Examining the Elasticity of New Zealand's Current Account to the Real Exchange Rate

Kam Szeto and David Oxley

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Abstract

The main purpose of this paper is to supplement the existing literature by quantifying the elasticity of New Zealand's current account to changes in the real exchange rate. The unusual composition of New Zealand's current account balance – particularly the large income deficit and the importance of the agricultural sector to the goods balance – suggests that this relationship for New Zealand may differ from that for other developed countries. As a result, we focus on modelling the relationship between New Zealand's exchange rate and the current account stripped of four main components: the net investment income balance, dairy exports, the value of both oil exports and imports, and education services exports: what we call the 'adjusted' balance.

We find that the responsiveness of New Zealand's current account to the real exchange rate is towards the lower end of most estimates used in other studies. Given that the trade elasticity is a key variable in macro-balance models of exchange rate valuation, we conclude that some previous studies may have underestimated the magnitude of the real exchange rate adjustment needed to help achieve external equilibrium in the long run.

JEL CLASSIFICATION F32 Current Account Adjustment
F41 Open Economy Macroeconomics

KEYWORDS Current account elasticity: exchange rate

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Examining the Elasticity of New Zealand's Current Account to the Real Exchange Rate

1 Introduction

Since reaching its trough in 2009, New Zealand's real effective exchange rate has appreciated by more than 35 percent. Before the onset of the global financial crisis (GFC) in late 2008, the New Zealand dollar had also been at an elevated level, similar to its current level. It has been suggested that the elevated real effective exchange rate has been detrimental to the performance of the tradable sector and has been associated with New Zealand's persistent current account deficits.

A number of studies have tried to assess the equilibrium level of New Zealand's real exchange rate[1]. However, few have focussed on quantifying the link between changes in the real exchange rate and movements in the current account. Previous studies have largely relied on 'standard' estimates[2] of this elasticity to assess how far away the current exchange rate is from its 'equilibrium' level. Some have tested the sensitivity of their results by subjecting their models to a range of elasticity estimates. The main purpose of this paper is to supplement the literature by focussing on quantifying the elasticity of New Zealand's current account to changes in the real exchange rate.

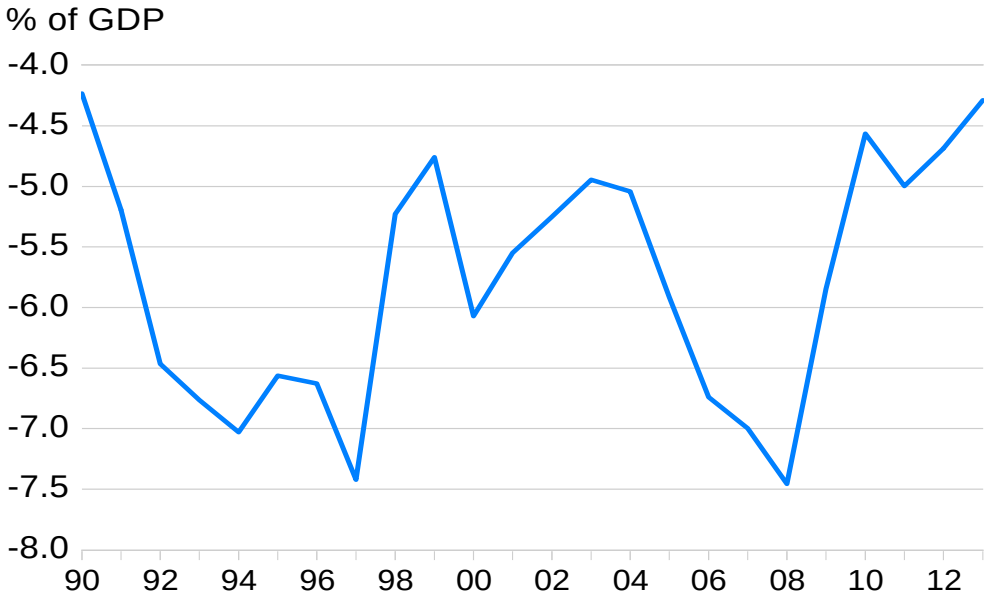
There are four main reasons why the link between the real exchange rate and the current account may be different for New Zealand than in other developed countries. The first is that a large part of New Zealand's current account deficit owes to a wide income deficit, which has averaged around 5.7 percent of GDP over the past 25 years. The income deficit increased gradually from 4.2 percent of GDP in 1990 to 7.4 percent of GDP in 1997, before falling back in 1998 as earnings from foreign investment in New Zealand fell sharply during the Asian Financial Crisis (Figure 1).

The income deficit followed a similar pattern in the first decade of the 21st century, with a widening in the deficit to 7.5 percent of GDP in 2008 before a large fall in 2009 associated with the GFC. Movements in the investment income component of the current account can overshadow movements in the trade components of the current account, particularly during times of global economic shocks (see Figure 2).

1 This literature includes Brooks and Hargreaves (2000), MacDonald (2002), Wren-Lewis (2004), Edison and Vitek (2009) and Graham and Steenkamp (2012).

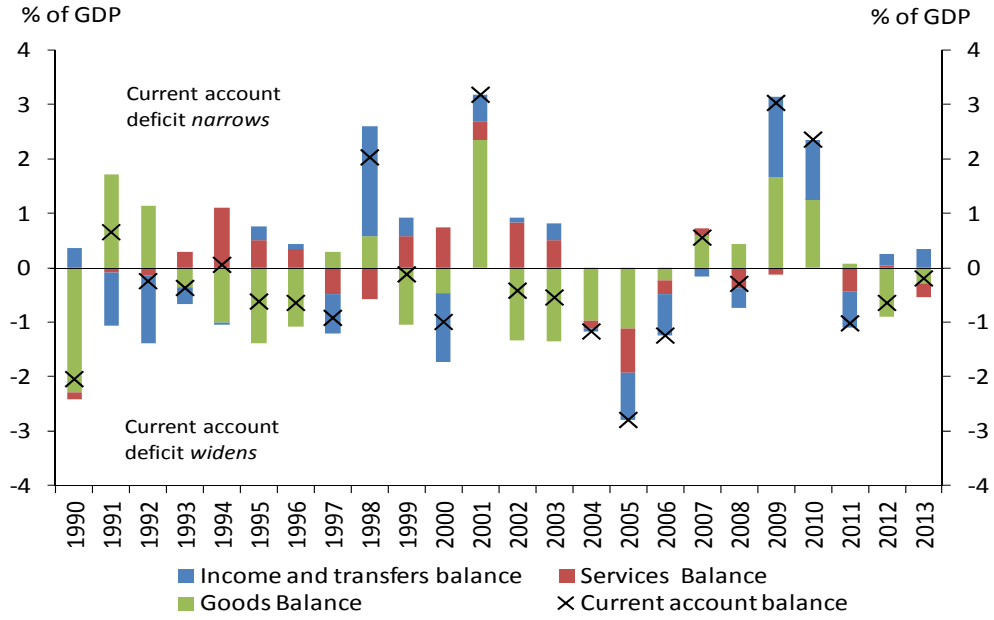
2 See Appendix 1 for a list of studies on the estimates of elasticity.

Figure 1 – Investment income balance



Sources: Statistics New Zealand, The Treasury

Figure 2 – Annual change in the current account and its components



Sources: Statistics New Zealand, The Treasury

The second reason why the relationship between the exchange rate and the current account in New Zealand may differ from than in other developed economies is the importance of agriculture to the external sector in New Zealand. Both the exchange rate and the current account in New Zealand are driven by a common factor – commodity prices. In recent years, dairy commodity prices have been the main driver behind the New Zealand commodity price index. Without controlling for commodity price movements, it would be very difficult to capture the "pure" impact of the real exchange rate on the current account.

The third reason why the current account elasticity to the real exchange rate for New Zealand may differ is the rising trend in New Zealand's net oil imports over time. Rising world oil prices over the period 2000 to 2008 contributed to an increase in the value of net oil imports from around 1 percent of GDP in 1999 to around 3 percent of GDP in 2008. The trend is additionally complicated by the significant shift in oil export receipts when the Maari oil field started its production in 2009.

The final reason is that there has been rapid growth in international students numbers in export education activities since 1999.

