Past, Present and Future Developments in New Zealand's Terms of Trade

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Abstract

This paper looks at the importance of the terms of trade for the New Zealand economy by examining the impact of changes in the trend and volatility of the terms of trade on economic growth. It is found that the volatility in the terms of trade has had a negative impact on New Zealand's economic growth between 1950 and 2005. However, it is found that rather than the level of the terms of trade having an impact on growth, it is the level of export prices that have had a significant positive effect with the level of import prices having an insignificant impact. This paper also examines the historical patterns in the trend and volatility to see if and why they have changed over time. As New Zealand is largely an exporter of primary commodities and importer of manufactures, the Prebisch-Singer hypothesis suggests that its terms of trade should have declined over time. However, this paper finds that the terms of trade has not declined and in fact, is showing an increasing trend since 1974. It is also found that the volatility in the terms of trade has declined over time. Using this evidence as well as other issues such as world trade reform and China, this paper draws conclusions as to future movements of New Zealand's terms of trade as well as any possible economic growth implications.

JEL CLASSIFICATION E30 General; F10 General; F41 Open economy macroeconomics; F43 Economic growth of open economies;

KEYWORDS Terms of trade; Commodity Prices; New Zealand; Economic Growth; Prebisch-Singer Hypothesis

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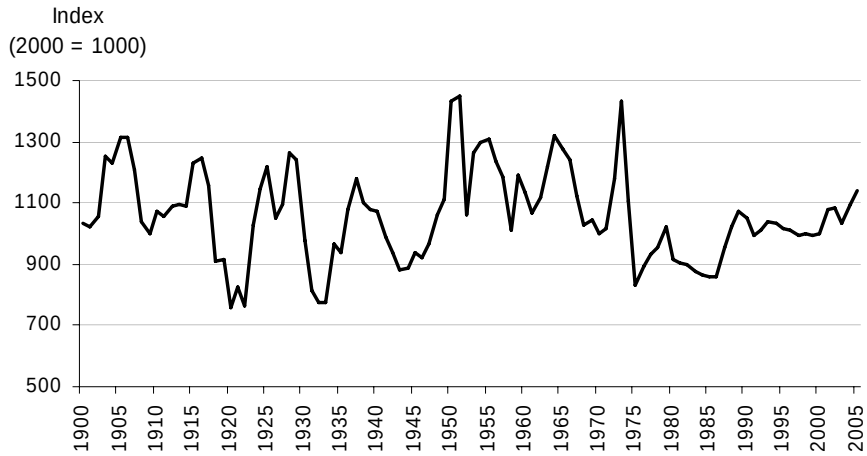
1 Introduction

New Zealand is a small economy dependent on its external sector as a major source of economic growth and development. Although its trade to GDP ratio is not high by OECD standards, at 60%, it does leave it prone to movements in the relative prices of internationally traded goods. The terms of trade, or the ratio of export prices to import prices, is a measure of these relative prices and can have substantial welfare effects on the economy.

Figure 1 – New Zealand's Merchandise Terms of Trade



Sources: NZIER, Statistics New Zealand

Figure 1 above shows New Zealand's merchandise terms of trade since 1900.[1] It is clear that there have been periods over this time when the terms of trade has changed considerably from both a trend and volatility perspective. This paper attempts to answer three questions: how the trend and volatility in the terms of trade impact on New Zealand's economic growth; whether or not the trends and volatility of the terms of trade have changed over time; and what factors are likely to influence the trends and volatility of the terms of trade in the future.

[1] This paper uses the goods terms of trade rather than the goods and services terms of trade due to better data availability. Statistics New Zealand has data on the SNA services terms of trade back to 1988. It is very highly correlated with the New Zealand TWI exchange rate (correlation = 0.95).

This paper adds to the ever growing literature on the drivers of New Zealand's economic growth by examining how the terms of trade affects the economy as well as what factors will influence the terms of trade in the future. As New Zealand is a small country, the terms of trade can be thought of as predominantly exogenous. Therefore rather than policy makers targeting the terms of trade as a policy instrument, it is more appropriate for them to have an understanding of how the terms of trade affects the economy and hence have an understanding of the policy implications of terms of trade movements. Policy makers, not only in New Zealand, but other countries are increasingly thinking of the terms of trade in this way.[2]

The debate in the literature on the macroeconomic effects of trends in the terms of trade is mixed. Views vary from the terms of trade having a positive effect to a negative effect on economic growth, with the former being the most common. This is because a rise in the terms of trade implies a rise in a country's real domestic income. An increase in export prices relative to import prices allows a larger volume of imports to be purchased for a given volume of exports, resulting in an increase in purchasing power.

The terms of trade can also be thought of as a return on investment and it is through this investment channel and the real domestic income channel mentioned above that the macroeconomic effects of the terms of trade are commonly studied. However, there is one area of the literature that concludes that increases in the terms of trade have a negative effect on a country's growth performance. One of the reasons proposed for this is known as the 'resource curse'. This is discussed further below.

The literature is much more united in its belief about the economic effects of volatility in the terms of trade. Increased volatility is found to have a negative impact on economic growth. Section two examines this literature as well as the literature looking at the macroeconomic impacts of trends in the terms of trade. In order to put it into a New Zealand context, an empirical analysis based on work by Grimes (2006) is tested in this section to see how economic growth in New Zealand is affected by trends and volatility in the terms of trade.

Section three looks at the historical trends and volatility of New Zealand's terms of trade. For the majority of New Zealand's economic history, primary commodities have dominated its goods exports while it has largely imported manufactured goods. According to the Prebisch-Singer hypothesis, which states that over time primary commodity prices decline relative to manufactures prices, New Zealand should have experienced a secular trend decline in its terms of trade. This section examines this hypothesis to assess whether it holds for New Zealand using the methodology of Gillitzer and Kearns (2005). They performed a similar study for Australia and found that its terms of trade have declined over time, albeit very gradually. The volatility of the terms of trade is also examined in this section to assess if it has changed over time.

Section four examines some developments in New Zealand export and import prices and how they have affected the trend and volatility of the terms of trade. Section five uses the analysis of the trends and volatility of the previous sections and considers other issues such as the emergence of China in the global market and potential trade reforms to assess possible future movements in New Zealand's terms of trade. The final section concludes as well as looks at policy implications and areas of future research.

[2] For example, Henry (2006) http://www.treasury.gov.au/contentitem.asp?NavId=008&ContentID=1112.

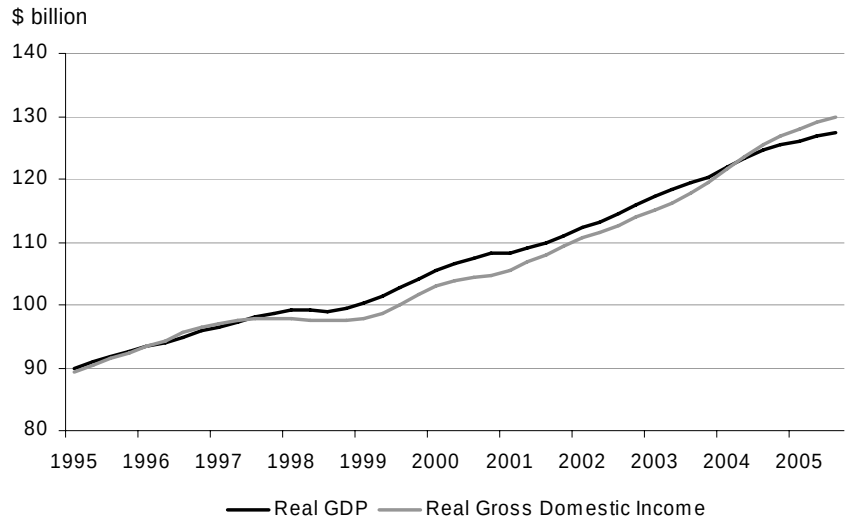
2 Why are the terms of trade important?

2.1 Terms of trade trends and economic growth

As movements in the terms of trade reflect changes in relative prices, it is often unclear how these movements affect the real economy. Although this has been debated extensively in the literature to date, there is still no consensus view about how trends in the terms of trade impact on economic growth.

The most common view is that the terms of trade has a positive impact on economic growth. An increase in export prices relative to import prices allows a larger volume of imports to be purchased with a given volume of exports. The implied increase in the real purchasing power of domestic production is equivalent to a transfer of income from the rest of the world and can have large impacts on consumption, savings and investment. The terms of trade can also be thought of as a rate of return on investment and therefore a secular improvement in the terms of trade leads to an increase in investment and hence economic growth. A graphical illustration of the income effect of a movement in the terms of trade is shown in Figure 2. Real gross domestic income (RGDI) measures the purchasing power of the total income generated by domestic production. The difference between real GDP and RGDI is defined as the terms of trade effect. The appreciation of the terms of trade over 2004 led to a boost in real incomes and this is shown by RGDI exceeding real GDP over 2004 and 2005.

Figure 2 – Terms of Trade Effect on Purchasing Power



Source: Statistics New Zealand

Although the changes to real incomes from terms of trade movements can be seen in Figure 2, the total economy-wide impacts of terms of trade movements are hard to quantify. Changes in the terms of trade can have different macroeconomic impacts depending on the composition of the relative price movements. If a fall (rise) in the terms of trade is due to a decrease (increase) in export prices, then this will initially impact on exporters before indirectly affecting households. However, if a fall (rise) in the terms of trade is a result of an increase (decrease) in import prices (for example, oil prices), this is likely to affect households and businesses more directly and the macroeconomic shock will be different.

Shifts in production and resources are often associated with relative price movements. An external shock such as an increase in prices which benefits one sector of the economy often leads to increased investment in this area or resources shifting to this sector from another. An example of this was the significant dairy conversions of the 1990s. Land used for dairy farming increased by over 35% between 1990 and 2000 while land used for sheep and beef farming fell by close to 13%.[3] This was due mainly to changes in relative prices as New Zealand dollar dairy prices increased by 31% during this period as opposed to only a 1% increase in combined meat and wool prices. The impact on economic growth as resources shift from one sector to another is difficult to interpret, as they are likely to be coupled with productivity changes and therefore the sole impact of a relative price change is hard to quantify.

Harberger (1950) and Laursen and Metzler (1950) were some of the first to look at the impact of a terms of trade shock on an economy. They suggested that a deterioration in the terms of trade will reduce a country's real income (or increase real expenditure for a given income level) consequently decreasing savings, through consumption smoothing behaviour. This later became known as the Harberger-Laursen-Metzler effect. Obstfeld (1982) and later Kent and Cashin (2003) extended this idea and showed that the duration or persistence of terms of trade shocks are important when determining the effect on an economy. A longer or more persistent shock may result in lower investment and potentially higher saving in anticipation of lower future output.

Much of the current literature looking at the relationship between a secular trend in the terms of trade and economic growth has concentrated on explaining cross-country differences between developing and industrialised nations. Some of the first to approach this idea were Prebisch (1950) and Singer (1950) who proposed that developing countries had experienced a downward trend in their terms of trade relative to developed countries. This theory (later known as the Prebisch-Singer hypothesis) has been one of the most extensively researched ideas in development economics. It states that over time, the price of primary commodities relative to the price of manufactured goods should decrease. Cashin and McDermott (2002) state that this is a result of a lower income elasticity of demand for commodities as well as smaller productivity increases for manufactured goods, while Gillitzer and Kearns (2005) suggest that manufactured goods are much less homogeneous than commodities and therefore producers have more price setting power. Related to this is the observation that primary commodities are generally products with low barriers to entry. These products are therefore more likely to have experienced increased competition with price pressures and tight margins than manufactured goods for which there is less competition as the products are more difficult to produce.

Grilli and Yang (1988), in a commonly cited study - and whose data is the basis for much of this field of research - found evidence supporting the idea of decreasing real commodity prices (the ratio of primary commodity prices to manufactures prices). More recently studies by Lutz (1999) and Cashin and McDermott (2002), using different methodologies, also find evidence supporting the Prebisch-Singer hypothesis.

