poverty line = 50% of median gross expenditure

Poverty headcount			Poverty gap			Squared poverty gap		
pre	**post**	**diff**	**pre**	**post**	**diff**	**pre**	**post**	**diff**
18.7	20.0	1.3	6.0	7.5	1.5	2.8	4.3	1.5

Notes. Results calculated using behavioural microsimulation model based on HES microdata. Poverty indices expressed as percentages; pre = pre-reform index; post = post-reform index; diff = percentage point difference. Results calculated using equivalised expenditure, with the individual as unit of analysis. See text for further detail.

7.6. Conclusion

This chapter provides the first estimates of a QUAIDS model for New Zealand. It uses this model to investigate who would benefit from the introduction of reduced GST rates in New Zealand, and whether reduced GST rates would be a more effective way of providing support to poorer households than New Zealand's current income-tested tax credit approach. The QUAIDS model is estimated using household expenditure microdata from the four most recent household economic surveys together with matching regional price data that provides sufficient price variation to estimate the model.

The estimated QUAIDS model covers nine non-durable expenditure groups. Expenditure and price elasticity estimates are highly plausible. All expenditure elasticities are positive, with the "food and non-alcoholic beverages", "transport fuels", and "household utilities, communication and education" expenditure groups found to be necessities. The "clothing and footwear", "recreation and culture", and "transport (excluding transport fuels)" groups were found to be clear luxuries. The "food and non-alcoholic beverages" and "recreation and culture" groups were found to be the least price-responsive, while the general "personal expenditure" and "household utilities, communication and education" expenditure groups were found to be the most price-responsive.

Two reforms are simulated. The first reform considers the introduction of reduced GST rates on two of the nine non-durable expenditure groups from the QUAIDS model: "food and beverages" and "recreation and culture". Both tax and welfare change results (presented across income and expenditure deciles) show that such a reform will have a small progressive effect – providing greater support to poorer households when measured as a proportion of their total spending. However, richer households are shown to gain considerably more in absolute terms – highlighting the poorly targeted nature of the GST system as a tool for supporting poorer households. Results are also found to differ between the two expenditure groupings. While the reduced rate on food largely mimics the overall results (and indeed drives them due to its greater budget share), the reduced rate on recreation and culture actually has a regressive effect. Kakwani, Reynolds-Smolensky and Atkinson index results confirm these findings.

The second reform simulates the removal of a simplified version of the income-tested family tax credit and replacement with reduced GST rates on the same two expenditure groups as above. The reduced GST rates are set to ensure revenue neutrality. Both tax and welfare change results (across deciles) show that, on average, poorer households lose from the reform, while richer households gain. The very poorest households with children are found to be particularly hard hit as they previously received the maximum possible tax credit amounts, and the small gain from the reduced GST rates is nowhere near enough to compensate them for the loss of the tax credit. Reynolds-Smolensky and Atkinson index results confirm that the reform increases inequality, while FGT poverty index results show the reform also increases poverty. Notably, the effectiveness of the income-based targeting of the family tax credit is highlighted by the fact that no high-income households lose from the reform – as they were never eligible for the tax credit.

The overall "progressive, but poorly targeted" result for reduced GST rates in New Zealand is consistent with the general findings for 23 OECD countries in Chapter 5, with the previous studies highlighted in that chapter, and with the non-behavioural analysis for New Zealand in Thomas (2015). Similarly, the "progressive, but poorly targeted" result for the reduced rate on food and beverages is consistent with the finding for food in New Zealand by Ball et al. (2016). More generally, the variation in results between the two expenditure groupings highlights that the effect of a reform can vary significantly depending on the type of expenditure subject to a reduced rate. This is again consistent with the findings for 23 OECD countries in Chapter 5, with the previous studies highlighted in that chapter, and with the non-behavioural analysis for New Zealand in Thomas (2015). The QUAIDS-based results above suggest that such variation is still present in New Zealand once behavioural responses to the tax changes are accounted for.

The results for the second reform also clearly confirm that the family tax credit is a far superior mechanism for providing support to poorer households than reduced GST rates. This is consistent with the findings for cash transfers more generally for 22 OECD countries in Chapter 6, and with the previous studies for OECD countries highlighted in that chapter. It is clear that New Zealand should maintain its current approach of a broad-based single-rate GST and income-tested tax credits to support poorer households.

CHAPTER 8. CONCLUSION

The purpose of this study has been to investigate the distributional effects of the VAT in OECD countries, and the merits of using reduced VAT rates to address distributional concerns. It has specifically examined three questions: whether the commonly held perception that the VAT is regressive is supported by evidence; whether reduced VAT rates are an effective way to provide support to poorer households; and whether targeted cash transfers are a superior policy instrument for providing support to poorer households. The study has also aimed to determine whether the answers to these research questions are consistent across OECD countries, or whether country-specific factors – such as varying VAT design characteristics and consumption patterns – lead to different conclusions. Finally, the research has aimed to derive broad policy recommendations for OECD countries regarding VAT design.

As background for this research, Chapter 2 has provided a summary of VAT rate structures both in theory and in practice. It has highlighted the weak theoretical case for using reduced VAT rates to achieve distributional goals, particularly when other more direct tools are available. It has also highlighted the weak case for the introduction of reduced VAT rates for other non-distributional purposes, as well as the administrative benefits of adopting a single-rate VAT structure. Nevertheless, the chapter has also shown that almost all OECD countries do attempt to use reduced rates to achieve distributional goals, and – to a lesser extent – social, cultural and employment-related goals.

A key motivation for the introduction of reduced VAT rates has been to address the perceived regressivity of the VAT. Chapter 3 has empirically reassessed this perception. It has assessed the competing methodological approaches used in previous studies of the distributional effects of the VAT, highlighting the misleading effect of savings patterns on cross-sectional analysis when VAT burdens are measured relative to income. It concludes that measuring VAT burdens relative to expenditure – thereby removing the influence of savings – will provide a far more reliable picture of the distributional impact of the VAT.

On this basis, the chapter has then drawn on a household expenditure microdata set of unprecedented size to examine the distributional effects of the VAT in 27 OECD countries. A consistent non-behavioural microsimulation methodology has been adopted to ensure comparability of results across countries. Overall, the chapter has found the VAT to be either roughly proportional or slightly progressive in most countries. This strongly contrasts with the general public perception, and the conclusion of much of the previous academic literature, that the VAT is regressive. Nevertheless, results for a small number of countries (Chile, Hungary, Latvia, New Zealand) highlight that broad-based VAT systems that have few reduced VAT rates or exemptions can produce a small degree of regressivity.

The chapter has also shown that even a roughly proportional VAT can still have significant equity implications for the poor – potentially pushing some households into poverty. This emphasises the importance of ensuring the progressivity of tax-benefit systems and expenditure programs, as a whole, in order to compensate poor households for the loss in purchasing power from paying VAT.

While the results of Chapter 3 imply that reduced VAT rates often have a small progressive effect, this does not necessarily mean they are a good way of providing support to poorer households. Chapters 4-6 have therefore examined whether reduced rates are an effective way to support poorer households, and whether the use of targeted cash transfers would be more effective. This analysis has been undertaken by extending the non-behavioural microsimulation models developed in Chapter 3 to take account of behavioural effects, and then using these models to simulate a range of policy reforms.

Chapter 4 has presented the methodology for incorporating behavioural effects into the microsimulation models. It was necessary to account for behavioural responses because the simulations alter the relative prices of goods and services, and the resulting changes in consumption patterns affect post-reform revenue and welfare. Ideally, behavioural responses would be incorporated into the models through the estimation of a demand system for each country. However, data limitations make this impossible for the majority of countries. Chapter 4 has therefore followed the Linear Expenditure System (LES) based approach proposed by Creedy and Sleeman (2006). While this approach imposes significant restrictions on consumer behaviour, it enables price elasticities, and the parameters of the LES, to be estimated using only cross-sectional household expenditure microdata.

Chapter 5 has then used these behavioural microsimulation models to investigate how effective reduced VAT rates are at supporting poorer households. Simulation results confirmed that reduced VAT rates have a progressive impact, as a whole, in at least 20 of the 23 countries examined. However, despite this progressivity, reduced VAT rates are shown to be a highly ineffective mechanism for targeting support to poorer households: not only do rich households benefit from reduced rates, but they benefit more in aggregate terms from reduced VAT rates than poor households do.

When looking at reduced rates on specific products, results are typically found to vary depending on the underlying policy rationale for introducing the reduced rate. Reduced rates specifically introduced to support the poor (such as reduced rates on food consumed at home and domestic utilities) are typically found to have a progressive impact – providing greater support to poorer households when measured as a proportion of their total spending. However, rich households still receive a larger aggregate benefit from the reduced VAT rate than poor households. In contrast, reduced VAT rates introduced to address non-distributional goals often provide such a large aggregate benefit to rich households that the reduced rates have a regressive effect. For example, reduced rates on restaurants and hotels benefit the rich vastly more than the poor, both in aggregate and proportional terms, in all 15 countries in which they are applied. Similar regressive results, but of less absolute magnitude, are also found for reduced rates on cultural and social expenditure (including cinema, theatre, concerts, museums, zoos, books, newspapers and magazines).