Therefore, the approach taken in this paper is to examine the elasticity of New Zealand's current account to the real exchange rate by focusing on the current account stripped of four main components: the net investment income balance, dairy exports, the value of both oil exports and imports, and education services exports (ie, an "adjusted" current account).

In this paper, we attempt to establish the impact of the real exchange rate on the "adjusted" current account using a set of reduced form equations. However, the main problem of using a reduced form approach is that commodity prices could be a third factor causing the current account and the real exchange rate to co-move (Chen and Rogoff, 2002).

Over the past decade, New Zealand's terms of trade were largely driven by commodity prices, particularly dairy products. Therefore, excluding dairy exports and mineral fuel imports should help to alleviate the problem of simultaneous equation bias. Furthermore, we also estimate all the equations of goods exports with the method of instrumental variables. The instrumental variables estimator yields consistent estimates when the explanatory variables are correlated with the error terms of the equation.

Finally, we carry out a Granger-causality test to ensure that the real exchange rate variable is statistically exogenous to the "adjusted" current account balance (i.e., after removing those volatile items, the current account balance and the real exchange rate are not simultaneously determined in a statistical sense).

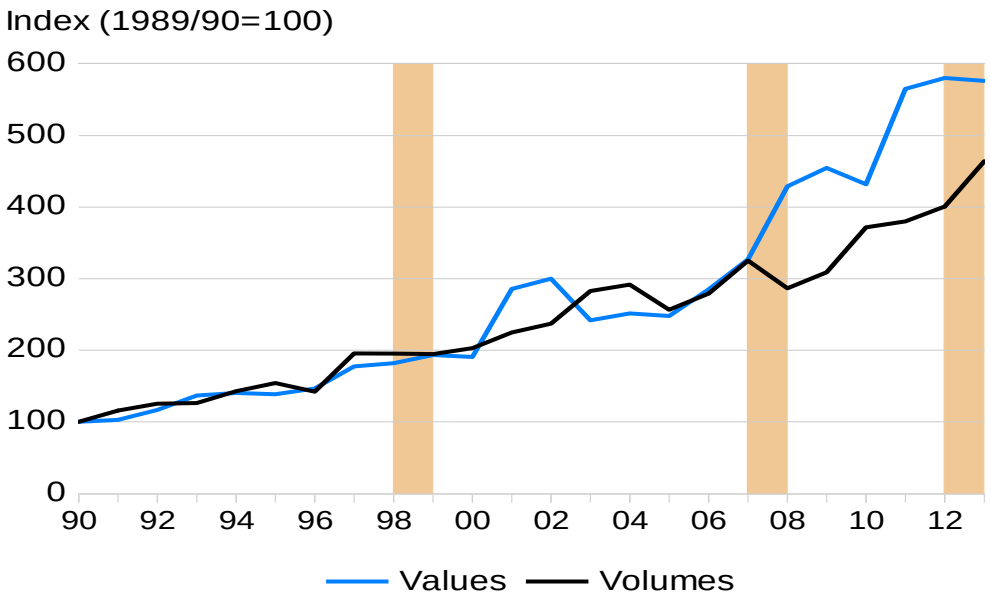
The structure of this paper is as follows. In section 2 we give a brief overview of the trends in the dairy and oil sectors. In section 3 we develop single-equation models, showing the relationships between the key components of the current account and the real exchange rate. These key components, which are expressed as a percentage of GDP, are the value of goods exports, goods imports, services exports and services imports. In section 4, we test the robustness of the coefficients by changing the start of the sample. In section 5, we estimate the elasticity of the current account balance to the real exchange rate and compare this estimate with estimates used in previous studies. In section 6, we test whether the real exchange rate is truly exogenous to the current account by carrying out Granger-causality tests. Section 7 uses the results of our estimations to make projections of the current account. Finally, section 8 concludes.

2 Trends in the dairy and oil sectors

2.1 Dairy industry

The value of New Zealand's dairy exports rose significantly from 2.8 percent of GDP in 1990 to 5.5 percent in 2012. As shown in Figure 3, dairy export volumes have been on an upward trend since 1990, reflecting a combination of widespread conversions by farmers to dairying over the period and other increases in the dairy herd size, as well as productivity gains in per-cow milk production. Between 1990 and 2012, the volume of New Zealand's dairy exports increased by more than a factor of four.

Figure 3 – New Zealand's dairy exports (dairy seasons, drought periods shaded)



Sources: Statistics New Zealand, The Treasury

Figure 3 also illustrates the important role that climatic conditions – both adverse and favourable – play in determining the amount of dairy exports that New Zealand exports in a given year. The shaded regions on the chart correspond to the droughts of 1997/98, 2007/08 and the most recent episode in the summer of the 2012/13 season. No two droughts are the same, and the geographical-coverage and timing of each drought episode will determine its overall impact on dairy production and exports. Indeed, in the 2007/08 dairy season, dry weather conditions contributed to a 12 percent drop in dairy export volumes, but there was a less marked impact on dairy export volumes in 1997/98 and 2012/13. In the case of the former, this was mainly because the drought was largely confined to the eastern parts of the country, which are more associated with meat farming than dairy production. In the case of the latter, while dry conditions affected the entire North Island (which is the traditional centre of the dairy industry and contains two-thirds of the dairy herd), the drought took hold reasonably late in the season and followed favourable weather conditions early on. As a result, while the drought weighed heavily on dairy production late on in the season, milk output in the season as a whole recorded only a modest drop.

Figure 3 also highlights the role that global dairy prices and movements in the New Zealand dollar play in determining the *value* of our dairy exports in NZD terms. Following a marked rise in global dairy prices over the period, the value of dairy exports in NZD terms rose by almost a factor of six between 1990 and 2012. In fact, given that dairy products are typically traded in USD, the sizeable appreciation of the NZD against the USD over the period was a notable buffer and offset to NZ dairy export receipts.

The interaction of global dairy prices and movements in the New Zealand dollar is perhaps most stark during the 2007/08 drought period, which coincided with the start of the global financial crisis. Although the volume of dairy exports fell by over 10 percent in the 2007/08 season, given the sharp depreciation in the NZD at the start of the GFC, and the previous surge in global dairy prices, the corresponding *value* of dairy exports in NZD terms *rose* by over 30 percent.

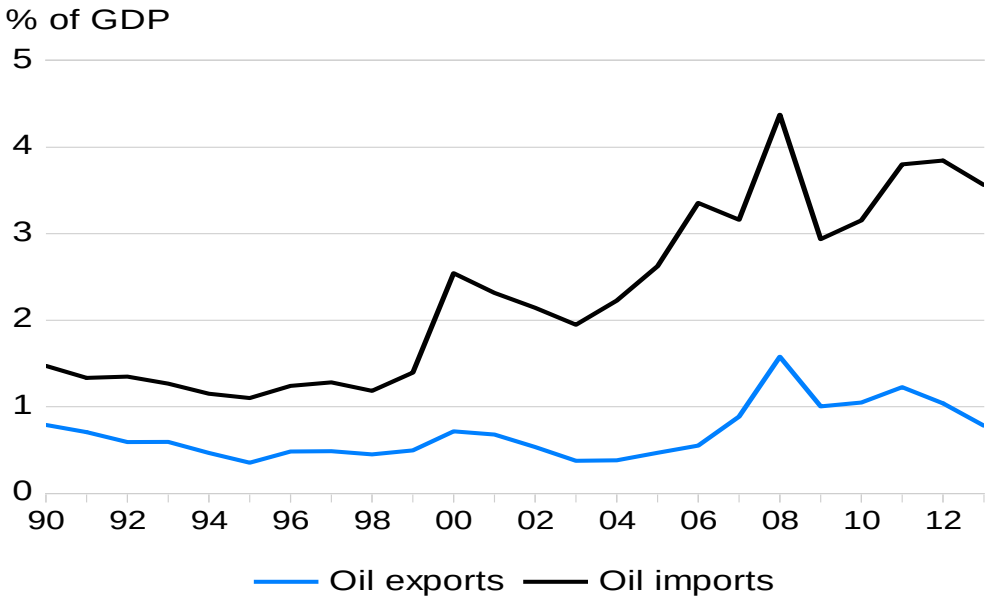
There are two other complicating factors at play, too. The first concerns the change in composition of our dairy exports over time. The amount of milk solids available for processing into dairy exports has increased over time as a result of increased dairying as well as productivity gains. However, New Zealand has also shifted to producing a higher proportion of milk powder at the expense of a fall in the proportion comprised of butter and cheese. All else equal, this shift means that the dairy industry now produces more dairy export volumes from a given quantity of milk solids than previously was the case.