However, there are studies that disagree with the Prebisch-Singer hypothesis of a secular decline in real commodity prices. The debate surrounds the appropriate use of deterministic or stochastic trends and the calculation of structural breaks. Powell (1991) found that after allowing for three breaks in the series, non-oil commodity prices and manufactured good prices are cointegrated, implying that the commodity terms of trade is

[3] These statistics are all courtesy of the Ministry of Agriculture and Forestry (MAF).

stationary and therefore not declining over time. Kellard and Wohar (2006) allowed for two structural breaks and found little evidence in support of the Prebisch-Singer hypothesis. They find that for the majority of commodities, a single downward trend is not the best representation but rather a "shifting trend" which often changes sign over the sample period is more appropriate. They argue that previous literature that finds evidence of a single downward sloping trend as support for the Prebisch-Singer hypothesis is too simplistic. This downward trend may in fact encompass several trends and therefore simplifying the result to a single downward trend may be misleading to policy makers.

Rather than looking at evidence for a secular decline in developing countries' terms of trade, other studies have focussed on the growth effects of terms of trade trends. Barro and Sala-i-Martin (2004) found that the growth rate of the terms of trade had a positive impact on growth (among other economic and demographic variables) as part of their cross-country regression analysis. Other studies which also find evidence of the positive economic growth effects of terms of trade movements include, inter alia, Mendoza (1997) and Easterby, Kremer, Pritchett and Summers (1993).

Although less common, there are studies that find empirical evidence to suggest a negative relationship between the terms of trade and economic growth. Hadass and Williamson (2001) found that the growth performance of developing nations was reduced by global terms of trade shocks between 1870 and World War I relative to developed countries. However, they found that in fact the terms of trade in these developing countries increased more than it did for the developed nations. Although they do not decide on an explanation for this, they suggest a possible reason. They suggest it could be due to what has come to be known as "resource curse". Sachs and Warner (1995, 2001) tested this idea empirically and suggest that resource-rich countries generally grow more slowly than resource-poor countries and any relative price shock that increases the value of these resources (particularly natural resources) will hamper development. This may happen for a number of different reasons, including a decline in the competitiveness of other economic sectors (Dutch Disease), the crowding out of human capital through the underinvestment in institutions and education, or as a result of corruption from the mismanagement of revenues from the natural resource sector. Note that the source of the curse is not natural resources, but government mismanagement when resources are present.

2.2 Terms of trade volatility and economic growth

A more recent development in the literature is to study the impact of terms of trade volatility on economic growth. Unlike the debate surrounding the growth effects of long-term trends in the terms of trade, it is generally agreed in the literature that terms of trade volatility has an adverse effect on economic growth. This is usually tested through the channels of uncertainty on investment decisions where increased volatility or uncertainty is associated with increased risk. As the terms of trade can be thought of as a return on investment, increased risk generally leads to a reduction in investment.

As with the trend analysis in the terms of trade, much of the literature looking at the growth effects of terms of trade volatility has focused on cross-country differences, particularly between developing and developed countries. Blattman, Hwang and Williamson (2003) tested the impact of terms of trade trends and volatility on economic growth. They showed that terms of trade movements are a very important determinant of economic growth, with volatility in the terms of trade much more significant than the long-term trends. They also found that this was particularly the case for developing nations

whose exports are dominated by primary commodities. Industrialised nations, which are more likely to have a broader export structure, appeared to be significantly less affected by both the trend and volatility of the terms of trade. This therefore makes it hard to interpret for New Zealand. The fact that New Zealand's goods exports have been dominated by primary commodities leads one to believe that the terms of trade is more important to New Zealand than other industrialised countries.

Mendoza (1997) also looked at the impact of terms of trade volatility on economic growth through the development of a stochastic growth model. In his model, growth in the terms of trade positively impacts consumption growth through increases in income, while volatility in the terms of trade has a negative impact on consumption growth through risk aversion. To test his model's key findings he ran cross-country panel regressions of developed and developing nations and concluded that terms of trade shocks account for close to half of the differences seen in cross-country growth rates. Like Mendoza, Turnovsky and Chattopadhyay (1998) found a negative relationship between economic growth and terms of trade volatility. However, rather than look at the differences between developed and developing nations, they focused only on small developing nations. One could argue that New Zealand, although not typically classed as a developing nation, has some similarities in the fact that its exports are dominated by primary commodities. Like the findings of Blattman *et al* (2003), one can draw important implications from this research for New Zealand. It shows that for primary commodity exporters, like New Zealand, it is important for economic growth if volatility in the prices of these commodities and hence the terms of trade is reduced.

It is also commonly agreed upon in the literature that commodity prices have a significant impact on the variation in a country's terms of trade. Cashin and McDermott (2002) report that on average real commodity prices have declined by approximately 1% per year. However, some prices have changed by up to 50% in a single year. Because of this volatility, interpreting results concerning trends in commodity prices (and the terms of trade) is difficult. Kellard and Wohar (2006) suggest that researchers should move away from analysis of the Prebisch-Singer hypothesis and more towards theoretical and empirical work examining local trends. This may allow a better understanding of the drivers of commodity prices and better policy analysis. Both types of analysis are undertaken below.

2.3 New Zealand evidence

To date there have been only a few studies that look at terms of trade trends and volatility and their impact on economic growth in a New Zealand context. One such study was Grimes (2006). He found that approximately half the variance in annual GDP growth between 1960 and 2004 can be explained by the level and volatility of the terms of trade. He found that the level of the terms of trade had a positive effect on economic growth while the volatility in the terms of trade (particularly import prices) had a negative impact on economic growth. This paper extends the methodology of Grimes (2006) by using slightly different measures of real export and import prices. This is discussed below in Section 2.3.1.

Another paper looking at the importance of the terms of trade for economic growth in New Zealand was Fox, Kohli and Warren (2003). Using a modified Diewert-Morrison decomposition, they separate out the contributions to New Zealand's GDP growth from total factor productivity (TFP) growth, labour and capital utilisation, the terms of trade, and the trade balance for the period of 1983 to 2001. They find that although the terms of trade did

not make the largest contribution to economic growth on average over this period, there were times when movements in the terms of trade made significant contributions to economic growth. This paper extends the work of Fox *et al* up to 2005 in order to include the recent increase in the terms of trade from 2003. It is found that in 2004 and 2005, the terms of trade accounted for close to two-fifths of real GDP growth in those years. A more detailed discussion of this method and the results are displayed in Appendix 2.

Buckle, Kim, Kirkham, McLellan and Sharma (2002) is another study which looks at the impact of terms of trade movements on the New Zealand economy. Their research was based on the development of a structural vector-autoregressive model of the New Zealand economy to help decompose the contributions to New Zealand business cycles. Part of their analysis looked at the impact of international variables such as export and import prices. Rather than use a "portmanteau" terms of trade variable, they separate out the contributions from export and import prices as their impact on GDP fluctuations varies over the sample period. They found that shocks to export prices tend to have relatively long cycles while import price shocks are much more volatile. They conclude that these international variables (along with foreign interest rates, foreign output and foreign equity returns) have had a significant influence on New Zealand's business cycle.

2.3.1 An empirical test

As discussed above, Grimes (2006) tested the impact of both the level and volatility of the terms of trade on New Zealand's GDP growth. His approach begins with an equation of the form shown by (1) below

$$\Delta \ln(GDP)_t = \beta_1 + \beta_2 \ln(TOT)_t + \beta_3 TOT10_t + \varepsilon_t \qquad (1)$$

where $\Delta \ln(GDP)_t$ is the annual growth rate in GDP between year *t-1* and *t*, $\ln(TOT)_t$ is the logarithm of the terms of trade in year *t*, and $TOT10_t$ is the 10 year moving standard deviation of the terms of trade.

As the terms of trade is a ratio of export and import prices, Grimes (2006) suggests that it is appropriate to test whether export and import prices individually affect economic growth. Therefore (1) above is extended into (2) where the level of the terms of trade, $\ln(TOT)_t$, and the volatility of the terms of trade, $TOT10_t$, are separated into their real export and import price components,

$$\Delta \ln(GDP)_t = \gamma_1 + \gamma_2 \ln(REXP)_t + \gamma_3 \ln(RIMP)_t + \gamma_4 REXP10_t + \gamma_5 RIMP10_t + \varepsilon_t \qquad (2)$$

where $\ln(REXP)_t$ is real export prices, $\ln(RIMP)_t$ is real import prices, $REXP10_t$ is the 10 year moving standard deviation of $REXP$, and $RIMP10_t$ is the 10 year moving standard deviation of $RIMP$.

Unlike in Grimes (2006) however, which calculates real export and import price indices by deflating by the New Zealand consumer price index, this paper deflates the export and import price indices by the IMF's Manufacturing Unit Value (MUF) series (which is common in this form of analysis).[4] The period tested is also 11 years longer, i.e. 1950 to

[4] Other studies that use the MUV index as a deflator include Cashin, Liang & McDermott (2000), Cashin, McDermott & Scott (1999), Bleaney & Greenaway (1993) and Cuddington & Liang (1998).

2005.[5] The results of this analysis are displayed in Table 1 below. Like in Grimes, the unrestricted regression (2) is initially estimated and then tested to see whether it can be restricted to the form of (1). This is done through the specification of four different regressions numbered Regression 1 to Regression 4.

Table 1 – Results from the Estimation of Equations (1) and (2)

Independent Variables	Regressions - Dependent Variable: $\Delta \ln(GDP)_t$				
	1	2	3	4	smoothed^
$\Delta \ln(GDP)_{t-1}$	—	—	—	—	0.725***
					(0.225)
$\Delta \ln(GDP)_{t-2}$	—	-0.375***	-0.301**	-0.389***	-0.497***
		(0.144)	(0.153)	(0.148)	(0.144)
$\ln(REXP)_t$	0.113**	0.106**	0.123***	0.072***	0.029***
	(0.050)	(0.043)	(0.030)	(0.020)	(0.007)
$\ln(RIMP)_t$	-0.040	-0.029	—	—	—
	(0.051)	(0.043)			
$\ln(TOT)_t$	—	—	—	—	—
$REXP10_t$	-0.022	-0.019	—	—	—
	(0.024)	(0.019)			
$RIMP10_t$	-0.057**	-0.096***	—	-0.114***	-0.064***
	(0.029)	(0.024)		(0.017)	(0.016)
$TOT10_t$	—	—	-0.000**	—	—
			(0.000)		
Constant	-0.052	-0.038	-0.119***	-0.035**	-0.003
	(0.050)	(0.038)	(0.037)	(0.027)	(0.012)
$\overline{R}^2$	0.211	0.349	0.279	0.354	0.711

***, ** and * denote rejection of the null hypothesis at the 1%, 5% and 10% significance levels respectively. Newey-West standard errors are presented in parentheses.

^ This equation uses a three year centred moving average of GDP as the dependent variable as well as lagged independent variables.

Regression 1 corresponds with (2) and it is found that real export prices and real import price volatility are significant at the 5% significance level while real import prices and real export price volatility are insignificant. Regression 2 includes a two year lag of the dependent variable (which is significant at the 1% level) after finding that the residuals from Regression 1 showed some evidence of serial correlation. This increases the explanatory power in comparison to Regression 1 markedly. Regression 3 drops all the insignificant variables from Regression 2, namely real import prices and export price volatility, and import price volatility is replaced by total terms of trade volatility. As found in Grimes (2006), the explanatory power falls when the total terms of trade volatility is added and so import price volatility is used as the chosen volatility measure.

Using a Wald test, Grimes (2006) finds that the coefficients on $\ln(REXP)_t$ and $\ln(RIMP)_t$ are equal in absolute value but of opposite sign. He therefore is able to replace these two variables with $\ln(TOT)_t$. However, in the regressions tested below, this Wald test is

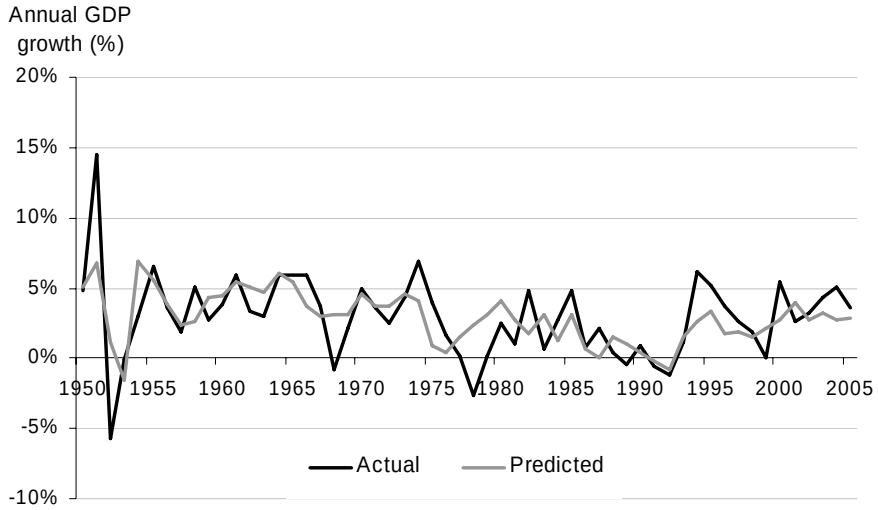
[5] For a description of the data used in this section see Appendix 1.

rejected and therefore it is only the level of real export prices rather than the level of the terms of trade that enters into Regression 4. The actual and predicted annual GDP growth is displayed in Figure 3.

