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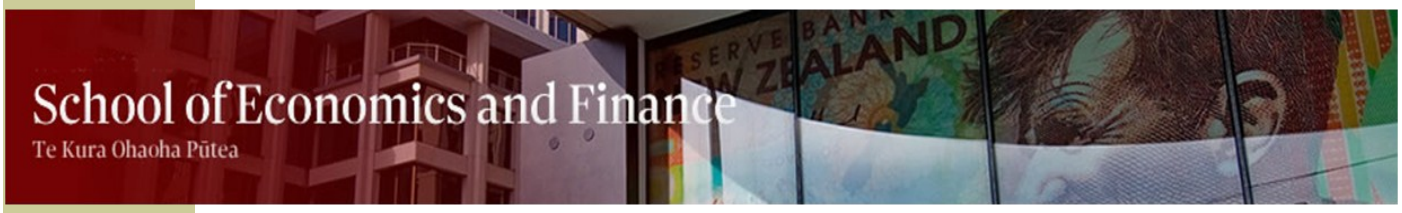

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The Short-run Nationwide Macroeconomic Effects of the Canterbury Earthquakes

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Abstract: We examine the short-run impact of the Canterbury earthquakes (4/9/2010, and 22/2/2011) on the New Zealand economy using VAR macro-models. Maybe surprisingly, we find little evidence of a pronounced impact on the aggregate economy. Our results suggest that the earthquakes reduced CPI inflation moderately, and the first earthquake had a small but short-lived, adverse effect on real gross domestic product (GDP) growth. At the very worse, it appears that policies (by the government and the Reserve Bank) have been successful in mitigating any serious adverse impact. The more significant impact of the earthquakes is to be found at the regional level.

Key words: Canterbury earthquakes, short-run, natural disasters, macroeconomic variables

JEL: E27, Q54

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* Correspondence: ilan.noy@vuw.ac.nz. A special thanks to Miles Parker and Daan Steenkamp for their valuable contributions to this project.

1. Introduction

We investigate what were the effects of the Canterbury earthquakes of 2010 and 2011 on the New Zealand economy. While the Canterbury earthquakes have gained a lot of media attention due to the disruption and devastation they have caused, the impacts of the earthquakes on the New Zealand economy have not been studied in much detail.

At this stage it is estimated that the cost of immediate damage is equivalent to more than 10 per cent of New Zealand's GDP (Parker & Steenkamp, 2012). It is useful to compare this with the earthquake and tsunami which struck Japan in 2011. The cost of damage associated with the Japanese earthquake/tsunami/nuclear meltdown was equivalent to around 3 to 4 per cent of Japan's GDP (Parker & Steenkamp, 2012). The cost of immediate damage from the Canterbury earthquake was therefore about three times greater relative to the Japan event (which was the costliest disaster in modern history in absolute terms).

The series of earthquakes in the Canterbury region began on the 4 September 2010. The first earthquake had a reported magnitude of 7.1 (Richter scale). While considerable damage was caused, no fatalities occurred. Unfortunately, another earthquake with a magnitude of 6.3 struck Christchurch on 22 February 2011 (GNS science, 2011). Because of its location and characteristics, more damage was caused to infrastructure and buildings and 185 lives were lost (New Zealand Police, 2012). Widespread liquefaction also added to the damage of the earthquake.[1] Combined, these two events led to about 400,000 insurance claims for damages, including 80,000 housing units that were significantly damaged; the New Zealand government's Earthquake Commission is expecting to pay about

[1] The 22/2/2011 earthquake was located closer to the city of Christchurch (the second biggest city in New Zealand) and it occurred at 12.51 pm, around lunchtime on a weekday. The peak ground acceleration was very high since the epicentre of the earthquake was very shallow and therefore violent shaking was felt on the surface (Canterbury Earthquakes Royal Commission, 2011).

$12 billion for these damages.[2] There have been more than 3500 aftershocks in the Canterbury region, with a reported magnitude greater than 3.0 between 3 September 2010 and 18 September 2012, with more than 50 above 5.0 (Parker & Steenkamp, 2012). New Zealand has a long history of destructive earthquakes, most notably in the Wairarapa in 1855, and Hawke's Bay (Napier) in 1931. The recent earthquakes which occurred in Christchurch, however, were largely unexpected since they occurred in a previously unknown fault.

Here, we aim to examine the aftermath of these destructive events and their impact on the New Zealand national economy. The scale of this event, relative to the size of the New Zealand economy, should enable us to clearly identify the ways in which a large exogenous and unexpected destructive shock affects a high-income economy. In the next section, we discuss the existing literature. Section three adds more details about Christchurch and the data used. We next set out the methodology and present our empirical conclusions. The last section puts these findings in context, identifies some limitations of this study, and also provides some suggestions for further research.

2. Literature Review

The economic literature on disasters distinguishes between the direct destructive effects of these events, and their indirect impact—both in the short- and in the longer-term.[3] The investigation of the direct effects (e.g., Kahn, 2004) is not of direct relevance to our investigation, and nor is the much more limited literature on the longer-term effects (e.g., Cavallo et al., 2013).

[2] About 40% of this sum was re-insured (mostly in Europe) and the rest will be covered by the EQC savings from previous years and about 1 billion is to be covered by government, as the last insurer (data from a public talk by Ian Simpson, Chief Executive of the New Zealand Earthquake Commission, 1/3/2013.

[3] Cavallo and Noy (2011) provide context and background to these distinctions.

The earlier literature on the short-run effects of natural disasters, in particular the seminal work of Albala-Bertrand (1993), generally identifies evidence for positive impact on GDP but adverse effects on both the government and the trade and current accounts. The basic mechanism that appears to explain this observation is that the destruction reduces the stock of goods available (rather than a flow) while it also leads to increased spending on reconstruction (a flow).

These arguments fit well within the conventional wisdom that countries/regions recover rapidly from exogenous adverse shocks to the capital stock since the most important asset in such economies is not physical but human capital; both Adam Smith (1776) and John S. Mill (1872) included descriptions of such dynamics in their seminal books.

Research in the past decade, however, is less sanguine about the impact of these events, both in the short- and longer-term. This recent research mostly focuses on developing countries, and especially small island states that appear to be especially vulnerable to disasters (e.g., Rasmussen, 2004, and Heger et al., 2010). Noy (2009), for example, finds that the short-run adverse impact of disasters is more significant in smaller economies.[4] More recent work that reaches similar conclusions includes Strobl (2012) who uses more detailed measurements for disaster data and a different identification technique and von Peter et al. (2012) who investigate the importance of insurance in ameliorating these adverse dynamics.

New Zealand is a high-income economy (income per capita of about PPP US$30,000)[5], and most of the research that investigate the impact of disasters stress that their conclusions about adverse short-term impacts are relevant for middle- and low-income

[4] Noy (2009) finds that middle- and low- income countries with a higher literacy rate, better institutions, higher per capita income, higher degree of openness to trade, and higher levels of government spending are in a better position to deal with the initial negative shock and prevent further spillovers into the macro-economy.
[5] *World Development Indicators 2011.*

countries only. Few events in higher-income countries in recent decades have been big enough to generate any observable impact at the national level. Notable exception may be the Kobe 1995 earthquake (Japan), Hurricane Katrina in 2005 (New Orleans) and more recently the 2010 Bío Bío earthquake (Chile) and the 2011 Tohoku earthquake and tsunami (Japan).

Horwich (2000) examines the 1995 Kobe (Japan) earthquake, and finds that it had little observable macroeconomic consequences for Japan. Following Kobe's earthquake in 1995, real GDP increased by 0.2 % for the first quarter—when the earthquake happened. For the subsequent two quarters, real GDP increased by 1.3 %, and then 2.3 % in the last quarter of that year. Moreover, the real growth rate for 1995 was 1.4% compared to 0.6 % for the previous year (Horwich, 2000). Similarly, the devastation caused by hurricane Katrina had no observable impact on the aggregate U.S. economy.

Another reason that the national income accounts will not show much impact from a catastrophic natural disaster is that production increases due to replacement capital, disaster related rescue, and other factors associated with helping in the clean-up and rehabilitation processes. Hallegate and Dumas (2009) also notes that adverse shocks can trigger re-investment and upgrading of capital stock, which in turn can lead to positive impacts on an economy. In a similar vein, the New Zealand Treasury is predicting that the sequence of Canterbury earthquakes in 2010-2011 will have a positive effect on economic activity once rebuilding gets underway (New Zealand Treasury, 2012).

The literature on the regional impacts of natural disasters, even in developed economies is less extensive, and in this case most papers identify some adverse impacts which may potentially persist for a long time (e.g., Vigdor, 2008, Coffman and Noy, 2012, duPont and Noy, 2013). Following Hurricane Katrina which struck New Orleans in August

2005, unemployment rose. This was reflected in the reduction of the payroll of private-sector firms located in New Orleans metropolitan area, which was estimated to have fallen by 13.6 percent between July 2005 and July 2007 (Vigdor, 2008). Almost 70,000 jobs were lost. The largest reduction in percentage terms was in service related industries, such as education and health, and leisure and hospitality. Conversely, there was an increase in employment in mining and construction (Vigdor, 2008).

The studies done so far on the Canterbury earthquakes have been more focussed on specific sectors. The Canterbury earthquakes have benefited some sectors of the economy and adversely affected others. For example, the initial clean-up activity and reconstruction is boosting demand in sectors such as utilities, construction, safety, healthcare and social assistance (Eaqub, 2011). However, reduction in population and aggregate employment remain notable. The region's population has decreased by 5,000 over the year to June 2011 and there have been 26,800 jobs losses over the year to September 2011 (Eaqub, 2011). Sectors particularly affected by the earthquakes in the Canterbury region were retail, hospitality and wholesale. Conversely, there has been a rise in employment in government and food manufacturing sectors (Eaqub, 2012). Not all job losses in the Canterbury region will affect unemployment at the national level, as some workers will move to other parts of the country. Eaqub (2012) also observes that economic activity in 2011 was 4% lower compared to 2010.

