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EXCHANGE RATE PASS-THROUGH AND
THE PRICES OF SELECTED
NEW ZEALAND IMPORTS

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1998

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ABSTRACT

Estimates of pass-through for a range of resource inputs integral to the economic function of New Zealand, are calculated for the period 1988(I) to 1997(III). Estimations explaining the relationship (the pass-through effect) are reported for the five largest imports into the New Zealand economy. Estimates are run on a bilateral and disaggregated basis for imports from Australia, Japan, UK, and USA.

Bilateral investigation finds a partial first quarter response but does not find complete pass-through for all products, with coefficient values displaying unexpected correlations with the exchange rate. By comparison pass-through for the aggregated data is found to be complete and rapidly achieved. All small country assumptions are found to hold for New Zealand.

ACKNOWLEDGEMENTS

The method and approach taken for this paper is an amalgam of the concepts theoretical and empirical that are to be found within the mass of Pass-Through literature readily available for examination. The approach and methodology used are of a proven nature and go some way towards extending the already existing body of knowledge.

Bearing in mind that nothing in or of itself is entirely original in either concept or content, I hereby declare that any similarities to others' work is not therefore intentional, nor is it made with disregard to the formalities of academic research.

I acknowledge the support and guidance of my supervisor Professor Srikanta Chatterjee, and of my second supervisor, Dr. Claudio Micheleni for his invaluable assistance with the econometric aspects of this study.

Lastly, the views expressed in this paper are those of the author and do not necessarily reflect the views of Massey University nor the Department of Applied and International Economics.

DEDICATION

There are many markers along the road to completion of a document such as this, some good and some less so but all undeniably bearable. Some have come with human shape, form, and thankfully, with senses outside of the physical alone. To those people, and the shared experience that has gone into the shaping of this paper, I say thank you.

That is the general, and now the specific, to the three most important people in my life George, Jack, and especially Amanda.

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Chapter I

1.1. Introduction

New Zealand's economic constraints, chiefly its small size, both physically and in population terms, render it unable to produce all that it wishes to consume and therefore, by necessity, it must trade with the rest of the world to finance its required imports. From this all-important international trade is determined New Zealand's investment levels, growth performance, and national standard of living.

Currently, as the 1990s draw to an end, New Zealand's net trade receipts are falling and net factor payments are moving against us¹.

The economic medicine prescribed for this malaise is a decrease in domestic investment and an increase in national savings. To achieve this the Reserve Bank of New Zealand (1998) suggests that a fall in the exchange rate and/or a raising of the domestic interest rate is required, in order to increase New Zealand's competitiveness abroad and to dampen demand domestically.

Crucial in this economic debate is an exchange rate, which over the last 13 years² has been maintained as a managed float, a system that has at times left exporters and importers exposed to the fluctuations in its level. Remembering of course that this does not mention its ultimate effect on the terms of trade or on consumers' preferences.

How this occurs is through variations in the price of internationally traded goods and through them into the product prices in domestic currency terms.³ (i.e. pass-through).

¹ The Reserve Bank of New Zealand's August 1998 Monetary Policy Statement.

² NZ moved to a floating exchange rate in March 1985.

This transmission process is known as the exchange rate pass-through, the estimation of the observed response of export and import prices to changes in the real exchange rate. In import terms specifically, it is the extent to which an exchange rate change is transmitted to the tangible price of import goods and by association to import prices in New Zealand dollars.

This paper explores the relationship, that is how changes in the nominal exchange rate affect NZ import prices over the long run, and then estimates how long the market has to wait for complete or incomplete pass-through to occur (the short term).

The hypothesis to be tested is that, under conditions of an appreciating currency or depreciating currency, it will be found that:

- 1) The standard small country assumptions hold for New Zealand in regard to manufactured imports.
- 2) All exchange rate changes are in the long-run, fully passed through into import prices across-the-border.

For exports from New Zealand to the respective foreign markets selected for study, a serious question to answer is whether the exchange rate changes through the period of floating exchange rates brought increased competitiveness in periods of depreciation and decreased in periods of appreciation.

³ The pass-through effect influences exports and imports. On the export side, pass-through effect refers to the extent to which an exchange rate change is transmitted to export prices in foreign currencies. On the import side the pass-through effect refers to the extent to which a change in the exchange rate is transmitted to import prices, measured in domestic currency.

This study investigates the importation of production inputs in relation to exchange rate changes and makes some comments on competitiveness and terms of trade.

The Reserve Bank of New Zealand (RBNZ Monetary Policy Statement, August, 1998) intimates that the flip side of rising/falling competitiveness is reduced/increased domestic demand. Therefore the question for imports is how domestic demand responds to exchange rate changes, and whether we can observe this through the changing domestic prices of imports.

In answering these questions, a micro approach is used to focus on specific production inputs into the New Zealand economy at a disaggregated bilateral level. Whereby this study will avoid some of the bias present in macro studies which result in findings of partial pass-through with no convergence to complete one in the long run.

Researchers, principally discussion papers from this country, contend that there is a dearth of studies pertaining to the smaller and less industrialised countries (Chatterjee & Gani 1994) and (King & Steel 1998). Finding then that this is the case, it can be accepted that this work is one that will contribute to an increase in the number of such studies.

In addition to the lack of small country studies, once it has also been recognised that in pass-through estimation the time-series nature of the data used and the non-stationarity of data series are sometimes inadequately managed. Then, upon recognising this potential for bias, an effort can be made to address it. This is the approach adopted throughout this paper.

How this will be achieved is through the use of distributed lag model using the disaggregated bilateral approach in estimating the exchange rate pass-through, similar to that undertaken by Winkelmann (1996) in which two countries only were used, 25 products and a control group. This paper uses four countries and addresses the estimation from the perspective of five major factor inputs.

In doing so it is ultimately recognised that there is no shortage of academic debate in the field of exchange rate pass-through, and, of the large number of studies surveyed, nearly 25% are in fact of small countries. Interestingly enough, a large number of these relate to Australia.

New Zealand's recent contributions have come from work done by or on behalf of the Reserve Bank, notably Hansen (1994) and Winkelmann (1996). There are of course New Zealand academic works, Chatterjee & Gani (1994) dealing with exports post 1985, and King & Steel (1998) where they cover imports for the periods pre-and-post 1985 (structural break). Both of the latter are departmental discussion papers dealing with Stage I of pass-through.

That is Stage one I, the estimation of pass-through from the exchange rate change to the price of consumption and production of imports over the borders.

In the estimation of Stage I pass-through, this paper utilises quarterly data for the five major imports to New Zealand⁴ from its four main import trading partners⁵. Data covers the period from 1988: (I) to 1997: (III), with disaggregation at the 2 and 3 digit New Zealand industrial Classifications (NZSIC) level.

With acknowledgement of the items introduced herein, their achievement, via the medium of this paper will make a worthwhile contribution to the steadily expanding body of knowledge in this field.

The study is divided into 6 parts:

⁴ By dollar value New Zealand's five largest imports are Mechanical machinery, Vehicles, Electrical machinery, Mineral fuels, Plastics and articles thereof.

⁵ New Zealand's four largest trading partners by nation and dollar value as of the 30th June 1996 are Australia, United States, Japan, and the United Kingdom

- ✓ Chapter 1, the introductory section of the paper, contains a broad description of the work's objectives. Included here is a statement of the major hypothesis and a brief explanation of the importance attached to this study as a research work.

- ✓ Chapter 2 is the literature review section, beginning with a critical analysis of the foundations of exchange rate pass-through, and covers significant prior research, to finish by presenting and placing the research question in a New Zealand context.

- ✓ Chapter 3 presents the theoretical underpinning of the analytical framework as described for use in empirical analysis of pass-through and derives the equations used in estimation. It explains the construction of the data indexes for all variables, and the estimation procedure undertaken.

- ✓ Chapter 4 presents the hypotheses, brief explanations, results, analyses, discussion of results and, finally, a detailing of all work completed in the extension of Chaterjee & Gani's (1994) discussion paper to encompass the years 1993 (II) through 1997 (III).

- ✓ Chapter 5 describes the results of this study – a factual statement only of those elements that have presented themselves. The discussion of those results in relation to other published research follows from the results.

- ✓ Chapter 6 the final chapter, is a summary of the investigation with critical emphasis initially on those aspects of the study that are considered to be the main findings for exports and, more details on those aspects that are pertinent to the prices of selected New Zealand imports. The final section suggests areas of possible further research.

Chapter 2

Literature Review

2.1 Early Years

Exchange rate pass-through is a development from early empirical work that was concerned with the estimation of import/export, demand/supply elasticities in international trade, wherein the relationship between exchange rate changes and traded goods prices is derived from the generated elasticity results.

Studies employing the elasticity approach to measure pass-through, such as Branson (1972), have traditionally focused on the aggregate outcomes for individual countries. Typically, these studies find that larger and less open economies experience much smaller pass-through than do smaller open economies (Kreinin 1977) and (Spitaller 1980).

More recent developments in the pass-through genre have tended to recognise the elasticity limitations and have for quite some time focused on the many other factors that can effectively influence pass-through.

These many influences are the factors that have now taken precedence in pass-through studies as a direct result of a the need to better understand:

- ❖ How long prices take to respond to changing exchange rates.
- ❖ The underlying rationale for different supply responses among nations, reliant as they are upon their industrial organisation and the inherent technologies specific to the industries being investigated.

Verified by Venables (1990) with his comments indicating that standard elasticity studies have thus far not assisted in adequately answering these two specific questions.

In order to do so it is necessary to still accept that as a starting point the standard elasticity framework is as good as any for the discussion of exchange rate pass-through. This is regardless of a country's size, or a country's economic location among nations. Even within its limitations, the standard elasticity theory does identify three important determinants affecting the size of any pass-through.