Although this paper uses different measures of real export and import prices (and hence volatility) to Grimes (2006), the conclusions are similar. Where they do differ is that rather than the total level of the terms of trade having a positive effect on economic growth, as it does in Grimes, it is only the level of real export prices that are found to have a significant impact on economic growth. Like in Grimes, this paper finds that the volatility in import prices has a highly significant negative effect on economic growth while export price volatility is found to be insignificant.

These are interesting conclusions. It is surprising that the level of real import prices did not have an impact on economic growth. One would expect higher import prices to have an adverse effect on economic growth through lower household consumption and lower investment, although if the higher prices were enough to encourage people to purchase domestic substitutes, then this may actually be positive for economic growth (particularly in the short-term). This is because imports would fall even though consumption stays at the same level or increases, leading to higher GDP. However, it may not be so positive in the longer-term as households' (and firms') purchasing power would have fallen. This could see a drop in economic welfare. It is not surprising however, that the volatility in import prices has a significant negative impact on economic growth. The majority of New Zealand's capital investment goods are sourced from overseas. If a firm saw that the prices of imported capital goods were very volatile, it may deter them from making new investment decisions. This would have negative impacts on economic growth.

Figure 3 – Actual and Predicted GDP Growth



Source: Statistics New Zealand, Author's calculation

As in Grimes (2006), Regression 4 is then finally tested using a three year centred moving average of GDP growth. The results are displayed in the far right column of Table 1 and as in Grimes, the amount of variation increases considerably (71% in this case).[6] This shows that once some of the variability in annual GDP growth is removed, the specification of Regression 4 is able to explain a considerable amount of the remaining

[6] Also tested is the effect of regime changes on these results such as the 1985 float of the New Zealand dollar. This did not have a major effect on the results (as in Grimes (2006)).

variability. That is, annual GDP growth can be explained by lags of itself plus the level of real export prices and real import price volatility.

The next section looks in more detail at how the level and volatility of New Zealand's export and import prices have changed over time.

3 Trends and volatility in New Zealand's terms of trade

The previous section described the current views in the literature surrounding the impact of terms of trade trends and volatility on economic growth and briefly looked at it from a New Zealand context. This section looks at the historical trend and volatility in New Zealand terms of trade to see if they have changed over time. It follows very closely the methodology used by Gillitzer and Kearns (2005) in their study of long-run trends and volatility in Australia's terms of trade. The description and sources of the data for this section are explained in Appendix 1.

3.1 Long-run trend

3.1.1 Has New Zealand's terms of trade declined over time?

Tables 2 and 3 below display the composition of New Zealand's merchandise trade over the past ten years. It is clear that New Zealand's exports are dominated by primary commodities while its imports are dominated by manufactured goods. For this reason, the Prebisch-Singer hypothesis implies that the terms of trade should have declined over history and should continue to decline. This would have implications for the economy, some of which were discussed in the previous section.

There have been some significant events in New Zealand's economic history that have had an impact on the terms of trade. One of these events was when the UK formally joined the European Economic Community (EEC) in 1973. At the time the UK was New Zealand's biggest export destination taking 72% of lamb exports, 73% of butter exports, 66% of cheese exports and approximately 20% of wool exports.[7] The UK joining the EEC had the effect of dramatically reducing the demand for New Zealand products in the UK and led to a significant reduction in export prices. It required New Zealand to identify new markets for its primary exports as well as develop new merchandise in order to remain competitive overseas. Other events at the time which may have affected the terms of trade were the commodity price boom of the early 1970s, followed by the first oil shock in late 1973.

[7] These figures were taken from Dalziel and Lattimore (2004).

Table 2 – New Zealand's Merchandise Exports Composition

Exported Product	1995		2000		2005	
year ended March 31	value $m	% of total	value $m	% of total	value $m	% of total
Non-commodity manufactures	4,345	20.8%	5,528	22.5%	8,434	27.1%
Dairy, casein and caseinates	3,337	15.9%	4,459	18.1%	5,678	18.3%
Meat and edible offal	2,689	12.9%	3,198	13.0%	4,688	15.1%
Forestry products	2,515	12.0%	2,942	12.0%	2,957	9.5%
Fruit	764	3.6%	1,059	4.3%	1,355	4.4%
Seafood products	1,084	5.2%	1,183	4.8%	1,126	3.6%
Aluminium and aluminium articles	826	3.9%	1,013	4.1%	1,071	3.4%
Wool	1,299	6.2%	760	3.1%	698	2.2%
Other goods exports	4,065	19.4%	4,473	18.2%	5,082	16.3%
Total	20,923	100.0%	24,615	100.0%	31,088	100.0%

Source: Statistics New Zealand

Table 3 – New Zealand's Merchandise Imports Composition

Imported Product	1995		2000		2005	
year ended March 31 (VFD)	value $m	% of total	value $m	% of total	value $m	% of total
Minerals, chemicals and plastics	4,322	22.6%	6,148	23.4%	8,611	26.0%
Machinery and mechanical appliances	5,092	26.6%	6,238	23.8%	7,865	23.7%
Vehicles and aircraft	3,267	17.1%	5,171	19.7%	5,910	17.8%
Other manufactures	1,528	8.0%	2,124	8.1%	2,488	7.5%
Metals and articles of metal	1,233	6.4%	1,489	5.7%	1,946	5.9%
Textiles and textile articles	1,165	6.1%	1,451	5.5%	1,554	4.7%
Other goods imports	2,529	13.2%	3,604	13.7%	4,764	14.4%
Total	19,136	100.0%	26,226	100.0%	33,139	100.0%

Source: Statistics New Zealand

Another influential period was the Korean War in 1950. This saw the demand for wool increase dramatically with the price of wool rising by over 150% in two years. The overall impact of this wool price shock saw the goods terms of trade reach a record high in 1951 before falling once the war was over.

In order to test whether any of these periods had a large influence on the trend or level in New Zealand's terms of trade, the Andrews and Ploberger (1994) test for a structural break was used.[8] However, it yielded inconclusive results and found no evidence of a structural break in the terms of trade (expressed in logarithms) for annual data from 1900 to 2005.[9]

[8] I thank Kam Szeto for performing this test for me.

[9] However, using quarterly data from 1950-2005, the test found evidence of breaks in the trend as well as other coefficients. The results of this test are available from the author.

Following the methodology of Gillitzer and Kearns (2005), unit root tests were performed to test the stationarity of the data. Although the Andrews and Ploberger (1994) test found no evidence of any structural break, the sample is split into two periods to display how the trend in New Zealand's terms of trade differs depending on the period examined. These periods are 1900 to 1973 and 1974 to 2005.[10]

The results of the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests are displayed in Table 4. They show that generally New Zealand's log terms of trade are stationary. However, the ADF unit root test is unable to reject that the terms of trade have a unit root for the period 1974 to 2005 while the PP test can only reject the hypothesis of a unit root when a trend is included. This may be a result of the relatively small sample size and the fact that the terms of trade has generally been increasing over this period.

Table 4 – Unit Root Tests for Log Goods Terms of Trade

	Augmented Dickey-Fuller		Phillips-Perron	
	Intercept	Trend	Intercept	Trend
1900-2005	***	***	***	**
1900-1973	**	*	**	**
1974-2005	—	—	—	***

***, ** and * denote rejection of the null hypothesis of a unit root at the 1%, 5% and 10% significance levels respectively

To estimate the linear trend in the log terms of trade, tot_t, (3) is estimated below. The results are displayed in Table 5.

$$tot_t = \alpha + \beta t + \varepsilon_t \qquad (3)$$

Table 5 shows that over the period 1900 to 2005 there has been a statistically insignificant downward trend in New Zealand's goods terms of trade of 0.1% per year. This is an interesting result because it appears to reject the Prebisch-Singer hypothesis that New Zealand's terms of trade should be trending downwards as a result of the composition of its exports and imports. If the sub-samples are examined, the period from 1900 to 1973 has a statistically insignificant trend, while the period 1974 to 2005 reports a statistically significant upward trend of 0.6% per year in the goods terms of trade. This appears to fit with the argument posed by Kellard and Wohar (2006) in that although a single trend may be present (insignificant in this case), there may be periods in which the trend - and the sign in particular - are different. The results show that for the past 30 years New Zealand has experienced an upward trend in its terms of trade. Consequently, this leads to a different interpretation of the results than if the entire 1900 to 2005 period is examined. However, it is not surprising that the terms of trade have trended upwards over the 1974 to 2005 period given that the date chosen as the break was close to the period where New Zealand experienced some significant downward shocks to the terms of trade that may have meant they were artificially low.

[10] These sub-periods were chosen by graphical observation and also with a belief that the UK entering the EEC in 1973 had a large impact on the terms of trade. However, as mentioned above, the oil shocks of the 1970s also occurred at this time, therefore not all of the initial downward movement in the terms of trade can be attributed to the UK joining the EEC.

Table 5 – Trend in Log Goods Terms of Trade

	1900-2005	1900-1973	1974-2005
α	6.997***	6.941***	6.387***
	(0.043)	(0.054)	(0.132)
β	-0.001	0.001	0.006***
	(0.001)	(0.001)	(0.001)
Q(1)	56.324***	37.782***	2.735*
Q(5)	78.065***	54.359***	4.099

***, ** and * denote rejection of the null hypothesis at the 1%, 5% and 10% significance levels respectively. Newey-West standard errors are presented in parentheses. Q(1) and Q(5) are the Ljung-Box statistics for autocorrelation at 1 and 5 lags respectively.

However as Gillitzer and Kearns (2005) found for Australia, this method of estimating the trend reports considerable autocorrelation in the residuals of (3). This is shown by the highly significant Ljung-Box statistics reported in Table 5 and suggests that there is a level of persistence in the terms of trade (with the exception of the 1974 to 2005 period). To correct for this autocorrelation in the residuals, a lagged dependent variable is added to the regression as shown by (4) where ρ is the autoregressive parameter.

$$tot_t = \alpha + \beta t + \rho\left(tot_{t-1}\right) + \varepsilon_t \qquad (4)$$

The results of (4) are displayed in Table 6 and show that the inclusion of the lagged dependent variable reduces the trend coefficient across the entire sample as well as the sub-samples. For the 1900 to 2005 period the downward trend is reduced from 0.1% per year in (8) to 0.0% per year (-0.0001%) in (4) (and it still remains insignificant). The trend is still also statistically insignificant for the period of 1900 to 1973 and the upward trend for the period of 1974 to 2005 has fallen to 0.5% per year (from 0.6%) but is still significant. The long-run parameter, defined as $\beta/(1-\rho)$, shows that the above results apply. That is, the trend for the 1974 to 2005 period is positive and highly significant at 0.8% per year.

Table 6 – Trend in Log Goods Terms of Trade (Allowing for Persistence)

	1900-2005	1900-1973	1974-2005
α	1.904***	1.889***	4.272**
	(0.403)	(0.518)	(1.643)
β	-0.000	0.001	0.005***
	(0.000)	(0.001)	(0.002)
ρ	0.728***	0.727***	0.310
	(0.057)	(0.074)	(0.258)
$\beta/(1-\rho)$	-0.001	0.001	0.008***
	(0.001)	(0.001)	(0.002)
Q(1)	3.159*	2.231	3.923**
Q(5)	6.818	7.057	11.476**
ρ (Andrews)	0.754	0.846	0.396
Half-Life	2.455	4.145	0.748

***, ** and * denote rejection of the null hypothesis at the 1%, 5% and 10% significance levels respectively. Newey-West standard errors are presented in parentheses. Q(1) and Q(5) are the Ljung-Box statistics for autocorrelation at 1 and 5 lags respectively. ρ (Andrews) is Andrews (1993) median-unbiased estimator of ρ. $\beta/(1-\rho)$ is the long-run parameter.