3. Data and Methodology

Data was collected from the Reserve Bank of New Zealand (RBNZ), Statistics New Zealand and BusinessNZ. Seasonally adjusted data was used when possible. The economic

variables used were quarterly real GDP growth rate (seasonally adjusted[6]), quarterly percentage change in gross fixed capital formation (general government and the private sector, both seasonally adjusted), the monthly difference for the 90-day interest rate, the quarterly percentage change in total exports and imports (both seasonally adjusted), the monthly percentage change in exchange rate measured by the trade-weighted index, CPI inflation, unemployment rate (seasonally adjusted), current account balance as a percentage of GDP, quarterly percentage change in consumption for the government (seasonally adjusted) and also for the private sector (seasonally adjusted), quarterly percentage change in total investment (seasonally adjusted), quarterly percentage change in New Zealand's net international investment position (NIIP) (seasonally adjusted), the performance of manufacturing index (seasonally adjusted) and the quarterly percentage change in net migration (seasonally adjusted). The data collected is in both monthly (M) and quarterly (Q) frequencies, where appropriate. We used all available data from 1999.

In 2010, a series of changes to policies were made in New Zealand which had direct effects on the consumer price index. For example, on the 1 October 2010 the GST rate rose from 12.5 % to 15 % (Inland Revenue, New Zealand, 2010). There was also a tax increase on tobacco in New Zealand on 28 April 2010. The excise rate for loose-leaf tobacco and factory made cigarettes increased by 24 % and 10 %, respectively (ASH New Zealand, 2010). The tobacco excise tax rose by a further 10 % on 1 January 2011, as well as on the 1 January 2012 (ASH New Zealand, 2010). Although these policy changes may not be completely independent from the first earthquake since they occurred after this event (with the exception of the initial tax increase on tobacco which occurred in April 2010), it is important that they are taken into consideration when assessing the effects of the earthquakes.

[6] We used GDP data collected using the production-based method following Statistics NZ recommendations.

4. Results

4.1 Data Description: Figures 1-16

Before we present our VAR results, we plot our macroeconomic series to establish some of the relevant trends in the periods before and after the Canterbury earthquakes, and assess whether the patterns in the New Zealand macroeconomic variables post-quakes appear different by historical standards. This analysis is purely observational and changes from the historical average around this time might not necessarily be directly related to the earthquakes. In section 4.2, the impact of the earthquakes on macroeconomic variables is estimated more systematically with macro VAR models.

Figure 1 shows the seasonally adjusted quarterly real GDP growth rate as a function of time. The upper and lower horizontal lines in this figure (and elsewhere in this paper) represent 1.5 standard deviations from the average value for the control period, calculated using the baseline data from 2000 Q1 to 2007 Q4, for each of the variables considered.[7] The only obvious outlier is the decline in GDP growth that is associated with the GFC. We observe more moderate declines that appear to be associated with both earthquakes, though in both cases the decline is still within the benchmark bounds.

Figure 2 shows the evolution of inflation; in the post 2009 data, we also account for two material policy changes, the increase in GST and the increase in cigarette taxes, as these both affected headline inflation.[8] As can be observed, once we account for these policy changes, we find only a moderate increase in inflation after the first earthquake, whereas

[7] In a few instances data was only available starting from a later date (after 2000 Q1), in which case we adjusted the baseline period.

[8] The adjusted CPI inflation excludes the direct impact of the increase in the rate of GST and the excise tax on tobacco, and the incorporation of stationary energy and liquid fuel sectors to the amended Emission Trading Scheme.

there is not much change from the average value around the time of the second earthquake.

Figure 3 shows the current account balance (% of GDP). Here, it is apparent that the period in the lead up to the global crisis was exceptional, and the large deficits that were prominent in 2005-2008 disappeared after the onset of the crisis, and before the earthquakes. This representation, at least, does not suggest any impact of the quake. The unemployment rate, in Figure 4, and the 90-day interest rate, in figure 5, both show dramatic changes after the onset of the GFC, but no visible impact of the Canterbury earthquakes, except for the second (more destructive) earthquake and the market interest rate.[9]

The percentage change in net international investment position for New Zealand (NIIP) is shown in figure 6. We observe a moderate increase after the first earthquake, followed by a more significant decline, and then a sharp increase after the second earthquake. A large part of the improvement reflected reinsurance inflows. According to Statistics New Zealand, as of 31 March 2011 New Zealand's international assets were valued at $180.6 billion (Statistics New Zealand, 2011). This was 17.0 percent higher than for 31 March 2010. The financial and insurance services industry increased its international assets by 20.7 billion from the 31 March 2010, to $117.0 billion at 31 March 2011 (Statistics New Zealand, 2011). This increase is partly attributable to overseas reinsurance claims resulting from the Canterbury earthquakes (Statistics New Zealand, 2011). However, this is likely to

[9] After the second earthquake, the Reserve Bank of New Zealand lowered the official cash rate (OCR) from 3% to 2.5%. As mentioned in the monetary policy statement, this was done to lessen the economic impact of the earthquake since there was considerable damage done to infrastructure and buildings, as well as disruption to business activity and a likely deterioration in consumer and business confidence (Reserve Bank of New Zealand, 2011).

only be a temporary improvement in the NIIP as much of this reinsurance money will have to be repatriated to pay claims on property damages resulting from the earthquakes.

For consumption by the private sector, in figure 7, we observe a decrease after the first earthquake which falls outside the lower 1.5 STD bound. There is a sharp increase after the second earthquake, but this lies within the bounds. Government consumption is shown in figure 8; here we find no significant deviation from the average value around the time of the earthquakes.

For investment, we reach no conclusions, as investment has typically been volatile. This also appears the case for imports, in Figure 10, and exports, in Figure 11. The exchange rate, remarkably, is extremely volatile in the period leading up and during the global crisis (2004-209), but has been quite stable in the post-crisis Canterbury earthquakes period of 2010-2011.

The Performance Manufacturing Index (PMI) is shown in figure 13. An observation above 50 denotes an expanding manufacturing sector, and we observe a slowdown but still expanding manufacturing after both large earthquakes. The index dropped significantly below 50 in the immediate aftermath of the Lehman collapse of 2008, and then again at the end of 2011, but this drop does not appear to be associated with the second Canterbury earthquake.

One potential outcome of a large shock is for people to leave; there is a very dramatic increase in migration to New Zealand in the immediate aftermath of the global crisis, and more moderate declines that appear to be associated with both earthquakes. The increase in the number of people leaving in 2011 compared to previous years can be partly

explained by the 22 February 2011 earthquake, with evidence of some people wanting to leave because of this event.[10]

Since we are, of course, interested here at the impact of the events at the national level, this data does not account for significant mobility within New Zealand, and some demographic changes in the Canterbury region that are clearly associated with the quakes.

For fixed capital formation by the private sector (Figure 15) and by the government (Figure 16) we again do not see any visible deviation from the average value during and after the time of the earthquakes. We do observe a very large decrease in private sector capital formation in the 2008 year of the GFC.

4.2 Impulse Response Functions

We estimate a set of structural vector autoregressions (SVAR) with identification obtained by placing restrictions on the contemporaneous correlation between the variables included in each of the three VAR models we estimate. Results for all three are presented in appendix tables A1-A3, as we are agnostic to what is the preferred model specification. To determine the appropriate number of lags, we examined the Akaike and Schwarz information criteria. In most cases, these tests selected VAR models with two lags, and we therefore consistently used two lags in our estimated models.

Given the interactions between the various variables, and the potential indirect impact of the earthquakes, a clearer understanding of their direct and indirect impact is provided by examining the impulse response function. The impulse we are interested in is the occurrence of a disaster similar in magnitude to the earthquakes, and we trace the impact of both earthquakes on the macroeconomic variables included in our three

[10] A large number of people have moved to Australia: 30,500 in 2010/2011 compared to 16,700 in 2009/2010 (Department of Labour, 2011, p.vi).

specifications discussed above. These results are presented in figures 17-19 and are described below.[11]

All of our three VAR models yield estimates of the national macroeconomic impact of the earthquakes that is almost never statistically significant at below the 5% level (the impulse response figures show the 2SD confidence interval). This lack of statistical significance may not be that surprising given the failure of other empirical models to identify much impact of natural disasters, adverse or otherwise, in high-income countries. However, several characteristics of these results are worth noting.

The first model includes real GDP growth, inflation, change in the unemployment rate, and change in the current account balance. The impulse responses suggest that, if they had any impact, both earthquakes decreased both New Zealand's real GDP growth and inflation. There were no noticeable impacts on the current account and unemployment. The second model adds change in net migration, private consumption, and investment, and obtains similar results, with some indication that unemployment may have decreased somewhat, but with a significant lag. We note, however, that none of these observations are found to be statistically significant using the common thresholds.

The third model includes all the variables in model two, in addition to exports, imports, and government consumption. Again, none of the results are statistically significant, and besides some indication that the real GDP did indeed decrease, even our previous observation about inflation does not seem to persist. In short, we conclude that the Christchurch earthquake had no real observable macroeconomic impact at the national level, even with a horizon of several quarters. This result is somewhat surprising given the

[11] In our VAR estimations, we include binary indicators for the two earthquakes and for the global financial crisis (Q3, 2008). We are not interested, however, in the global financial crisis per se, and therefore do not present the relevant impulse response functions.

exceptional magnitude of the event (in relative terms) for a developed high-income economy, and is in contrast to informal discussions of their impact.

5. Discussion / limitations

It is difficult to isolate the effects of the earthquakes from other macroeconomic shocks during the period under consideration. For example, while it was feasible to control for the immediate onset of the global financial crisis, as it peaked some time before the first earthquake, the GFC, and its most recent evolution into the Euro crisis, has had a continuing impact on economies around the world. There have also been offsetting shocks and policy changes that will mask the effects of the earthquakes. For example, it is possible that the expansive monetary policy embarked on by the Reserve Bank of New Zealand offset some of the effects of the shock, and that a favourable terms-of-trade environment (especially high agricultural export prices) also contributed to a rapid New Zealand recovery; without these countervailing forces, the New Zealand economy could have suffered worse.[12] While we have attempted to control for the counterfactual, a VAR estimated over a 10 year period will only be able to do that imperfectly.