- ❖ Pass-through is likely to depend on the relative elasticities of import supply and demand, and, in particular, the degree of pass-through is likely to be higher the greater the elasticity of import supply and the less elastic is demand for imports. Theoretically, therefore pass-through is expected to be complete in the small country case where a country is assumed to face a perfectly elastic supply curve for imports and is essentially a price taker in world markets.
- ❖ Aspects of the macroeconomic environment may either reinforce or offset demand and supply influences, so that the degree of pass-through may tend to be relatively high, irrespective of the elasticity of import supply and demand (Piggot & Reinhart 1985) - a result not-dissimilar to that reported in Lafleche (1996/97).
- ❖ The size of the pass-through effect in individual industries will depend on the type of the product being traded and the specific structural features of foreign and domestic markets, both of which affect the shape and elasticity of the demand curve facing foreign suppliers and hence their pricing policies.

In this context, no one completely ignores the elasticity theory and its early investigative work; they merely extend it, and thus the work is enlarged to encompass other economic theories. This is done in order to further explain those issues which are still to be resolved in the exchange rate pass-through area.

2.2 The Law of One Price Extended

Having identified the requirement for further analysis of exchange rate pass-through, it becomes apparent that any further investigation is in accordance with the identified shortcomings and strengths of the elasticity approach. The method usually adopted is to start with PPP⁶ as a foundation and differentiate between imperfect and perfectly competitive markets.

Most studies start with PPP-or rather the law of one price (LOOP)⁷ as it is supposed to work under conditions of perfect competition in both domestic and international markets. Under those conditions, for a given change in a nation's exchange rate, foreign prices held constant, domestic prices change in line with the exchange rate, and pass-through is then considered 100% complete.

The other option is to accept theoretically the possibility of less than 100 % pass-through, by researchers extending the analysis to include imperfect competition and by allowing profit margin adjustments by firms in the short run (Mann 1986).

The rationale behind this latter approach is that many of the relevant empirical studies have, over the years, found that the law of one price does not hold true in the short-run at least for manufactured goods at a highly disaggregated level. Ohno (1989), Knetter (1989), Marston (1990), and Kasa (1992) support this and thereby lend weight to the rationale for the relaxation of the perfect competition assumption. This then creates the scope for introducing profit margin adjustments.

⁶ (PPP). *"Purchasing power parity holds that the exchange rate between any two national currencies adjusts to reflect the differences in the price levels in the two countries"*. (Baumol & Blinder 1991, page. 397).

⁷ (LOOP). Purchasing power parity itself has two versions, the absolute and the relative. It is the absolute version, wherein perfect arbitrage ensures that a goods price will when converted through the exchange rate, be the same in each of two countries.

Further on this point, Kenny & McGettigan's (1998) paper contends that studies by Froot & Rogoff (1995) reinforce the possibility of a failure of the LOOP in the short run, but establish a long run convergence to PPP.

It is however conceivable in this long-run movement, that in a less than perfectly competitive market, where products are not perfect substitutes, suppliers might respond in the short term to a change in the exchange rate in different ways.

One such way is to accept that the method they use may be to adjust their foreign currency prices to relevant markets (Pricing-to-Market). In such a situation, any significant amount of market power can lead to full pass-through (Phillips 1988).

In such imperfect environments, firms have the ability to price above their marginal cost and to alter their profit margins over time. This may involve their accepting reduced profit margins to protect market-shares following a devaluation of the domestic currency (Froot & Klemperer 1989).

In a recent New Zealand pass-through study (King & Steel 1998) the focus has been manufactured imports using the standard mark-up model which has been used in much of the pass-through literature. In this way, an attempt is made to account for differing levels of pass-through. These comments therefore have provided a justification to relax the second (LOOP) assumption: no barriers to trade. It thus allows further extension of the trade model.

Many of the findings suggest that any analysis of imports using a trade model based on imperfect competition and profit variation will predict that exchange rate changes will not have a one-to-one correspondence with international prices. What this suggests therefore is incomplete (partial) pass-through.

In theory, the findings from the extended studies attempt to explain incomplete pass-through by emphasising the role of market structure,

followed by product differentiation. They seek to explain whether pass-through merely reflects the squeezing of profit margins by exporters in the short-run or whether particular types of market organisation do always lead to a limited price response for a given exchange rate change.

What these extended studies describe is imperfect competition. Under the suggested conditions implied by imperfect competition and variable profit margins, pricing will no longer be based on marginal costs. This allows firms to charge a mark-up on those said costs, enabling them to earn above normal profits even in the long run. An interesting question these studies bring to the fore is how this mark-up over marginal cost might vary in response to an exchange rate change?

Factors affecting this have come to the fore with an answer having already been mentioned, (Phillips 1988):

- ❖ Substitution between imports and domestically produced products.
- ❖ The degree of market integration or separation.
- ❖ Product differentiation.

Rather interestingly, the degree of exchange rate pass-through was found by (Yang 1997) to be negatively related to the degree of substitution among the different variants in the industry and positively to the degree of product differentiation.

To explain this, when products are highly substitutable, a price rise is more likely to lead to consumers switching products; foreign producers therefore, are more likely to keep their prices in line with domestic prices. Ultimately, they absorb exchange rate shocks rather than passing them on in prices (Pricing to Market). But if this doesn't happen then a price increase is passed on in full to customers.

The alternative situation is in which a firm has a larger market share and its market dominance gives it a stable price path even in the face of cost shocks. A firm in this situation with higher market share has increased mark-up due to relatively low elasticity, it is therefore more able to absorb any cost shocks by varying its profit margins. This is known as “The-large-firm pricing stabilisation effect”, (Yang 1997).

2.3 Other Factors Influencing Pass-Through

Researchers have concluded that the permanency or otherwise of any change in the exchange rate is an important factor. Kim, (1990) is of the view that a transitory change leads to a lower and/or slower pass-through, dependent upon:

- ❖ Foreign exporters' speed of response.
- ❖ Whether price adjustment costs are dependent on their being sunk costs.
- ❖ Whether market re-entry is prohibitively expensive.

This indicates their degree of willingness to accept a below par profit margin for some time.

The size of the economy in question also influences the pass-through: a smaller and more open economy is thought to have a higher degree of pass-through than a larger less open one. Why? Because importers into a small economy may have greater control over the domestic market than domestic manufacturers of substitutes; therefore changes in domestic demand are less likely to affect world demand.

It is also possible that pass-through does not operate symmetrically and any pass-through and its size will be specific to the foreign exporters. One possibility is they are slow to pass on the effects when their own currency appreciates in order to try and preserve their market share against local

producers. By contrast, they may be quick to lower their prices with a depreciated currency in an effort to boost their market share at the expense of local firms (King & Steele 1998).

Furthermore, if domestically based competition is found/or known to be insignificant then foreign exporters may be quick to increase prices following a depreciation so as to maintain profit margins, but be reluctant to lower prices when domestic currency appreciates. This results in transitory periods of economic rent (King & Steel 1998)

There is ample evidence to support the position that the factors mentioned here do influence the degree of pass-through. Studies such as (Dixit & Stiglitz (1977) Salop (1979) and Dornbusch (1987) confirm this.

2.4 Oligopolistic Models

Fischer (1989) moved the analysis forward by theorising for Bertrand competitors⁸, finding that if markets are segmented with limited arbitrage, then an appreciation leads to higher pass-through if the domestic market is monopolistic relative to the foreign market. This is a feature commonly found in disaggregated manufacturing studies.

Failure of the LOOP model in respect of manufactured goods at a disaggregated level, however, is acceptance of significant and non-transitory differences in prices following exchange rate changes. These differences are considered the result of either imperfect substitution between goods or the presence of segmented markets (Ohno 1989), (Knetter 1989), (Marston 1990), (Kasa 1992).

⁸ A strategic firm interaction that arises within an industry that contains only a small number of participants. Under Bertrand competition a firm sets its price ahead of its competitors and lets the market determine quantity sold.

Supportive of this are studies that investigate the pervasiveness of intra-industry trade in manufactures, which lend support to the view that foreign and domestic manufactured goods are imperfect substitutes.

The more recent examination of market structures and of the differing firm behaviours, along the lines of Cournot⁹ found pass-through to be positively related to the number of foreign firms and to the total number of firms (Dornbusch 1987).

With regard to Dornbusch's (1987) number of firms, the domestic market concentration of each industry in the importing country is said to systematically affect the pass-through relationship to the point that the higher the concentration the smaller the pass-through. Estimates for Korea (Lee, 1997) suggest that partial pass-through is prevalent in manufacturing imports, the influence being market concentration.

This position is found to, again, support Dornbusch (1987) where he finds that pass-through becomes smaller as an industry becomes less competitive under Cournot assumptions.

It is then restated in Feinberg (1989) that market concentration can reduce pass-through in both the domestic and import prices in the US. The interpretation of this result is that imperfect competition is the decisive factor in the pass-through of a small country also.

Finally, support for these findings comes also from Lee (1997). His research demonstrates that market concentration is important in explaining inter-industry variation of pass-through.

⁹ A type of oligopolistic behaviour where within an industry, for a given forecast, each firm chooses a profit maximising output for itself and seeks an equilibrium where each firm finds its beliefs (forecasts) about the other to be confirmed.

In an extension of the Cournot style oligopolistic¹⁰ models, many recent studies have included a variable to measure some of the demand pressures faced by exporters.

The implications inherent in this for any exporting firm's price response is that they are now tempered by the knowledge of actual measured demand pressures. This is contrasted against indeterminate temporary/permanent exchange rate changes that can result in variable price responses at worst, and at best, lead to foreign firms pricing very aggressively in their target countries in order to gain an increase in market share.

The more recent work has been with the hysteresis pricing models of Krugman (1989), Dixit (1989), and Menon (1995). The hysteresis effect suggests that competition in the market will remain unchanged as long as exchange rate changes fluctuate within a set band, and that this band will be greater the higher the costs associated with factors such as entry and exit.

This sort of response will result in a lower rate of pass-through, as firms fight either to stay in the market or to deter entry of others. If the exchange rate moves outside this band, however, then entry and exit decisions that follow will permanently alter the structure of the market. (Menon 1995).

2.5 Restrictive Practice and Large Firm Decision Making

The studies that have explored restrictive practice and large firm pricing decisions are of a more recent phenomenon, their importance though needs recognising especially in relation to the small country case and for both exports and imports.