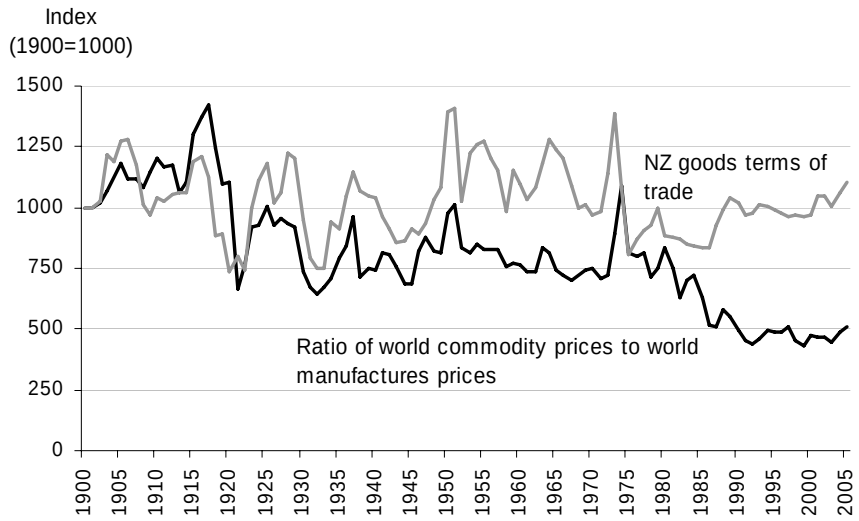
Also reported in Table 6 is the median-unbiased estimate of ρ based on Andrews (1993). This estimate corrects for biases associated with ordinary least squares estimation with lagged dependent variables (like the form of (4)). The Andrews (1993) estimate of ρ in all three sample lengths is higher than that estimated by least squares to correct for the downward bias. The half-lives of unit shocks are also presented in Table 6 and these show that shocks to the terms of trade do not appear to be persistent (consistent with the finding of stationarity). Shocks appear to dissipate after approximately four years for the period of 1900 to 1973 and have decreased to less than one year for the period 1974 to 2005. Applying this result to the findings of Obstfeld (1982) and Kent and Cashin (2003) suggests that shocks to the terms of trade impact on the New Zealand economy as suggested by the Harberger-Laursen-Metzler effect as they are relatively short-lived.

As reported above, there is little evidence that New Zealand's terms of trade have declined over time, which contradicts the Prebisch-Singer hypothesis. As discussed above, there is no statistical evidence that there were any structural breaks present. However, when examining the sub-periods, there is strong evidence that the terms of trade have experienced an upward trend over the past 30 years.

Following Gillitzer and Kearns (2005) methodology, New Zealand's terms of trade is compared with the ratio of world commodity prices and world manufacturing prices. This series is taken from Grilli and Yang (1988) and is extended to 2005 using IMF commodity price data. Figure 4 below displays the series since 1900.

Prior to the mid 1970s, New Zealand's goods terms of trade and the ratio of world commodity prices to world manufacture prices (relative commodity prices) had a similar downward trend as well as similar cycles. However, following this period the series have diverged. The terms of trade have increased while relative commodity prices have continued decreasing at a more rapid pace. This development has important implications for the New Zealand economy because it suggests that over the last 30 years New Zealand has benefited from a terms of trade that is higher than implied by relative world commodity prices.

Figure 4 – Relative Commodity Prices and New Zealand's Terms of Trade

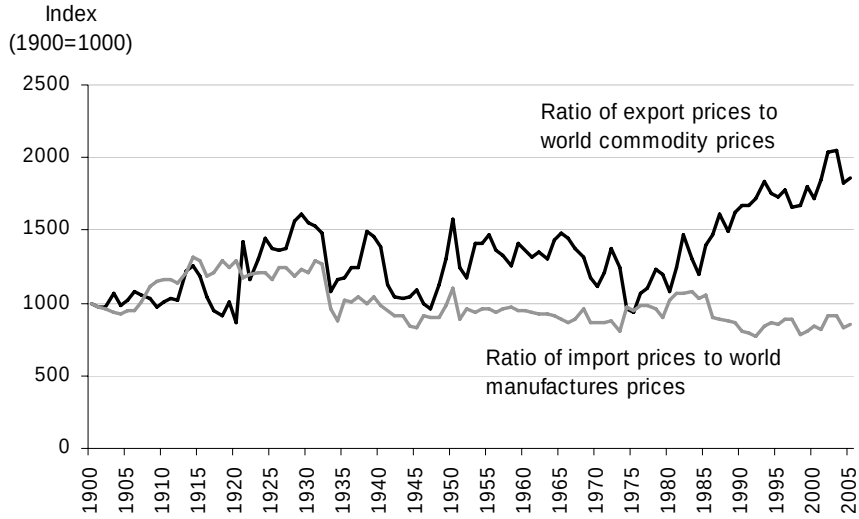


Sources: Grilli and Yang, IMF, NZIER, Statistics New Zealand

There appear to be three distinct periods when the ratio of world commodity prices to world manufacturing prices experienced different properties. Prior to 1920, the ratio was at a relatively high level. However, after a downward shock around 1920 the level appears to be permanently lower, and stayed around this level until the mid-1970s. Some suggest that the downward shock in the 1920s was a result of increased farm production in Europe once soldiers returned from duty after World War I, which led to lower world primary commodity prices. After the mid-1970s the ratio has declined considerably although it has flattened out in the last 15 years which may be a result of falling relative manufacturing prices (at the same speed as primary commodity prices) as "low-cost" countries such as China increase their presence in international markets.[11]

Figure 5 displays the ratio of New Zealand goods export prices to world commodity prices and the ratio of New Zealand goods import prices to world manufacturing prices. An interesting observation is that the ratio of New Zealand's export prices to world commodity prices has been increasing while the ratio of import prices to world manufacturing prices has stayed relatively flat. The upward trend in "relative" export prices also appears to have accelerated after the mid-1970s and helps explain why New Zealand's goods terms of trade has a smaller downward trend than the ratio of world commodity prices to world manufacturing prices as shown in Figure 5. Because of this, one may ask why New Zealand has not performed better relative to other countries since 1975. New Zealand typically compares itself to other OECD countries and these countries are generally manufactured goods exporters rather than primary commodity exporters. Therefore, rather than being able to draw conclusions from Figure 5 about New Zealand's relative performance compared with the OECD, it may be more appropriate to compare it to other primary commodity exporters (which are typically developing countries). It suggests that New Zealand has experienced higher prices for its exported goods than other primary commodity exporters.

Figure 5 – Relative Export and Import Prices



Sources: Grilli and Yang, IMF, NZIER, Statistics New Zealand

Section 4 looks in more detail at some of the reasons why New Zealand's terms of trade is higher than implied by real world commodity prices and why the ratio of New Zealand export prices to world commodity prices has increased dramatically since the mid 1970s.

[11] This point is discussed further in Section 5.2.

3.2 Volatility

3.2.1 Measuring volatility

The previous section illustrated that there is no evidence of a secular decline in New Zealand's terms of trade and in fact the past three decades have seen an upward trend. This section looks at the volatility in the terms of trade to see if it has also changed over time.

As illustrated in Figure 1, New Zealand has experienced some large fluctuations in its terms of trade. These have been a result of both export price movements as well as import price movements. For example, the oil price shocks of the mid-1970s had a large impact on import prices while the Korean War of 1950 saw a considerable increase in export prices through the price of wool. Some measures of volatility of the terms of trade are summarised in Table 7 which also shows how volatility has changed over time. The series is again split into the familiar periods of pre-1973 and post-1973 as in the trend discussion above. It is found that volatility (measured by the variance) is almost 70% less in the post-1973 period than the 1900 to 1973 period.[12] Also displayed in Table 7 is a measure of the range of the terms of trade relative to the mean. This has fallen by over 50% between the period 1900 to 1973 and 1974 to 2005.

Table 7 – Measures of Volatility in New Zealand's Log Goods Terms of Trade

	1900-2005	1900-1973	1974-2005
Variance	0.020	0.023	0.007
Range/Mean*	0.651	0.632	0.311

* The estimate is based on the actual terms of trade data (not logarithms).

Table 7 shows how the volatility has changed between the two periods. However, these two periods are arbitrary and chosen by "eye-balling" a graph. It is therefore of interest to test whether a structural break is present in the volatility of the terms of trade. In their paper, Gillitzer and Kearns (2005) apply the Bai and Perron (1998) test to see whether there are any statistically significant breaks in the mean of the absolute log difference in the terms of trade and it is this methodology that is repeated here and displayed in Table 8.

Both the UDMax test and the WDMax test, which test for an unknown number of breaks, reject zero breaks against an unknown number of breaks at the 1% significance level. The BIC information criterion indicates that there is one break while the LWZ criterion does not find evidence of any breaks. After allowing for one break, the SupF test cannot reject one break in favour of two or two breaks in favour of three at the 5% significance level. The sequential test using the results of the SupF test therefore finds one break in the volatility of the terms of trade and the Bai and Perron test selects the most likely date as 1980.

[12] A similar observation was observed for Australia in the work by Gillizter and Kearns (2005) in that the volatility of its terms of trade has also reduced significantly. It would be interesting to see if this reduction in volatility is more of a world-wide phenomenon, but that is beyond the scope of this paper.

Table 8 – Results of Bai and Perron (1998) Test for Structural Break in Volatility of Terms of Trade

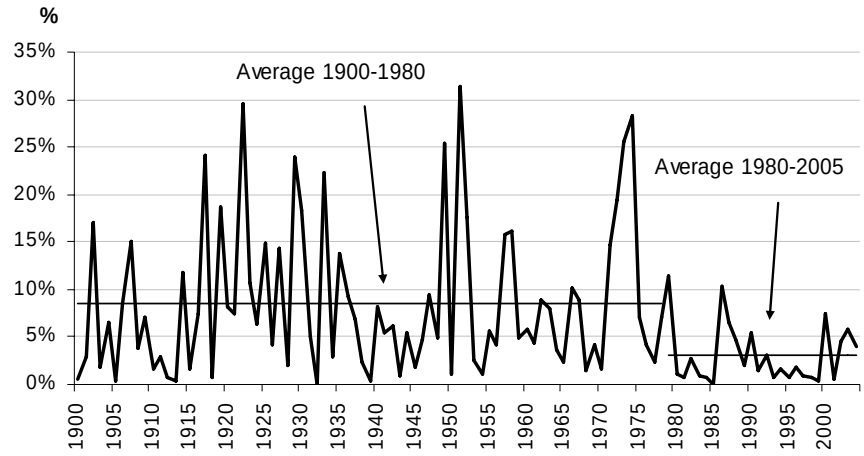
Double maximum tests	Information criteria	SupF(*i*+1|*i*)	Sequential test	Break dates
UDMax	BIC	SupF(2|1)	1 break	1980
26.951***	1 break	7.748*		
WDMax	LWZ	SupF(3|2)		
27.484***	0 breaks	4.180		

The double maximum tests are tests for an unspecified number of breaks against the null of zero breaks. Both the WDMax and UDMax test statistics evaluate an F-statistic for 1-5 breaks, with the breakpoints selected by global maximisation of the sum of squared residuals. The UDMax statistic weights the five F-statistics equally, while the WDMax statistic weights the F-statistics such that the marginal p-values are equal across the number of breaks. The WDMax test statistic reported is for a 1% significance level test. The LWZ statistic is a modified Schwarz criterion. The SupF(i+1|l) test is a test for i+1 breaks against the null of i breaks. The sequential test selects the number of breaks stepwise from zero breaks using the SupF test. The break dates are those identified by minimising the sum of squared errors conditional on the number of breaks found.

***, ** and * represent significance at the 1%, 5%, and 10% levels of significance respectively.

Figure 6 below displays the absolute log difference in the terms of trade and the means of the two periods selected by the Bai and Perron (1998) test. It is clear that volatility is significantly lower in the period after 1980. It also illustrates that there have been some periods when the volatility in the terms of trade has been significant. Specifically the period between the two World Wars looks to have been a period of significant volatility as well as more one-off periods like the early 1950s and mid-1970s. Another interesting observation is that although the period between 1900 and 1980 experienced higher volatility on average than the period after 1980, this appears to be a result of an increased number of one-off shocks rather than generalised volatility. Section 4.1.2 will go into the reasons why this is likely to have occurred.