Maybe the biggest drawback of our study is that we are missing the regional impact. The data, for example, suggest that there have been large changes in employment in the Canterbury region. Both the Household Labour Force Survey (HLFS) and the Quarterly Employment Survey (QES) showed that employment in the Canterbury region dropped by about 5% as of the last quarter of 2012; with those working part-time, youth, females and workers in the retail trade and accommodation industries most affected (Statistics New

[12] The only important export sector that was clearly hurt by the earthquakes was international tourism. Christchurch was a major tourist destination, and all of the main attractions in the city centre, as well as most hotels, have been destroyed (Parker & Steenkamp, 2012).

Zealand, 2011). Over the next few years, these changes will be masked in aggregate employment numbers by increased employment in the construction industry. This sector has increased employment in the Canterbury region by 25% from June 2010, just before the first earthquake, to June 2012 (Parker & Steenkamp, 2012). These changes also manifested in a demographic change: an increase in the number of young males and a decrease in the number of somewhat older males and females and small children. We leave a detailed investigation into the regional short- and long-term impact of the Canterbury earthquakes for future work.

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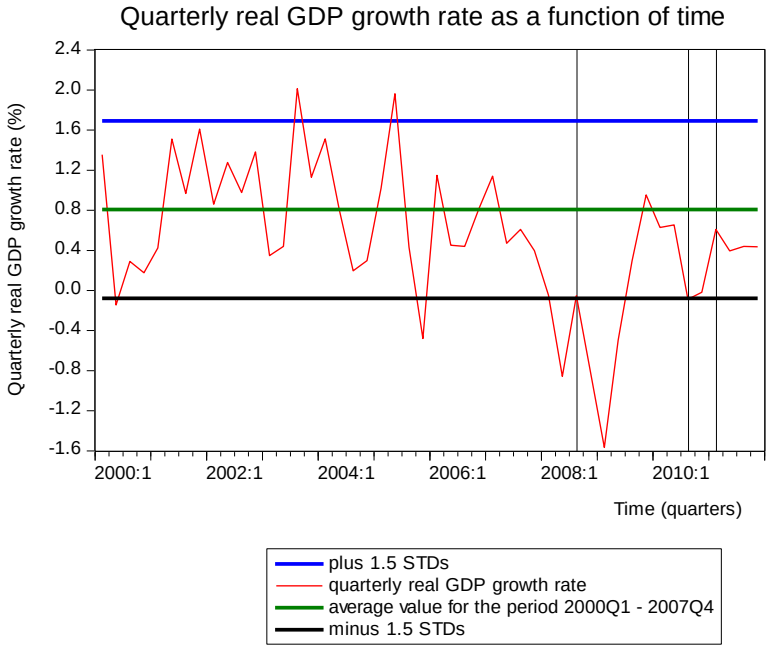
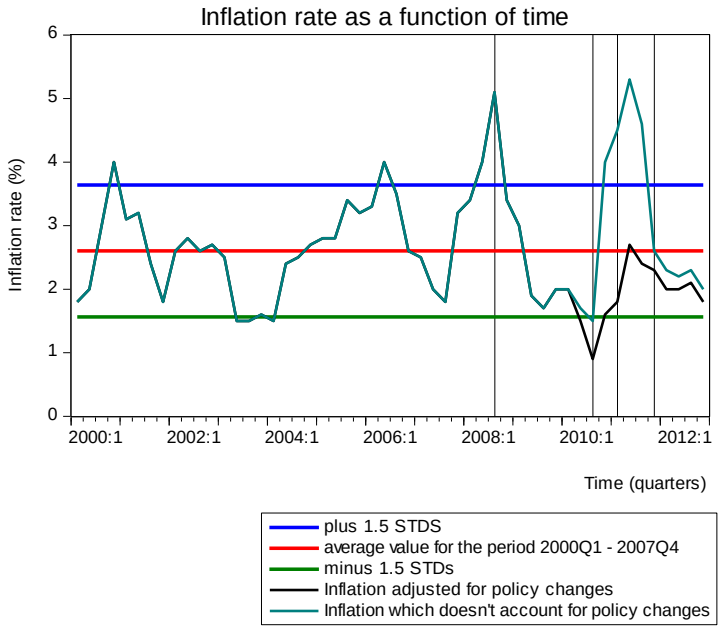
Figure 1: Quarterly real gross domestic product growth rate (seasonally adjusted)



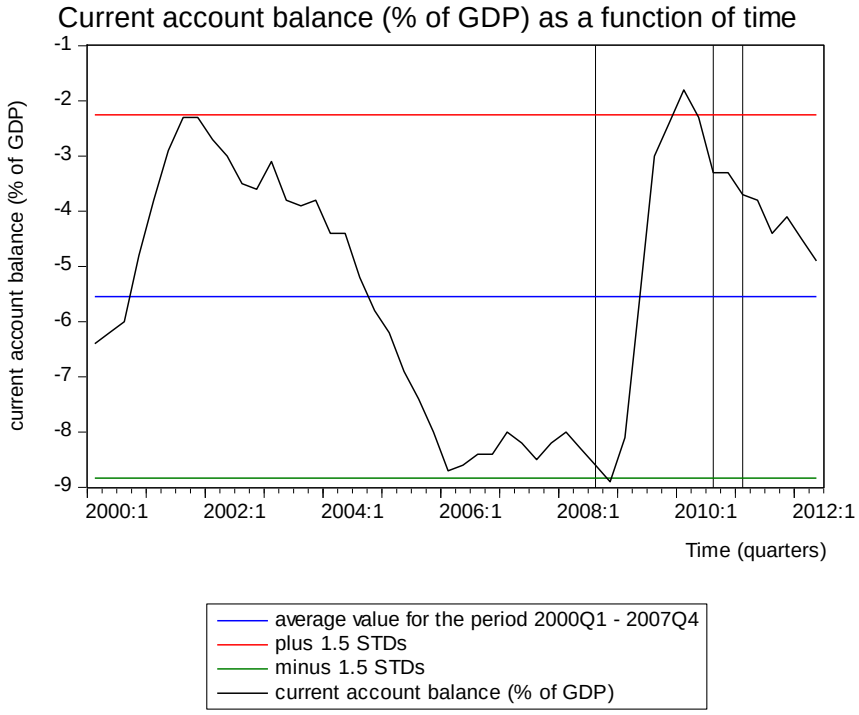
Source: Reserve Bank of New Zealand

Figure 2: CPI inflation before and after policy adjustments (darker line)



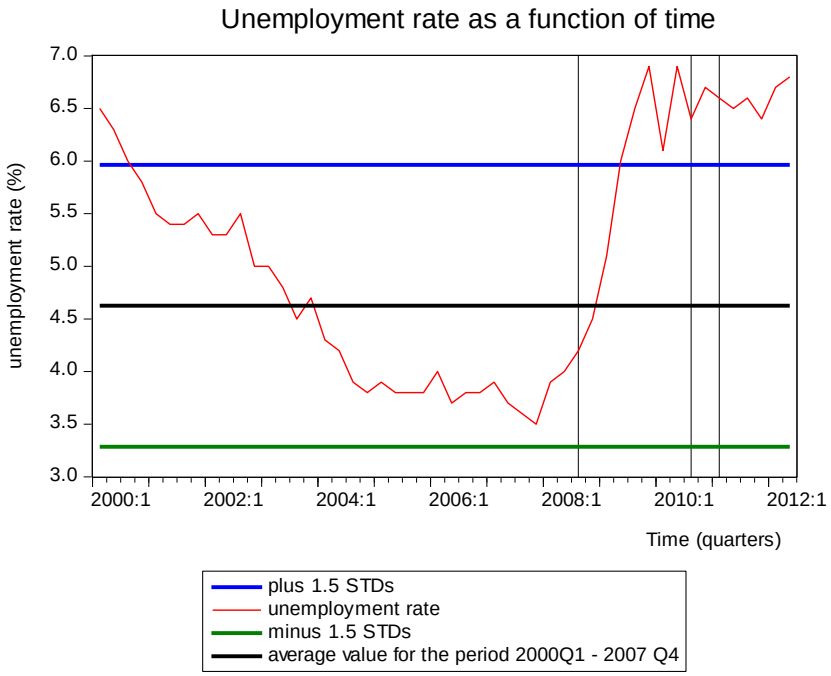
Source: Reserve Bank of New Zealand

Figure 3: Current account balance (% of GDP)



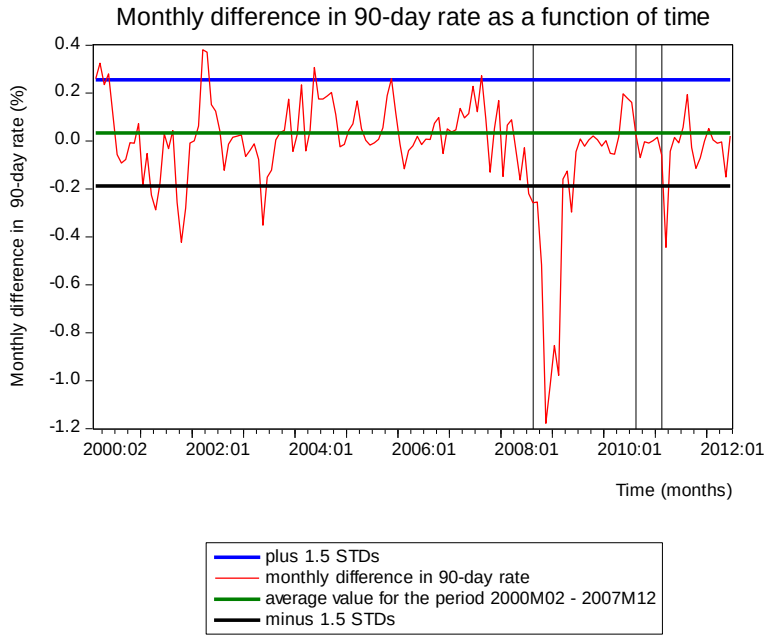
Source: Reserve Bank of New Zealand

Figure 4: Unemployment rate (seasonally adjusted)