The second complicating factor relates to the build-up and run-down of inventories within a dairy season. These cycles can distort the picture of dairy exports from season-to-season, particularly if large amounts of dairy products are carried over from the previous season and sold in the next, as was the case at the start of the 2012/13 season. This specific factor should not be a problem for the annual data used in this study, but it is indicative of the need to remove dairy exports from total exports in our model's dataset.

2.2 Oil exports and imports

A similar argument for omission can be made for exports and imports of oil. The value of New Zealand's oil exports roughly doubled from an average of around 0.5 percent of GDP between 1990 and 2007, to an average of just over 1 percent of GDP from 2008 onwards (Figure 4). As to be expected, the value of New Zealand's exports and imports of oil move broadly in line with trends in global oil prices. Indeed, the second period mentioned above includes a large increase in the value of oil exports in 2008, which followed the sharp spike in global oil prices seen in the middle of the year. The step-change in the value of our oil exports also relates to the start of production from the Maari oilfield off the South Taranaki coast which came online in 2009. Accordingly, if we did not exclude oil exports from the data in the model, the model would not be able to explain the exogenous step-change in oil exports with changes in the explanatory variables.

Figure 4 – New Zealand's trade in oil (calendar years)



Sources: Statistics New Zealand, The Treasury

The value of New Zealand's oil imports has also risen across the period, from around 1.5 percent of GDP in 1990 to around 3.6 percent of GDP in 2013. The value of New Zealand's oil imports fell back sharply in 2009 in line with the subsequent collapse in global oil prices in early 2009. Compared to the less pronounced drop-off in the value of our oil exports over the same time period, this further highlights the role that the introduction of the Maari oilfield has had on our oil export revenues. Overall, though, given that the volume of oil imports has grown at a faster rate than the volume of oil exports over the period as a whole, New Zealand's position as a net importer of oil has become more entrenched.

3 Modelling New Zealand's current account

The estimation dataset covers 26 annual observations over the period 1988-2013. In the following section, we present 4 sets of equations to model the key components of the trade balance. The reasons for making our focus of empirical investigation on annual estimates are threefold: (1) our focus is to examine the long-run impact of the real exchange rate on trade flows; (2) there are some concerns regarding the reliability and accuracy of quarterly GDP data for our trading partners, particularly China and other Asian economies, and; (3) the quarterly trade flows exhibit considerably more variability than the annual data owing to the fact that some components of New Zealand's exports and imports are quite lumpy.

We construct the dataset using quarterly SNA data for all the components of GDP. Dairy exports, oil exports and oil imports are taken from the monthly Overseas Merchandise Trade statistics. Quarterly education export services are taken from quarterly Merchandise Trade statistics for 1996q2 to 2012q4. Before 1996q2, we estimate the value of education export services using the number of public tertiary foreign fee-paying students. The real exchange rate is taken from the IMF. The real exchange rate index is the nominal effective exchange rate index adjusted by CPI ratios.

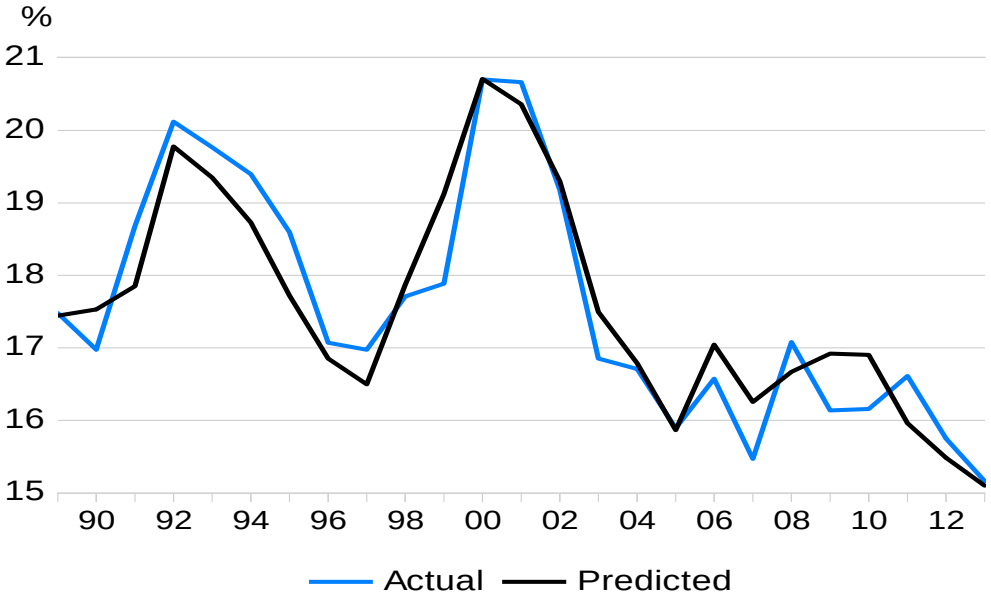
3.1 Goods exports

The dependent variable is the value of goods exports as a percentage of GDP, stripped of dairy and oil exports, which is regressed on the log of the real effective exchange rate (rer) and New Zealand's trading partner growth (tpg). Instrumental variables estimation is used in the regression and the instrumental list is the first lag of the dependent variable, the first lag of rer, tpg and the Australian real exchange rate. Table 1 reports the result of the estimation. In general, the model fits the data very well with an adjusted R^2 of 0.87. This is indicated by Figure 5, which shows that the predicted values match the actual values of the dependent variable closely.

The t-statistics indicate that all the coefficients are significant. The coefficient on the real exchange rate is highly significant at the 1 percent level and the coefficient on trading partner growth just falls short of the 1 percent level. The real exchange rate coefficient indicates that on average a 1 percent increase in the real exchange rate results in a reduction in the value of goods exports of 0.15 percent of GDP. For trading partner growth, a percentage point increase leads to a 0.24 percent of GDP increase in the value of goods exports. Given that the value of goods exports excluding dairy and oil exports accounts for around 18 percent of GDP over the sample period, this implies that the foreign income elasticity of our goods exports is close to 1.3. The Durbin-Watson statistic of 1.65 suggests the absence of autocorrelation in the regression residuals.

Adding the lag of the real exchange rate makes only a small improvement in the overall fit of the model, suggesting that the impact of changes in the real exchange rate on the value of good exports is felt mostly within a year.

Figure 5 – Actual and predicted goods exports as a percent of GDP



Source: The Treasury

3.2 Goods imports

The dependent variable is defined as the value of goods imports as a percentage of GDP, stripped of oil and military imports[3]. We first estimated the equation using the real exchange rate, New Zealand real GDP growth and a dummy variable for the GFC as regressors. We found that there was a positive serial correlation among the error terms. As a result, we have included a lag of the dependent variable in the equation to model the persistent impact of the real exchange rate, suggesting that the exchange rate affects goods imports with a lag.

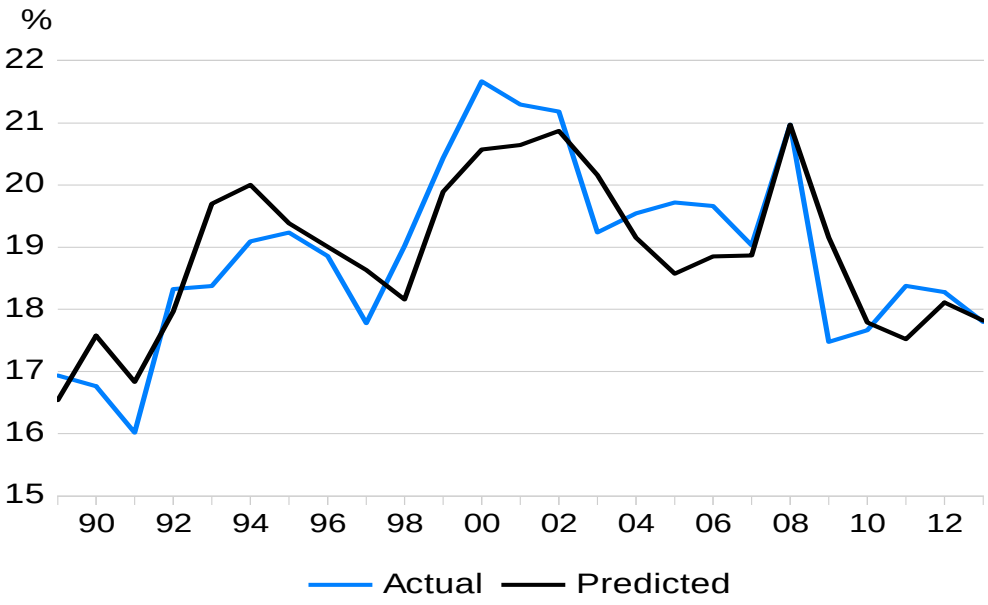
The coefficient on the real exchange rate implies that a 1 per cent increase in the real exchange rate decreases the value of goods imports by 0.04 percent of GDP within a year. The long-run impact of changes in the real exchange rate is closer to 0.06 percent of GDP[4].