In this instance Knetter (1992) lists several factors which he considered likely to affect pass-through in a further exploration of the imperfect market model.

These are:

¹⁰ A position where there is more than one firm, but not so many as to regard each of them as having a negligible effect on price.

- ❖ Invoicing decisions.
- ❖ Transfer pricing practices.
- ❖ Trade policies.
- ❖ Degrees of market segmentation between countries.

These factors are intrinsic to the functioning of the larger corporate and nation state alike.

When considering this in relation to the large corporate entity, MNCs¹¹ and intra-industry trade, we have a situation in which firms are considered to exist in a dynamic environment that has foreign markets regularly experiencing instability and suffering large exchange rate movements.

Menon (1995) argues that MNCs actively employ intra-firm pricing policies, along the lines suggested in (Knetter 1992), whereby they circumvent and/or delay the full transmission of any of these exchange rate changes into prices in individual markets, thus helping subsidiaries of MNCs to avoid losing market share. The alternative is to seek increased market share.

With respect to non-tariff barriers, NTB¹²s, when a nation's currency depreciates, the premium on NTB restricted imports would fall instead of import prices increasing. Pass-through in this context would then imply a reduction of the premium on imports rather than in rising prices. If the currency appreciates, then of course the premium rises and pass-through is hidden, being disguised within increased profit margins.

In such a situation there could conceivably be some absorption of the impact of exchange rate changes before it is reflected in prices. If and only if

¹¹ MNCs are large multi national corporations, unconstrained by national boundaries.

¹² (NTB) Non tariff barriers, the like of quantity controls and other import restrictions.

depreciations are large enough to push prices to the point where quantity restrictions are no longer binding, then we will observe some pass-through.

Tariffs, once imposed on a product, raise the supply price of each unit by the amount of the tariff. This may not in itself have any effect on the degree of pass-through. For instance, a tariff imposed on a product sold under competitive conditions would be fully passed through to selling prices.

In a market characterised by imperfect competition, foreign sellers (exporters) have been shown to use their market power to translate changes to tariff levels into monopoly profits rather than passing them through to prices. Feenstra (1989) accepts and postulates this hypothesis.

Similarly, quantitative restraints are known to affect the pass-through relationship even under conditions of perfect competition. Unlike tariffs the effect that quantitative restrictions will have on the pass-through relationship does not depend on particular market structures (Menon 1995).

Feinberg (1989) empirically examined some other industry characteristics affecting pass-through in domestic producer prices using the variables of import penetration, non-tariff barriers, elasticity of substitution, capital intensity, and selling expenses as a % of sales, but all of these were found to be statistically insignificant.

2.6 Current Position

It is a contention among some researchers (Andrew & Dollery 1990) that most of the existing literature focuses on the across the border import price, that is Stage I. For those studies that investigate beyond the first stages of pass-through, they make the assumption that the over-the-order pass-through is completed quite quickly and in full as they move forward to investigate Stage II (Andrew & Dollery 1990).

Backup for this comes from Dywer & Lam (1995), for example, stating that what is known as Stage I pass-through is assumed complete and rapid, in accordance with the set theoretical predictions and assumptions of a small open economy.

In relation to Stage I and incomplete versus complete pass-through, an adverse exchange rate change is assumed as a cost shock. In the event of this occurring, the foreign firm may choose to fully pass on the cost (complete pass-through) or to absorb the shock and keep its selling price unchanged (no pass-through), or to adopt a position between the two.

Recent studies as described, have drawn heavily on models of industrial organisation and have focused on the impact of market structure in an attempt to explain foreign firm pricing behaviour.

Published work also suggests that pass-through varies across industries (Winkelmann 1996). This variability of pass-through is theorised as being related to the characteristics of the market dynamic such as the degree of competition, the availability of substitute products, and the relative domestic and foreign shares in the market. In the suggested Cournot models, pass-through is estimated to be larger the more competitive the industry (a lower mark-up over and above marginal cost) and the larger the firm's share of imports in relation to total sales.

Interestingly, Yang (1997), shows that partial pass-through can result from increasing marginal cost as well as from variable demand elasticity. It also shows that where product substitution determines demand elasticity, pass-through is larger than for the more differentiated or less substitutable products, and the smaller the elasticity of marginal cost with respect to output.

2.7 Small Countries

It was cited in Menon (1995) that much of the work in the recent past has concentrated on the experience of the large economies. There is ample evidence for the large country case (McKee, Patton & Kapoor 1995). But,

given that many small country studies are reportedly based on the work in relation to large country studies, examining pass-through in a multi-country context produces mixed and contradictory evidence. But what is the position among smaller nations?

Canada is an example from one of the studies surveyed. Because of the small size of its market compared with the world market, Canada is assumed to be a price taker for imports, whether for industrial inputs or finished goods. However, partial pass-through only is still expected, for even in the short-term, the effects of exchange rate movements will depend on several of the factors mentioned previously (Lafleche 1996/97).

In the small country case, where the exchange rate is supposed to have virtually no impact on home pricing, we can see that in the oligopoly models an attempt is made to explain both unchanging/changing prices. The market structure, import shares and concentration are then considered the key parameters that explain the outcome (Dornbusch 1987).

The most recent study for imports and pass-through in a small country framework is by (Kenny & McGettigan 1998), in which they find evidence for full pass-through in the long run but with an asymmetry of response.

That study was expressly for a small open economy (Ireland) and they support the view that it is a failure of many pass-through studies to observe the time-series nature of the data, thereby leading to results that estimate for incomplete pass-through.

For the reason given they have used the Johansen¹³ technique to manage the relationship among the data series. In so doing Kenny & McGettigan (1998) have adopted econometric measures in keeping with King & Steele (1998) of Error Correction Models, Vector Analysis and Engle Granger estimations.

¹³ The Johansen technique is an econometric method for establishing whether variables are cointegrated, that is, a single variable may be non-stationary but a linear combination of variables may be stationary and therefore is termed cointegrated.

2.8 Shortcomings

Menon's (1993), survey of 48 pass-through studies along with the other relevant imports and pass-through literature tell us that most studies suffer from many common faults:

- Most researchers have ignored the time-series properties of the data in conducting their estimations. Given data is usually trended, it is likely that previous estimates of pass-through have been biased as a result of non-stationary data. (Kenny & McGettigan 1998).
- Most previous studies are subject to limitations imposed by the inadequacies of the data used with respect to import and competitor prices, resulting in a bias for reported pass-through estimates.
- Much of the pass-through work has concentrated on large country experience. Examining pass-through in a small open economy fills a missing part of the literature.
- The use of nominal prices will bias the estimate of pass-through (Lee, 1997). Generalisations based on these are highly questionable for small country studies.
- Formal empirical studies of cross industry variations of exchange rate pass-through are apparently lacking in the current literature except for Cumby & Huizinga (1990) and Lee (1991), and as Knetter (1993) points out, "*industry is the critical dimension in explaining firms pricing behaviour*".
- Econometric analysis of exchange rate pass-through for Stage I is common, studies of the impact of this pass-through on the profits of distributors, Stage II, is not (McKee, Patton & Kapoor 1995).
- Some of the studies enter the lags unconstrained while others impose constraints and at different points. The most common is the tail

constraint, which has the effect of forcing neighbouring lag weights to come too close to zero, thus distorting both the lag structure and the cumulative pass-through estimate (Menon 1995).

- In regard to the construction of the foreign cost of production variable, the results indicate sensitivity to the choice of data and the methodology used.
- Studies using a disaggregated approach find that *pass-through* tends to vary significantly across industries or product categories (Menon 1995).
- Given that the world price is perhaps the least satisfactorily measured variable of those that are used to estimate pass-through in these industries, there is a strong possibility that measurement error might be responsible for the failure to observe a higher degree of pass-through (Phillips 1988).

Current literature suggests that further research in the area of exchange rate pass-through should pay particular attention to the following issues:

- First, the imbalance in the country sample needs to be addressed; the experience of small open economies has received very little attention in the literature.
- The second lesson relates to data. The common usage of price proxies, such as the unit value, and the lack of studies that use data disaggregated at the product level are particularly unsatisfactory. While this study makes use of unit value data it joins a small group of New Zealand studies using disaggregated product data.
- Third, most studies have employed conventional econometric estimation techniques without paying attention to the time series properties of the data. Much of the data used to estimate pass-through is usually non-

stationary, which is a common factor in time series data. Significant differences in the estimates of pass-through obtained by different researchers studying the same country, commodity and time period highlight the importance of the choice of data and methodology.

2.9 New Zealand

Current New Zealand examples are few in number, but what there are combine many of the approaches and theories discussed in this literature review section. All of the domestic explorations make use of the standard mark-up model that is to be found in most recent studies and all seek to remedy the shortage of small open economy studies at the same time as avoiding the problems associated with cointegrated data series. They extend and investigate the pass-through experience for New Zealand and do so in relation to international trade theory.

Hansen's (1994) PTM study allowed for inadequate export data that was believed to have caused asymmetric responses dependent upon the nation-specific exchange rate movements. Countering this required the inclusion of variables for demand pressures and foreign prices.

Findings implied that a high degree of pass-through was present in the New Zealand dynamic, but that PTM was only weakly supported, with collinearity and/or what Hansen terms competitive or currency pricing implied. One topic mentioned for further research was to include better data on market structures within New Zealand (tariffs and quotas).

In a (1996) study by Liliana Winkelmann, attention is paid to that factor of market structure stressed in Hansen (1994). That finding is for export firms operating in segmented markets, a situation that allows for pricing according to the specific destination market dependent upon the exporters market power. There was also support for a reduction of the firm mark-up as a result of tariff reductions.

Winkelmann's results find for price discriminatory producers operating in segmented markets, with the result that pass-through is partial for half of the 25 products listed and there exist an unstable relationship between the exchange rate and prices - a rejection of PPP. Future research needs to cover pricing behaviour, changing competitiveness of international firms, mark-up responses to exchange rate changes and /or tariff variations.