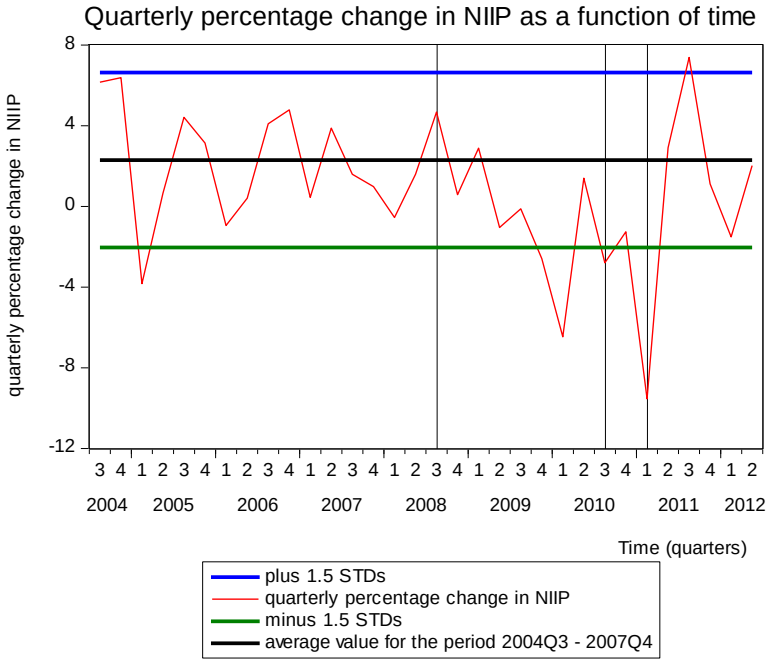
Source: Statistics New Zealand

Figure 5: Monthly difference in 90-day interest rate



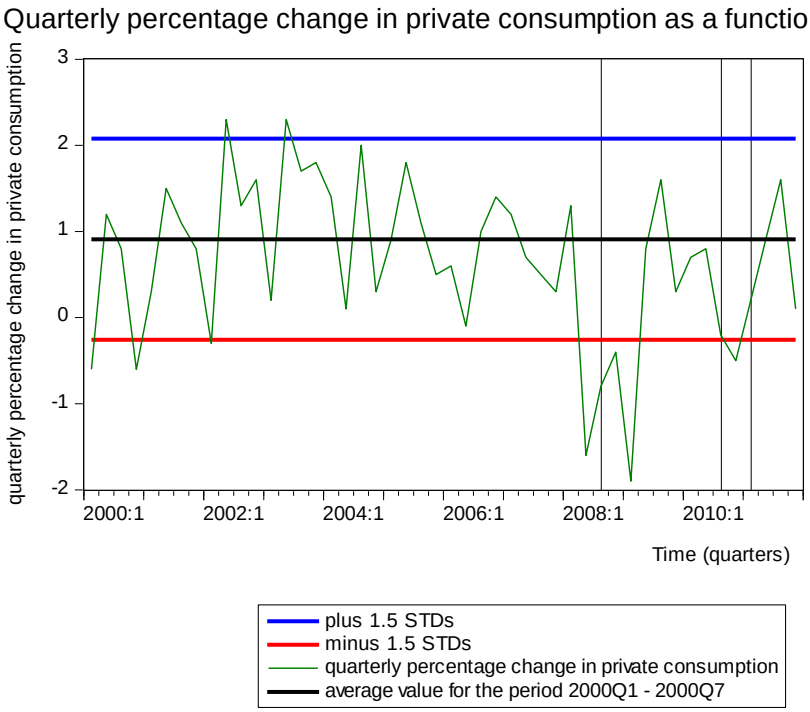
Source: Reserve Bank of New Zealand

Figure 6: Quarterly percentage change in net international investment position (seasonally adjusted)



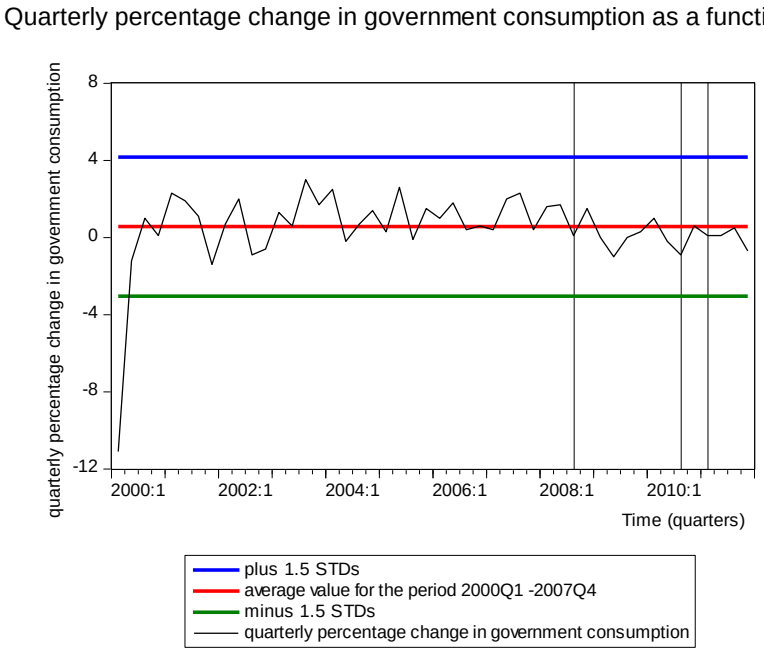
Source: Statistics New Zealand

Figure 7: Quarterly percentage change in private consumption (seasonally adjusted)



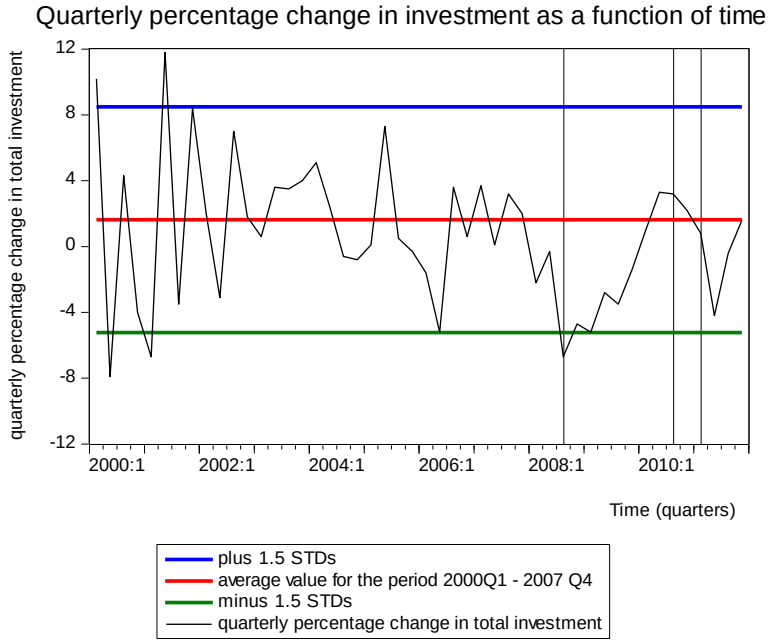
Source: Reserve Bank of New Zealand

Figure 8: Quarterly percentage change in government consumption (seasonally adjusted)



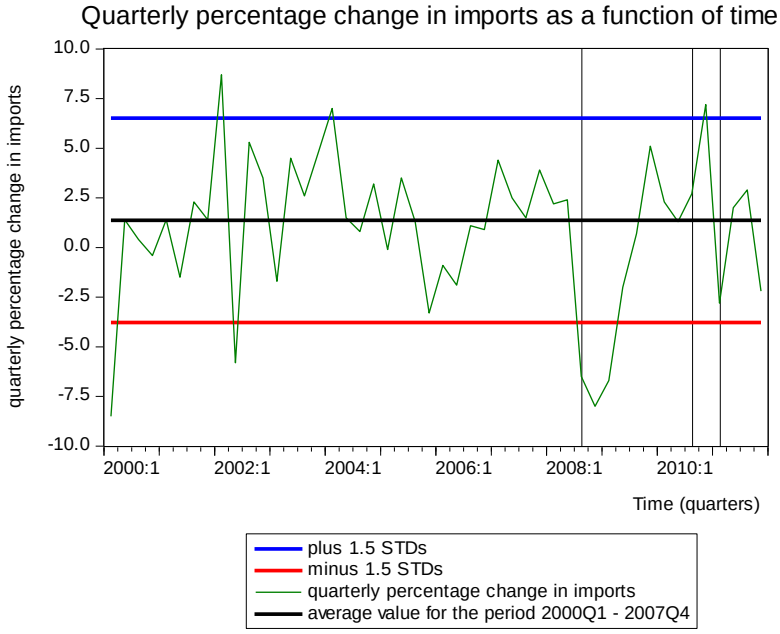
Source: Reserve Bank of New Zealand

Figure 9: Quarterly percentage change in total investment (seasonally adjusted)



Source: Reserve Bank of New Zealand

Figure 10: Quarterly percentage change in total imports as a function of time (seasonally adjusted)