The domestic growth coefficient indicates that on average over the period, an increase by 1 percentage point in the growth rate of real GDP had a positive impact on the value of goods imports of 0.27 percent of GDP in the first year and the accumulated impact of around 0.4 percent of GDP. As shown in Figure 6, the predicted value also tracks very closely to the actual value of the dependent variable.

3 The military imports are lumpy, particularly the import of the two military ships in 1997 and 1999.

4 The estimated long-run elasticity = $c_1/(1-c_2)$ where c_1 is the real exchange rate coefficient and c_2 is the coefficient of the lagged dependent variable.

Figure 6 – Actual and predicted goods imports as a percent of GDP

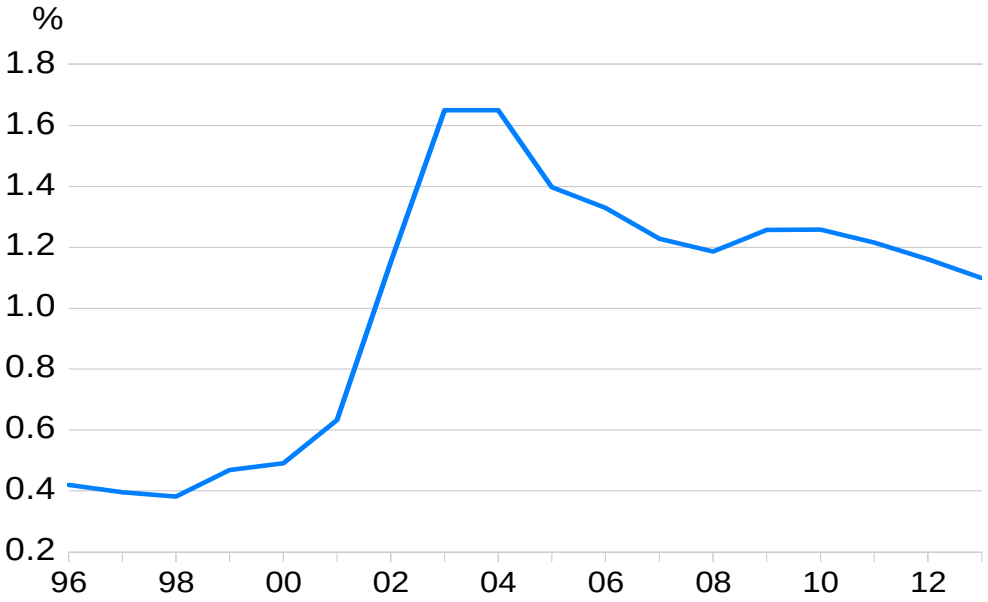


Source: The Treasury

3.3 Services exports

Since 1999, New Zealand has entered a new phase of engagement in international education. Education services exports rose from 0.5 percent of GDP in 2000 to over 1.6 percent in 2003. As shown in Figure 7, changes in the education sector over the period 1999-2003 may cause a divergence in the relationship between services exports and the real exchange rate.

Figure 7 – Exports of education services (Percent of GDP)



Source: The Treasury

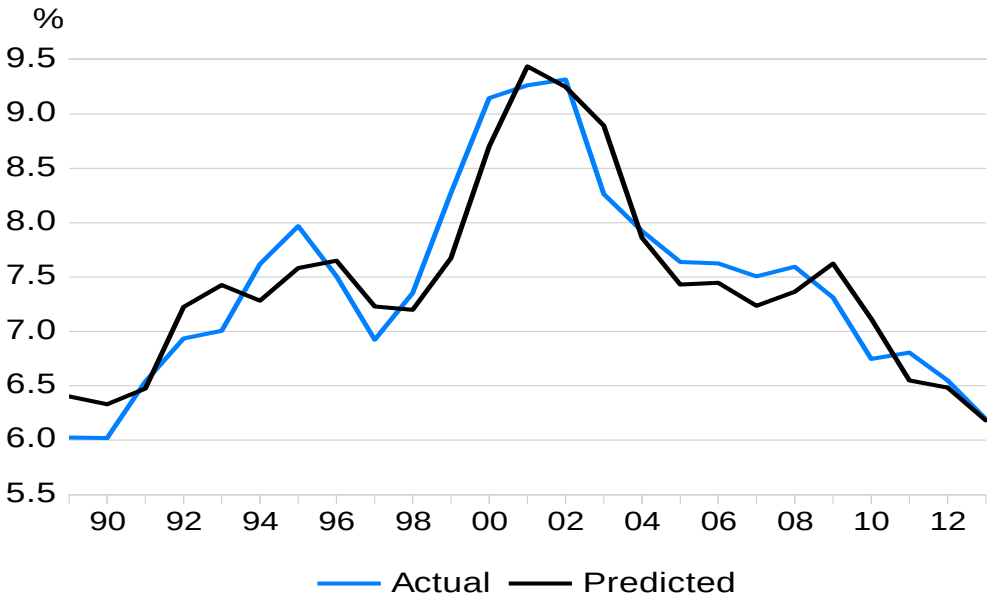
We therefore estimated the equation for services exports excluding education services exports using the equation estimated above on goods exports. However, given that the coefficient on trading partner growth was not statistically significant, we found no evidence

of the linkage between trading partner growth and services exports. The results of the estimation also indicated a high degree of autocorrelation in the regression residuals. As a result, in the results reported in Table 1, we have left out trading partner growth and have added a lagged dependent variable to model services exports.

The coefficient of around -0.03 on the real exchange rate is much smaller than that the coefficient of -0.15 found in the goods exports equation, reflecting the fact that most of New Zealand's services exports are priced in local currency. The lower coefficient implies that changes in the exchange rate do not have much impact on the domestic price of services exports in the short run. The adjusted R^2 is very high at 0.87, as reflected in Figure 8 which compares the actual and predicted value of services as a percentage of GDP.

However, services exports exhibit a larger response to changes in the real exchange rate over a longer period. The long-run elasticity of services exports with respect to the real exchange rate is estimated to be close to -0.14 – closer to the coefficient on goods exports. Given that goods exports in 2013 were about three times higher than services exports, it follows that services exports are around three times more responsive to the real exchange rate than goods exports in the long run.