Despite their poorly targeted nature, for there to be a case to remove reduced VAT rates a better alternative policy instrument must exist with which to support poorer households. As such, Chapter 6 has used the behavioural microsimulation models to examine whether a cash transfer would be a more effective tool for providing support to poorer households than reduced VAT rates. Simulation results show that an income-tested cash transfer will better target support to poorer households than reduced VAT rates in all 22 countries examined. Additional simulations show that even an entirely untargeted universal cash transfer would better target poorer households than reduced VAT rates, and that an income-tested cash transfer that replaced all reduced rates except those on food would still improve the targeting of poorer households.

Results also showed that it is very difficult for an income-tested cash transfer to fully compensate all poor households for the removal of reduced VAT rates. This is due to the significant variation in the underlying consumption patterns across households. Nevertheless, while a small number of poor households would likely lose out from replacing reduced rates with targeted cash transfers, those that receive support would instead be determined by income and family characteristics as opposed to consumption tastes – thereby increasing horizontal equity. Furthermore, many households would be lifted out of poverty as revenue previously transferred to richer households would now be transferred to poorer households.

Given the restrictive nature of the LES-based approach, Chapter 7 has examined an alternative approach to modelling behavioural responses – the modelling of a Quadratic Almost Ideal Demand System (QUAIDS). Given the significant data and resource requirements, this is limited to one country, New

Zealand, for which data has recently become available making estimation feasible. Chapter 7 consequently provides the first estimates of a QUAIDS model based on New Zealand data.

The QUAIDS model is used to examine two reforms. The first reform considers the introduction of reduced VAT (GST) rates on two of the nine non-durable expenditure groups from the QUAIDS model: “food and beverages” and “recreation and culture”. Simulation results are consistent with those of the LES-based modelling: the introduction of reduced GST rates on these expenditure groups has a small progressive effect, but is poorly targeted, providing larger aggregate gains for richer households. Results are also found to differ between the two expenditure groupings. While the reduced rate on food largely mimics the overall progressive result, the reduced rate on recreation and culture has a regressive effect. The second reform simulates the removal of a simplified version of New Zealand’s income-tested family tax credit and its (revenue-neutral) replacement with reduced GST rates on the same two expenditure groups as above. Results are again consistent with the LES-based simulations: the income-tested family tax credit, despite not being strongly targeted at the poorest households, is still shown to target support to poor households vastly better than reduced GST rates.

Taken as a whole, the research highlights the importance of focusing on the overall impact of tax-benefit systems (and expenditure programs), rather than on the individual components, in achieving a government’s distributional goals. While the research has shown that most VAT systems are not regressive, it has also shown that they contribute very minimally to overall redistribution, and can have significant poverty effects. However, the VAT does not need to be used to address distributional goals. In this regard, the research has empirically confirmed the theoretical expectation that, where available, direct mechanisms (whether via the income tax or benefit system) will better achieve distributional goals than reduced VAT rates. All OECD countries have well developed income tax and benefit systems in place that can feasibly be adjusted or extended to pursue the distributional goals for which reduced VAT rates are currently used. As such, countries that currently employ reduced VAT rates to achieve distributional goals should consider removing these reduced rates and adjusting their income tax or benefit systems to achieve these distributional goals instead.

Additionally, the regressive impact of many reduced rates introduced on specific products for non-distributional reasons, combined with the weak case for their use (as outlined in Chapter 2), suggests that countries should also consider removing these reduced VAT rates where a more effective instrument is available to achieve the particular policy goal. For example, age- or income-based subsidies could be used to encourage social and cultural activities considered to produce positive externalities. At a minimum, the merits of these reduced VAT rates should be reassessed in light of their negative distributional impact.

From a political economy perspective, countries that face political difficulty removing all reduced VAT rates should, in the short-term, consider removing at least those that have regressive effects. In the long-term, though, they should still consider removing all reduced rates and adopting more targeted policy solutions with less negative distributional consequences. Not only would a move to a single-rate VAT system improve distributional outcomes, it would simplify the VAT system – thereby reducing administrative and compliance costs, and reducing opportunities for abuse. The clear "packaging" of the increases in targeted support together with the removal of reduced VAT rates in any public communication is likely to increase public support for the reform.

Finally, countries that currently do not employ reduced rates in their VAT system (such as New Zealand) should be very cautious regarding any proposals to introduce reduced rates. This is particularly important in light of the potential political economy difficulties of removing them once they are in place.

Looking forward, there are several potential avenues of future research. While this study has focused predominantly on reduced VAT rates, future work could focus on the distributional impact of VAT exemptions by utilising input-output tables to estimate the amount of tax embedded in the supply chain due to the inability to claim input tax credits. Harris et al. (2018), for example, have adopted such an approach for four developing countries. Future work could also look to improve the underlying dataset by estimating imputed rental expenditure in the four countries for which estimates are not currently available. Brewer and O'Dea (2012), for example, use data on region, house size and property taxes reported in the United Kingdom's household budget survey to estimate imputed rental expenditure.

Over time, as more time-series price and expenditure data becomes available, it may also be possible to undertake QUAIDS modelling for additional countries. Greater availability of price data by region and month would also aid identification. In New Zealand, for example, Statistics New Zealand collects a greater regional breakdown of price data than is currently publicly available. If this becomes available to researchers then the resulting increase in price variation would likely enable a more detailed set of expenditure groupings to be included in the QUAIDS model. Finally, beyond the VAT, there is much scope for empirical work examining the distributional effects of excise taxes on health-related and energy-related expenditures.

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APPENDIX 1. SENSITIVITY ANALYSIS

A1.1. Introduction

This appendix provides sensitivity analysis regarding a number of assumptions and key modelling decisions made throughout the thesis. It considers: the choice of parameters in the equivalence scale; the impact of the inclusion/exclusion of actual and imputed housing costs; the choice of poverty line; and the choice of Frisch parameter in the LES-based model. For brevity, results are presented for a selection of the indicators presented throughout the thesis, focusing predominantly on the presentations in Chapter 3.[136]

A1.2. Equivalence scale

Recall the parametric equivalence scale adopted in the thesis:

$$m_i = \left(n_{a,i} + \theta n_{c,i}\right)^{\alpha}$$

where m_i is the equivalent size of household i, θ measures the degree of need of children relative to adults; α specifies economies of scale in consumption; $n_{a,i}$ is the number of adults in household i and $n_{c,i}$ is the number of children.

Throughout the thesis, the following parameters have been adopted: $\theta = 0.5$ and $\alpha = 0.7$. These parameter settings closely approximate the commonly used "OECD modified" scale, but provide for additional economies of scale at greater household sizes. This section examines how variation in these parameters affects results. For brevity, it focuses on the Kakwani and poverty headcount index results from Chapter 3, though these are representative of variation in results throughout the thesis.

A1.2.1. Kakwani index

Figure A1.1 presents the average across 26 countries for the Kakwani progressivity index results initially presented in Table 3.8 in Chapter 3, for values of α between 0.05 and 1, for four different values

[136] Access to the New Zealand Household Economic Survey data used in this study was provided by Statistics New Zealand under conditions designed to give effect to the security and confidentiality provisions of the Statistics Act 1975. The results presented in the study are the work of the author, not Statistics New Zealand.

of θ.[137] This provides broad coverage of the feasible range of values of α and θ: α must be positive and less than one if economies of scale are considered to exist (with lower values indicating greater economies of scale); θ must be positive and less than one if a child is considered to need less consumption than an adult to attain the same level of wellbeing (with lower values indicating less need for children relative to adults).

The results show, on average, a very slight rise in the Kakwani index as α initially increases, before a larger fall at higher levels of α. The fall at higher levels of α is greater for higher values of θ. However, the total variation in the index is relatively low, ranging from a minimum of 0.024 to a maximum of 0.037.