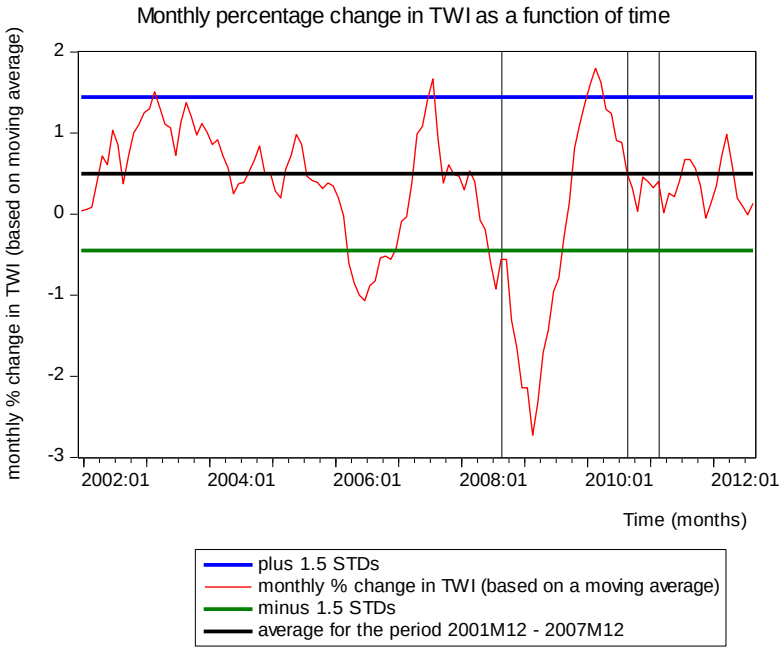


Source: Reserve Bank of New Zealand

Figure 11: Quarterly percentage change in exports (seasonally adjusted)

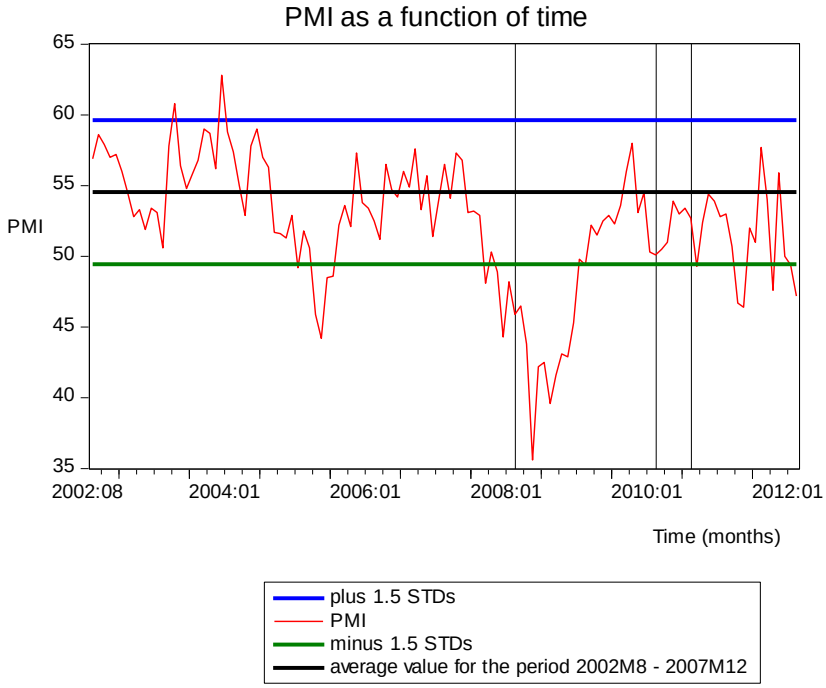
Source: Reserve Bank of New Zealand

Figure 12: Monthly percentage change in trade weighted index



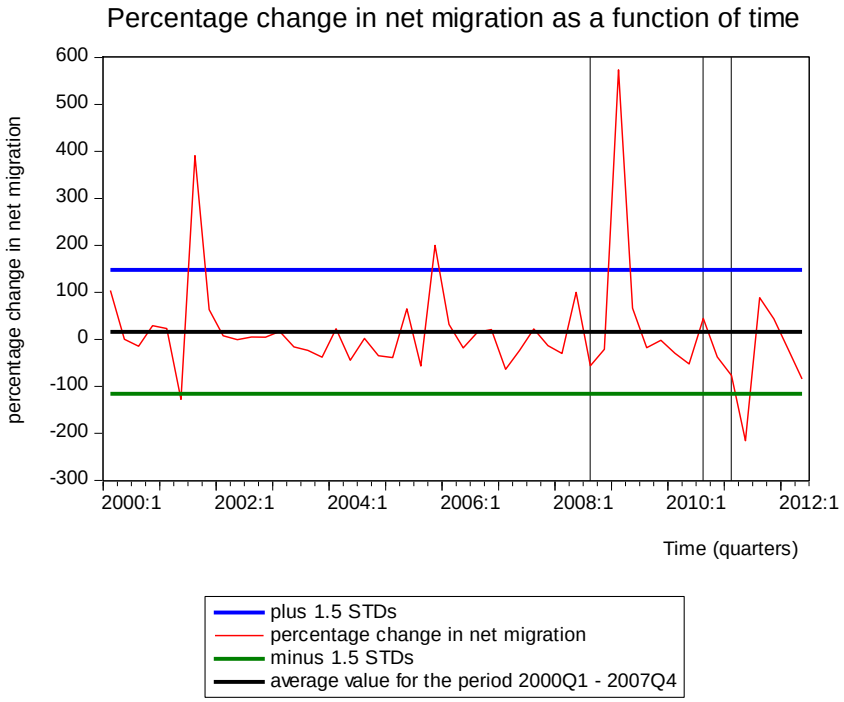
Source: Reserve Bank of New Zealand

Figure 13: Performance manufacturing index (seasonally adjusted)



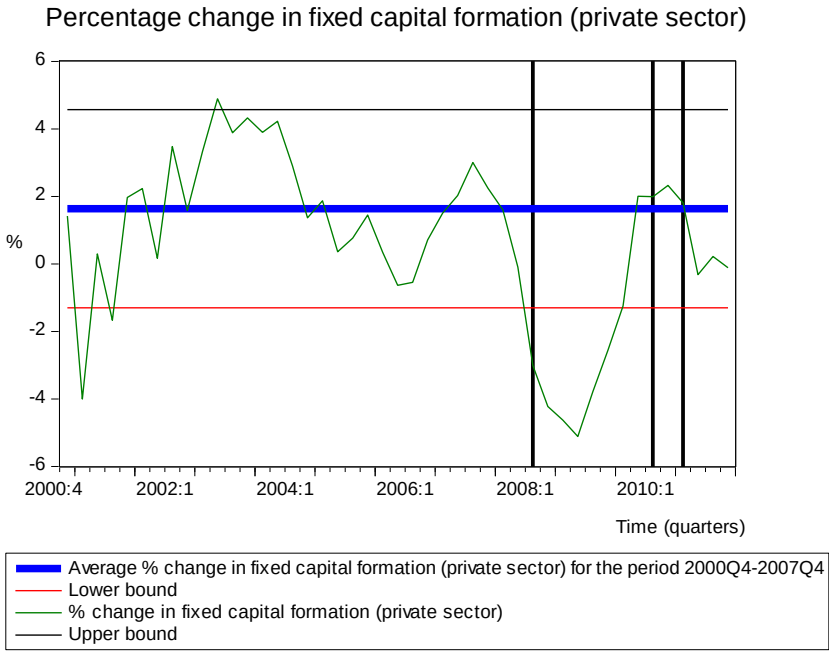
Source: BusinessNZ

Figure 14: Percentage change in net migration (seasonally adjusted)



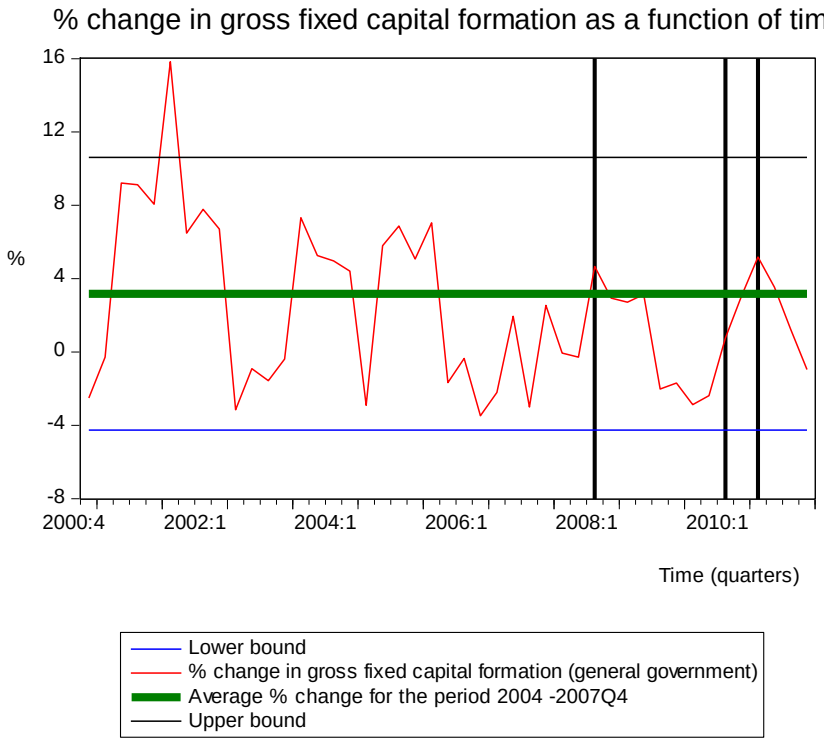
Source: Statistics New Zealand

Figure 15: Percentage change in gross fixed capital formation (private sector, seasonally adjusted)



Source: Statistics New Zealand

Figure 16: Percentage change in gross fixed capital formation (general government, seasonally adjusted)