Figure 6 – Goods Terms of Trade Volatility[13]



Source: Author's calculation

3.2.2 Decomposing the volatility

It is of interest to assess the source of this volatility in the terms of trade. Gillitzer and Kearns (2005) suggest a way to decompose the variance of the terms of trade into the variance of export and import prices and their covariance. The log terms of trade, tot_t, is the difference between detrended log export and log import prices where p_t^X and p_t^M are

[13] Volatility is defined as the absolute log difference.

log export and import prices respectively and d_t is calculated by averaging the export and import prices and detrending using an HP filter as shown in (6). The purpose of this detrending is to remove common trends between export and import prices.

$$\begin{aligned} tot_t &= p_t^X - p_t^M \\ &= \left(p_t^X - d_t\right) - \left(p_t^M - d_t\right) \end{aligned} \tag{6}$$

The variance of the terms of trade can therefore be decomposed as in (7). Using this method, the terms of trade is split into the periods 1900 to 1979 and 1980 to 2005 and the results are displayed in Table 9 below. The table also splits the series into 20 year periods to get a better appreciation of how the volatility and contributions to the volatility have changed over time.

$$\text{var}\left(tot_t\right) = \text{var}\left(p_t^X - d_t\right) - \text{var}\left(p_t^M - d_t\right) - 2\,\text{cov}\left(p_t^X - d_t, p_t^M - d_t\right) \tag{7}$$

Export price volatility made the larger contribution to terms of trade volatility in the period from 1900 to 1979 while import price volatility made the larger contribution in the period from 1980 to 2005. However, if the 20 year periods are examined in more detail, the results vary. For example, in the period between 1900 and 1920 import price volatility made a significantly larger contribution to total terms of trade volatility than export price volatility. This pattern was reversed for the periods 1921 to 1940 and 1941 to 1960 where export price volatility made a significantly larger contribution. Although the pattern was again reversed for the three periods after 1960, when import price volatility made the larger contribution. The volatility in the terms of trade was highest in the period 1921 to 1940 and only just higher than the period 1941 to 1960. However, this has reduced dramatically, with volatility in the 1981 to 2000 period approximately five times lower than the period 1921 to 1940.

Table 9 – Decomposing the Log Terms of Trade Variance

	Export Component	Import Component	-2 x Covariance Component	Terms of Trade Variance
Variance				
1900-1920	0.006	0.020	-0.008	0.018
1921-1940	0.022	0.004	0.001	0.027
1941-1960	0.015	0.004	0.005	0.024
1961-1980	0.007	0.008	0.005	0.019
1981-2000	0.002	0.007	-0.004	0.005
2001-2005	0.009	0.012	-0.016	0.005
1900-1979	0.013	0.009	0.001	0.023
1980-2005	0.004	0.008	-0.005	0.007

4 Why have the trend and volatility changed?

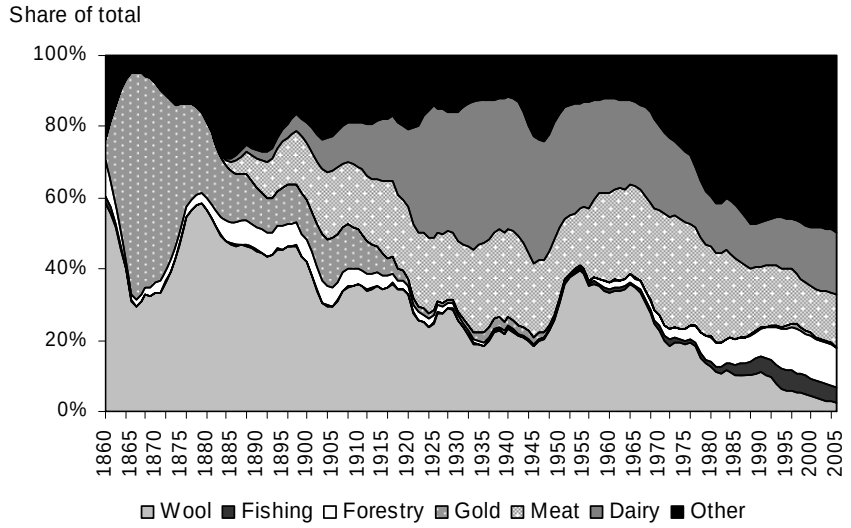
4.1 Compositional change in New Zealand's goods exports

4.1.1 Impact on the trend

Figure 5 above reveals that New Zealand export prices have risen relative to world commodity prices. There are a number of possible explanations for why this has occurred. Firstly, it may be that New Zealand goods experience a premium over other similar commodities overseas. This would suggest that the "law of one price" in international commodity markets does not hold and that commodity prices experienced by various countries do not converge in the long run. This could be because New Zealand is becoming more of a 'price-maker' in the international market. That is, its producers now have more price setting power now than they did in the past. Or it could be that other countries may have displayed higher productivity growth rates over time, allowing them to be more competitive at lower prices.

However, the more likely reason for New Zealand's export prices outperforming world commodity prices is compositional change. Over history, the types of goods New Zealand exports have gone through significant transformation. Exporting has moved from a focus on a few primary commodities to the exporting of a much broader range of goods.[14] This compositional change is illustrated in Figure 7 below.

Figure 7 – New Zealand's Good Export Composition (5 year moving average)



Sources: NZIER, Statistics New Zealand

As described by Briggs (2003) and shown in Figure 7, wool exports as a proportion of total goods exports have decreased significantly over time, from a peak of 75% in 1860, to just 3% in 2001.[15] With the exception of the 1860s "gold-rush" (when gold became the largest

[14] Although not the focus of this paper, New Zealand has also experienced a compositional shift towards services exports, as well as that which occurred within goods exports.

[15] These numbers are actual figures and therefore do not match accurately with the data from Figure 7 as that data has been smoothed.

exported commodity) and the 1950's Korean War (when demand for wool increased), this decrease in the proportion of wool exports has been relatively steady. The decline in the demand for wool (as a result of the development of cheaper man-made substitutes) and the development of other export products explain this decline in wool's share of total goods exports.

The development of refrigeration in the late 19th Century saw dairy and meat products emerge as important export industries and by 1902, the value of wool exports was exceeded by the combination of dairy and meat exports.

Dairy, meat and wool products continued to be the major exported commodities up until the late 1960s. After this period there was an increasing contribution from the 'other' category of goods exports. 'Other' goods exports are made up of products such as fruit, aluminium and manufactured goods. The fact that the prices of manufactured goods (according to the Prebisch-Singer hypothesis) have not decreased by as much as primary commodities could partly account for the increases seen in New Zealand goods export prices relative to world commodity prices. The 'other' goods export category has increased considerably as a proportion of total goods exports in the last 40 years. This has been aided by trade treaties with New Zealand's major trading partner Australia (the largest destination for manufactured exports). These treaties are the New Zealand Australia Free Trade Agreement in 1965 and Closer Economic Relations (CER) in 1982. This increase in the 'other' goods category has led to primary goods exports as a proportion of total goods exports decreasing from 87% in 1965 to just over 50% in 2005.[16,17]

It is difficult to test empirically how the compositional change in New Zealand's goods exports has affected the level of the terms of trade. There are feedbacks and endogenous movements that make separating out the specific effects complex. The real question of interest should be the ability of the economy to respond to external changes in both relative prices and conditions in the market place. An economy that is more dynamic will be able to benefit from these changes by shifting resources to areas where they are used more efficiently than an economy that is sluggish to respond to external changes. It is the expectation of future movements in relative prices that lead to shifts in resources. However, as it is impossible to know what people's expectations of future movements are at any point in time, the impact of compositional change on the terms of trade must be tested in some other way. Grimes (2006) attempts to do this by holding export value shares constant at their 1972 levels and compares the implied terms of trade with the current terms of trade. He finds that if New Zealand was still exporting the same bundle of goods as it did in 1972, the terms of trade would be higher today. However, there are some issues which need to be considered with this form of analysis.

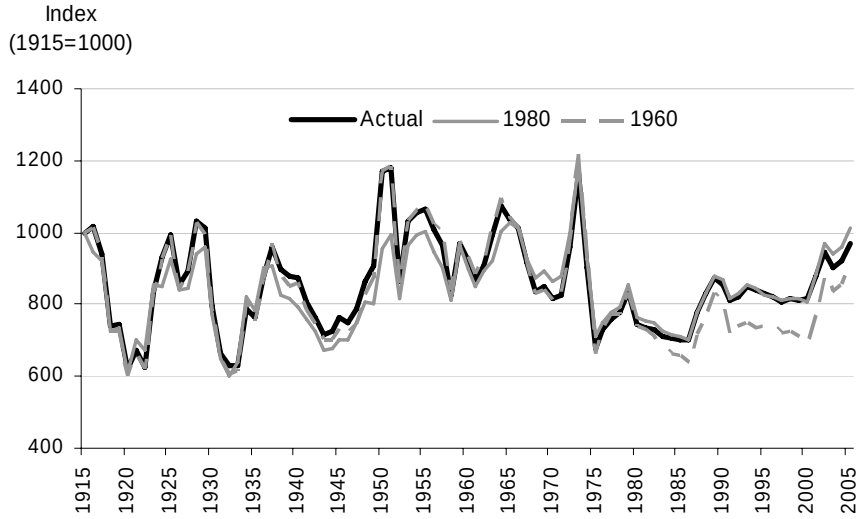
The use of export value shares as weights could bias the results as these shares are not independent of the price level in that year. It would be more appropriate to use export volume shares as suitable weights. However, accurate historical volume data is not available for all products and even if it were, the way in which volume or "real" measures are calculated is not totally independent from the price level as a base price series is needed as a deflator in order to calculate a "real" series. Related to this is the choice of the base year in which to hold export shares constant. If the base year chosen corresponded to a year that experienced some significant price shocks, then this would affect the individual export value shares. As an experiment, this paper tests different base years, namely 1960 and 1980 and compares them with Grimes' base year of 1972. It is

[16] 'Primary' good exports are defined as the sum of wool, fishing, dairy, forestry, gold and meat exports.

[17] For more information on New Zealand's primary sector from a historical perspective see Harrington (2005).

found that if the bundle of goods was held constant at their 1960 shares then the terms of trade would be considerably lower than they actually were in 2005, while if the 1980 export shares are used as a base, then the terms of trade would be slightly higher than they actually were in 2005. This is displayed in Figure 8. While the analysis of Grimes is more comprehensive than that used in this paper (as he uses much more disaggregated data on export shares and prices), the results using the 1960 and 1980 base years show that the choice of base year is important.

Figure 8 – Goods Terms of Trade Using Actual, 1960 and 1980 Export Shares

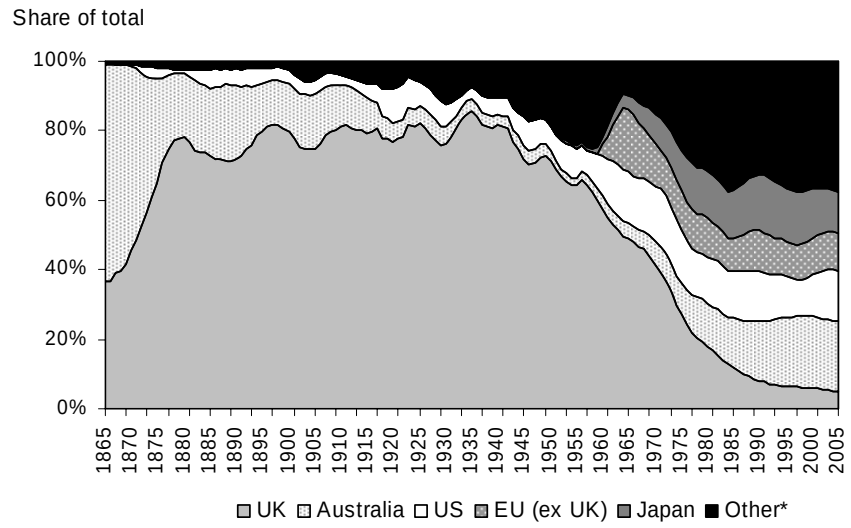


Source: NZIER, Statistics New Zealand, Author's Calculation

Figure 8 illustrates that if New Zealand was still exporting the bundle of goods it was in 1960, the terms of trade would have been considerably lower. This shows that the compositional change in New Zealand's goods exports has had a positive impact on the terms of trade over the past 40 years. The results using the 1980 export shares show that it is only in the last three years that the re-weighted terms of trade are higher. This is likely to be due to the significant increases in the prices of dairy and meat exports over these years and because dairy and meat exports made up a greater share of total goods exports in 1980 than currently, which results in the re-weighted terms of trade being at a higher level.