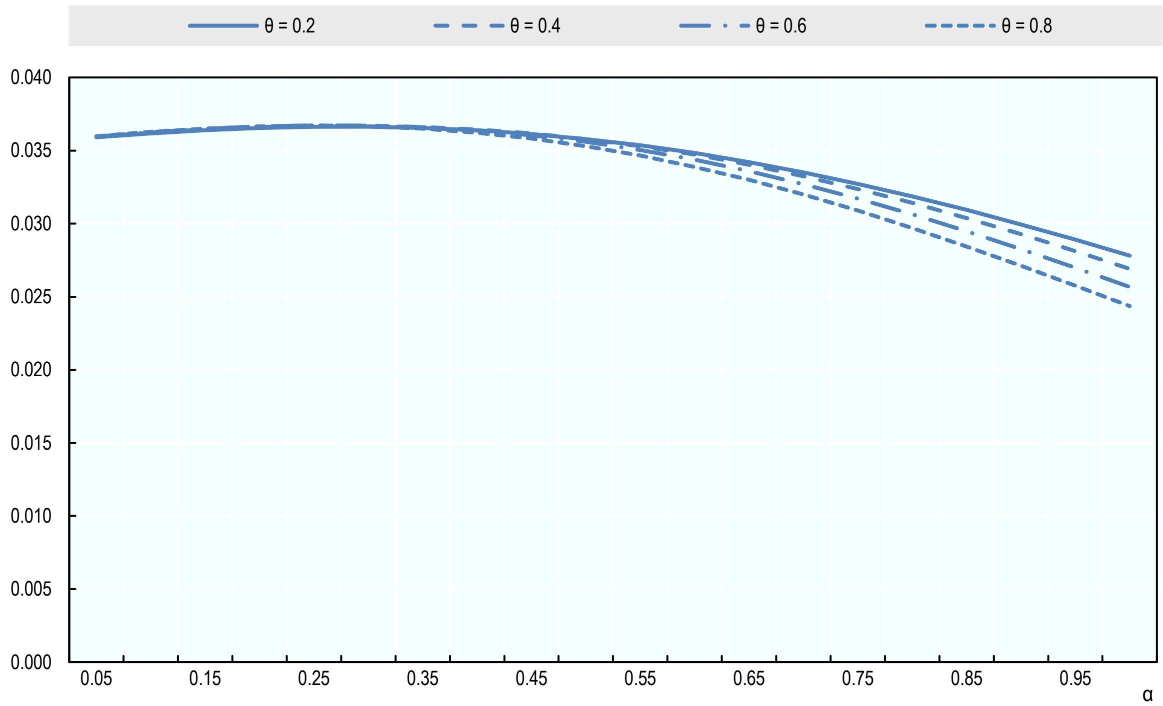
These overall averages do mask a small degree of variation across countries. Some countries (e.g. the Czech Republic, Estonia, Switzerland and the United Kingdom) exhibit a greater increase in the Kakwani index before it begins to fall. In contrast, several countries show a continuous fall in the Kakwani index (e.g. Hungary, Italy, Latvia, the Slovak Republic and Turkey). In general, there is very little variation in results for different values of θ, though any differences are greatest at high levels of α.

Overall, the results do not vary significantly enough to alter the broad conclusion in Chapter 3 that the VAT is generally roughly proportional or slightly progressive. However, in three out of 25 countries, where Kakwani index results are very close to zero, a change in parameter can alter the exact conclusion for that country. In Hungary and Latvia, results change from slightly positive to slightly negative as α increases. As such, if greater economies of scale are considered to exist than is assumed in the main text ($\alpha = 0.7$) then this may lead to a conclusion of slight progressivity in these two countries.[138] That said, the range of variation in the Kakwani index is very low in Latvia (a range of 0.005 – even less than the range of 0.013 for the overall average), though larger for Hungary (0.031). Additionally, in the Slovak Republic, while the Kakwani index is almost always positive, it is negative at one extreme of α (no economies of scale) for high values of θ. The other two regressive results (for Chile and New Zealand) hold for all feasible values of α and θ.

[137] This presentational approach follows that of Creedy and Sleeman (2006). Results for Korea were unable to be calculated due to data access restrictions.

[138] Similar variation occurs in a number of cases in the results in Chapter 5. For example, Kakwani index results for Estonia for the tax expenditure from all reduced rates (see Figure 5.3 and Table 5.3) change from slightly positive to slightly negative as α increases. As such, if greater economies of scale are considered to exist than is assumed in the main text then this could change the conclusion of slight regressivity to one of slight progressivity. This is also possible in Latvia, although it would require particularly large economies of scale ($\alpha < 0.25$ for most values of θ).

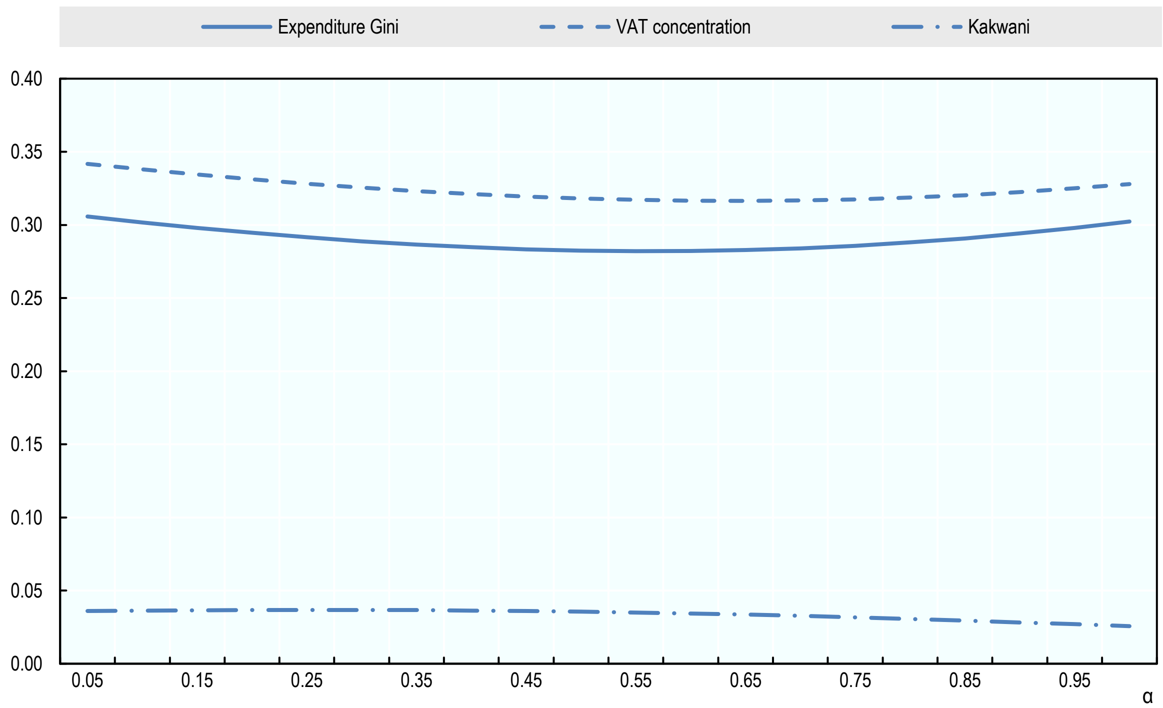
Figure A1.1. Kakwani index



Notes. Results calculated using microsimulation models for 26 countries based on household expenditure survey microdata. Results present the simple mean across all countries of the Kakwani index, for variations in the equivalence scale parameters α and θ. Results calculated with the individual as unit of analysis. See text for further detail.

Figure A1.2. Kakwani index (decomposition)

$\theta = 0.6.$



Notes. Results calculated using microsimulation models for 26 countries based on household expenditure survey microdata. Results present the simple mean across all countries of the components of the Kakwani index, for variations in the equivalence scale parameter α. Results calculated with the individual as unit of analysis. See text for further detail.

The variation in the Kakwani index exhibited in Figure A1.1 is driven by variation in the underlying inequality measures that it compares – the Gini index of expenditure and the concentration index of VAT. These are shown – again for the 26 country average – in Figure A1.2. Patterns are almost identical for different values of θ, so for ease of presentation only the results for $\theta = 0.6$ are presented.

Both the Gini and concentration index follow a U-shaped pattern, with inequality first falling before rising again. As highlighted by Coulter et al. (1992) and Creedy and Sleeman (2006), two opposing effects drive this pattern: a concentration effect and a re-ranking effect. As α starts to increase, economies of scale fall thereby reducing the equivalised expenditure of larger households. As larger households tend to have higher expenditure, the expenditure distribution becomes more concentrated. As α increases further, though, the reduction in equivalised expenditure of larger households starts to change the ranking of households, acting to increase inequality. At low values of α the concentration effect dominates the re-ranking effect, whereas the opposite is true at higher values of α. Though not illustrated in Figure A1.2, higher values of θ increase the re-ranking effect. The greater variation in the Gini index of expenditure than in the concentration index of VAT results in the slight n-shaped pattern of the Kakwani index.