Figure 8 – Actual and predicted services exports as a percent of GDP



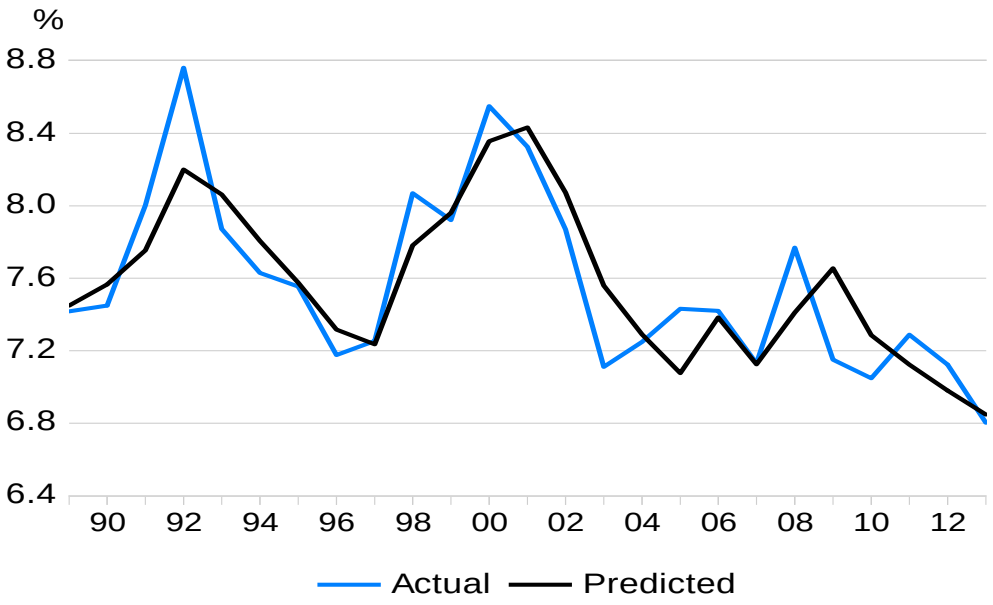
Source: The Treasury

3.4 Services imports

We initially used equation (3) in Table 1 as a basis for modelling services imports. However, the coefficient on domestic growth had a negative sign and was not statistically significant at the 5 percent level, suggesting that it does not contribute to the ratio of the value of services imports to GDP. We therefore excluded the domestic growth variable in the equation. We find that a 1 per increase in the real exchange rate lowers the value of services imports by 0.04 per cent of GDP. Note that the relative sizes of the coefficients on the real exchange rate are very similar for both goods imports (equation 3) and services imports (equation 7). However, in a similar situation to exports, given that goods imports account for around three-quarters of total imports, it follows that services imports are around three times more responsive to the real exchange rate than goods imports in the short run.

In the long run, the response of services imports is two times larger than that of goods imports. As shown in Figure 9, and in keeping with the other equations in the study, the model has a high goodness of fit.

Figure 9 – Actual and predicted services imports as percent of GDP



Source: The Treasury

3.5 Other estimations

We also re-estimated the above equations using the nominal trade-weighted index (TWI) instead of the real exchange rate (the results are not presented in this paper). In general, the use of the TWI results in a small decline in the goodness of fit of the regressions. However, the coefficients on the TWI variable are very similar to that on the real exchange rate, suggesting that the movements in the real exchange rate over the sample period are dominated by the nominal exchange rate.

We also estimated the above equations (or a variant) using quarterly observations. As expected, the quarterly series of each dependent variables exhibit considerably more variability than its corresponding annual series. This increased variability results in a fall in the goodness of fit of the regressions. However, the estimated long-run elasticities with respect to the real exchange variable are generally similar to those estimated using annual observations. The results of modelling quarterly the components of the trade balance are presented in Appendix 2.

Table 1 – The results of the estimations

Equation variables	Goods Exports[5]		Goods Imports		Services Exports		Services Imports	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample period	1989-13	1999-13	1989-13	1999-13	1989-13	1999-13	1989-13	1999-13
Constant[6]	83.1*	77.3*	30.0*	50.8*	15.8*	24.3*	25.8*	23.6*
Real exchange rate[7]	-0.15*	-0.14*	-0.04**	-0.07*	-0.03*	-0.05*	-0.04*	-0.04*
Trading partner growth	0.24**	0.18						
Domestic growth[8]			0.27**	0.41**				
Dummy variable			3.15*	3.28*				
Lagged Dependent variable			0.37*		0.78*	0.52*		
Adj. R-squared	0.87	0.89	0.66	0.72	0.87	0.91	0.75	0.74
Durbin Watson	1.65	1.98		1.36			1.91	2.02
Durbin-h			1.46		1.16	0.91		

5 Instrumental variables estimation is used for the equations of goods exports.

6 *significant at the 1 percent level, ** significant at the 5 percent level and *** significant at the 10 percent level.

7 The log of real exchange rate *100.

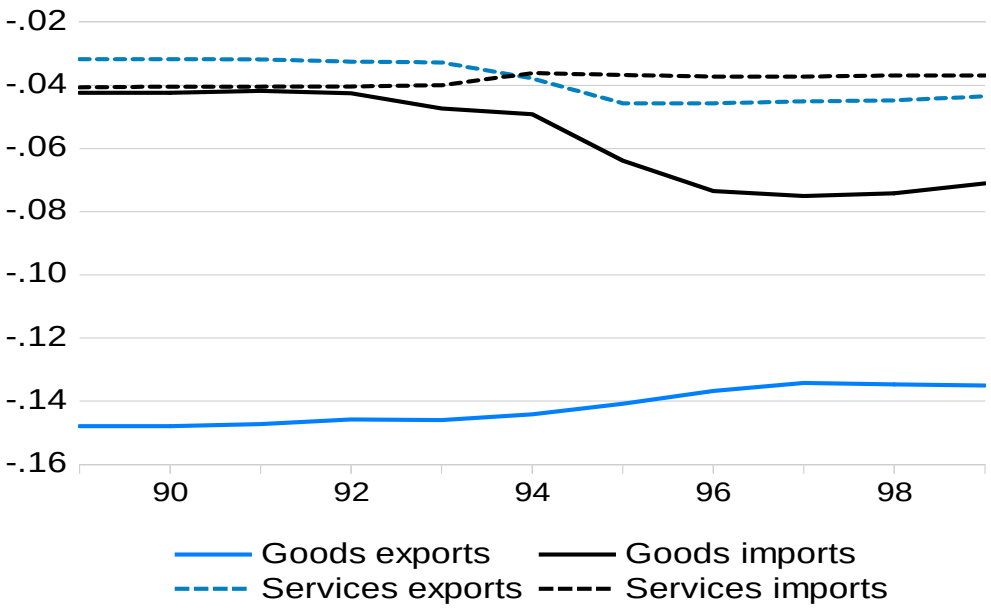
8 Annual real GDP growth rate.

4 Robustness of estimations

Since 1984, New Zealand has undergone tremendous changes in the economy, particularly in financial and product markets. One important aspect of the reforms was to open up the market to more competition and it could take more than a decade for the economy to fully adjust to its new structure. In this study, we test the robustness of the coefficients on the real exchange rate presented earlier by changing the start of the sample over a period of 11 years from 1989 to 1999. The results of the estimations for the sample period 1999-2013 can be found in Table 1.

Apart from the goods imports equation, all of the other coefficients are not greatly influenced by the sample period. Figure 10 summarises the estimates of the short-run elasticity of the modelled current account components with respect to the real exchange rate.) The goods imports component is gradually getting more responsive to the exchange rate, reflecting the fact that the tariff reform has been a gradual phasing-out process.

Figure 10 – The coefficient estimates of the real exchange rate



Source: The Treasury

Furthermore, the lag of the dependent variable in the goods imports equation becomes insignificant when the sample begins after 1995. Therefore, when the sample begins after 1995, we have estimated the goods imports equation without the lag of the dependent variable. This suggests that the exchange rate pass-through to goods imports is now complete within a year. As a result, the results provide some evidence that the reforms in the late 1980s and early 1990s have made the goods imports market more flexible.