A more recent discussion paper by (King & Steele 1998) tested the New Zealand data on both sides of a structural break (1985) and found complete pass-through tied to a long adjustment period, with adjustment slower under a fixed exchange rate rather than a floating rate. There is also backing for the idea that import prices respond asymmetrically and react to costs at home and prices in destination markets, more than exchange rate changes do.

2.10 Conclusion

In closing this survey we mention the areas into which exchange rate pass-through for imports logically extends. In general, there are the distributors' profit margins, consumer prices and monetary policy.

Phillips (1988) asserts that the influence of exchange rate pass-through enters monetary policy via the floating exchange rate, wherein movements of the exchange rate, whether volatile or not, strain domestic price competitiveness for import competing goods. This chokes off any import substitution possibilities and fuels domestic inflationary pressures.

Support for this position comes from (Lafleche 1996/97) and the Reserve Bank of New Zealand's August 1998 Monetary Policy Statement, where they state that exchange rate movements effectively impact domestically in three ways, the first being direct transmission through import prices and prices of domestic substitutes. Secondly by indirect means, that is through changes in foreign demand and buyer behaviour, and the third way is via inflationary expectations.

If the behaviour of the "invisible hand", which is the above, does not alter traded goods prices, it would hinder the efficient operation of markets (Menon 1995). Furthermore, if transmission of exchange rate changes to prices and the quantity supplied, is a lagged response, then adjustments to a nation's trade balance may not occur as per theory. An explanation of trade flows after exchange rate changes may then lie in imperfect competition theory as (Knetter 1993) and (Menon 1995) suggest and which is now the commonly accepted position.

The current New Zealand economic environment supposedly encompasses greater retail market competition, meaning that in future prices should be more responsive to movements in the exchange rate. Add to this a low inflation environment, thanks to the national policy of price stability and a firm's ability to pass on the full extent of cost increases resulting from any exchange rate event such as a depreciation of the currency is supposedly restricted.

This result is according to Lafleche (1996/97) that in the short run there will be increased factor and input prices leading, in some cases, to cost absorption or a profit squeeze by manufacturers, and profit taking by foreign exporters.

In the context of the above it needs to be remembered that any exchange rate change is also heavily dependent upon many other factors, such as the cost of adjusting prices and producer/consumer expectations of whether the depreciation is a temporary or a lasting phenomenon.¹⁴

The price changes that we are discussing also have relevance in investigating the effects of trade liberalisation. The theory is that a small country facing perfect competition can, by freeing its economy, gain an advantage in world markets, for example, enjoying price reductions in proportion to the tariff reductions. If markets are less than fully competitive, then Dornbusch (1987)

¹⁴ The exchange rate is one of many factors that can influence prices. There are 15 quoted in Kevin Wilson's (The National Bank, NBNZ economics, Rural Report. <http://www.nbnz.co.nz>).

believes the advantage rests with those nations that have an interest in others' tariff reductions and removals.

In the small country context, however, such action can accentuate vulnerability as tariff reductions allow for the much larger and quicker transmission of changes in exchange rates.

With regard to pass-through, the findings realised from New Zealand studies report that the degree of pass-through varies across industries and is known to be complete for some and incomplete for other products investigated within a disaggregated product format (Winkelmann 1996).

Aggregate studies find substantial pass-through but believe that the evidence does not totally support the PTM theory.

The key reasons for their findings of less than full pass-through may well have something to do with the data used in their studies, or in the time series nature of it. King & Steele (1998) by contrast, when researching pass-through either side of the 1985 structural break, found evidence for full pass-through and a slow speed of adjustment. This study does take account of the simultaneous nature of the data.

Finally though, in all of the New Zealand studies surveyed, the factors that have come to light, for example market power, segmented markets, discriminatory pricing, and asymmetry in response are believed to change the size and speed of pass-through.

When techniques appropriate to the time series nature of the data are used in pass-through papers, there is every reason to believe that the assumptions inherent in international trade theory for small open economies will be found to hold. In essence, then, this paper covers the issues highlighted by King & Steel (1998) which are to:

1. Assist in correcting the small country imbalance.

2. Take account of the time-series nature of the data.
3. Estimate pass-through for selected production inputs at a disaggregated level.

Chapter 3

Theoretical & Analytical Framework

3.1 New Zealand a Small Country

An understanding of what underpins the hypothesis expressed in the introduction begins with the small country assumptions so common in international trade theory and applicable to this study.

Small country assumptions (Sodersten & Reed 1994) include:

- A small nation is dependent upon the incomes of its trading partners.
- All shocks to its trading partners' economies will be transmitted into its own economy.
- A small country cannot transmit its own economic disturbances to its trading partners.
- A small nation is a price taker in world markets.
- It cannot affect the price it pays for its imports or receives for its exports by varying the quantity that it trades.
- A small country has a perfectly elastic (horizontal) supply curve for imports and perfectly elastic (vertical) demand curve for exports.
- The flexible exchange rate in a small country is always stable.
- The domestic interest rate is determined on world markets.
- Policy implementation domestically has no effect on the welfare of its trading partners.

- Any and all effects are arrived at via market induced changes in prices.

The last small country assumption intimates that the degree of pass-through and its timing is the final arbiter of price, driven by the (derived) demand for and supply of foreign currency manifested through the medium of the foreign currency markets.

It is signals delivered via the FX¹⁵ markets that control prices, and the fluctuations inherent in the said markets that alter price levels between countries and brings about a level of “stability” in and among nations, via the PPP¹⁶.

As a result there is shifting of any variability into goods and services prices such that trade patterns and trade payments alter, with a new equilibrium derived. Pursuant to this, any estimation of the pass-through event and its subsequent temporal behaviour will be dependent upon the assumptions inherent in the model utilised for investigation.

Having stated the basic foundations upon which this study is built, it is necessary to comment further only in relation to the nature and conduct of the firms involved and about the structure of the markets in which they operate.

3.2 Perfect Competition & the Exchange Rate

Starting as per, McKee, Patton & Kapoor (1995) and Winkelmann (1996), within the fundamentals of LOOP¹⁷, wherein we utilise one of its key tenets,

¹⁵ Foreign exchange markets.

¹⁶ (PPP). *“Purchasing power parity holds that the exchange rate between any two national currencies adjusts to reflect the differences in the price levels in the two countries”.* (Baumol & Blinder 1991, page. 397).

¹⁷ (LOOP). The key assumptions for the law of one price are perfect arbitrage between markets under conditions of perfect competition and that there are no barriers to trade. (Sodersten & Reed 1994, page. 582).

perfect competition¹⁸. This is a situation where imported and domestically produced goods are perfect substitutes for each other and then move on into derived demand, *FX* market behaviour and finally the exchange rate as the final arbiter of prices internationally and domestically.

In this perfectly competitive model, the exchange rate is the key, and it adjusts the price ratio among nations. This exchange rate is the price of foreign currency in terms of domestic currency, and by the nature of the economic structure, demand for foreign currency is derived to support the trade in goods services and securities.

The two related variables are the domestic price level P and the price level of the rest of the world P_w which are linked to the exchange rate ER . That is (1.0):

$$e = \frac{P}{P_w} \text{ or, } P = eP_w \quad (1.0)$$

Where for the same basket of goods arbitrage will equalise the prices of those goods between countries, that is PPP which leads on to LOOP, which in turn gives us (1.1):

$$P_a = eP_b \text{ or, } e = \frac{P_a}{P_b} \quad (1.1)$$

Where P_a and P_b are the price levels in country a and b . Under these conditions for a given change in the relevant national exchange rate, and foreign prices are held constant, then pass-through into domestic prices is 1 for 1 (100%).

Purchasing power parity itself has two versions, the absolute and the relative, it is the absolute version, that is LOOP, wherein perfect arbitrage ensures that a goods price will when converted through the exchange rate, be the same in each of two countries.

¹⁸ Perfect competition: Many firms, competes on price, horizontal demand curve, no barriers to entry, all firms produce "identical" products.

For both exporters and importers, under conditions of perfect competition the result of a change in e is quite similar. Any difference is a measure of the price differential between nations.

3.3 Imperfect Competition

The less than perfectly competitive market structure for most industries is now a recognised fact. There are many LOOP studies that overwhelmingly support imperfect competition and the view of variable pass-through because of imperfect substitute products, segmented markets, and differing market structures (Dornbusch 1987).

Empirical work in recent years (Hansen 1994), (Winkelmann 1996), (King & Steele 1998) has for this reason focused on the fact that there has historically been less than 100 % pass-through of foreign currency changes into New Zealand import prices for consumption and production items. The phenomenon is referred to as pricing-to-market (PTM) by Hansen (1994) a situation whereby the extent of the pass-through depends upon the dollar prices of competitors.

Work done by Hansen (1994) has not conclusively proven this to his satisfaction and it is suggested that if there is a response, such as pricing to market behaviour, it doesn't come about solely as a result of the changing prices of substitutes.

For evidence that is clearly consistent with the theories of both short-run/long-run equilibrium and imperfect competition, and that implies that pass-through clearly has a relationship to industry organisation in some way, we look for more information from King & Steele (1998). Their findings suggest that for a depreciation of the New Zealand dollar the exchange rate pass-through is estimated to be greater in magnitude, with a correspondingly quick effect for transmission. With an appreciation, it has been estimated to be smaller in size and slower in its effect, that is exchange rate pass-through will not be complete. As reported in the literature review (page 11/12).

The theory of imperfect competition also encompasses the assumption of rent being available to exporters, thus any currency change is split between that passed forward to customers (importers), and that passed backwards to manufacturers through profit variations.

This opportunity to make greater than normal profits is a necessary event for producers who realise that if they can't make rent, then any adverse exchange rate change would have to hasten the decline of any producer involved in that industry. A result of such a dire arrangement would manifest itself in the effects of a currency change being passed through to customers (importers) more completely and/or faster.