The destinations for New Zealand's exports have also changed dramatically in the last century. New Zealand has moved from having a single country (i.e. the UK) as its main export market, to a scenario where New Zealand's exports are now sent to a much wider range of countries. The UK now takes less than 5% of New Zealand's goods exports compared with over 80% in the late 1930s. When the UK joined the EEC in 1973 New Zealand was "forced" to diversify the countries it exported to and Australia as well as many Asian countries increased their share. The "other" category of countries has increased the most and indicates the greater proportion of exports sent to Asian countries. This is shown in Figure 9.

Figure 9 – Destination of New Zealand's Good Exports (5 year moving average)



Sources: NZIER, Statistics New Zealand
* The "other" category includes some EU countries prior to its formation.

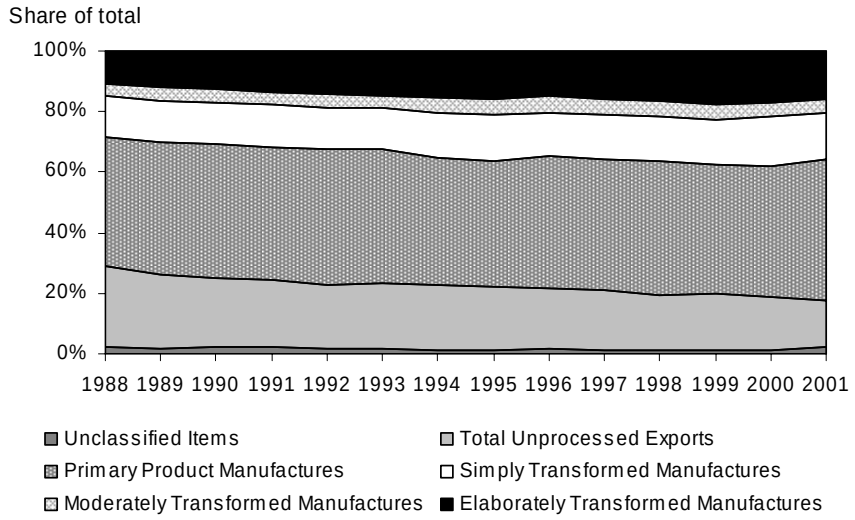
4.1.2 Impact on volatility

The significant reduction in volatility in the terms of trade is also likely to be due to the compositional change in New Zealand's exports. As previously discussed, New Zealand has moved from exporting a limited range of commodities to exporting a much broader array of goods. This has left it less exposed to large swings in the price of individual commodities. For example in 1950, the price of wool more than doubled as a result of strong demand owing to the onset of war in Korea. At the time, wool made up approximately 30% of total goods exports and this led to the terms of trade increasing by 29% between 1949 and 1950. In recent times however, the largest share of any single commodity is dairy at 18%. If the price of dairy products were to double (or halve) the impact on the terms of trade would be much less (but still significant).[18] Another reason for the reduction in volatility recently, as suggested by Gillitzer and Kearns (2005), is that with an increased proportion of New Zealand exports being manufactured, the compositional differences between the import and export baskets has reduced and so any price shocks are likely to affect both export and import, with less effect on the terms of trade.

Not only has New Zealand moved into producing a greater proportion of manufactured goods, but it has increased the "value-added" of many of its primary commodity products. Black, Vink and White (2003) discuss how there has been a steady decrease in the proportion of goods exports leaving New Zealand in an essentially unprocessed form. Figure 10 below (from their paper) shows how the proportion of total unprocessed products has gone from over 27% of total goods exports in 1988 to just 15% in 2001. Elaborately transformed manufactures, as well as primary product manufactures, made up the majority of the off-setting increase. This latter category of exports has been dominant throughout, and still accounts for nearly half of New Zealand's total merchandise exports and includes goods such as meat and most dairy products.

[18] In fact the impact on the terms of trade could be proportionately less as dairy exports have been diversified into products such as casein and cheeses for example.

Figure 10 – New Zealand's Good Exports by Level of Processing



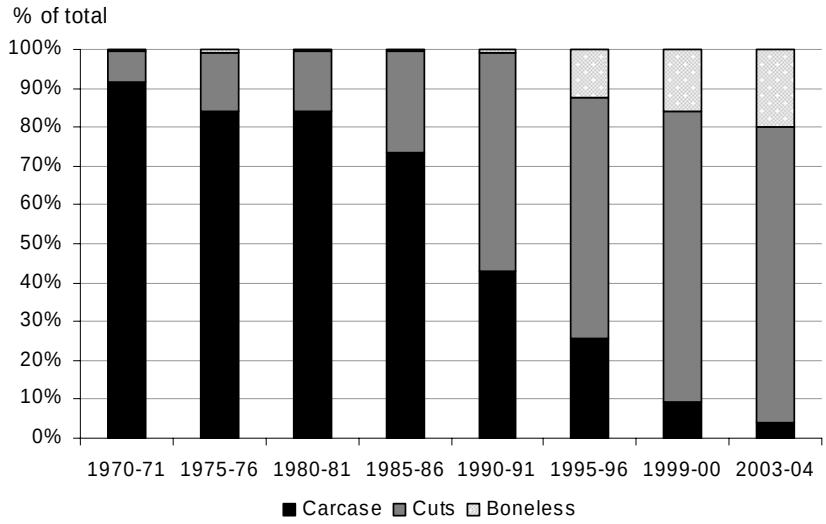
Sources: Statistics New Zealand, Black, Vink and White (2003)

Kaplinsky (2005) suggests that this reduction in volatility is a world-wide phenomenon and is a result of "de-commodification" of some primary products. The term de-commodification refers to commodities now being less homogeneous than they once were, enabling producers to benefit from higher barriers to entry as it is more difficult for new firms to enter and compete in the same markets. Kaplinsky cites the anecdotal example of Jamaican Blue Mountain coffee as evidence of this occurring. This type of coffee is a premium product and has been able to avoid the downward price pressures that the market has experienced recently. It is suggested that demand for this type of coffee is much more inelastic than for other coffee varieties enabling producers greater power in setting prices. Kaplinsky also suggests that this characteristic is becoming more widespread and falling primary commodity prices are not an inevitable outcome, as more value is added to basic commodities.

> The impetus for the increase in the prices of niche-based "soft commodities" lies in the growth of per capita incomes of the high-income economies. This is a form of Engels Law reversal, which is reflected in the fact that the most accurate predictor of the per capita incomes of shoppers in UK supermarkets lies in the proportion of fresh fruit and vegetables in their shopping trolleys.
>
> Kaplinsky, 2005:10

There is evidence that New Zealand is also "de-commodifying" some of its exports in order to reduce price variability and gain market share. An example of this is shown in Figure 11 below which displays how the lamb export product mix has changed in the last 30 years. In 1970/71 lamb carcases made up over 90% of total lamb exported; in 2003/04 this had fallen to less than 4%. There has been a move into the more 'value-added' products such as processing a carcase into cuts and boneless products. This is also illustrated by Figure 10 which shows that the share of total unprocessed products has fallen since 1988.

Figure 11 – Export Lamb Product Mix

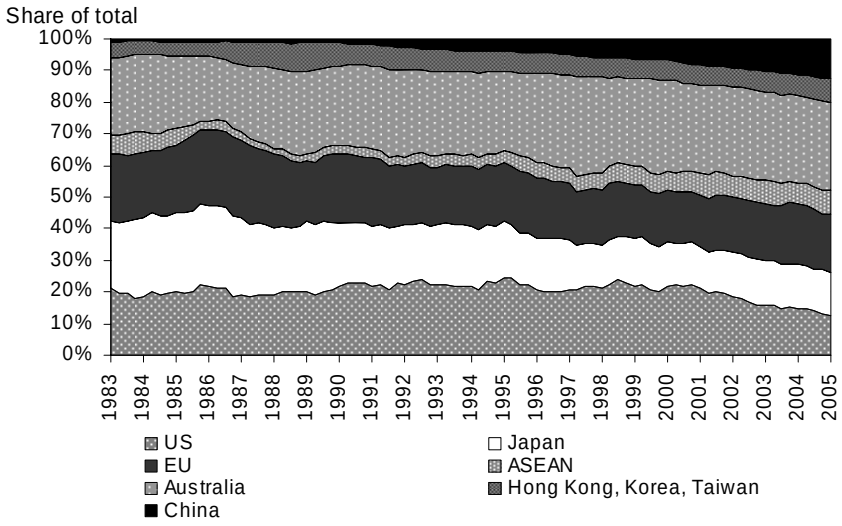


Source: Meat & Wool New Zealand Economic Service

4.2 Compositional change in New Zealand's goods imports

New Zealand's imports composition has also changed in the last two decades. New Zealand is moving more towards importation of manufactured goods from "low-cost" countries such as China and the ASEAN (Association of South-East Asian Nations) countries and away from "high-cost" countries such as the US and Japan. Figure 12 below shows how imports from China have gone from less than 1% of total good imports in 1983 to over 10% in 2005. The fact that there has been an increase in the proportion of imports that New Zealand sources from the low-cost Asian countries has allowed it to keep its imported manufactured prices low relative to world manufactured prices, as shown in Figure 5.

Figure 12 – Source of New Zealand's Good Imports



Source: Statistics New Zealand

4.3 Endogenous nature of New Zealand's terms of trade[19]

The upward trend in New Zealand's terms of trade over the past three decades is influenced by compositional change in its exports and imports. Improved institutions that allow economic agents to respond more freely to market price signals may mean that relative price movements can now play a more important role in the allocation of resources within the economy than occurred in the past. This would result in New Zealand's terms of trade becoming more endogenous in the sense that it is influenced by decisions made within the New Zealand economy and not just the exogenous fortunes of international markets. Take for example export prices: if more resources are moved to producing an exported good that has a relatively higher price, then this in turn will lead to higher terms of trade as the good with the higher price will receive a greater weighting in the total bundle of New Zealand's goods exports.

The terms of trade may be becoming more endogenous as the institutions within New Zealand become more adaptive to relative price movements. The fact that the volatility in these price movements has also reduced will add in this shifting of resources as it lowers the risks of new investment decisions.

4.4 The impact of China

One factor that is having a significant impact on the relative prices of internationally traded goods is the growing influence of China. Between 1974 and 2004, China's GDP (measured in 1990 US dollars) has grown considerably faster than any other regional group of countries (8.3% compared with the world average of 3.0%). The composition of China's growth has also changed over this period. The source of China's production has moved from domestically-oriented activities to an increasing proportion of outward-oriented activities. While this theme is not uncommon and has been experienced by other Asian outward-orientated countries such as Hong Kong, Korea, Taiwan and Singapore, the size of the Chinese economy as well as its huge population base may lead to a different impact on the rest of the world (Kaplinsky, 2005).

This increasingly outward-orientated activity by China is reflected in its increasing share of imports into New Zealand. Between 1983 and 2005, its share of New Zealand's total goods imports increased from less than 1% to over 10% (Figure 12). A similar situation has been experienced by other countries. For example, Chinese imports (mainly manufactured) into the US between 1980 and 2002 increased from close to zero to 14% of total goods imports (Kaplinsky, 2005).

China's momentous growth over the last 20 years has seen its demand for commodities increase significantly. Not only are these commodities needed as inputs into the production of consumption goods for its huge population and for significant infrastructure projects, but many of the hard commodities are used as inputs into the production of China's manufactured exports. The increases in these hard commodity prices are driven by the same broad demand side factors that have led to the increases seen in some soft commodity prices recently e.g. New Zealand dairy and meat export prices.

[19] I thank Bob Buckle for bringing this to my attention.

5 Factors likely to influence the terms of trade in the future

This section of the paper pulls together the findings of the previous sections as well as other recent developments in order to apply them to the outlook for New Zealand's terms of trade. Although the future of the terms of trade is uncertain, this discussion aims to increase the knowledge about what factors in the future will affect the terms of trade movements.

5.1 Changes in the trend and volatility

Section 3 examined some statistical properties of New Zealand's terms of trade over time. It was found that there was no statistical evidence that the terms of trade has declined since 1900. However, as suggested by Kellard and Wohar (2006), this analysis may be over-simplistic. Looking at the post 1973 period, there is evidence that the terms of trade has been on an upward trend over this period. Much of this increase in New Zealand's terms of trade (especially relative to world commodity prices) is a result of higher prices received for New Zealand's exported products. The question is whether this trend will continue into the future.