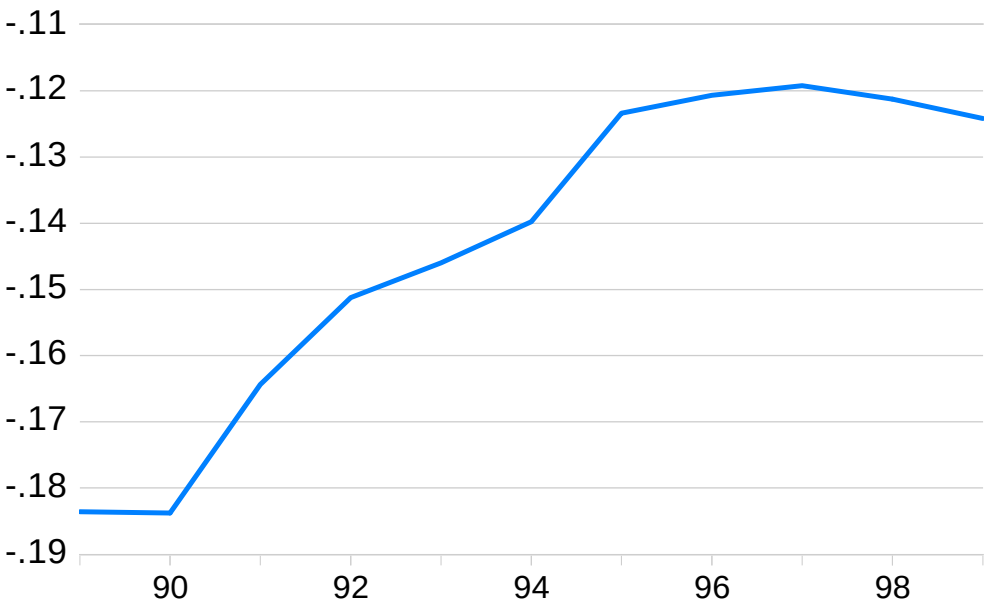
5 Trade balance elasticity

5.1 Estimates

Our results suggest that the long-run elasticity of our 'adjusted' trade balance as a percentage of GDP with respect to the real exchange rate is around -0.18. In other words, over the full sample period from 1989 to 2013, a 1 percent increase in the real exchange rate decreases the 'adjusted' trade balance by roughly 0.18 percent of GDP. As shown in Figure 11, our results provide evidence that this elasticity has decreased over time in absolute terms. Using the last 15 years of the sample, the estimate of the elasticity drops to -0.12.

It is generally agreed that a country more open to trade tends to be more sensitive to changes in its exchange rate (ie, has a larger trade balance elasticity in absolute terms). Our results suggest that the economic reforms of recent decades have not made New Zealand's current account more responsive to the real exchange rate.

Figure 11 – The long-run elasticity of the 'adjusted' trade balance to the real exchange rate



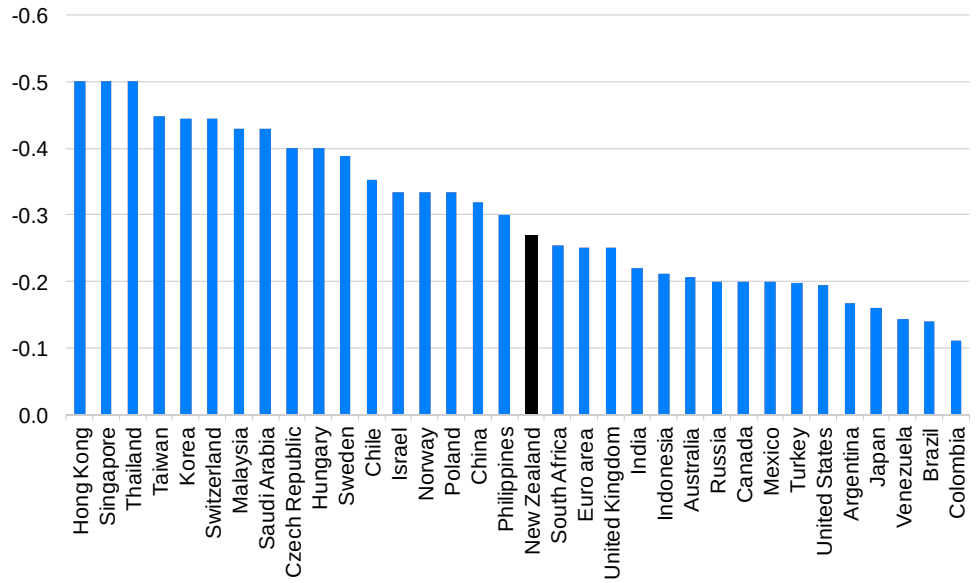
Source: The Treasury

5.2 Comparison with other studies

Our estimate of the elasticity of the 'adjusted' trade balance as a percentage of GDP with respect to the real exchange rate (in the range of -0.18 to -0.12) is lower in absolute terms than most estimates used in other studies. The baseline scenario of the recent IMF study Edison and Vitek (2009) uses the trade elasticity of -0.21. Graham and Steenkamp (2012) uses a distribution of elasticity estimates with a mean of -0.40. Cline (2013) uses a current account elasticity for New Zealand of -0.27, but there is a considerable range in the estimates used for the other countries in the study (Figure 12)[9].

[9] As in the other semi-annual publications in the *Estimates of Fundamental Equilibrium Exchange Rates* series, the estimates of the elasticity of the current account to the real exchange rate for each country in Cline (2013) are bounded between -0.1 and -0.5.

Figure 12 – Elasticity of current account to real exchange rate from Cline (2013)



Sources: Cline (2013), the Treasury

Our estimate of the elasticity of the *actual* trade balance to the real exchange rate is higher in absolute terms than our corresponding estimate for the 'adjusted' trade balance. This partly relates to the fact that dairy and oil products, which we excluded from our estimations, are commonly priced in foreign currency terms. Assuming a one-to-one pass-through from movements in the exchange rate, all else equal a 1 percent fall (rise) in the exchange rate will automatically result in a 1 percent increase (decrease) in the value of dairy exports and net oil imports.

In addition, there are also long-term volume responses to the change in the exchange rate to consider. For example, we have assumed that a 1 percent fall (rise) in the exchange rate is, on average, associated with a 0.25 percent increase (decrease) in dairy volumes in the long run, reflecting higher (lower) incentives for farmers to invest on the back of higher (lower) NZD returns.[10] Conversely, we have assumed that a 1 percent fall (rise) in the exchange rate is, on average, associated with a 0.3 percent decrease (increase) in net oil imports.[11]

All told, factoring in reasonable assumptions of the price and volume effects into our estimated elasticity of the *'adjusted'* trade balance, our estimate of the implied elasticity of the *actual* trade balance to the real exchange rate is in the range of -0.24 to -0.18. The mid-point of this range is in line with the -0.21 figure used by Edison and Vitek in their baseline scenario.

[10] Based on calculations in Smith (2004)
[11] Based on calculations in Cooper (2003)

6 Granger-causality tests

Apart from examining the stability and robustness of the model as shown in the earlier section, we have also investigated whether the real exchange variable is truly exogenous. In the set of relationships estimated in this paper, causation is assumed to be from the real exchange rate to the components of the balance of trade. If there is a reverse causation present from the current account to the real exchange rate, the real exchange rate and the current account should be modelled jointly. It is well established that if the real exchange variable is not truly exogenous, the coefficient estimates in this paper will be biased and inconsistent.

In particular, there is a suggestion that New Zealand's low national saving rate could be the reason for the overvaluation of New Zealand exchange rates (Reddell, 2013). Therefore, it is important to test whether the real exchange rate is truly exogenous to the current account.

A Granger-causality test is carried out to test the forecasting power of the current account for the real exchange rate and vice versa. In addition to the current account, we include the investment income balance, the trade balance and the trade balance stripped of the components mentioned in the earlier sections of the paper. Quarterly frequency is used in the analysis and the number of lags included in the Granger-causality test is determined by the Akaike Information Criteria (AIC).

In order to test whether the real exchange rate causes the current account, the current account is first regressed on its past values and the lagged real exchange rate. This is called the unrestricted equation. In the second step, the current account is then regressed on its past values. This is called the restricted regression. The statistic is defined as:

$$F = \frac{((SSR_r - SSR_u)/n)}{SSR_u/(T-(m+n+1))}$$

where SSR_u and SSR_r are the two sums of squared residuals related to the unrestricted and restricted equation respectively; m and n are the number of lags of the current account and the real exchange rate respectively and T is the number of observations. The same procedure is used to test for the inverse Granger-causality relation.

The results of the Granger-causality test are shown in Table 2. The values of the F statistics suggest that the real exchange rate does not Granger-causes the current account and the current account does not cause the real exchange rate. For the relationship between the investment income balance and the real exchange rate, the values of the F statistics also suggest that the null hypothesis of no causality in both directions is not rejected. The results support that the responsiveness of the income balance to the real exchange rate is not significant, justifying the rationale of excluding the investment income balance in this study.

Similarly, the null hypothesis of no causality in both directions is not rejected for the relationship between the trade balance and the real exchange rate. Finally, the results confirm that the real exchange rate is a good indicator for predicting the stripped down version of the trade balance but not vice versa.

Overall there seems to be no causality from the current account or its sub-components to the real exchange rate. However, there is clear evidence that the real exchange rate is a leading indicator of the stripped down version of the trade balance.