On this basis, for a small country actively involved in international trade and according to the stated assumptions, there can then rationally be argued a case for zero pass-through of exchange rate changes to export and import prices, or of an incomplete one in the long run. Therefore, given the relevant industrial organisation specific to each case, it is these factors including those above that will influence the amount and speed of exchange rate pass-through.

3.4 Scale Effects for Pass-Through

The reality for firms facing imperfect competition is that they will differ in their production efficiency and the cost structures involved. The difference lies not only in differentiated products but also in the choice exporter/importers have made regarding their scale of operations. An efficient firm in an equilibrium position that is effectively minimising its long run costs has no need to change scale. One that isn't, forces operational changes such that costs are reduced until profit margins improve.

In such a climate, higher prices (returns) will act as an incentive for the ill-informed manufacturers (exporters) to supply regardless of whether they are operating in/or outside of their most efficient scale of operations. In the short run these exporters will look on any adverse exchange rate movement as a

fall in prices with reduced returns, an event some may see as indistinct from the actual real fall in demand.

Irrespective of impairment, pressure falls on the marginal suppliers, those who are less efficient (with a higher cost structure) and have little market power. They must simply operate at a loss with the possibility of business failure unless they improve their efficiency.

In contrast, the already efficient firm can absorb the fall in price (returns), meaning that an adverse exchange rate movement will not be passed forward into export prices, at least in the short run.

When importers on the other hand suffer a similar occurrence they see that prices (returns) do not fall. Thus, the quantity supplied by the exporters and the quantity demanded by the importers will drop by an equal amount. In the long run it is the total change in prices that will fully reflect the full exchange rate pass-through, with the speed of pass-through in this situation clearly depending upon how widely the suppliers differ in efficiency.

The assumption is that exporters do change scale in the long run and that therefore the degree of exchange rate pass-through changes. In such an event, the response is determined in some measure by the actions of competitors. That is, if competitors supplying to and within the destination markets also raise their prices at the same time, then the exporting firms' demand will be less affected by a currency appreciation than if other firms had not acted and so more will be passed forward and sooner.

The actions of competitors is in the context of substitute products that compete with available imports, and their presence or the lack of their presence will be the determinant of the slope of the demand curve, the elasticity of demand for imports within New Zealand. Moreover, the fewer or less perfect the domestic substitutes the greater will be the pass-through.

3.5 Mark-up Model

We know that the exchange rate, ER , is key in any model attempting to estimate pass-through; this we get from our early knowledge of PPP and LOOP. While fully accepting this but still wishing to extend the imperfectly competitive model to incorporate some of the realities, we use the “mark up” model.

There is no shortage of studies that use the “mark up” model of determination, (Woo 1984) (Hooper & Mann 1989) (Kim 1990), (Athukorala 1991), (Dwyer 1994), (Mann 1992/1995/1996), (King & Steele 1998) and (Kenny & McGettigan 1998). Thus what is presented here is an explanation of the mark-up model as adapted from the references described herein.

The foundation of the model is that under conditions of imperfect competition, pricing will no longer be at marginal cost and firms will be in a position to charge a mark up on costs, to earn above normal profits regardless of the time period involved.

The important question is what factors are involved in this mark up over marginal cost and what causes it to vary when responding to an exchange rate change. An answer is found in the direct influence of micro variables and indirectly via the macro variables involved in the dynamic. Now if profit margins are to be considered as a key link between the exchange rate and prices of imports and we have relaxed the assumptions of perfect competition to allow for this, therefore there is a rearrangement of the familiar bilateral LOOP equation (1.1) to:

$$P_{nz} = eP_b \quad (1.4)$$

Where we have changed a to nz and retained b for the other country in order to get equation (1.4). Following on, we next introduce producer profit margins, and hence we have a commonly accepted term for the variable P_b , which gives us $P_b = C_b + M_b$. What this means is that a foreign nation's export

price for a given product from a given firm is related to the firm's marginal cost C plus its mark-up M . Equation (1.4) then becomes:

$$P_{nz} = e(C_b + M_b) \quad (1.5)$$

Thus to utilise Mann (1986) *pass-through* becomes simply:

$$\Delta P_{nz} = \Delta ER + \Delta C_b + \Delta M_b \quad (1.6)$$

Where the change in the import price reflects the change in the exchange rate firstly, and changes in foreign producer costs and their mark-ups secondly. If C_b is constant then P_{nz} will not change greatly given that M_b is allowed some variability in response to exchange rate changes and if exporters choose to do so.

When C_b alters in conjunction with M_b , there will be a greater the effect on the profit margins and therefore a greater change in P_{nz} as exporters respond to price signals. For this reason, an export nation's production costs are included in the choice and make up of the variables prepared for estimation.

Recognising that market structure is important in the ΔP_{nz} , this being in the form of foreign exporter having/not having market power (substitute products). Acknowledgement of this means that consideration can then also be given as to whether or not there are many firms or only a small number, and that there may be forward contracts for wages and purchases that limit the speed and size of any adjustment process. We also need to recognise that producers can exhibit changing returns to scale in production technology and that this will initiate action on the part of the foreign firm.

The demand for imports into New Zealand is therefore a function of domestic demand and foreign supply influences combined, together with some exposure to exchange rate and demand shocks.

As a result of this not only do we need to consider profit margins from the micro perspective but accept that macro-uncertainty can and will impact on profit margins and affect pass-through.

3.6 Model and Variables

Thus the next move is to incorporate some of these dynamic variables and, in observing pass-through as the change of the import price with respect to the nominal exchange rate, we use a model that relates import prices to the exchange rate and other selected variables. Hence we start with the now familiar mark-up model used by (Menon 1995/1996) (King & Steele 1998) and (Kenny & McGettigan 1998). With the following a standard adaptation of those they have utilised.

It is assumed that the typical foreign exporting firm sets the home currency export price P_b at a mark-up M_b on the normal per unit marginal cost of production C_b , (1.7). With the New Zealand import price derived by multiplying through by the foreign currency exchange rate ER . (1.8):

$$P_b = M_b \cdot C_b \quad (1.7)$$

$$MP = ER \cdot P_b = ER \cdot (M_b \cdot C_b) \quad (1.8)$$

In this case M now becomes more than the mark-up on costs alone but is the profit margin of exporters to New Zealand and is expected to result from

$$MP = f(NI, CP, ER, FC, FI) \quad (1.9)$$

- MP *Specific Production or Consumption Import.*
- NI *New Zealand Domestic aggregate Demand.*
- CP *Competitive Pressure (Both Domestic and International).*
- ER *Exchange Rate (Country Specific).*
- FC *Exporters Cost of Production (Scale Factors).*

➤ *FI* *The Impact of International Demand Factors Facing Foreign Exporters to New Zealand.*

According to King & Steele (1998) this profit margin is dependent upon changes in domestic demand pressures, from the changing competitive state of the New Zealand business environment; upon demand pressure from all other markets combined; upon foreign cost structures; and on the degree of market concentration. Therefore it is assumed to fluctuate - an occurrence observable through these variables. Therefore the gap between the price of import competing goods and foreign production costs in New Zealand dollars is assumed to be a proxy for local competitive pressure and results in the variable *CP*.

As a measure of demand pressure facing exporters, capacity utilisation indexes are normally used but in this study the GNI index for respective nations is substituted. For the chosen export nation the variable *FI* is appropriate terminology. This is under the assumption that firms exporting to New Zealand for a given degree of technology operate in temporal regions of increasing returns to scale per unit of output in the long run and in the short run for diminishing returns.

The rationale for this is that in response to overall demand and returns to scale fall, the cost of production rises, and as returns to scale increase costs diminish. Indirectly, therefore, we expect that a GNI price index movement in the same direction is an indication of the demand conditions internationally for a nation's exports.

To directly measure this variability for selected export products, we use their own production cost *FC* as a proxy of the marginal costs facing producers, and according to their scale of operations, it is specific in controlling mark-up and profit margins. This variable measures and accounts for the changes in specific market characteristics of individual industries rather than the overall macro environment such as the *FI* variable. A New Zealand GNI measure *NI*

is included for similar reasons, but also because we seek to see if there are any recognisable demand changes as a response to variable exchange rates.

The inclusion of an *ER* (exchange rate) variable for the foreign nations involved in this study is to recognise that foreign firms cannot accurately forecast the larger macro variables, they are vulnerable to exchange rate and demand shocks.

Finally, these variables which are included in the profit margin function are there because of their considered impact via micro economic market structures and macro uncertainty. This is therefore expressed in the following manner, familiar to (Menon 1995) (King & Steele 1998) and (Kenny & McGettigan 1998):

$$MP = (CP/C.ER)^\alpha (FI.NI)^\beta \quad (2.0)$$

Where the first three variables of the first term (*CP/C.ER*) are considered to be able to directly influence the price of imports through exporters profit margins whilst the two variables (*FI.NI*) that make up the second term are thought of as less direct. The alpha and beta values and their significance to the model are explained directly after equation (2.2). The approach used here is common to many if not all of the recent studies on pass-through and most certainly those conducted and published within the bounds of New Zealand, witness King & Steele (1998) as an example.

What is different in this study from that of contemporary studies is the inclusion of *FI* and *NI* to measure demand pressures facing exporters in their home economy and demand at home. A more common approach is to use capacity utilisation indexes and only those for the export nation.

Substituting (2.0) into (1.8) returns the following, which is rearranged and we have (2.1) and (2.2):

$$MP = ER.FC \{ (CP/C.ER)^\alpha (FI.NI)^\beta \} \quad (2.1)$$

$$MP = CP^\alpha . ER^{1-\alpha} . FC^{1-\alpha} . FI^\beta . NI^\beta \quad (2.2)$$

Assuming as per King & Steele (1998) that a rise in the import competing price (meaning a positive value for α on CP) relative to foreign costs implies a lessening of competitive pressure in the import nation and an opportunity for foreign exporters to increase their profit margins and or market share. If negative then the reverse is the option.

A positive β indicates that when demand is high internationally/domestically and foreign exporters are at their optimum they will increase prices and hence profits rather than changing scale. If demand is low and we have a negative β , reflective of a negative demand shock, then foreign exporters may reduce prices rather than face operating in a region of diminishing returns to scale.