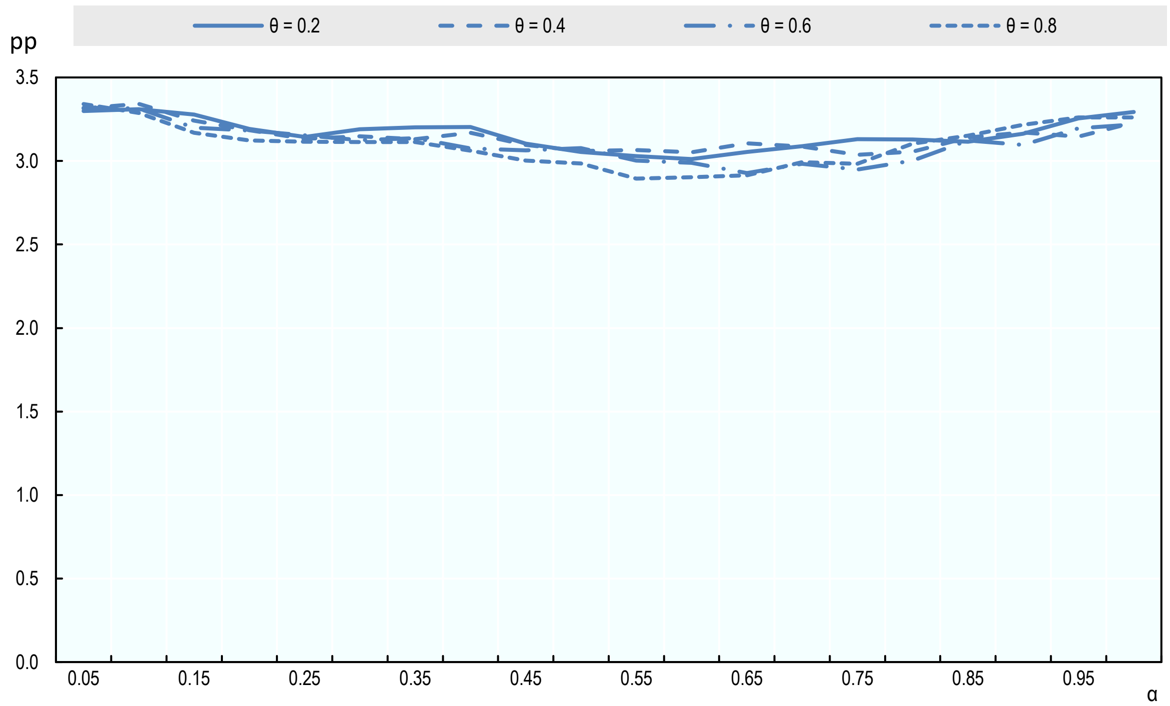
A1.2.2. Poverty headcount

Figure A1.3 presents the average across 26 countries of the difference in poverty headcount results (between gross and net expenditure) initially presented in Table 3.9 in Chapter 3, for the same range of α and θ as in Figure A1.1. The results show very little change in the difference in poverty headcount, ranging from 2.9 to 3.3 percentage points, with a very small dip at mid-range values of α, and no clear pattern across values of θ.

Results are similar for individual countries, with minimal variation across the range of α and θ. In some countries (e.g. Greece, Hungary, Poland) there is a slight increasing pattern as α increases; while in several others (e.g. the Czech Republic, Denmark, the Netherlands) there is a slight decreasing pattern. However, results are always positive, and variation is always small, emphasising the robustness of the conclusion in Chapter 3 that the VAT increases the poverty headcount.

The broad consistency in the difference in the poverty headcount is explained by the consistent pattern in the underlying headcount measures, as illustrated in Figure A1.4. As above, patterns are broadly consistent across values of results for θ, hence only results for $\theta = 0.6$ are presented.

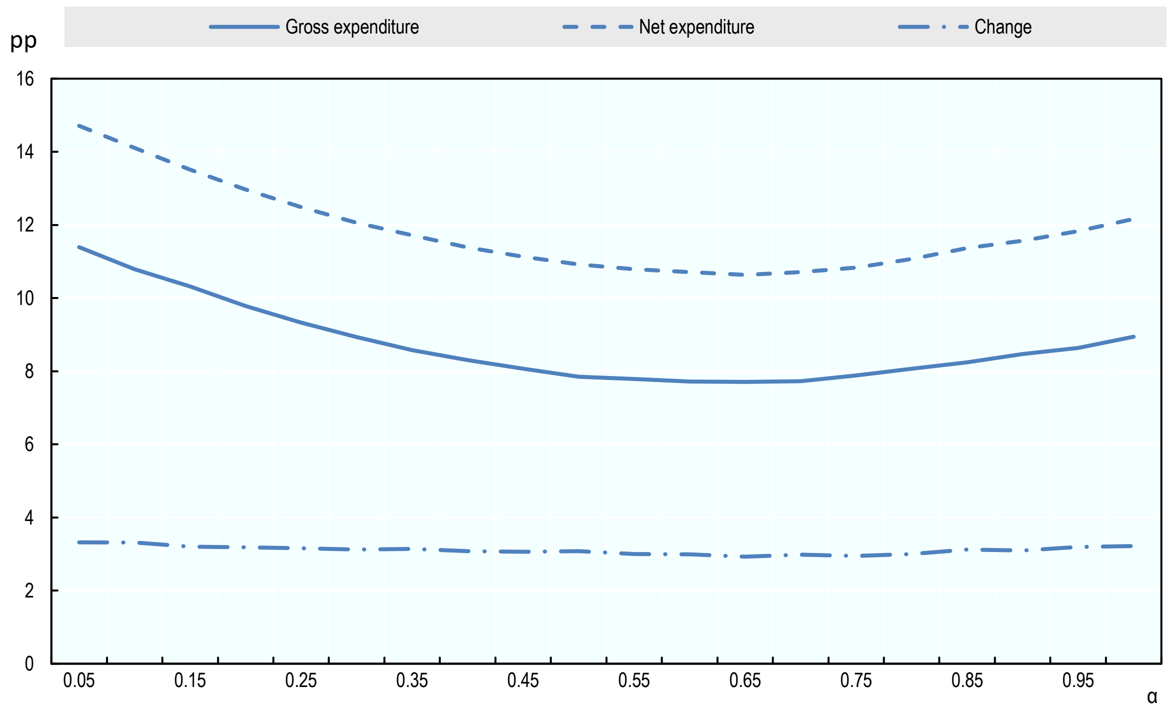
Figure A1.3. Percentage point change in poverty headcount



Notes. Results calculated using microsimulation models for 26 countries based on household expenditure survey microdata. Results present the simple mean across all countries of the percentage point change in the poverty headcount, for variations in the equivalence scale parameters α and θ. Poverty line = 50% of median gross expenditure. Results calculated with the individual as unit of analysis. See text for further detail.

Figure A1.4. Percentage point change in poverty headcount (decomposition)

$\theta = 0.6$.



Notes. Results calculated using microsimulation models for 26 countries based on household expenditure survey microdata. Results present the simple mean across all countries of the poverty headcount for gross and net expenditure, for variations in the equivalence scale parameter α. Poverty line = 50% of median gross expenditure. Results calculated with the individual as unit of analysis. See text for further detail.

For both gross and net expenditure, the poverty headcount falls as α initially increases, before rising at higher levels of α. The variation in the poverty headcount measures are also driven by the concentration and re-ranking effects noted above. Initially, the concentration effect leads to median expenditure falling to a greater extent than the expenditure of poorer households, thereby lifting households above the relative poverty line. However, at higher levels of α, re-ranking of households results in the median falling to a lesser extent than the expenditure of poorer households, and hence to an increase in relative poverty.

A1.3. Housing costs

While actual rental expenditure data are available in the household budget surveys (HBSs) for all 27 countries covered by this thesis, imputed rental expenditure data are only available for 23 countries. This raises concern about the comparability of results between renters and homeowners in countries where imputed rental data are unavailable. For this reason, where both rental and imputed rental expenditure are available for a country, both are included in the modelling. However, for countries where only actual rental expenditure is available, this is excluded from the modelling. This approach has been adopted throughout the thesis.

This section examines how results differ depending on whether housing costs (defined as actual plus imputed rental expenditure) are included in the analysis. As above, the Kakwani and poverty headcount index results from Chapter 3 are focused on, though these are again representative of the impact of housing costs more generally. The analysis covers 22 countries. The Czech Republic, New Zealand, Switzerland and the United Kingdom are excluded as imputed rental expenditure data are not available in the HBSs, while Korea is excluded due to data access restrictions.

A1.3.1. Kakwani index

Figure A1.5 presents results for the Kakwani index initially presented in Table 3.8 in Chapter 3, with and without housing costs. In all countries except Hungary, the Kakwani index is lower when housing costs are excluded. In two countries, Estonia and the Slovak Republic, results change from slightly progressive to slightly regressive, increasing the number of countries with (slightly) regressive results from three to five.

The reduction in the Kakwani index on exclusion of housing costs is due to the more equal distribution of (equivalised) housing expenditure than (equivalised) non-housing expenditure (with the exception of Hungary). While richer households spend more on housing in aggregate terms than poorer households, they spend less in relative terms. Inclusion of housing costs therefore acts as an equalising factor lowering the Gini index of gross expenditure. Meanwhile, there is minimal change in the VAT concentration index as no VAT is imposed on housing costs in any of the countries (so there is only a re-ranking effect based on gross expenditure), so the difference – the Kakwani index – falls.[139]

The reductions in the Kakwani index are generally significant in proportionate terms – falling by more than 50% in 13 of 22 countries. However, the reductions (as with the levels) are small in aggregate terms, with results still indicating a low degree of progressivity in most countries, often extremely close to proportionality. An overall conclusion drawn on the basis of the "exclusive of housing costs" results would therefore remain consistent with the broad conclusion that the VAT is generally either roughly proportional or slightly progressive.

A1.3.2. Poverty headcount

Figures A1.6-A1.8 present the poverty headcount results initially presented in Table 3.9 in Chapter 3, with and without housing costs. Figure A1.6 presents the change in poverty headcount results. It shows that, in every country, the increase in the poverty headcount on imposition of VAT is greater when housing costs are excluded than when included. Underlying this result is an increase in the poverty headcount for all countries for net expenditure when excluding housing costs (Figure A1.7), and a similar increase – though to a smaller extent – in the poverty headcount for 20 out of 22 countries for gross expenditure when excluding housing costs (Figure A1.8).