Table 2 – The results of Granger-Causality tests

Granger-Causality test between the current account and the real exchanges rate

Dependent variable	**m**	**n**	**F**
Current account	1	1	3.8 (1,101)
Real exchange rate	1	2	1.1 (1,100)

Granger-Causality test between the investment income balance and the real exchanges rate

Dependent variable	**m**	**n**	**F**
Investment income balance	2	2	1.4 (2,99)
Real exchange rate	1	2	1.1 (1,100)

Granger-Causality test between the trade balance and the real exchanges rate

Dependent variable	**m**	**n**	**F**
Trade balance	4	2	1.1 (2,96)
Real exchange rate	1	2	0.2 (1,100)

Granger-Causality test between the trade balance stripped of some components and the real exchanges rate

Dependent variable	**m**	**n**	**F**
Trade balance stripped of some components	4	1	17.4 (1,94)*
Real exchange rate	1	2	0.7 (1,100)

* significant at the 1 percent level

Source: The Treasury

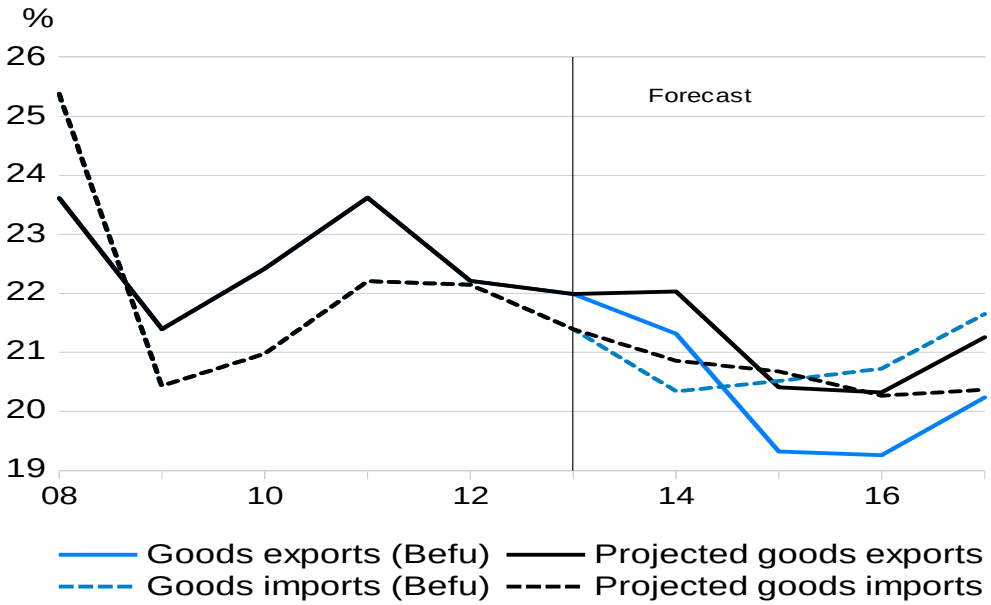
7 Projections

Using equation (1), (3), (5) and (7) from Table 1, we project the non-oil, non-dairy and non-international education services trade balances, and then add in the separate projections of other components of the current account (see Appendix 3 for the details). The projections of other components are based on the Budget 2014 forecasts. Our projections are also based on the Budget forecasts for real exchange rates, trading partner growth and domestic real GDP growth.

Figure 13 and Figure 14 plot the projections of the main components of the trade balance and compare them with the Budget 2014 forecasts. Overall the directions of the projections are broadly similar to the Budget 2014 forecasts. For goods exports, there is a difference of 0.7 percent of GDP in 2014 between the model's projection and the Budget forecast. The gap enlarges to around 1 percent of GDP in 2017. The difference between the Budget forecasts and our model's projections could be due to the fact that the economic impact of the drought is better captured in the Budget forecasts.

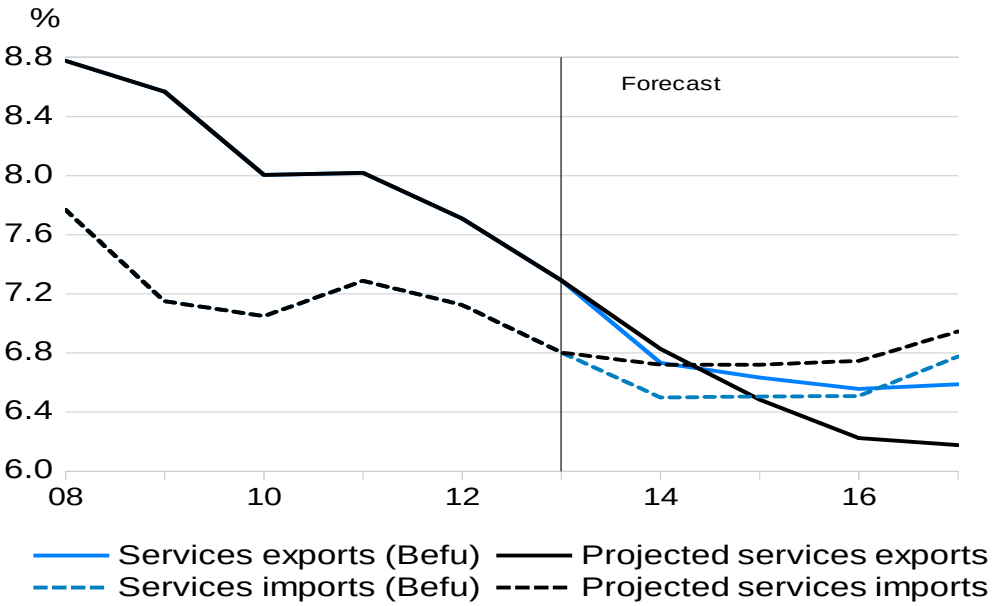
There is a divergence of 1.3 percent of GDP in goods imports in 2017 between the Budget forecasts and the projections. This divergence could be associated with the fact that the projections do not take into account the impact of the Canterbury rebuild on goods imports.

Figure 13 – Projection of goods exports and good imports (Percent of GDP)



Source: The Treasury

Figure 14 – Projection of services exports and services imports (Percent of GDP)



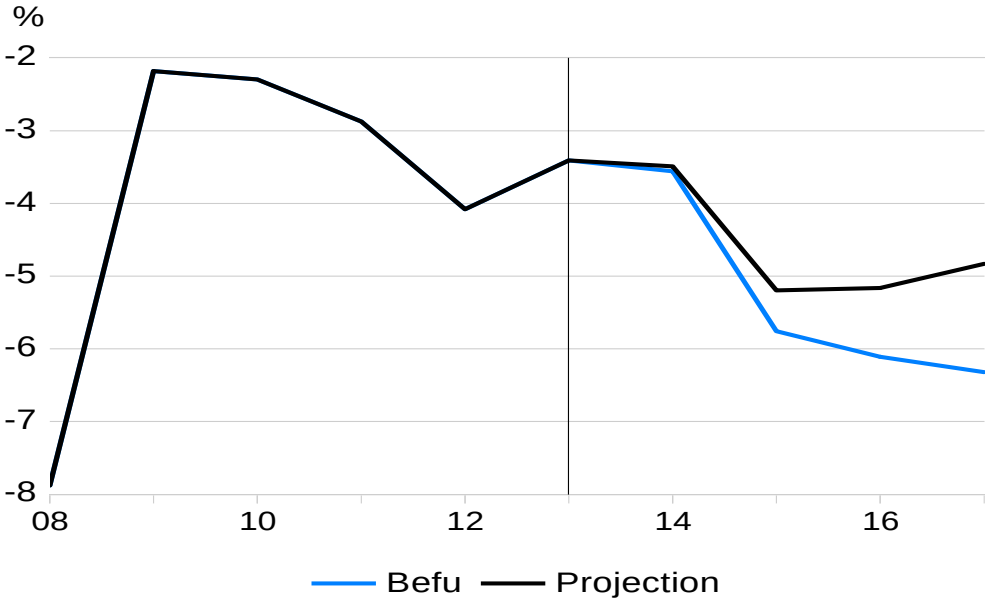
Source: The Treasury

Figure 14 shows that the projected path of services imports is rather muted in comparison with that of the Budget forecasts in 2014. The projected path is higher than the Budget forecast in 2014 by 0.2 percent of GDP. The gap between the projections and the Budget forecast remains unchanged over the forecasting period.