Equation (2.2) is then changed to logs (see Hooper & Mann 1989, Menon 1995, King & Steele 1998 and Kenny & McGettigan 1998):

$$\ln mp_t = \alpha \ln cp_t + (1-\alpha) \ln er_t + (1-\alpha) \ln fc_t + \beta \ln fi_t + \beta \ln ni_t \quad (2.3)$$

Initially our α determines the amount of exchange rate pass-through with respect to a changing ER but it is also more than that, when described in the above form, the coefficient on er is complementary to cp and fc , that is equal in magnitude to changes in fc and er .

The essential pass-through coefficient is determined with respect to the exchange rate, $1-\alpha = \phi$ (pass-through). This is where we expect $0 < \alpha < 1$, which in turn means:

If $\phi = 1$ then pass-through = nil.

If $\phi = 0$ then pass-through = complete.

If $0 < \phi < 1$ then pass-through = partial.

Explaining the first statement, if FI is held constant then the foreign exporter sets its export price equal to its own costs and the exchange rate change, with foreign costs holding no influence. If at the other extreme there are, in the import markets, no import competing industries in existence, then the pass-through will be complete and the changes in the exchange rate and competitive pressures are fully passed-through and LOOP holds.

That is essentially the long-run position. To introduce transitory differences between short-run/long-run equilibrium positions, a k period lag is placed on the exchange rate variable er , in assuming a less than instantaneous adjustment of prices to any exchange rate change. The distributed lag on the exchange rate is also considered a reflection of exporter's profit margins altering over time. The form this lag takes is (see Chatterjee & Gani 1994):

$$0 \leq \sum_{j=0}^k \alpha_{1j} \leq 1 \quad (2.4)$$

A one-period shipping lag is assumed to all intents and purposes already in existence given the difference over time from FOB prices to CIF per unit prices used in the estimation. Given the lagged variable the pass-through equation is now (2.5):

$$\rho = 1 - \sum_{j=0}^k \alpha_{1j} \quad (2.5)$$

With equation (2.3) now becoming:

$$\ln mp_t = \alpha_1 \ln ps_t + 1 - \sum_{j=0}^k \alpha_{2j} \ln er_{t-j} + 1 - \alpha_3 \ln fc_t + \beta_1 \ln fi_t + \beta_2 \ln ni_t \quad (2.6)$$

To complete the estimation version of the model (2.6) we introduce an error term in order to recognise the many other factors that influence import prices and are not directly included in the model.

Finally, a constant term is added which represents economically the average value of the import price for good (j) in time (t), when the independent variables cp , er , fc , fi and ni are equal to zero (held constant). With the addition of these two we can now redefine the models parameters and relax the theoretical assumptions made in relation to the meaning of coefficient values as per equation (2.0) onwards to arrive at:

$$\ln mp_{it} = \beta_0 + \beta_1 \ln cp_{it} + 1 - \sum_{j=0}^k \beta_{2j} \ln er_{it-j} + \beta_3 \ln fc_{it} + \beta_4 \ln fi_{it} + \beta_5 \ln ni_{it} + e_{it} \quad (2.7)$$

The rationale for relaxing the theoretical parameters surrounding coefficient values and their dependence is the potential endogeneity of many of the explanatory variables. Kenny & McGettigan, (1998) state that for the case of small open economies assumptions about the nature of variables and their relationship may be restrictive, resulting ultimately in potential bias and inefficiency of estimations.

Equation (2.7) is essentially as King & Steele, (1998) describe it, a long-run relationship. To take account of the time series nature of the task, and access the temporal and interactive nature of exchange rate pass-through a distributed lag model is proposed. It is intended to take the form for each explanatory variable of:

$$\sum_{j=n}^{k_r} \beta_n Z_{it}$$

Where n is a number greater than or equal to zero indicative of the specific independent variable, k is also greater than or equal to zero and specifically relates to the lag length. Z is our explanatory variable, beta our variable coefficient, r the order of polynomial and lastly m is the endpoint restriction. Hooper & Mann, (1989) use a similar approach (the descriptive terminology in the equation is my own). Equation (2.8) would then take on the form.

$$mp_{t-1} = \beta_0 + \sum_{j=n}^{k_m^r} \beta_1 cp_{t-1} + 1 - \sum_{j=n}^{k_m^r} \beta_1 er_{t-1} + \sum_{j=n}^{k_m^r} \beta_1 fc_{t-1} + \sum_{j=n}^{k_m^r} \beta_1 fi_{t-1} + \sum_{j=n}^{k_m^r} \beta_1 ni_{t-1} + u_t \quad (2.8)$$

The concept of exchange rate pass-through as represented in (1.4) and is the extent to which foreigners adjust their foreign currency prices to the New Zealand market. As cited by Phillips, (1988) econometric studies of *pass-through* adopt the approach of relating the observed domestic currency prices of imports in order to approximate as a measure of exchange rate changes.

A variable used to control for the influence of other factors that impact upon the foreign currency price of imports to New Zealand also needs to be used. In this instance, the variable *FI* (defined page 17 & 18) is used in preference to any suitable world price index, and is reflective of the impact of all foreign markets on the prices of exports. The rise or fall of international demand is expected to be indicative of foreign currency export prices reaction for all markets. The simplest model of estimation is then:

$$\ln mp_t = \alpha_0 + \sum \beta_1 \ln er_t + \chi_2 \ln fi_t + \mu_t \quad (2.9)$$

As this study is essentially a Stage I¹⁹ pass-through investigation and therefore equation (2.9) is very appropriate. It has in place an unrestricted lag, which can appropriately represent the exporter adjustment and response to change in the exchange rate, in terms of currency prices and effects on profit margins. Looking for clearer feedback on the response of import prices to change, the effects of foreign and domestic markets must be included and thus we arrive back at equation (2.7) which will become the mark-up model with the $1-\alpha = \phi$ (pass-through) concept retained:

$$\ln mp_{it} = \alpha_0 + \beta_1 \ln cp_{it} + 1 - \sum_{j=0}^k \beta_{2j} \ln er_{it} + \beta_3 \ln fc_{it} + \beta_4 \ln fi_{it} + \beta_5 \ln ni_{it} + \mu_{it} \quad (3.0)$$

¹⁹ Stage I of pass-through refers to the respondent price of production and consumption inputs across the docks on arrival in the destination market.

3.7 Data

All the data used for this investigation of pass-through are quarterly observations covering the period 1988(I) through to 1997(III). The period chosen represents a structural break²⁰ in exchange rate management for New Zealand. Most of the data is readily available from reference material and each exact variable source is listed. There are five sub aggregates selected for this study:

- Mineral fuels, mineral oils and products of their distillation (*code 27*).
- Plastic and articles thereof (*code 39*).
- Mechanical machinery: Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof (*code 84*).
- Electrical machinery and equipment and parts thereof; sound recorders, television and sound recorders and reproducers, parts and accessories of such articles (*code 85*).
- Vehicles; other than railway or tramway rolling stock, and parts and accessories thereof.

All data in relation to these products is derived from Statistics New Zealand and the selection of these particular products came from the 1996 figures found in (*Treasury, 1997*). They were chosen according to their respective dollar values, and the selection of nations used are by size (volume) the four largest exporters to New Zealand for the same period.

In Table 1 we present the NZ imports of factors of production²¹ and consumption coming from the four selected markets. All are in a form that is a

²⁰ Pre 1985 New Zealand maintained a fixed exchange rate. Post 1985 the exchange rate system was of a managed float.

²¹ Factors of production are inputs in the production process.

percentage of the total amount imported for that specific product from all nations. The country columns are then totalled to indicate the quantity of the overall importation of that specific product which is attributable to those countries. These import product shares of the four major trading partners are then used as a weighting system to construct the necessary aggregate and individual indexes appropriate for analysis.

Table 3.1 Proportion of Imports²² From The Four Selected Foreign Markets, 1996

<u>NZSIC²³</u>	<u>Australia</u>	<u>Japan</u>	<u>UK</u>	<u>USA</u>	<u>% of Total MP</u>
Mineral Fuels (27)	0.3619%	0.0017%	0.0012%	0.0358%	40%
Plastics (39)	0.2447%	0.0685%	0.0584%	0.2282%	60%
Mech Machn (84)	0.1087%	0.1234%	0.0519%	0.3183%	60%
Elect Machn(85)	0.1449%	0.1343%	0.0503%	0.2080%	54%
Vehicles(87)	0.1825%	0.5243%	0.0586%	0.0597%	82%

For use in changing variables into real rather than nominal values a quarterly GDP deflator series was constructed for New Zealand and the four nations exporting production inputs to New Zealand. It covers the period 1984 (II) to 1997 (III).

All data series used are transformed into index form with 1988 as the base year for all indexes. All prices not already in New Zealand dollars have been transformed accordingly.

The variable *MP* is the real import price in New Zealand dollar of the production inputs into New Zealand from each specific export nation. They are converted into an index with the base year 1988.1 and the value 100. The weightings as per Table 1 are then used to transform these indexes into an

²² The imports were selected according to their dollar value (cost to NZ in NZ dollars), and descend in order of importance.

²³ New Zealand Standard Industry Classification codes and product definition.

aggregated series incorporating all product (i) at time (t). Data for this variable was obtained from Statistics New Zealand, it was unavailable in the form required from official statistical publications.

The real exchange rate²⁴ is ER), which in index form, is measured by the weighted average of the real exchange rate NZD per foreign currency for the four major import nations. It is based on the 1996 average import shares as per Table 1. The nominal exchange rate is taken from the various years and months Key Statistics publications (Statistics New Zealand 1984/1998) and checked against the Reserve Bank's series.

The real exchange rate is defined as per Chatterjee and Gani (1994) where the nominal rate is adjusted for price levels at home and abroad. The method of weighting used throughout for the transformation of variables is as described for the exchange rate:

$$ER = \frac{\sum P_t Q_{o_i}}{\sum P_{o_i} Q_{o_i}} * 100$$

Here, the weighted exchange rate index (ER) for product (industry) in period t is calculated when P_t is the nominal exchange rate for product i in the current period, Q_{o_i} are the weights for product i and P_{o_i} is the base period nominal exchange rate for product i .