Source: Statistics New Zealand

Figure 17: VAR 1

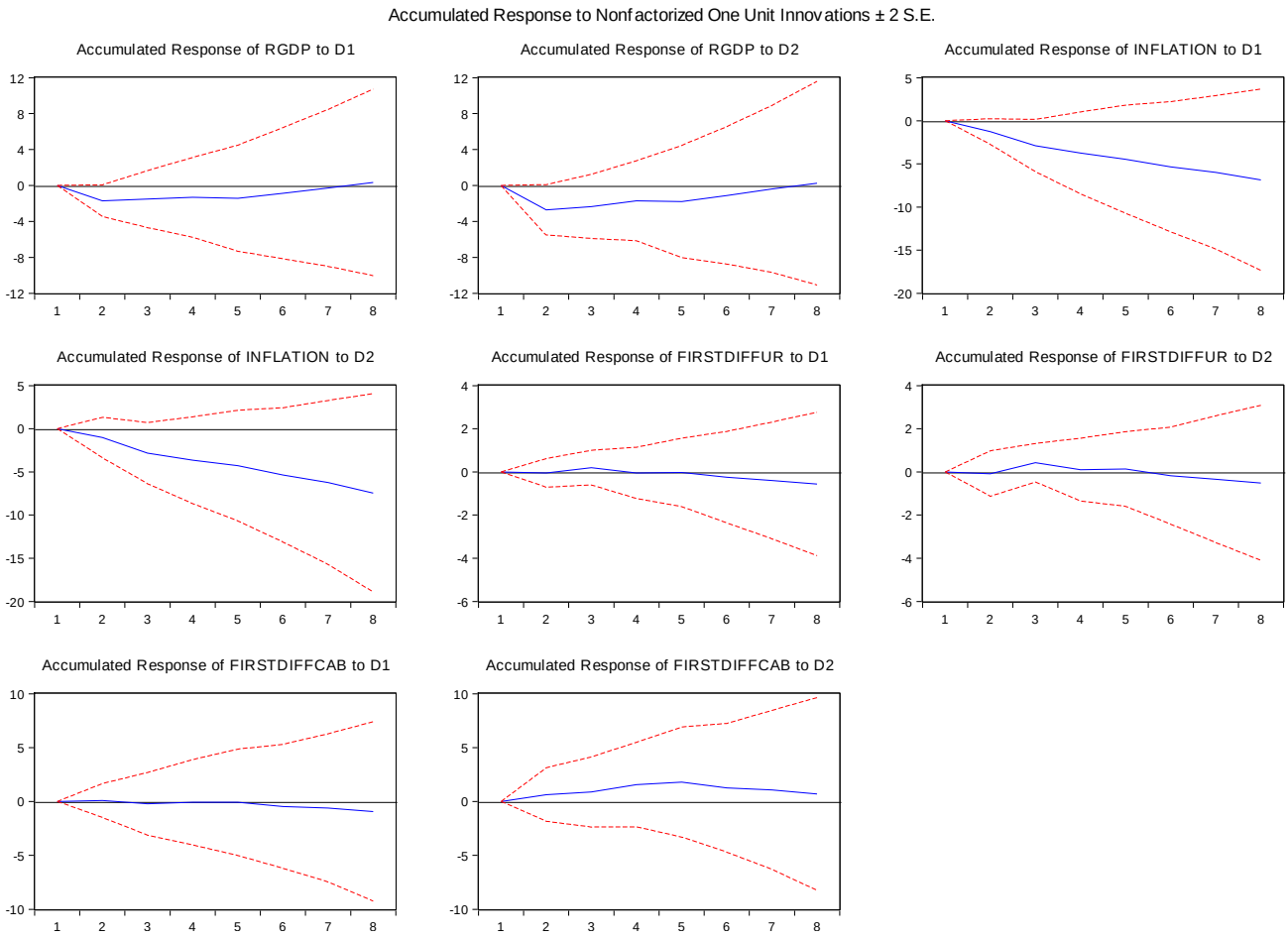


Figure 18: VAR 2

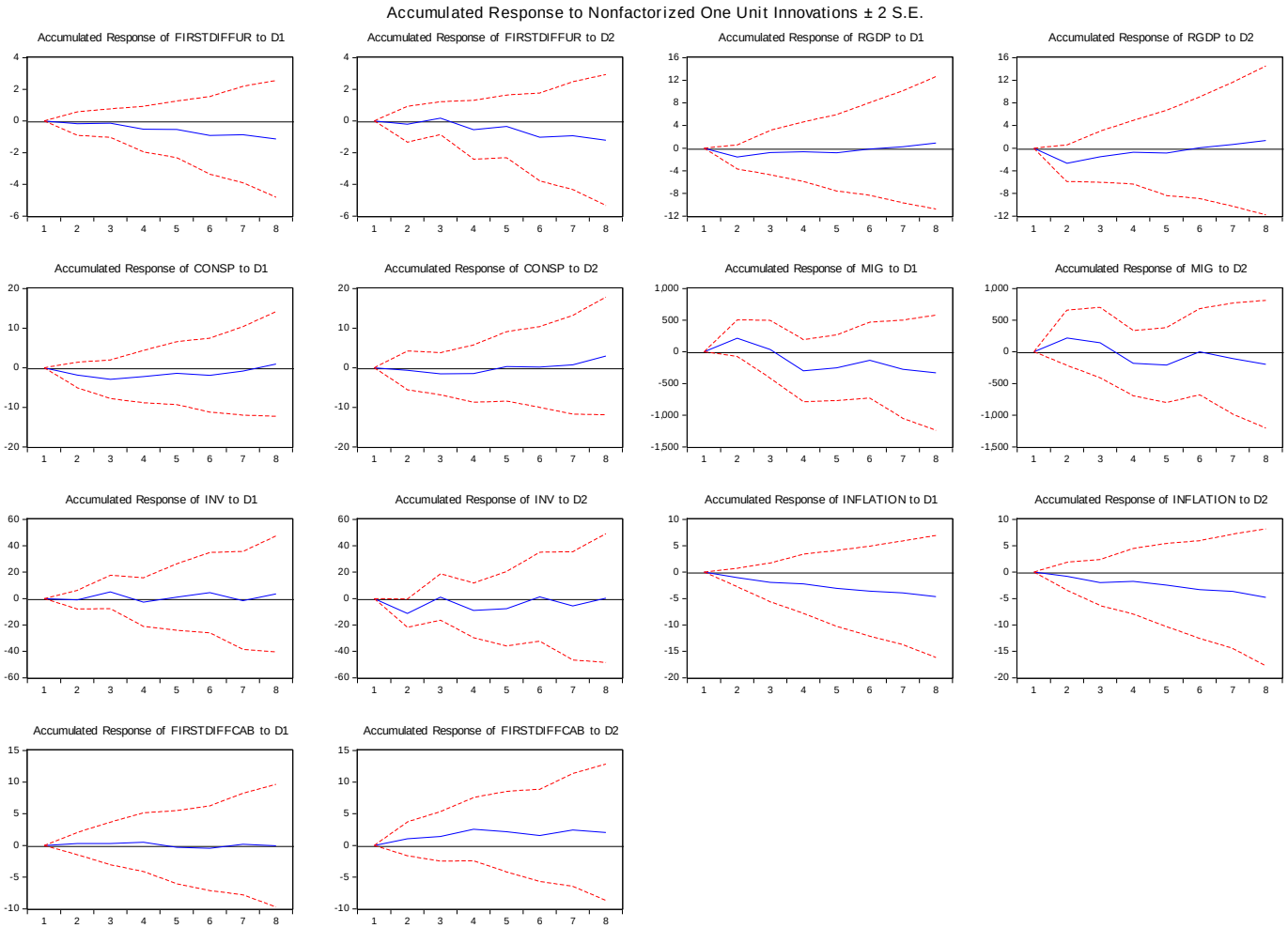
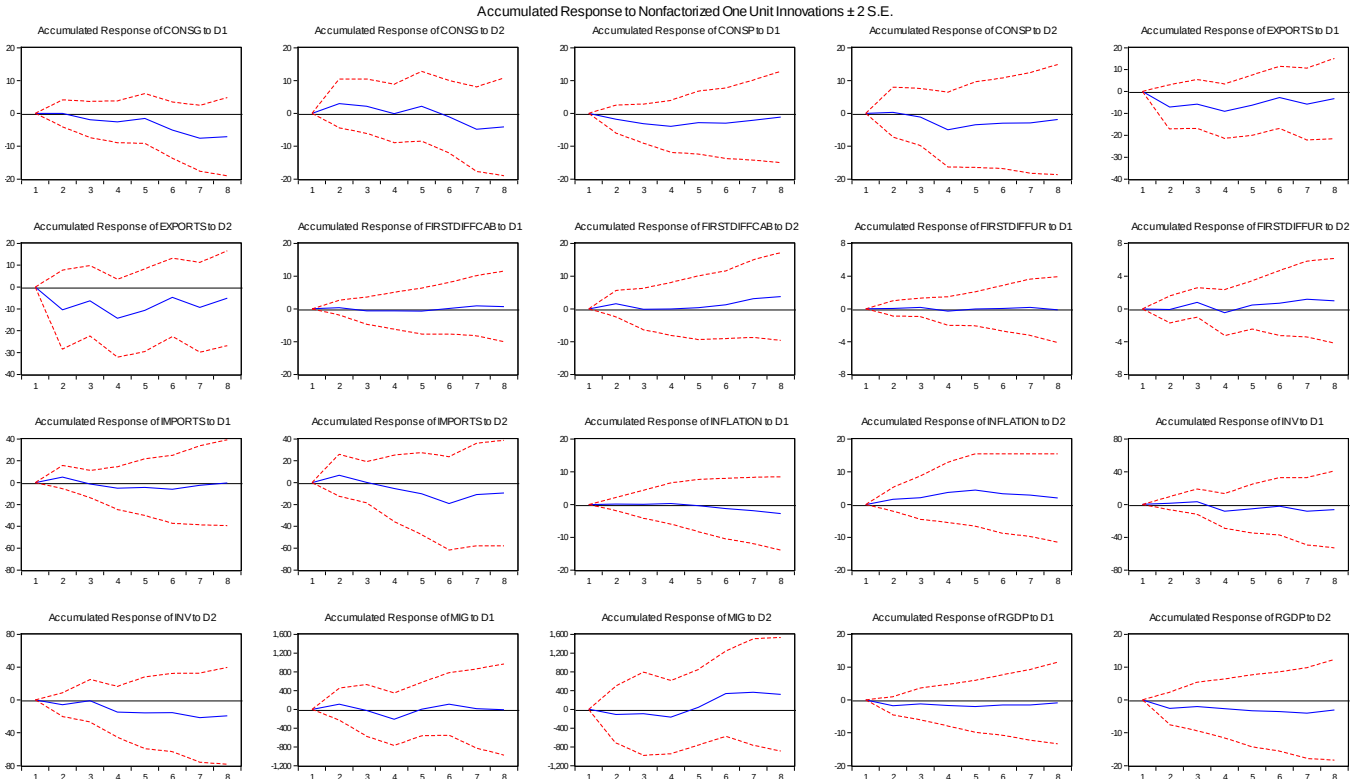