It was also found that this upward trend in the terms of trade exceeded that suggested by relative world commodity prices (Figure 5). Much of this increase in New Zealand's terms of trade relative to world commodity prices is a result of higher prices received for New Zealand's exported products. Specifically, New Zealand appeared to be experiencing higher prices for its exports than other primary commodity exporters. The compositional change that New Zealand's exports have gone through over the past 40 years is arguably the major reason for this strong growth in relative export prices. This therefore suggests that New Zealand needs to continue in this vein in order to extend this trend in prices into the future. The recent "de-commodification" of some of New Zealand's primary export commodities is also a pattern that may need to continue. Kaplinsky (2005) suggested that this de-commodification gives producers greater price setting power and by developing new "value-added" products such as that demonstrated in Figure 11 would allow New Zealand to continue to develop and open new markets overseas.

The discussion to this point has ignored the cyclical properties of the terms of trade and these are important. Even though there may be an upward trend in the terms of trade, there will still be cyclical movements as a result of international developments. This paper has found, however, that the volatility in the terms of trade has decreased and that the New Zealand economy is in a better position to handle shocks to commodity prices as it is no longer focused on exporting a small number of commodities to a small number of countries but has diversified the types of goods it exports and where it exports to. It also found that the largest contributor to this decrease in volatility was falling volatility in aggregate export prices. If New Zealand continues to move away from the exportation of unprocessed primary commodities and into less homogeneous products, this pattern is likely to continue.

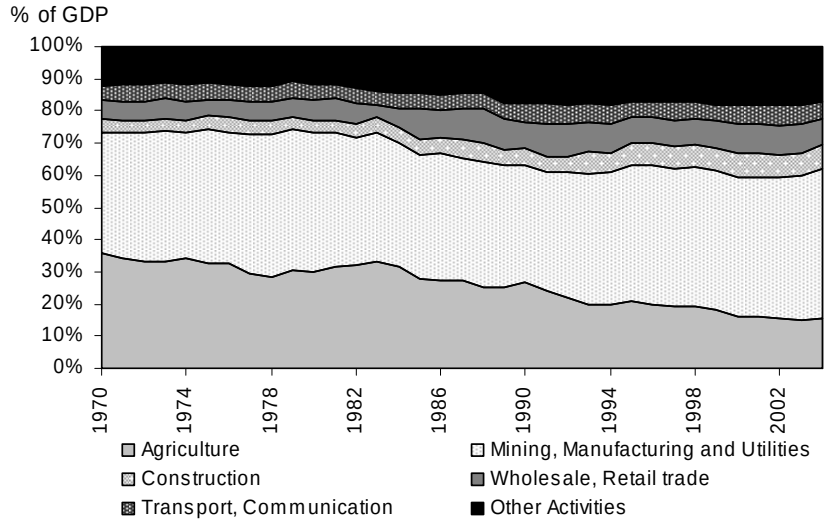
5.2 China

5.2.1 Implications for New Zealand's export prices

Kaplinsky (2005) reported that for the first half of 2004, China had a trade deficit on foodstuffs of US$3.7 billion. This is predicted to widen considerably as more of the population enjoys higher income levels as a result of the recent economic boom. For example, according to the US Dairy Association, per capita dairy consumption averaged 6.9 kilograms in 2000 – well below the world average of 46.4 kilograms per capita. It is expected that as income levels rise, the consumption of dairy products in China will increase. This has already started to occur with Chinese imports of whole milk powder increasing by 120% between 2000 and 2004.

Figure 13 below displays how the contribution of agriculture to China's GDP has been trending downwards since 1970. This is a result of both the considerable growth in other areas of the economy as well as a shift in resources from agriculture to other sectors. Kaplinsky (2005) suggests that this is likely to be a result of land conversions from farming to industrial uses, as well as low agricultural productivity growth and this pattern is one that is expected to continue into the future. This therefore leaves New Zealand with a huge opportunity to take advantage of the growing demand in China (due to increases in disposable incomes) to increase its agricultural exports. However, it is likely to face strong competition from other countries in meeting this extra demand from China. Some of this is discussed in Section 5.3.2. If New Zealand was able to gain a larger presence in the Chinese market, this extra demand would likely flow into higher prices for New Zealand's exported commodities.

Figure 13 – Proportion of GDP by Economic Activity for China



Source: United Nations Statistical Division

Although there are likely to be increases in the prices of some of New Zealand's exported commodities due to increased demand from China, there may also be some offsetting movements in the price of other exported goods. This could be the case for New Zealand manufactured goods exports. As discussed above (and below in Section 5.2.2), China has an extremely large labour force which has enabled it to produce many manufactured products relatively cheaply in comparison to other countries. In a sense they have been

exporting deflation over recent times. If China continues to play a greater role in the world market and exports manufactured goods at prices lower than other countries, then the downward pressure on world manufacturing prices is likely to continue. However, New Zealand may be able to avoid this price pressure to some extent by differentiating its products from those produced in China and competing on quality rather than price. This is very similar to the "de-commodification" idea of Kaplinsky (2005). If New Zealand is able to export manufactured products that are unique it will give producers greater price setting power and the opportunity to develop niche markets overseas.

5.2.2 Implications for New Zealand's import prices

As discussed above, China has also arguably had a significant impact on the price of manufactured goods traded on the international market. Kaplinsky (2005), using Harmonised System trade data, performed an analysis of EU import categories to study the source and extent to which import prices had fallen. It was found that one third of the imports sourced from China had experienced price falls between 1988 and 2001. This compares with only 9% of products sourced from high income countries over the same period.

> As a general rule, the higher the per-capita income group of the exporter, the less likely the unit-prices were to fall. Thus, within a large number of product groups, the prices of products exported into the EU by China and low income economies was more likely to decline than the prices of the same product-groupings sourced from other high income economies.
>
> Kaplinsky, 2005:17

It was concluded that as China's participation in global markets increases, the likelihood of price decreases (particularly for manufactures) also increases (as long as China is still catching up with the rest of the world in labour and manufacturing costs).

This has implications for New Zealand. As discussed previously, New Zealand is primarily an importer of manufactured goods and, as illustrated by Figure 12, China is a growing source of these imported goods. If New Zealand continues this recent trend of sourcing more of its imports from China (and other "low-cost" nations such as the ASEAN countries) then it should continue to experience falling prices for some of its manufactured imports.

However, as with export prices, there are some factors that could partially offset any gains made through lower manufactured import prices (and higher export commodity prices). One of these is the fact that Chinese demand has driven up the price of many hard commodities and these are often used as inputs into production of their manufactured exports. If the prices of these hard commodities continue to increase, then the gains that China has in terms of low labour costs may be offset by the increasing costs of other factors of production which in turn could be passed on through higher manufactured goods prices. Another issue is the fact that New Zealand is a net importer of oil and petroleum products. For the year ended December 2005, New Zealand imported just over $4.2 billion of mineral fuels, approximately 24% more than the previous year. Undoubtedly, this significant increase was due to higher prices for crude oil and part of

this price increase is a result of extra demand from China.[20] If that demand from China were to continue, the price of oil may stay high for some time.

5.3 Other issues

5.3.1 World trade reform

Other issues that have the potential to impact on New Zealand's terms of trade include the progression of world trade liberalisation. Through protectionist policies and export subsidies, agricultural products are extensively supported by governments across the world. This protectionism distorts world trade and results in the oversupply of primary products on the world market, by lowering world prices.

A reduction in agricultural protectionist trade policies is one of the critical parts of the WTO's Doha Development Agenda. Rae and Strutt (2004) model the potential impacts on New Zealand of a reduction in these policies in a Doha framework. They find that the welfare gain to New Zealand is relatively large and it is principally a result of a higher level of the terms of trade. Anderson and Martin (2005) also looked at the impacts of a successful Doha round and the impact on New Zealand (among other countries) and had similar conclusions to Rae and Strutt.

The Australian Bureau of Agricultural and Resource Economics (ABARE) have looked at a more generalised reduction in protectionist trade policies and the impact on the dairy industry. They measure the impact of a 100% increase in all tariff-quota volumes and a 50% reduction in all tariff rates. They find this has a large impact on the world price and on Australian and New Zealand production. They estimate price increases of 23.8%, 26.5% and 34.5% for skim-milk powder (SMP), cheese and butter respectively. In another simulation, they examine the impact on world dairy prices from a 50% reduction in subsidised exports in 1999 by the EU and the US. This has the effect of lifting SMP prices by 30.9% and butter prices by 17.4%.

In other studies on trade liberalisation, the OECD models the impact of the EU's Common Agricultural Policy (CAP) reforms.[21] These reforms change the way in which subsidies are paid to EU farmers (who are among the most heavily subsidised in the world). Rather than based on their level of production as previously was the case, farmers will now receive the same payment each year. The OECD find that with the lower incentive to farmers both dairy and beef production will fall. More specifically they estimate that (relative to baseline) the beef cattle inventory will be 1% lower in 2006 and 2.4% and 3.2% lower in 2007 and 2008 respectively. This is similar for the dairy cow inventory which is predicted to be 2.2% lower in 2006 and 0.9% lower in 2008.

The lower dairy cow inventory will impact on EU dairy production. Butter exports are expected to fall by between 16% and 19% between 2005 and 2008. SMP and whole-milk powder (WMP) exports are also expected to decline by between 8% and 21% for SMP and 12% and 22% for WMP over the same time period.

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[20] Not all the recent increases in the oil price can be attributed to increased demand from China. There have also been significant capacity constraints recently both from a production and refining perspective and this has also contributed to the price increases, as well as geopolitical uncertainty.

[21] The figures quoted are based on the OECD's "maximum decoupling" scenario.

This reduction in EU production and exports will impact on the world price for dairy products. The world price for butter is expected to be 3.4% higher in 2008 with smaller increases in price for SMP and WMP. Similar price increases were estimated for beef in the longer term as production falls.

These simulation studies illustrate the importance to New Zealand of reducing world protectionist trade policies.

5.3.2 Growing presence of South America

One issue that does not support as much optimism for world commodity prices from New Zealand's perspective is the emergence of other primary commodity-based exporters such as South America. This is particularly the case for dairy exports where some countries in South America have experienced rapid growth in their milk production. Brazil, in particular, has experienced 25% growth in its milk production between 2000 and 2005. Brazil's dairy cow population is currently around 20 million with those cows producing around 25 billion litres of milk.[22]

> Dairy sector growth in Brazil has been constrained by the fact that around 40% of milk is produced on small, non-specialised farms. Per cow productivity, and willingness to grow, remains relatively low in this sector. However, the emergence of increased numbers of large-scale commercial operations with low production costs has pushed up milk supply.
>
> Phillips, 2006:2

The potential for Brazil (and other South American countries) to improve their per cow production through the adoption of more modern equipment, the increased use of fertiliser, and the sowing of new pastures mean that it is going to have a growing presence in the global market. This increased milk supply could have a depressing effect on world dairy prices.

5.4 What are the growth impacts?

Section 2 of this paper found that, for New Zealand, the level of export prices and import price volatility (and to a lesser extent, total terms of trade volatility) had important implications for New Zealand's growth. It concluded that the level of (real) export prices between 1950 and 2005 has had a positive impact on New Zealand's GDP growth while (real) import price volatility has had a negative effect. This section therefore looks at what the outlook for the terms of trade, as discussed above, implies for New Zealand's economic growth going forward.

The previous section described a number of factors that could influence particularly the level of export prices, in the future. These were, for example, the likelihood of further increases in soft commodity prices as demand from China grows as a result of a larger proportion of its population becoming exposed to higher income levels. The trend of New Zealand exporting a greater share of goods with a higher value-added content could also see the level of export prices higher in the future as primary commodities are

[22] In comparison to Brazil, New Zealand's dairy herd is currently around 5 million cattle producing approximately 14 billion litres of milk per year.

"de-commodified". Finally the continuation of world trade reform, particularly for agricultural products, is also likely to be positive for New Zealand's export prices. These factors all have the potential to result in higher average export prices in the future and as shown in Section 2.3.1, this could have also have positive economic growth implications for New Zealand.