The variable CP , equation (1.9) is a proxy of competitive pressure faced by exporters in their destination markets and is found in the ratio of the New Zealand producer price index to the foreign cost of production indexes. The foreign producer costs are also used for the variable FC , equation (1.9). The New Zealand producer price series was obtained from the Key Statistics publications, while the foreign producer price indexes from the OECD publication (Indicators of Industrial Activity 1984/1998).

²⁴

The real exchange rate, sometimes called the terms of trade, is the relative price of the goods of two countries. It tells us the rate at which we can trade goods of one country for the goods of another.

Foreign income, FI , equation (1.9) uses the proxy of the four selected markets GNI data deflated by their respective GDP price deflators. This is then converted into New Zealand dollars and changed into an index. This information was obtained from the IMF publication (International Financial Statistics 1983/1998). New Zealand domestic demand pressures NI , equation (1.9) also uses a GNI series as a proxy, it was obtained from Statistics New Zealand (1984/1998).

The following page (44) contains the GDP deflator series constructed for use in transforming nominal figures into real. Computations for all foreign nations were conducted on data obtained from the OECD data published in Quarterly National Accounts (1997). The New Zealand series is a compilation of several individual series, available on request from the offices of Statistics New Zealand.

Table 3.2 GNI Inflation Measure, Percentage Change 1/4 To 1/4, 1984 II-1997 III.

YEAR	Quarter	New Zealand	Australia	Japan	United States	United Kingdom
1984	II	2.76%	0.02%	0.51%	0.75%	1.80%
	III	2.24%	1.85%	0.57%	0.87%	0.80%
	IV	2.33%	0.85%	0.99%	0.73%	1.60%
1985	I	4.38%	1.22%	0.20%	1.06%	1.16%
	II	4.79%	2.00%	0.71%	0.80%	1.72%
	III	3.31%	2.30%	0.28%	0.64%	1.25%
1986	IV	2.50%	1.31%	0.41%	0.87%	1.46%
	I	0.21%	1.62%	0.44%	0.45%	0.20%
	II	8.09%	1.45%	1.02%	0.51%	0.41%
1987	III	3.05%	1.83%	-0.08%	0.77%	0.56%
	IV	3.50%	2.28%	-0.18%	0.75%	1.09%
	I	3.25%	1.77%	0.01%	0.78%	1.52%
1988	II	4.04%	1.67%	-0.20%	0.72%	1.45%
	III	0.91%	2.04%	0.32%	0.78%	1.38%
	IV	0.55%	1.47%	-0.04%	0.91%	1.16%
1989	I	3.58%	2.07%	0.33%	0.68%	1.01%
	II	1.86%	2.14%	-0.04%	1.05%	1.77%
	III	1.01%	3.06%	0.34%	1.26%	1.98%
1990	IV	1.18%	1.18%	0.47%	0.89%	2.23%
	I	1.40%	2.39%	0.02%	1.14%	1.43%
	II	2.23%	1.43%	1.21%	1.05%	0.98%
1991	III	0.19%	1.36%	0.65%	0.82%	2.09%
	IV	4.09%	0.93%	0.78%	0.83%	2.07%
	I	-0.33%	1.38%	0.08%	1.22%	1.34%
1992	II	0.34%	1.63%	0.83%	1.26%	0.79%
	III	0.01%	-0.07%	0.25%	0.09%	2.59%
	IV	0.54%	1.02%	0.75%	1.94%	0.38%
1993	I	-0.54%	0.19%	0.83%	1.21%	1.98%
	II	1.33%	0.01%	0.49%	0.75%	2.42%
	III	0.63%	1.08%	0.58%	0.72%	0.74%
1994	IV	-1.07%	0.54%	1.07%	0.62%	1.31%
	I	0.17%	0.12%	-0.12%	0.82%	0.68%
	II	1.54%	0.16%	0.79%	0.66%	2.12%
1995	III	0.31%	0.275	-0.04%	0.38%	0.37%
	IV	1.16%	0.215	0.30%	0.70%	0.14%
	I	0.89%	0.93%	0.03%	0.94%	1.02%
1996	II	0.17%	0.12%	-0.08%	0.49%	1.03%
	III	0.20%	-0.10%	0.48%	0.47%	1.00%
	IV	0.46%	0.46%	0.11%	0.65%	0.10%
1997	I	0.66%	0.17%	0.25%	0.60%	0.35%
	II	0.09%	-0.07%	-0.23%	0.55%	0.13%
	III	0.60%	0.74%	-0.22%	0.64%	0.51%
1998	IV	0.45%	0.13%	-0.39%	0.66%	0.35%
	I	1.09%	0.69%	0.10%	0.80%	0.94%
	II	0.31%	1.01%	-0.51%	0.49%	0.81%
1999	III	0.03%	1.16%	0.33%	0.52%	0.17%
	IV	1.93%	0.22%	-0.22%	0.55%	0.91%
	I	0.05%	0.51%	-0.26%	0.71%	1.08%
2000	II	0.24%	0.67%	0.08%	0.41%	0.32%
	III	0.21%	0.10%	-0.09%	0.64%	0.74%
	IV	0.00%	0.79%	-0.38%	0.46%	0.93%
2001	I	-0.48%	0.61%	0.26%	0.59%	0.22%
	II	0.30%	0.39%	0.71%	0.45%	0.81%
	III	0.23%	-0.07%	0.34%	0.36%	0.70%

3.8 Estimation

In estimating time series data, such as that in use for this study, the first goal is the identification of the pattern represented by the sequence of data collected, and the second is that of forecasting and predicting. With regard to the first, in identification of any trend the first realisation is that as most time series data is found to consist of systematic pattern and random noise, with both often found when using real life data. Nonetheless this does not represent a major problem as the noise in time series data can be successfully filtered out, and the pattern then accounted for.

This is managed through early data analysis and then the pattern/trend is re-describing as a linear function, that is transforming the data by changing all to logs, with the addition of a polynomial function for all estimations - a procedure followed for these estimations.

Any seasonal pattern present is removed or changed through differencing, a procedure that will either eliminate or highlight such seasonal patterns, as well as making the series stationary, meaning a constant mean, variance and autocorrelation measure through time. Trend data is also made stationary by the same procedure. The estimation may then proceed.

Simplification of the required task, that is data analysis and model estimation, is managed throughout by the use of SHAZAM – Econometric Computer program version 8.0, White (1997).

Descriptive statistical tests were run for each product, for each specific country in the study and for an aggregate grouping of all nations. Equations are then run using OLS estimation methods comparatively in both SHAZAM and EXCEL. Diagnostic tests were also performed specifically in relation to heteroscedasticity, autocorrelation, and normality of residuals. This was a cursory analysis of the fit of the data, model specification and the possibility of spurious relationships, Finally, F tests are run on the key variables to ascertain their significance or otherwise.

The nominal form of pass-through (2.9) is first estimated, with the unrestricted (in terms of polynomial or endpoint) distributed lag on the exchange rate. The simple lag structure adopted assumes that for quarterly data, any lag length longer than four periods has little value as an explanatory variable given the fundamental economic structure of the New Zealand market. The critical value for T is that of a 5% probability level (2.042). Thus we have:

$$\ln mp_t = \beta_0 + 1 - \sum_{j=0}^k \beta_{1j} \ln er_{t-j} + \mu_t \quad (3.1)$$

Moving on to equation (3.2) the variables cp , fc , fi , ni are of a contemporaneous nature and are there to control for competitive pressures in destination markets, international demand, foreign costs of production and demand pressures in destination markets. The final form of the pass-through relationship for this is (3.2):

$$\ln mp_{it} = \beta_0 + \beta_1 \ln cp_{it} + 1 - \sum_{j=0}^k \beta_{2j} \ln er_{it} + \beta_3 \ln fc_{it} + \beta_4 \ln fi_{it} + \beta_5 \ln ni_{it} + \mu_{it} \quad (3.2)$$

From this, a check was run on the order of integration of the data series. OLS analysis assumes that the individual series are all $I(0)$.²⁵ If this condition does not hold then the chance of spurious relationships increases. We begin by testing for the presence of unit roots in the variables using the augmented Dicky-Fuller tests and the Dicky-Fuller cointegration test.

First differencing was used to transform the data and the unit root tests were run accordingly up to fifth order level. Throughout this procedure the critical values were set at 5% with the lag number set by default to the highest significant lag order.

²⁵

If an economic time series is known to exhibit stationarity (mean, variance and correlations do not change over time), then in relation to cointegration it is considered integrated of the order zero and therefore denoted as $I(0)$.

Some series were found to be neither non-stationary in levels, nor in first differences. Given this, then equation (2.8) can only be assumed valid in estimation if there exists, a linear combination of the levels of the variables that are cointegrated. This means that a stable long-run equilibrium relationship is required between the variables.

3.9 Lagged Models

Time series data analysis lends itself to either distributed lag models or vector auto regressive models. Here we use a distributed lag model, (Hooper & Mann 1989), and (Swamy & Thurman 1994) where variations in import prices are determined by current and lagged values of the explanatory variable(s), plus a random disturbance.

In such a model, the explanatory variables are considered exogenous, but as already mentioned, the difficulty with this is that many variables may in fact be endogenous, leading to biased and inefficient coefficients. This simultaneous nature of the data, though, is a fact of econometric life and can result in estimated parameters that may not be particularly informative.

The estimation is of a finite distributed lag model, where we consider that the effect of change is exhausted over n periods. As this is a conventional linear model we estimate using OLS. Expecting multicollinearity to be evident in the t tests for lag coefficients and the high R squared figures finding for linear dependence among explanatory variables, we use non-sample information to solve this problem.

An Almon polynomial distributed lag is used to improve the coefficient estimates. Running of the equations with up to 24 lags finds for a third degree polynomial, which has the effect of smoothing the lag pattern, and providing a linear restriction which is expected to increase estimation precision and reduce variance.