Figure 19: VAR 3



Appendix Table 1A

t-statistics in [ ]	VAR 1			
	Real GDP growth rate	Inflation	F.D u.r	F.D c.a.b (% of GDP)
Real GDP growth rate (-1)	0.214011 [1.31635]	-0.099304 [-0.78397]	-0.109229 [-1.65873]	-0.051397 [-0.34911]
Real GDP growth rate (-2)	-0.143676 [-0.84137]	-0.381371 [-2.86647]	-0.023954 [-0.34632]	-0.390621 [-2.52613]
Inflation (-1)	-0.392148 [-2.36638]	0.864267 [6.69389]	-0.071748 [-1.06893]	-0.232410 [-1.54877]
Inflation (-2)	0.112253 [0.68670]	-0.303186 [-2.38052]	0.110006 [1.66145]	0.228123 [1.54111]
F.D unemployment rate[13] (-1)	0.069224 [0.17620]	0.645453 [2.10868]	-0.337762 [-2.12258]	-0.417549 [-1.17369]
F.D unemployment rate (-2)	0.013559 [0.03655]	0.991950 [3.43172]	0.294723 [1.96130]	0.132627 [0.39478]
F.D c.a.b (% of GDP) (-1)	0.045593 [0.26290]	-0.435099 [-3.22016]	0.216792 [3.08631]	0.501978 [3.19650]
F.D c.a.b (% of GDP) (-2)	0.206617 [1.21522]	0.191177 [1.44318]	-0.261874 [-3.80264]	-0.196771 [-1.27805]
C	1.457567 [2.96792]	1.692025 [4.42209]	-0.037824 [-0.19015]	0.256386 [0.57652]
D_1	-1.191317 [-2.31693]	-1.108486 [-2.76702]	0.104051 [0.49961]	-0.162596 [-0.34921]
D_2	-0.306748 [-0.83911]	-0.557921 [-1.95886]	-0.025086 [-0.16942]	-0.157216 [-0.47493]
D_3	-1.141889 [-2.42929]	-1.578715 [-4.31079]	0.205119 [1.07737]	0.387068 [0.90937]
R-squared	0.517632	0.786024	0.616887	0.637144
Adj. R-squared	0.356843	0.714699	0.489183	0.516192
Sum sq. resids	11.01409	6.685836	1.806930	9.031403
S.E. equation	0.577720	0.450112	0.233999	0.523143
F-statistic	3.219322	11.02029	4.830594	5.267744
Log likelihood	-32.18378	-20.95213	8.486017	-27.71825
Akaike AIC	1.963723	1.464539	0.156177	1.765256
Schwarz SC	2.445500	1.946316	0.637954	2.247032
Mean dependent	0.551661	2.582222	0.008889	0.042222
S.D. dependent	0.720375	0.842693	0.327402	0.752115
Determinant resid covariance (dof adj.)	0.000691			
Determinant resid covariance	0.000200			
Log likelihood	-63.75496			
Akaike information criterion	4.966887			
Schwarz criterion	6.893994			

[13] F.D, c.a.b, cons. government, cons. private, u.r, investment and migration, represent first difference, current account balance, consumption government (% change), consumption private (% change), unemployment rate, investment (% change in total investment) and net migration (% change), respectively.

Appendix Table 1B

t-statistics in [ ]	VAR 2						
	F.D unemployment rate	Real GDP growth rate	% change in private consumption	% change in net migration	Investment	Inflation	F.D c.a.b (% of GDP)
F.D u.r (-1)	-0.261151	0.208115	0.209597	-32.53521	0.792625	0.711778	-0.723289
	[-1.33486]	[0.40677]	[0.26480]	[-0.38128]	[0.36031]	[1.78555]	[-1.70493]
F.D u.r (-2)	0.352329	0.053979	-0.225578	-78.79505	-1.542210	1.030478	-0.027938
	[2.13038]	[0.12481]	[-0.33713]	[-1.09232]	[-0.82931]	[3.05795]	[-0.07790]
Real GDP growth rate (-1)	-0.100951	0.378181	0.439773	-45.34783	2.840050	-0.036205	-0.016626
	[-1.15095]	[1.64871]	[1.23927]	[-1.18534]	[2.87965]	[-0.20258]	[-0.08742]
Real GDP growth rate (-2)	-0.003962	-0.127520	0.429599	66.00915	2.475065	-0.308498	-0.356388
	[-0.04611]	[-0.56755]	[1.23588]	[1.76144]	[2.56198]	[-1.76222]	[-1.91292]
Cons. private (-1)	0.039894	-0.016993	-0.094005	19.60029	0.057655	-0.114053	0.047253
	[0.63723]	[-0.10379]	[-0.37113]	[0.71777]	[0.08190]	[-0.89408]	[0.34807]
Cons. private (-2)	-0.119056	-0.040564	-0.276693	8.659212	-1.070461	0.034341	0.072674
	[-1.84114]	[-0.23987]	[-1.05760]	[0.30701]	[-1.47222]	[0.26064]	[0.51828]
Migration (-1)	0.000433	0.000873	0.000601	-0.242969	0.005448	-0.000479	0.002092
	[1.08672]	[0.83795]	[0.37297]	[-1.39836]	[1.21628]	[-0.59044]	[2.42150]
Migration (-2)	-0.000511	-0.000398	-0.000518	-0.169121	-0.005269	0.000221	0.000500
	[-1.07250]	[-0.31936]	[-0.26858]	[-0.81326]	[-0.98287]	[0.22743]	[0.48318]
Investment (-1)	0.010238	-0.042166	-0.035884	13.81715	-0.724824	-0.015083	0.021872
	[0.70451]	[-1.10952]	[-0.61033]	[2.17990]	[-4.43584]	[-0.50938]	[0.69409]
Investment (-2)	0.003654	-0.017462	-0.026298	0.196134	-0.347024	-0.025860	-0.020270
	[0.27597]	[-0.50435]	[-0.49097]	[0.03397]	[-2.33115]	[-0.95862]	[-0.70608]
Inflation (-1)	-0.023804	-0.399609	-0.284719	-1.208976	-3.548928	0.777653	-0.055794
	[-0.28641]	[-1.83848]	[-0.84670]	[-0.03335]	[-3.79741]	[4.59191]	[-0.30957]
Inflation (-2)	0.040056	0.008642	-0.225768	91.66638	0.891087	-0.273053	0.136659
	[0.49304]	[0.04067]	[-0.68686]	[2.58681]	[0.97544]	[-1.64947]	[0.77571]
F.D c.a.b (% of GDP) (-1)	0.231571	0.027849	0.486666	38.41832	0.431851	-0.446618	0.508404
	[3.02098]	[0.13892]	[1.56922]	[1.14906]	[0.50103]	[-2.85945]	[3.05859]
F.D c.a.b (% of GDP) (-2)	-0.270015	0.189909	-0.351960	-38.71263	-0.288559	0.172697	-0.171422
	[-3.57098]	[0.96038]	[-1.15049]	[-1.17380]	[-0.33939]	[1.12090]	[-1.04548]
C	0.065894	1.759396	1.978417	-292.2430	6.810860	1.874468	-0.221679
	[0.24418]	[2.49303]	[1.81205]	[-2.48285]	[2.24457]	[3.40899]	[-0.37883]
D_1	0.067039	-1.195763	-1.250538	77.44832	0.109352	-1.201776	0.213643
	[0.28325]	[-1.93190]	[-1.30595]	[0.75023]	[0.04109]	[-2.49199]	[0.41627]
D_2	-0.130919	-0.458140	-0.485487	52.40122	-3.220144	-0.604452	0.243518
	[-0.67523]	[-0.90353]	[-0.61889]	[0.61962]	[-1.47702]	[-1.53000]	[0.57920]
D_3	0.159983	-1.382015	-0.440451	270.2699	-4.584544	-1.708378	0.670812
	[0.71520]	[-2.36248]	[-0.48668]	[2.77009]	[-1.82271]	[-3.74820]	[1.38295]
R-squared	0.687599	0.558673	0.378259	0.562000	0.734378	0.804218	0.721639
Adj. R-squared	0.490902	0.280800	-0.013208	0.286223	0.567134	0.680949	0.546374
Sum sq. resids	1.473423	10.07700	24.11859	280315.4	186.2932	6.117348	6.928346
S.E. equation	0.233605	0.610919	0.945136	101.8924	2.626737	0.475992	0.506562
F-statistic	3.495724	2.010535	0.966260	2.037875	4.391060	6.524046	4.117430
Log likelihood	13.07693	-30.18308	-49.81944	-260.4349	-95.81707	-18.95272	-21.75380
Akaike AIC	0.218803	2.141470	3.014198	12.37489	5.058536	1.642343	1.766836
Schwarz SC	0.941468	2.864135	3.736863	13.09755	5.781201	2.365008	2.489501
Mean dependent	0.008889	0.551661	0.680000	17.72712	0.582222	2.582222	0.042222
S.D. dependent	0.327402	0.720375	0.938955	120.6036	3.992452	0.842693	0.752115
Determinant resid covariance (dof adj.)	8.435194						
Determinant resid covariance	0.236131						
Log likelihood	-414.4899						
Akaike information criterion	24.02177						
Schwarz criterion	29.08043						