The projected path of services exports tracks very closely with the Budget forecasts in 2014. Service exports are projected to fall from 7.3 percent of GDP in 2013 to 6.8 percent of GDP in 2014, reflecting the persistent lagged impact of the high real exchange rate on services exports. However, services exports are projected to fall further to 6.2 percent of GDP in 2017, compared with the Budget forecast of 6.6 percent.

Overall, according to the model-based projections, the current account deficit remains in a range of 3.5 to 5.0 percent of GDP over the next four years (see Figure 15). Apart from the first year of the forecast period, the projections show a narrower current account deficit than that expected in the Budget forecasts. As noted earlier, this may be because the model does not fully capture the impact of the Canterbury rebuild. However, our projections suggest that the Budget forecasts for the current account deficit may be on the high side.

Figure 15 – Projected current account deficit (Percent of GDP)



Source: The Treasury

8 Conclusion

The main purpose of this paper is to examine the elasticity of the current account to the real exchange rate. We identify three reasons why this elasticity for New Zealand may differ from standard estimates used for other countries. The first is the nature of New Zealand's current account deficit, particularly the dominant role of the income deficit. The second is the importance of the agricultural sector to New Zealand's external trade. Developments in such sectors are influenced by a wide range of factors, notably weather conditions. The final reason is structural changes in our oil trade, most notably from the opening of the Maari oilfield in 2009. The approach of this paper is to examine the impact of the real exchange rate on an 'adjusted' current account stripped of the three factors.

We acknowledge a number of limitations with the approach taken in this paper. First, by only stripping out dairy exports and oil imports and exports from the current account, we may have overlooked other trade items, like dairy and oil, which are driven largely by factors other than changes in the exchange rate in medium run (eg, meat). Further research, perhaps using factor analysis to group together responsive and unresponsive sectors, may be able to further enhance the fit of the estimations used in this study. Second, the methodology does not offer a general equilibrium solution to how changes in the exchange rate affect the current account in the long run. Finally, our approach is carried out at an aggregate macroeconomic level and therefore does not shed any light on within-industry/firm differences in the elasticity to the real exchange rate.

That said, these limitations do not inhibit the main purpose of the paper. The relative simplicity of our approach makes the paper accessible to a lay-audience and is well-suited to its intended purpose to provide guidance for the Treasury's economic forecasts over the medium term. Similarly, although our approach does not provide a general equilibrium solution, it is well-suited to supplementing the existing literature and informing the application of the current account elasticity in equilibrium exchange rate models.

Overall, we estimate that the elasticity of New Zealand's current account to the real exchange rate is in the region of -0.24 to -0.18, with a mid-point of -0.21[12]. This elasticity is smaller in absolute terms than that used in a number of other studies, although our estimate is in line with the baseline figure from a 2009 IMF paper (Edison and Vitek, 2009). Given that the trade elasticity is a key variable in macro-balance models of exchange rate valuation, we conclude that some previous studies may have underestimated the magnitude of the real exchange rate adjustment needed to help achieve external equilibrium in the long run.

Our analysis also suggests that the extensive reforms of recent decades appear to have made New Zealand's current account less responsive to changes in the real exchange. We find that this primarily relates to goods imports, which have gradually been getting more responsive to the exchange rate as tariffs have been gradually reduced. By contrast, the elasticity of the other main trade components appears to have remained more constant over time.

[12] This is derived from our estimates of the elasticity of the 'adjusted' current account to the real exchange rate (-0.18 to -0.12), factoring in assumptions over the responsiveness of the sectors that we stripped out in the estimations to the exchange rate.

Finally, our findings broadly support our current trade forecasts and the appropriateness of the structural parameters in the New Zealand Treasury Model. Projections using the models in this paper suggest that the direction and magnitude of movements in the trade variables in our forecasts are broadly consistent with the forecast magnitude depreciation of the exchange rate.

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Appendix 1: Studies on the estimate of elasticity

A1.1 Studies on the estimate of elasticity

There is only one recent study (Smith, 2004) which focused only on how export volumes (as opposed to export values) are influenced by the exchange rate. Campa and Goldberg (2002) have examined the exchange rate pass-through into import prices for OECD countries over the period 1975-1999. They found that there has been a tendency toward declines in the exchange rate pass-through for New Zealand. They have tested the sensitivity of their results by subjecting their models to a range of elasticity estimates.

Not all the estimates were based on an empirical work. For example, there is no empirical work which investigates how export prices in local currency are affected by the exchange rate. Graham and Steenkamp (2012) simply assumed that export prices tend to react less than one-for-one to exchange rate changes.

There is no empirical paper which directly addresses the impact of the exchange rate on import volumes. Huchet-Bourdon and Korinek (2009) estimated the trade effect of the real bilateral exchange rate on the value of goods exports and imports for three major trading partners using monthly trade data from Jan 1999 to June 2009. Services trade were not covered in the study. Their results suggest that the level of exchange rate has a strong effect on New Zealand's exports with all three major trading partners but has a negligible effect on imports. They also found that not all elasticities are statistically different from zero.

Apart from Huchet-Bourdon and Korinek (2009), all the previous studies were carried using the data which is out of date. As New Zealand's trade data is notoriously volatile, it may not be appropriate to estimate a long-run relationship using monthly data for three trading partners. Therefore, there is a need to re-estimate the trade effect of real exchange rates using a more aggregate data with a lower frequency and with the removal of some volatile items.

Appendix 2: Quarterly estimations

Table 3 – The results of the quarterly estimations

Equation variables	Goods Exports[13]		Goods Imports		Services Exports		Services Imports	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sample period	1988q2-2013q4	1988q2-2013q4	1988q2-2013q4	1988q2-2013q4	1988q2-2013q4	1988q2-2013q4	1988q2-2013q4	1988q2-2013q4
Constant[14]	82.0*	26.4*	47.2*	10.7*	30.2*	6.3*	26.0*	11.7*
Real exchange rate[15]	-0.14*	-0.05*	-0.06*	-0.02**	-0.05*	-0.01*	-0.04*	-0.02*
Domestic growth[16]			0.18	0.04				
Lagged Dependent		0.66*		0.82*		0.88*		0.54*
Adj. R-squared	0.79	0.85	0.21	0.79	0.31	0.89	0.67	0.75
Durbin Watson	0.80		0.32		0.16		0.81	
Breusch-Godfrey LM test $\chi^2(2)$[17]		1.18		1.6		10.0*		13.1*

[13] Instrumental variables estimation is used for the equations of goods exports.

[14] *significant at the 1 percent level, ** significant at the 5 percent level and *** significant at the 10 percent level. When there is no lagged dependent variable in the equation, Newey-West standard errors are used in the regression.

[15] The log of real exchange rate *100.

[16] Annual real GDP growth rate.

[17] Test for serial correlation up to order 2.

Appendix 3: Projecting the stripped-out components

A3.1 Projecting the stripped-out components

As noted in Section 7, using our model to project the current account as a whole required adding back in projections of the components that we had stripped out of our estimations (namely the investment income balance, dairy exports, oil imports and exports, and education services exports). This section explains how we projected each of the stripped-out components.

The investment income balance simply used the forecast track as a percentage of GDP from the Budget 2014 forecasts. Education services exports were assumed to remain steady as a proportion of GDP from their last data point across the projection period.

Value series in NZD terms for dairy exports and oil imports series were grown forward from their last actual data point using the growth rate of the corresponding System of National Accounts-based nominal series that we forecasted at Budget. These were then converted into a percentage of GDP series using the Budget's nominal GDP forecasts.

Given that we do not explicitly forecast oil exports, making a projection into the future needed a different approach and required making judgements on both the future volume and value of oil exports. We assumed that oil export volumes remain stable across the projection period in line with their most recent level. Note that while export volumes can be volatile on a quarterly basis, they exhibit long-run and slow-moving trends. We subsequently inflated this projection of export volumes using a forecast oil export price series based on the estimated historical relationship between global oil prices, the USD/NZD exchange rate, and the price of New Zealand's oil exports. By combining these two components into a corresponding projection of exports values, the NZD-value oil export series was grown forward from its last actual data point using the projected value-series growth rate and, in turn, converted into a percentage of GDP series as detailed above.