As with the change in the Kakwani index, the increase in poverty headcount is driven by the equalising effect of housing costs. Including housing costs increases the expenditure of poorer households proportionately more than richer households. While median expenditure (and hence the relative poverty line) increases, more people are lifted above the poverty line. The poverty headcount for gross expenditure increases by less than for net expenditure as housing expenditure makes up a smaller proportion of gross expenditure than net expenditure and hence has a smaller impact on the overall gross expenditure distribution.

These results highlight that the poverty index results presented for the Czech Republic, Switzerland and the United Kingdom (in Chapters 3 and 6), and for New Zealand (in Chapters 3 and 7) are likely to be overstated as a result of the exclusion of housing costs. Nevertheless, the overall conclusion that the VAT increases the poverty headcount appears robust.

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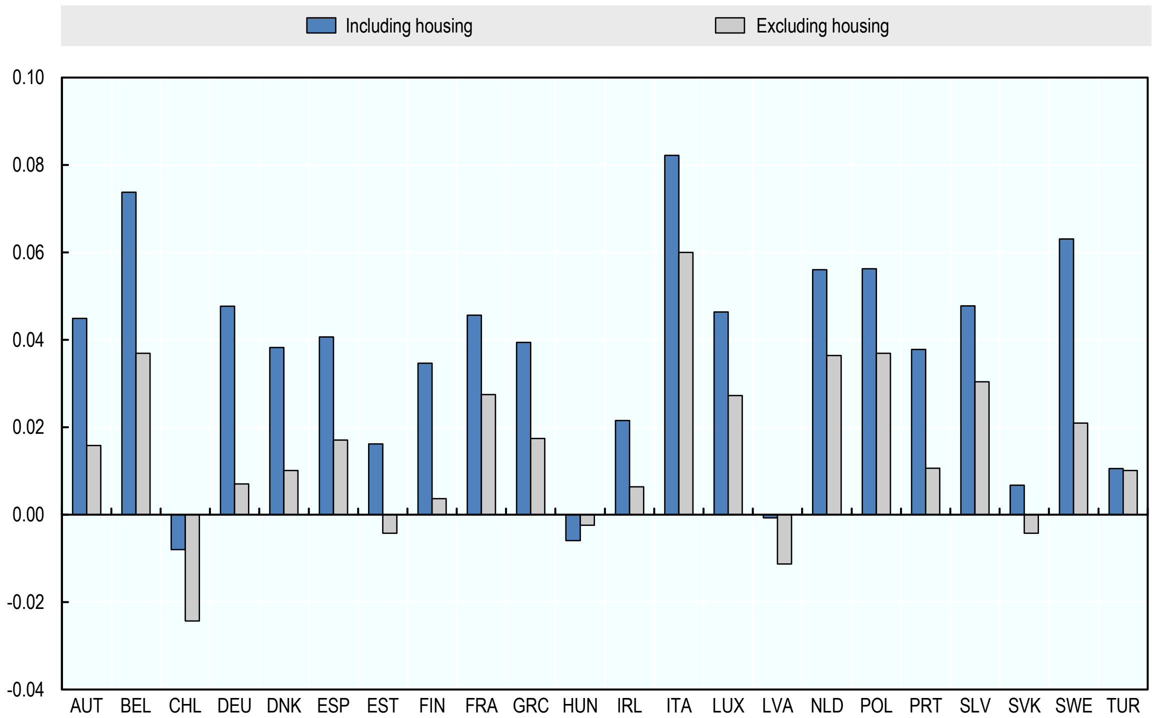
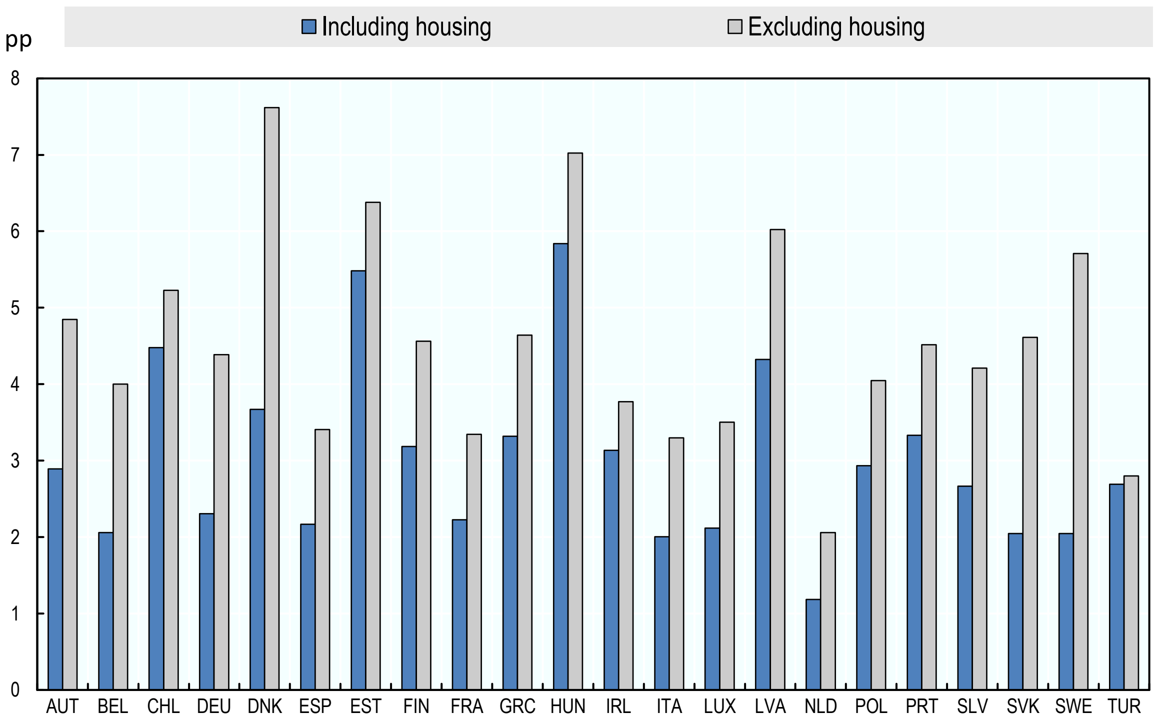
[139] There may potentially be some VAT capitalised into rental expenditure as a result of the imposition of VAT on new house purchases, however this is not able to be captured in the analysis.

Figure A1.5. Kakwani index, with and without housing



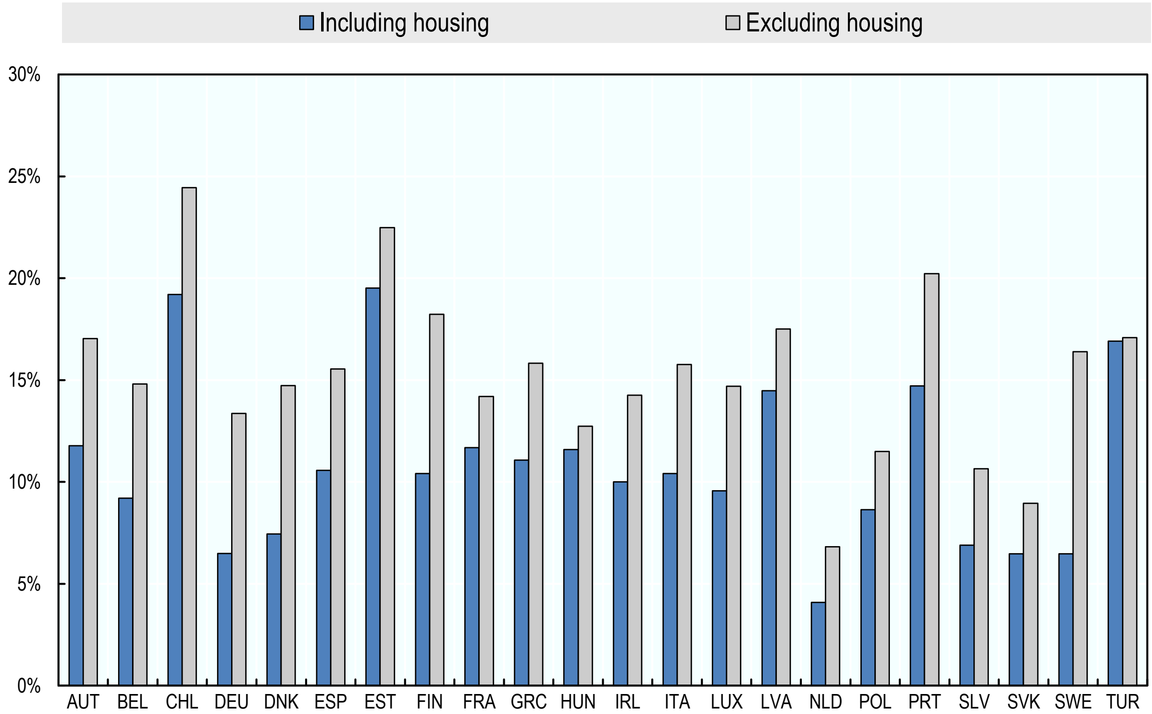
Notes. Results calculated using microsimulation models for 22 countries based on household expenditure survey microdata. Results calculated using equivalised variables, with the individual as unit of analysis. See text for further detail.