Appendix Table 1C

t-statistics in [ ] VAR 3

	Cons. (government)	Cons. (private)	Exports	Imports	F.D c.a.b (% of GDP)	F.D u.r	Inflation	Investment	Migration	Real GDP growth rate
Cons. government (-1)	-0.224254	-0.186770	0.231678	-0.503170	0.048361	0.058170	0.240919	0.140336	12.21283	-0.159902
	[-0.91446]	[-0.77788]	[0.39793]	[-0.83764]	[0.38282]	[1.00602]	[2.11072]	[0.26255]	[0.48018]	[-1.04931]
Cons. government (-2)	0.083786	0.006441	-0.044144	0.317019	0.006835	0.011767	-0.046499	0.564302	0.685918	0.022771
	[0.47509]	[0.03730]	[-0.10543]	[0.73385]	[0.07523]	[0.28299]	[-0.56648]	[1.46800]	[0.03750]	[0.20778]
Cons. private (-1)	-0.166495	-0.187079	0.465002	0.453306	0.041842	0.076251	-0.117291	0.347993	18.75852	-0.061146
	[-0.56612]	[-0.64970]	[0.66597]	[0.62924]	[0.27618]	[1.09960]	[-0.85686]	[0.54286]	[0.61499]	[-0.33458]
Cons. private (-2)	-0.276594	-0.386568	-0.893830	0.162206	0.054073	-0.098427	0.145118	-0.896269	11.08351	-0.145335
	[-0.88583]	[-1.26448]	[-1.20575]	[0.21208]	[0.33617]	[-1.33691]	[0.99852]	[-1.31691]	[0.34225]	[-0.74904]
Exports (-1)	-0.201951	0.032578	-0.374553	-0.065636	0.061355	-0.007800	0.041841	-0.457086	-5.331420	-0.034153
	[-1.96874]	[0.32437]	[-1.53798]	[-0.26122]	[1.16108]	[-0.32248]	[0.87635]	[-2.04433]	[-0.50112]	[-0.53579]
Exports (-2)	-0.085748	-0.001949	-0.171391	0.172059	0.039440	-0.022206	0.096605	0.215085	-7.920684	-0.025209
	[-0.77655]	[-0.01803]	[-0.65377]	[0.63612]	[0.69335]	[-0.85291]	[1.87964]	[0.89364]	[-0.69162]	[-0.36739]
Imports (-1)	0.058983	-0.028425	0.021748	-0.547986	0.015377	-0.002978	-0.013561	0.536683	-12.15366	0.012753
	[0.70401]	[-0.34653]	[0.10934]	[-2.67021]	[0.35628]	[-0.15074]	[-0.34775]	[2.93889]	[-1.39870]	[0.24496]
Imports (-2)	-0.013341	-0.096202	-0.242646	-0.190599	-0.048458	0.012826	-0.014813	0.395738	-9.073653	-0.046202
	[-0.17485]	[-1.28778]	[-1.33950]	[-1.01980]	[-1.23287]	[0.71292]	[-0.41711]	[2.37955]	[-1.14662]	[-0.97446]
F.D c.a.b (-1) (% of GDP)	0.318638	0.303194	-0.240934	1.266189	0.320340	0.262798	-0.573486	2.266395	37.93286	0.082515
	[0.70952]	[0.68955]	[-0.22597]	[1.15102]	[1.38468]	[2.48181]	[-2.74360]	[2.31532]	[0.81441]	[0.29568]
F.D c.a.b (-2) (% of GDP)	-0.197329	-0.195425	-0.293880	-0.045100	-0.068918	-0.257602	0.223782	-2.384761	-12.62758	0.145487
	[-0.47009]	[-0.47549]	[-0.29488]	[-0.04386]	[-0.31871]	[-2.60265]	[1.14536]	[-2.60640]	[-0.29005]	[0.55775]
F.D u.r(-1)	0.158497	0.243981	-0.606767	2.158372	-0.917498	-0.235390	0.443798	-1.075282	-10.81126	0.242007
	[0.16482]	[0.25913]	[-0.26577]	[0.91630]	[-1.85211]	[-1.03815]	[0.99153]	[-0.51301]	[-0.10840]	[0.40499]
F.D u.r (-2)	-0.061288	-0.282522	0.181913	2.147828	-0.120141	0.384399	1.009380	-2.041560	-60.70014	0.002833
	[-0.08328]	[-0.39211]	[0.10412]	[1.19150]	[-0.31691]	[2.21533]	[2.94688]	[-1.27276]	[-0.79529]	[0.00619]
Inflation (-1)	-0.245079	-0.373328	0.154597	-2.021661	-0.001566	-0.002406	0.945891	-3.353002	3.899248	-0.468360
	[-0.60755]	[-0.94524]	[0.16142]	[-2.04597]	[-0.00754]	[-0.02529]	[5.03785]	[-3.81343]	[0.09320]	[-1.86844]
Inflation (-2)	-0.074893	-0.399695	-1.730859	-1.813310	0.105465	0.039658	-0.270053	2.110943	54.71948	-0.075953
	[-0.18252]	[-0.99492]	[-1.77680]	[-1.80415]	[0.49895]	[0.40991]	[-1.41404]	[2.36030]	[1.28583]	[-0.29789]
Investment (-1)	-0.045942	-0.047470	-0.038478	-0.128012	0.028159	0.010591	0.023486	-0.796502	14.97441	-0.063282
	[-0.62389]	[-0.65841]	[-0.22009]	[-0.70968]	[0.74229]	[0.60998]	[0.68522]	[-4.96239]	[1.96067]	[-1.38293]
Investment (-2)	0.064910	-0.010106	-0.199832	-0.147485	-0.007482	0.001280	0.001742	-0.488071	3.922903	-0.020193
	[0.94582]	[-0.15040]	[-1.22647]	[-0.87733]	[-0.21164]	[0.07912]	[0.05453]	[-3.26278]	[0.55114]	[-0.47350]
Migration (-1)	-0.004603	-0.000432	0.005617	-0.002212	0.001773	0.000571	-0.000320	0.011624	-0.318387	0.000537
	[-2.37991]	[-0.22792]	[1.22327]	[-0.46684]	[1.78008]	[1.25111]	[-0.35585]	[2.75759]	[-1.58733]	[0.44722]
Migration (-2)	-0.002104	-0.001907	0.000889	-0.005583	0.000711	-5.92E-05	0.001447	-0.004274	-0.127276	-0.001582
	[-0.83077]	[-0.76899]	[0.14786]	[-0.90010]	[0.54540]	[-0.09921]	[1.22759]	[-0.77435]	[-0.48460]	[-1.00515]
Real GDP growth rate (-1)	0.157528	0.553548	0.704719	1.521303	-0.058982	-0.159863	-0.111501	3.438205	-49.26150	0.529351
	[0.36686]	[1.31666]	[0.69127]	[1.44635]	[-0.26664]	[-1.57895]	[-0.55789]	[3.67350]	[-1.10613]	[1.98385]
Real GDP growth rate (-2)	-0.275083	0.332586	1.159767	0.292550	-0.442100	0.055995	-0.399803	2.239834	82.70824	-0.140640
	[-0.64738]	[0.79943]	[1.14964]	[0.28107]	[-2.01971]	[0.55889]	[-2.02151]	[2.41837]	[1.87675]	[-0.53264]
C	2.746203	3.266345	4.639957	12.12931	-0.293385	-0.109092	1.031061	0.205140	-186.9375	2.511178
	[1.65369]	[2.00892]	[1.17687]	[2.98178]	[-0.34295]	[-0.27861]	[1.33394]	[0.05667]	[-1.08537]	[2.43347]
D_1	-2.049651	-2.080791	-1.088808	-0.436609	0.221259	0.244765	-0.660718	4.492503	60.68565	-1.600103
	[-1.54625]	[-1.60327]	[-0.34597]	[-0.13447]	[0.32402]	[0.78312]	[-1.07090]	[1.55488]	[0.44141]	[-1.94256]
D_2	-2.409195	-1.074419	-0.550097	-3.753115	0.308651	0.006095	-0.030289	-1.325086	53.70672	-0.910865
	[-2.25895]	[-1.02893]	[-0.21725]	[-1.43663]	[0.56179]	[0.02424]	[-0.06102]	[-0.57002]	[0.48554]	[-1.37440]
D_3	-0.987060	-1.075185	0.688853	-7.075742	0.766963	0.196036	-1.190350	0.116616	195.4691	-1.707793
	[-0.80656]	[-0.89734]	[0.23709]	[-2.36039]	[1.21657]	[0.67937]	[-2.08978]	[0.04372]	[1.54004]	[-2.24571]
R-squared	0.558209	0.455989	0.451073	0.770726	0.765283	0.740504	0.847366	0.850873	0.629989	0.627708
Adj. R-squared	0.074342	-0.139832	-0.150133	0.519617	0.508213	0.456293	0.680195	0.687544	0.224738	0.219960
F-statistic	1.153641	0.765311	0.750280	3.069287	2.976939	2.605476	5.068870	5.209561	1.554566	1.539450
Log likelihood	-47.76547	-46.81446	-86.67405	-88.08068	-17.91664	17.25170	-13.35120	-82.82827	-256.6395	-26.35564
Akaike AIC	3.189576	3.147309	4.918847	4.981364	1.862962	0.299924	1.660053	4.747923	12.47287	2.238028
Schwarz SC	4.153130	4.110863	5.882400	5.944917	2.826515	1.263478	2.623606	5.711476	13.43642	3.201582
Mean dependent	0.757778	0.680000	0.757778	1.135556	0.042222	0.008889	2.582222	0.582222	17.72712	0.551661