Section 2.3.1 also suggested that terms of trade volatility, particularly volatility in import prices, has had a negative effect on New Zealand's economic growth. As mentioned above, the majority of New Zealand's capital investment goods are sourced from overseas and therefore if these import prices were volatile it may deter a firm from making new investment decisions which would have negative growth impacts. Section 3.2 showed how the volatility in New Zealand's terms of trade has reduced and that the reduction in export price volatility was the significant contributor to this. Therefore it is surprising that export price volatility was found to have had an insignificant effect on economic growth. It may be because this is being picked up in the reduced terms of trade volatility as a whole rather than just the level of export price volatility. Although there was no discussion of the outlook for import price volatility in the previous section, the trend of New Zealand exporting a more diverse array of goods is likely to see the volatility in the terms of trade remain at low levels (by historical standards) in the future and this could also have positive growth implications for New Zealand.

However as mentioned above, the outlook for the terms of trade is uncertain and some of the factors that pose positive implications for New Zealand export and import prices could also have negative implications. As a result of this the future growth implications are also uncertain.

6 Conclusion

The first part of this paper examined how the trend and volatility of the terms of trade have affected New Zealand's economic growth since 1950. The literature generally suggests that an upward trend in the terms of trade is growth-enhancing while increased volatility in the terms of trade has an adverse effect on growth. Putting this into a New Zealand context, this paper extended the work of Grimes (2006) and found that the level of (real) export prices has had a positive impact on New Zealand's economic growth between 1950 and 2005. However, it was also found that the level of (real) import prices has had an insignificant effect on economic growth over this time. This is surprising given that the majority of New Zealand's capital goods are sourced from overseas and one would expect that higher prices for these goods would deter new investment and therefore reduce economic growth. This analysis also found that volatility in the terms of trade (particularly import price volatility) has had a negative impact on New Zealand's GDP growth. While this is unsurprising, as increased volatility will deter new investment decisions, what is surprising is that the volatility in export prices was found to have had an insignificant impact on GDP growth.

This paper also looked at the historical trends and volatility of the terms of trade to see if they have changed over time. It was found that there was no statistical evidence that the terms of trade has declined since 1900. This appears to reject the Prebisch-Singer hypothesis that New Zealand's terms of trade should experience a long-term decline. In fact looking at the post-1973 period, there is evidence that the terms of trade has been on an upward trend. The volatility in the terms of trade has also fallen over this period and calculations show that the reduction in export price volatility made the larger contribution

to the reduction in terms of trade volatility. This observation appears to be a variance with the finding that export price volatility has had an insignificant impact on economic growth. However, it was also found that total terms of trade volatility has had a significant negative impact on growth and therefore the growth effects of export price volatility may be working through this channel.

Arguably the major reasons for the increasing trend and reduction in volatility of the terms of trade are compositional change and the de-commodification of some goods exports. However, improved institutions within New Zealand that allow resources to shift more efficiently in response to relative price shocks and the more recent phenomenon of the growing presence of China in the international market are also likely reasons.

The conclusions one can draw from this work concerning the outlook for the terms of trade are unclear. There are factors that could result in higher prices for some exports, such as the continued de-commodification of New Zealand's primary commodity exports, further world trade reform and the growing demand from China as more of the population enjoys higher income levels. However, these could be offset by lower prices for some other exports due to increased supply from some emerging markets such as South America or the continued downward pressure China is putting on world manufacturing prices, including New Zealand manufactured export prices. The same can be said for New Zealand import prices. Some import prices may stay relatively low in future as New Zealand sources more of its manufactured goods from "low-cost" countries such as China and the ASEAN countries. However, China's growing presence on the world market may also result in other import prices being higher in the future, for example oil prices.

Although the outlook for the terms of trade is uncertain, there are polices that could help to highlight the positive factors discussed above which could then have positive growth implications. One of these is the continued push for world trade reform, particularly in agriculture. New Zealand is already playing a role in this area and it will need to continue in this vein. The potential for higher export prices as a result of trade liberalisation is large. Other policies that may help include the development of opportunities for New Zealand firms to export more value-added products. This will give them more price-setting power overseas and the opportunity to develop niche markets. The marketing of New Zealand products overseas may also assist with this. Also important to consider are the institutions within New Zealand. It was suggested that one reason why New Zealand's terms of trade has increased over the past three decades is that its institutions have a greater ability to respond to relative price movements than they did in the past, therefore resulting in the terms of trade becoming more endogenous. If policies can be developed that would continue to allow the efficient response to relative price movements, or policies that lower the adjustment costs from shifting these resources, then this could see the terms of trade continue to increase.

One area of work that was not examined in this paper was the drivers of import price volatility. It was found that volatility in import prices have had a significant negative impact on New Zealand's economic growth. If future research is able to examine what has been causing the volatility, then there may be an opportunity to address it and this could also have positive economic growth implications.

Appendix 1 – Data Description and Source

The annual real GDP (1991-1992 prices) data from 1950 to 2005 used in Section 2.3.1 is sourced from the Statistics New Zealand long-term data series. The long-term data for New Zealand's export and import prices up until 2001 come from Briggs (2003). This data is drawn from work by Easton (1984) and McIlraith (1911). It is updated to 2005 using Statistics New Zealand OTI data.

The data sources for Section 3 are shown in Table 1 below. The long-term data for New Zealand's export and import prices are from the same sources as the data used in Section 2.3.1. However it is extended back to 1900 and then converted into US dollar terms by dividing through by the NZ/US exchange rate. The data on the world commodity and world manufacturing prices in US dollars are taken from Grilli and Yang (1988). Using the IMF's International Financial Statistics, this data is updated to 2005.

Appendix Table 1 – Data Sources for Section 3

Series (annual data)	Date	Source
World Commodity Prices	1900-1986	Grilli and Yang Commodity Price Index - Grilli and Yang (1988)
	1987-2005	Updated by author using IMF's International Financial Statistics (IFS)
World Manufacturing Prices	1900-1986	Manufacturing Unit Value (MUV) data - Grilli and Yang (1988)
	1987-2005	Updated using IMF MUV series
New Zealand Export Prices	1900-2001	New Zealand Institute of Economic Research (NZIER), Briggs (2003)
	2002-2005	Statistics New Zealand OTI series
New Zealand Import Prices	1900-2001	NZIER, Briggs (2003)
	2002-2005	Statistics New Zealand OTI series
NZ/US Exchange Rate	1900-1960	NZIER, Briggs (2003)
	1961-2005	Reserve Bank of New Zealand (RBNZ)
Composition and Destination of New Zealand's Exports	1900-2001	NZIER, Briggs (2003)
	2002-2005	Statistics New Zealand OTI series
Exports by Level of Processing	1988-2001	Statistics New Zealand TREC data used in Black, Vink and White (2003)
Composition and Source of New Zealand's Imports	1983-2005	Statistics New Zealand

Appendix 2 – Decomposing New Zealand's economic growth

The technique below, developed by Fox, Kohli and Warren (2003), is used to decompose the sources of New Zealand's economic growth. Using a modified Diewert-Morrison decomposition, the contributions of total factor productivity (TFP) growth, labour and capital utilisation, the terms of trade, and the trade balance to New Zealand's GDP growth for the period of 1983 to 2005 are examined.

The technique, originally proposed by Kohli (2003), allows for the fact that the terms of trade effect is not homogeneous of degree zero in prices. This is because a proportional change in export and import prices will change the impact of the terms of trade unless the trade is balanced.

Using the same notation and definitions as in Fox *et al* (2003), nominal GDP growth, real value added and real GDP are decomposed as follows:

$$\Gamma^{t-1,t} = R^{t-1,t} \cdot P_S^{t-1,t} \cdot G^{t-1,t} \cdot H^{t-1,t} \cdot X_L^{t-1,t} \cdot X_K^{t-1,t}$$

Real value added is

$$\Gamma^{t-1,t} / P_S^{t-1,t} = R^{t-1,t} \cdot G^{t-1,t} \cdot H^{t-1,t} \cdot X_L^{t-1,t} \cdot X_K^{t-1,t}$$

and real GDP is

$$\Gamma^{t-1,t} / \left(P_S^{t-1,t} \cdot G^{t-1,t} \cdot H^{t-1,t}\right) = \Gamma^{t-1,t} / P^{t-1,t}$$

$$= R^{t-1,t} \cdot X_L^{t-1,t} \cdot X_K^{t-1,t}$$

Where $\Gamma^{t-1,t}$ is the growth in nominal GDP between periods *t-1* and *t*. $R^{t-1,t}$, $G^{t-1,t}$, $H^{t-1,t}$, $X_L^{t-1,t}$ and $X_K^{t-1,t}$ are the contributions to nominal GDP growth from changes in TFP, the terms of trade, the trade balance, labour utilisation and capital utilisation respectively. $P_S^{t-1,t}$ is the growth rate in domestic prices and $P^{t-1,t}$ is the contribution to nominal GDP growth from prices.[23] Table 1 presents the results for 1991 to 2005 as well as geometric means for the entire period and the periods from 1991 to 1999 and 2000 to 2005.

The analysis uses annual Statistics New Zealand National Accounts data for 1990 to 2005. All variables are as defined in Fox, Kohli and Warren (2003) with domestic expenditure equalling the sum of public and private consumption and private investment. To calculate the input of labour, Statistics New Zealand data on the total number of people employed and the average weekly paid hours were multiplied together. Capital stock data was taken directly from Statistics New Zealand which differs from the methodology used by Fox *et al* as they use a method comparable with that of the OECD. Compensation of employees was taken as the value of labour with the share of labour defined as the value of labour divided by nominal GDP. The share of capital is defined as the remainder over nominal GDP.

[23] To see how these equations are calculated please see Fox, Kohli and Warren (2003).

For the entire period, nominal GDP grew at an average annual rate of 5.0%.[24] However for the period of 2000 to 2005, this annual growth rate in nominal GDP average 6.1%. The difference between 'real value added' and 'real GDP' is due to changes in the terms of trade and the trade balance. Over the period, the contribution from changes in the trade balance average out to be zero. As a result, the difference between the growth in real value added and the growth in real GDP is due exclusively to improvements in the terms of trade. Although the terms of trade contributed only 0.2% to the average growth in real GDP since 1991, this increased to 0.6% for the period of 2000 to 2005. In fact, for 2004 and 2005, this contribution was significantly higher. For these years the terms of trade accounted for 1.8% and 1.4% respectively (approximately two-fifths) of real GDP growth.

Appendix Table 2– Decomposition of GDP Growth using Fox et al (2003) Alternative Methodology

Year	NGDP	Domestic Prices (P_S)	Real VA	Real GDP	Terms of Trade (G)	Balance of Trade (H)	Labour (X_L)	Capital (X_K)	TFP (R)
1991	1.040	1.040	1.000	1.015	0.985	1.000	0.991	1.021	1.003
1992	0.997	1.013	0.984	0.992	0.992	1.000	0.985	1.008	0.999
1993	1.022	1.018	1.004	1.000	1.002	1.001	1.000	1.013	0.987
1994	1.071	1.007	1.063	1.056	1.007	1.000	1.013	1.029	1.013
1995	1.075	1.015	1.059	1.055	1.005	0.999	1.026	1.037	0.991
1996	1.066	1.022	1.043	1.042	1.002	0.999	1.015	1.031	0.995
1997	1.054	1.014	1.039	1.036	1.003	1.000	1.011	1.022	1.003
1998	1.037	1.011	1.026	1.032	0.995	1.000	1.006	1.014	1.011
1999	1.024	1.013	1.011	1.014	0.996	1.000	1.000	1.016	0.998
2000	1.048	1.006	1.042	1.042	1.000	1.000	1.003	1.020	1.018
2001	1.059	1.026	1.032	1.029	1.002	1.001	1.012	1.029	0.988
2002	1.074	1.024	1.049	1.038	1.010	1.000	1.015	1.026	0.997
2003	1.054	1.014	1.039	1.049	0.993	0.998	1.018	1.032	0.998
2004	1.064	1.002	1.062	1.044	1.018	0.999	1.011	1.042	0.991
2005	1.069	1.019	1.049	1.034	1.014	1.000	1.016	1.061	0.960
Geometric Means									
1991-2005	1.050	1.016	1.033	1.032	1.002	1.000	1.008	1.027	0.997
1991-1999	1.042	1.017	1.025	1.027	0.999	1.000	1.005	1.021	1.000
2000-2005	1.061	1.015	1.045	1.039	1.006	1.000	1.012	1.035	0.992

[24] To calculate percentage growth figures from the index numbers from Appendix Table 2 above, subtract one and multiply by one hundred.

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