Figure A1.6. Percentage point change in poverty headcount, with and without housing



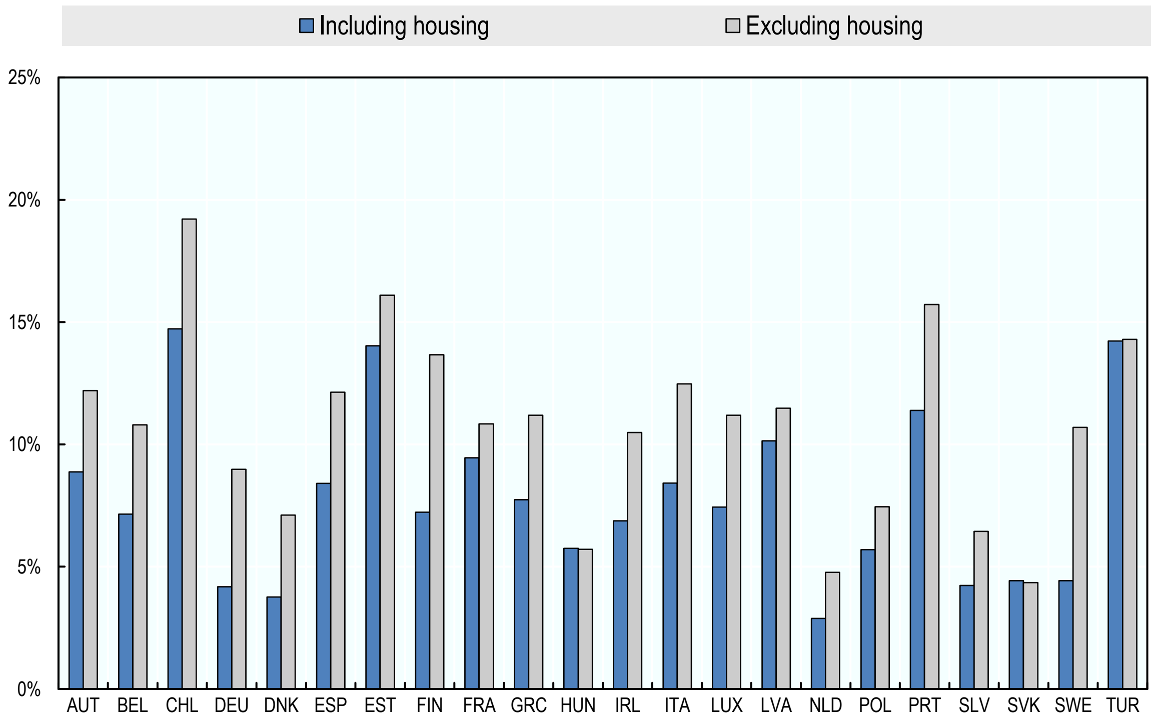
Notes. Results calculated using microsimulation models for 22 countries based on household expenditure survey microdata. Poverty line = 50% of median gross expenditure. Results calculated using equivalised expenditure, with the individual as unit of analysis. See text for further detail.

Figure A1.7. Net expenditure poverty headcount, with and without housing



Notes. Results calculated using microsimulation models for 22 countries based on household expenditure survey microdata. Poverty line = 50% of median gross expenditure. Results calculated using equivalised expenditure, with the individual as unit of analysis. See text for further detail.

Figure A1.8. Gross expenditure poverty headcount, with and without housing



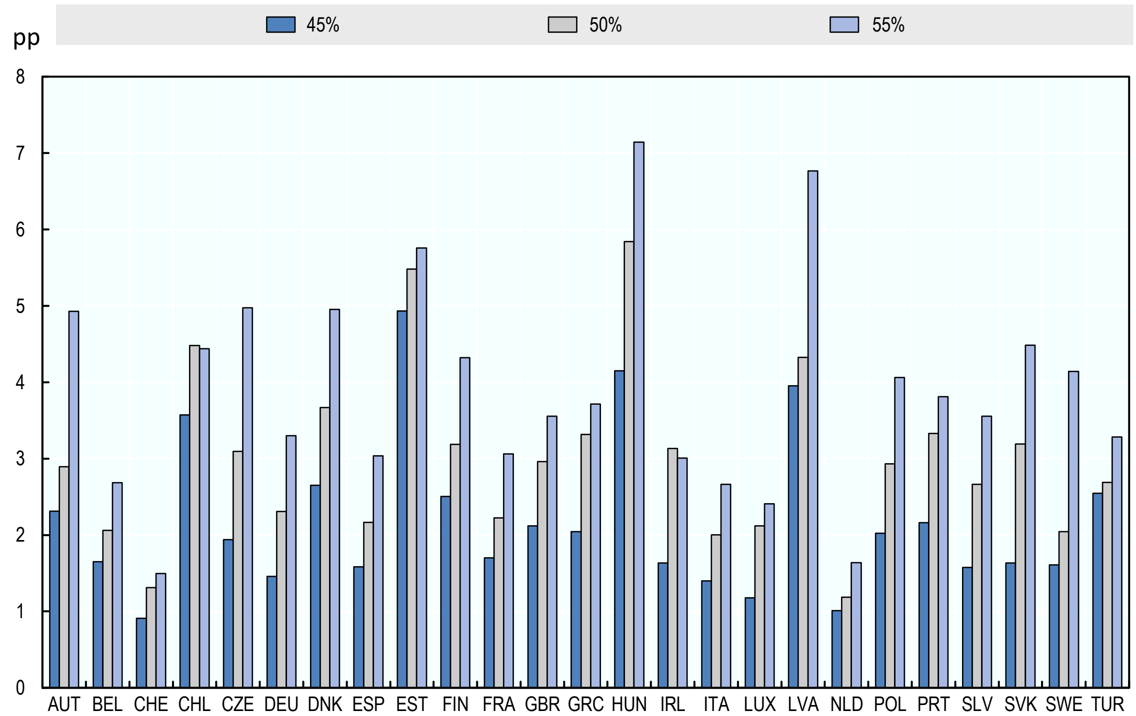
Notes. Results calculated using microsimulation models for 22 countries based on household expenditure survey microdata. Poverty line = 50% of median gross expenditure. Results calculated using equivalised expenditure, with the individual as unit of analysis. See text for further detail.

A1.4. Poverty line

Poverty index results are also sensitive to the choice of poverty line. The focus of analysis in the thesis has therefore been on changes in the poverty indices (as a result of the VAT or simulated VAT reforms), rather than their underlying values. Nevertheless, this section illustrates the sensitivity of the underlying poverty index values to the choice of poverty line. Again, poverty headcount results from Table 3.9 in Chapter 3 are focused on as a representative example.

Figure A1.9 shows the percentage point change in poverty headcount results (from gross to net expenditure) for 25 countries for a poverty line of 45%, 50% and 55% of median gross expenditure.[140] In 23 of 25 countries, the poverty headcount increases as the poverty line increases. In two countries (Chile and Ireland) the difference increases as the poverty line moves from 45% to 50% of median gross expenditure, but falls slightly as the poverty line moves from 50% to 55%. However, the difference is always positive – emphasising the robustness of the conclusion that the VAT increases the poverty headcount.

Figure A1.9. Percentage point change in poverty headcount, for differing poverty lines



Notes. Results calculated using microsimulation models for 25 countries based on household expenditure survey microdata. Results calculated using equivalised expenditure, with the individual as unit of analysis. See text for further detail.

[140] Results for Korea and New Zealand were unable to be calculated due to data access restrictions.

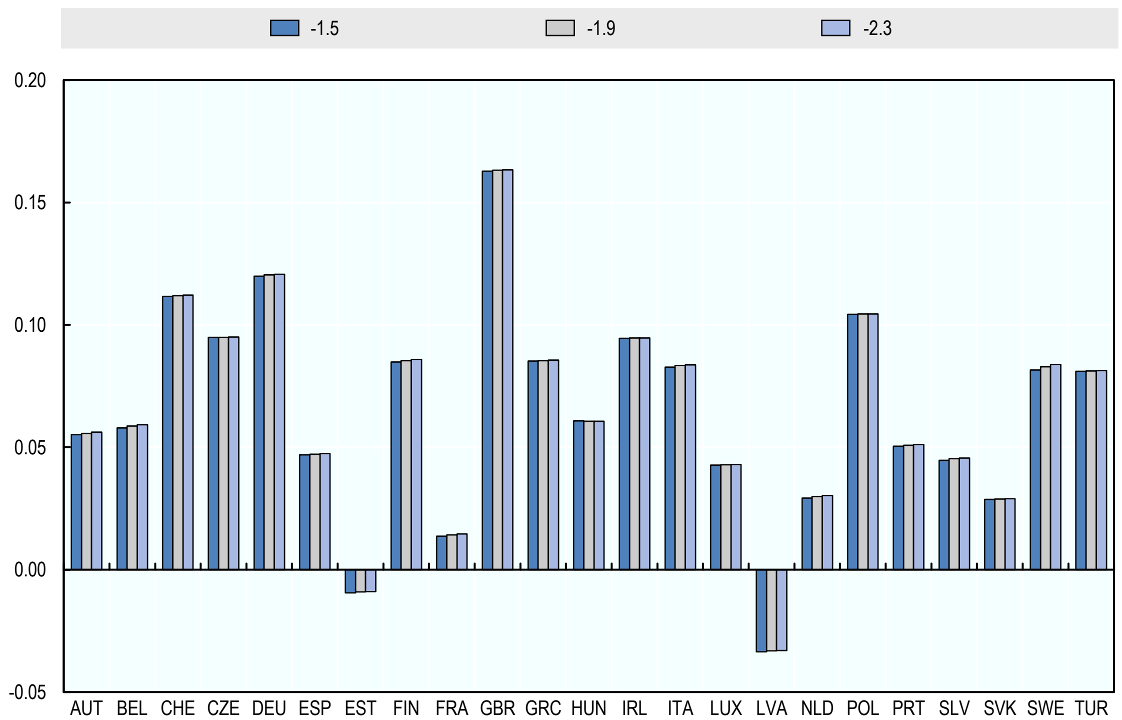
A1.5. Frisch parameter

The estimation of price elasticities in Chapter 4 requires an estimate of the elasticity of the marginal utility of total expenditure with respect to total expenditure (the "Frisch parameter"). Following Creedy and Sleeman (2006), a fixed Frisch parameter of -1.9 is adopted in the calculations in Chapter 4 for all households. This section first examines the impact of variation in the fixed Frisch parameter applied to all households. It then considers the adoption of a Frisch parameter that falls in absolute value terms as household expenditure increases. Kakwani index results from Chapter 5 are used to illustrate the impact of variation in the Frisch parameter.

A1.5.1. Fixed Frisch parameter

Figure A1.10 presents Kakwani index results for the tax expenditure from all reduced rates (initially presented in Figure 5.3 and Table 5.3 in Chapter 5) for three fixed values of the Frisch parameter: -1.5, -1.9 and -2.3. Figure A1.10 shows that there is almost no variation in Kakwani index results. The change in the fixed Frisch parameter does result in a small change in price elasticities (in absolute value terms, these increase as the Frisch parameter falls), but the resulting behavioural change is not sufficient to significantly alter the Kakwani index results. Conclusions regarding the progressive/regressive effect of the reduced rates consequently remain unchanged.

Figure A1.10. Kakwani index, for differing Frisch parameters



Notes. Results calculated using behavioural microsimulation models for 23 countries based on household expenditure survey microdata. Results calculated using equivalised variables, with the individual as unit of analysis. See text for further detail.

A1.5.2. Falling Frisch parameter (as expenditure increases)

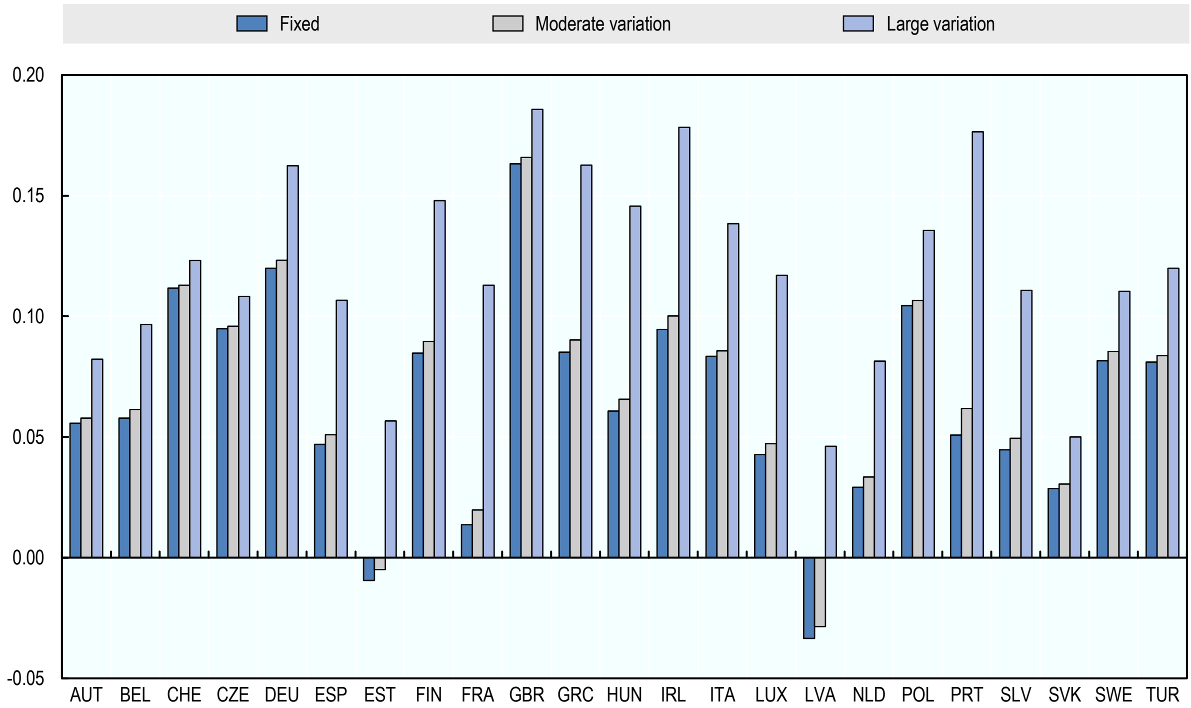
It is also arguable that the Frisch parameter may fall (in absolute value terms) as expenditure increases. This was the expectation expressed by Frisch (1959). Cornwall and Creedy (1997, 1998), for example, consequently applied a Frisch parameter that fell with expenditure. However, more recent studies (e.g. Ball et al., 2016; Creedy and Sleeman, 2006) have adopted a fixed Frisch parameter. Creedy and Sleeman (2006) carry out sensitivity analysis around their fixed value of -1.9, finding that analytical results were not sensitive to the adoption of a fixed rather than falling parameter.

This section compares the results for the fixed Frisch parameter of -1.9, with two scenarios involving a varying Frisch parameter. The first involves "moderate" variation in the Frisch parameter as follows: -2.7 for households in the bottom expenditure decile, falling by 0.2 each decile to reach -0.9 for the top expenditure decile. The second scenario involves a far larger variation (similar to that initially suggested by Frisch, 1959) as follows: -10 for the bottom two expenditure deciles; -4 for the 3rd and 4th deciles; -2 for the 5th and 6th deciles; -0.7 for the 7th and 8th deciles; and -0.1 for the top two deciles.[141]

Figure A1.11 presents Kakwani index results (again for the tax expenditure from all reduced rates initially presented in Figure 5.3 and Table 5.3 in Chapter 5) for the fixed, moderate variation and large variation scenarios. As with Creedy and Sleeman (2006), minimal difference is found between the fixed and the moderate variation scenarios. However, results change more significantly in the "large variation" scenario, although to differing degrees depending on the country. In most countries, the overall conclusion of progressivity does not change, just the degree of progressivity increases. However, the conclusions for Estonia and Latvia now change, moving from slightly regressive to moderately progressive.

[141] Frisch (1959) suggested the following values: -10 for the "extremely poor"; -4 for the "slightly better off but still poor"; -2 for the "median part"; -0.7 for the "better off" part; and -0.1 for the "rich part" of the population. As Creedy (1998b) notes, Frisch did not specify how these figures were determined.

Figure A1.11. Kakwani index, for fixed and varying-with-expenditure Frisch parameters



Notes. Results calculated using behavioural microsimulation models for 23 countries based on household expenditure survey microdata. Results calculated using equivalised variables, with the individual as unit of analysis. See text for further detail.

APPENDIX 2. COMPARING QUAIDS AND LES MODELS FOR NEW ZEALAND

A2.1. Introduction and methodology

This appendix compares the results from the Quadratic Almost Ideal Demand System (QUAIDS) model developed for New Zealand in Chapter 7 with those obtained by applying the Linear Expenditure System (LES) based methodology of Chapters 4-6 to the 2015-16 New Zealand Household Economic Survey (HES) data.[142] The LES model is estimated following the approach detailed in Chapter 4. For comparability, the same nine expenditure groups are used in the LES model as in the QUAIDS model. The appendix first compares the expenditure and own-price elasticity estimates from each model, before examining how they impact simulation results.

A2.2. Elasticity estimates

Table A2.1 compares the expenditure, uncompensated own-price and compensated own-price elasticities derived from the models. To ensure comparability, the elasticities for both the QUAIDS and LES models are calculated as the weighted means for all observations. As such, the QUAIDS elasticities are slightly different to those presented in Chapter 7 – which are evaluated at the means of the variables. Such an approach is not possible for the LES model as the individual estimates are calculated based on 11 different sets of regression parameters relating to each household type.

Table A2.1. Elasticity estimates for New Zealand in QUAIDS and LES models

	Expenditure elasticity		Uncompensated price elasticity		Compensated price elasticity	
	QUAIDS	LES	QUAIDS	LES	QUAIDS	LES
1. Food and non-alcoholic beverages	0.755	0.817	-0.519	-0.562	-0.289	-0.318
2. Alcohol and tobacco	1.201	1.346	-0.928	-0.725	-0.880	-0.680
3. Clothing and footwear	1.692	1.696	-0.536	-0.901	-0.470	-0.838
4. Healthcare	1.175	1.436	-0.675	-0.771	-0.625	-0.708
5. Transport (excluding transport fuels)	1.462	1.607	-1.493	-0.863	-1.379	-0.742
6. Transport fuels	0.688	0.772	-0.465	-0.433	-0.418	-0.384
7. Recreation and culture	1.481	1.626	-0.503	-0.874	-0.391	-0.751
8. Other non-durable personal expenditure	1.450	1.177	-2.514	-0.682	-2.316	-0.516
9. Household utilities, communication and education	0.613	0.547	-1.652	-0.373	-1.518	-0.247

Notes. Results are weighted means of the estimated elasticities for each household from QUAIDS and LES-based models based on HES microdata.

[142] Access to the New Zealand Household Economic Survey data used in this study was provided by Statistics New Zealand under conditions designed to give effect to the security and confidentiality provisions of the Statistics Act 1975. The results presented in the study are the work of the author, not Statistics New Zealand.

Table A2.1 shows that the expenditure elasticity estimates produced by each model are relatively similar for all nine expenditure groups. In both models, the food and non-alcoholic beverages, transport fuels, and household utilities, communication and education categories are necessities, and the other categories are luxuries.

There is more variation in the price elasticities. The compensated and uncompensated price elasticities for food and beverages are very similar in each model, while those for the alcohol and tobacco, healthcare, and transport fuel categories are also relatively similar. However, the highly responsive estimates in the QUAIDS model for the other non-durable personal expenditure, and household utilities, communication and education categories are vastly different to the LES estimates.

A2.3. Simulation results

Tables A2.2-A2.4 compare the simulation results from the QUAIDS and LES models for the first reform in Chapter 7. This reform scenario introduces reduced GST rates of 7.5% on the food and beverages and recreation and culture expenditure groups. The standard GST rate on other expenditure groups remains unchanged at 15%. Table A2.2 presents results for both models for the change in tax and the welfare gain (compensating variation) across disposable income deciles. For consistency with Chapter 7, welfare gains are presented as positive numbers. Table A2.3 presents the same results, but across expenditure deciles. Table A2.4 presents Kakwani and Reynolds-Smolensky indices.

The simulation results of both models are very similar. This holds both for the change in tax results and the welfare change results, as well as across income and expenditure deciles. Additionally, as with the findings in Chapters 5-7, welfare change results are always slightly higher than tax change results, and income decile results are always more compressed than expenditure decile results. That said, a common pattern of difference does occur in each case: Poorer households are expected to gain slightly less (in aggregate and proportional terms) from the reform under the LES model than the QUAIDS model. Meanwhile, richer households are expected to gain more under the LES model than the QUAIDS model. As a consequence, the tax expenditure from the reduced GST rates appears slightly less progressive in the LES model than the QUAIDS model.

This pattern is largely driven by the food and beverages category. An analysis of decile averages of elasticities shows that poorer households have slightly lower uncompensated price elasticities (in absolute value terms) for food and beverages in the LES model than in the QUAIDS model. As such, they substitute slightly less towards reduced-rated food and beverages than in the QUAIDS model, and so gain slightly less from the reduced rate. In contrast, richer households on average have higher uncompensated price elasticities for food and beverages in the LES model than in the QUAIDS model (though lower than for poorer households). They therefore substitute more towards food and beverages, and gain more from the reduced rate, than in the QUAIDS model. While households in all deciles in the LES model are more responsive to the change in price of recreation and culture than in the QUAIDS model, this impact is outweighed due to the significantly greater budget share spent on food and beverages (29% vs 7%).

Table A2.2. Simulation results (reducing GST rates) for New Zealand in QUAIDS and LES models across income deciles

	Change in tax				Welfare change (compensating variation)			
	QUAIDS		LES		QUAIDS		LES	
Income decile	Average gain	% of expenditure	Average gain	% of expenditure	Average CV	% of expenditure	Average CV	% of expenditure
1	601	2.038%	587	1.984%	662	2.279%	650	2.193%
2	609	1.934%	599	1.888%	672	2.177%	664	2.090%
3	832	2.040%	824	2.035%	917	2.279%	914	2.256%
4	828	1.950%	825	1.941%	920	2.193%	915	2.149%
5	967	1.983%	967	1.989%	1,072	2.222%	1,073	2.206%
6	1,041	1.836%	1,058	1.872%	1,152	2.050%	1,174	2.075%
7	1,097	1.835%	1,118	1.873%	1,214	2.048%	1,241	2.078%
8	1,179	1.856%	1,209	1.905%	1,306	2.075%	1,343	2.114%
9	1,257	1.759%	1,308	1.818%	1,394	1.975%	1,456	2.018%
10	1,795	1.687%	1,919	1.791%	1,978	1.881%	2,141	1.994%

Notes. Results calculated using QUAIDS and LES behavioural microsimulation models based on HES microdata. To aid comparison with change in tax results, welfare change (compensating variation) results are presented with positive values reflecting welfare gains. Results presented across equivalised income deciles, with the individual as unit of analysis. See text for further detail.

Table A2.3. Simulation results (reducing GST rates) for New Zealand in QUAIDS and LES models across expenditure deciles

	Change in tax				Welfare change (compensating variation)			
	QUAIDS		LES		QUAIDS		LES	
Expenditure decile	Average gain	% of expenditure	Average gain	% of expenditure	Average CV	% of expenditure	Average CV	% of expenditure
1	320	2.104%	314	2.031%	371	2.465%	346	2.237%
2	534	2.057%	527	2.048%	606	2.338%	583	2.268%
3	647	2.023%	650	2.040%	729	2.282%	720	2.260%
4	787	1.998%	781	1.996%	882	2.241%	866	2.212%
5	888	1.940%	896	1.969%	989	2.164%	994	2.183%
6	1,042	1.934%	1,053	1.958%	1,159	2.151%	1,168	2.172%
7	1,114	1.858%	1,134	1.893%	1,236	2.063%	1,259	2.101%
8	1,279	1.782%	1,297	1.812%	1,412	1.967%	1,440	2.011%
9	1,500	1.725%	1,533	1.766%	1,642	1.889%	1,703	1.961%
10	2,099	1.496%	2,233	1.580%	2,264	1.618%	2,496	1.764%

Notes. Results calculated using QUAIDS and LES behavioural microsimulation models based on HES microdata. To aid comparison with change in tax results, welfare change (compensating variation) results are presented with positive values reflecting welfare gains. Results presented across equivalised expenditure deciles, with the individual as unit of analysis. See text for further detail.

These results are confirmed by the Kakwani, Reynolds-Smolensky, and Atkinson index results presented in Table A2.4. Results are very similar for the change in tax, with the Kakwani index slightly higher for the QUAIDS model than the LES model, indicating a slightly greater degree of progressivity. Meanwhile, the similarly low Reynolds-Smolensky and (change in) Atkinson index results for both models indicate minimal redistribution. Differences between the models are larger for the welfare change results – due to the larger welfare change values. The comparatively smaller gains at the bottom of the distribution in the LES model are also emphasised by the lower (change in) Atkinson index results at higher levels of inequality aversion. Nevertheless, both models still show the tax expenditure from reduced rates to be progressive, but to have minimal redistributive impact.

Table A2.4. Simulation results (reducing GST rates) for New Zealand in QUAIDS and LES models: Kakwani and Reynolds-Smolensky indices

	Change in tax		Welfare change (compensating variation)	
	QUAIDS	LES	QUAIDS	LES
Kakwani	0.0575	0.0475	0.0350	0.0133
R-S	0.0011	0.0010	0.0009	0.0003
Atkinson 0.2	0.0003	0.0002	0.0002	0.0001
Atkinson 0.7	0.0008	0.0007	0.0006	0.0002
Arkinson 1.2	0.0012	0.0009	0.0009	0.0002

Notes. Results calculated using QUAIDS and LES behavioural microsimulation models based on HES microdata. Kakwani = Kakwani progressivity index; R-S = Reynolds-Smolensky redistribution index; Atkinson = change in Atkinson inequality index, with degree of inequality aversion equal to 0.2, 0.7 and 1.2. Results calculated using equivalised variables, with the individual as unit of analysis. See text for further detail. Positive results indicate progressivity/redistribution.

Overall, given the broad similarity of the results, the conclusions of the simulation under both QUAIDS and LES models are consistent. The introduction of the reduced GST rates in New Zealand is shown to have a progressive effect. However, the reduced rates are shown to be badly targeted at poor households and to have minimal redistributive impact.