In the absence of any hard data on how long the changes take to completion if at all we fit an endpoint restriction on the right-hand side of the polynomial. Given the sample size there is a restraint on the number of lags on all variables at one time. From reasoning presented earlier in this section we have settled on four. Thus our estimated model becomes:

$$mp_{t-1} = \beta_0 + \sum_{j=n}^{k_m^r} \beta_1 c p_{t-1} + 1 - \sum_{j=n}^{k_m^r} \beta_1 e r_{t-1} + \sum_{j=n}^{k_m^r} \beta_1 f c_{t-1} + \sum_{j=n}^{k_m^r} \beta_1 f \tilde{i}_{t-1} + \sum_{j=n}^{k_m^r} \beta_1 n i_{t-1} + u_t \quad (3.3)$$

That is where $K=4$, lag length
 $m=3$, polynomial
 $r=2$, endpoint restriction.

This, in its final form, is ready to be used in conjunction with country specific data initially and then for investigating an aggregated version of the data. From these procedures and the resultant output, objective analysis is undertaken such that informative material on how changes in the exchange rate influence the prices of imports in current and subsequent periods is explained.

3.10 Almon Polynomial Distributed Lag Model

"The distributed lags analysis such as the one used here is a specialised technique designed to examine the relationships between variables that contain some delay (lag)... In our case the event is a change in the exchange rate and a response in the dependent variable (s). Time lagged correlations are recognised as being quite commonly found in econometrics where we have independent or explanatory variables that affect the dependent variable with some lag. The distributed lag method allows investigation of those lags..."

In the general form, the model describes the relationship between variables as a simple linear relationship:

$$Y_t = \sum \beta_i * x_{t-i}$$

Where the dependent variable at time t is expressed as a linear function of x measured at times $t, t-1, t-2$, etc. Thus the dependent variable is a linear function of x and x is lagged by 1, 2, etc time periods. The beta weights (β_i) can be considered slope parameters in this equation... Any weighting for the lagged time periods that are found to be statistically significant enables us to conclude that the Y variable is explained with the respective lag...

Use is made of the Almon distributed lag for the simple reason that the values of corresponding independent variables are highly correlated, in the context of multiple regression this general computational problem is termed multicollinearity. Almon in 1965 introduced a procedure to reduce this multicollinearity problem...

Multicollinearity is a common problem encountered in econometrics with some of the variables responsible unable to be eliminated immediately prior to estimation. As the number and complexity of variable selection and preparation increases it is often not immediately apparent that some variables could be surplus to requirement. Once involved in the estimation, the predictors can then only indicate their redundancy when used alongside other variables.

Specifically, Almon suggested expressing each weight in the linear regression equation in the following manner:

$$\beta_i = \alpha_0 + \alpha_1 * i + \dots + \alpha_q * iq$$

He could show that in many cases it is easier (as this procedure avoids the multicollinearity problem) to estimate the alpha values rather than the beta weights. Note that in this method the precision of the beta weight

estimates is dependent on the degree or order of the polynomial approximation.

A limitation of this technique is that the lag length and the correct polynomial degree are not known a priori. The effect of miss-specification for parameters is therefore high and can be potentially serious in respect to biased estimations...". (StatSoft Inc 1995).

Chapter 4

Export Update

4.1 Hypotheses

1. New Zealand fulfils the small country assumptions with regard to exchange rates and international trade.
2. Pass-through is found to be complete and rapidly approaches zero.

4.2 Update

Importance was placed on a rebuilding of the database used in the study. Original data was found incomplete and did not extend to a long enough time period. The essential variable values relating to import prices underwent a classification change in 1988 rendering pre- and post-1988 ANZSIC series for some codes dissimilar to each other. Because of these difficulties the data used encompasses a similar time span of years but does now cover the period 1988 (II) to 1997 (III). There is now an established solid foundation from which to extend further study on this topic with the intention of monitoring and evaluating changes within and without the specific New Zealand circumstances.

4.3 Estimation

Descriptive and statistical tests were run with correlation matrices inspected; performed HET and Auto-correlation tests with options, first differences, various lag lengths, tests to ascertain the functional form, and ran Pool GLS and Auto estimations. Further investigation was conducted of the lag restrictions²⁶ with an F test and a Likelihood ratio test.

²⁶ The relevant test outputs are not included herein but are available upon request to the author.

F testing of the key variables of the model completed this aspect of the research.

Final estimation runs for the model (Chatterjee and Gani' 1994, page. 7) utilised ordinary least squares regression analysis upon the form:

$$XP_t = \beta_0 + 1 - \sum_{j=0}^k \beta_{1j} ER_{t-j} + \beta_2 TFC_t + \beta_3 FI_t + \beta_4 PS_t + u_t \quad (1)$$

4.4 Results

All the core results are included below in the tabulated format. The key variable is highlighted in bold print. All T statistics are reported beneath their respective coefficient estimates and are bracketed and in *italics*.

Table 4.1 Regression Results of Exchange Rate Pass-Through in Resource-Based Manufactured Exports of New Zealand

Industry	<i>DAIRY</i>	<i>LEATHER</i>	<i>WOOD</i>	<i>PAPER</i>	<i>CARPETS</i>	<i>ALUMINI</i>
R-square	0.7026	0.6089	0.8637	0.3302	0.1124	0.4789
adjusted Variable	Estimated	Estimated	Estimated	Estimated	Estimated	Estimated
Name	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
er	0.0186	-0.0156	0.0690	0.0453	0.0040	0.01792
(<i>T-ratio</i>)	(<i>4.395</i>)	(<i>-5.204</i>)	(<i>8.703</i>)	(<i>3.990</i>)	(<i>0.488</i>)	(<i>4.673</i>)
tfc	-0.0040	0.0244	0.0403	0.0188	0.0263	0.0160
(<i>T-ratio</i>)	(<i>-0.448</i>)	(<i>3.047</i>)	(<i>1.895</i>)	(<i>0.850</i>)	(<i>1.176</i>)	(<i>1.552</i>)
fi	-0.0202	0.0115	-0.0676	-0.0842	0.0037	-0.0288
(<i>T-ratio</i>)	(<i>-2.387</i>)	(<i>2.011</i>)	(<i>-4.760</i>)	(<i>-3.874</i>)	(<i>0.232</i>)	(<i>-4.202</i>)
ps	0.0193	-0.0104	0.0004	-0.0121	0.0025	-0.0084
(<i>T-ratio</i>)	(<i>2.374</i>)	(<i>-2.437</i>)	(<i>0.049</i>)	(<i>-1.126</i>)	(<i>0.212</i>)	(<i>-1.790</i>)
CONSTANT	3.5454	3.0805	0.1268	7.1599	1.3242	4.5924
	(<i>3.239</i>)	(<i>3.520</i>)	(<i>0.056</i>)	(<i>2.696</i>)	(<i>0.542</i>)	(<i>4.202</i>)

4.5 Analysis

- All exchange rate signs are positive excepting Leather, indicating the price sensitivity of that product in international markets and of the type of good it is in its destination markets.
- *T* values indicate significance of the ER variable, and while the coefficients of other variables did not indicate any independent influence over export prices, their values provide supporting evidence for the following statements:
 - Exporters of dairy and leather goods are concerned with maintaining prices constant in foreign currency terms by accommodating movements in the exchange rate via their profit margins.
 - Wood, Paper, Aluminium increased their product returns as a result of increased FI in destination markets not as a direct result of currency movements.
 - There is no real difference across industries in regard to pass-through, only in the circumstances specific to that product within its destination market.
 - For Dairy products, foreign income and the price of substitutes are significant factors.
 - Leather goods find more for TFC at home and the price of substitutes overseas for an impact upon returns per unit.
 - Textiles show significance only for the exchange rate variable. The key to this is that its lagged response is inversely related and is larger in magnitude²⁷.

²⁷

While lagged results are not tabulated they are available upon request to the author.

Assuming that New Zealand exporters comply with international trade theory, we expect them then to operate a mark up on cost approach to pricing. Because of this, the high values of absolute pass-through (98%, 98%, 93%, 96%, 99%, 98%) in tandem with the low real values for export price changes (2%, 2%, 7%, 1%, 2%) provide support for the concept current in the literature of some variation in profit margins occurring.

4.6 Discussion of results

The exchange rate coefficient is very similar to that estimate by Chatterjee and Gani (1994) for the variable Dairy and that for Aluminium with the latter considerably stronger than previously. A stronger influence is exhibited also in all of the other variables, Leather, Wood, Paper and Carpets, with all of the last four carrying a different sign to that in the previous study. That is a complete reversal of behaviour.

All of the *T* ratios listed for the exchange rate regressor were of greater value than that previously realised in the Chatterjee & Gani's (1994) study. It is considered that while a comment in the same vein could be made of every other regressor/variable estimation combination there is far too great a variability from that seen in the 1994 study to comment specifically without further in depth and more specific analysis.

We can assert from the theory put forward in Chapter 3 that for a rising exchange rate a movement in the same direction for the product of interest would indicate increasing competitive pressures in export markets, and the opposite will occur, for a movement in the other direction. Therefore, while Dairy and Aluminium continued to exhibit this basic theoretical posit, leather did not continue to do so. The other products Carpets, Wood and Paper now also display this fundamental behavioural pattern. A change from the 1994 study results. Overall though there is no change in real terms for the pass-through position from that recorded in Chaterjee & Gani (1994).

4.7 Conclusion

In closing, exchange rate changes impact via the margins and not in total per unit returns for export products. The average pass-through for all products estimated is 97%, a figure not considerably different from one²⁸ and therefore is assumed complete pass-through. Accompanying this is the lagged result, indicating the completion for all intents and purposes of pass-through rather rapidly.

The results therefore find for the stated hypothesis and suggest that it is highly unlikely that any of these industries are able to exert much influence in setting prices in the destination markets studied.

The many barriers to trade that face New Zealand exporters should not be forgotten when analysing these results for they also direct the industry approach and response for specific types of goods in destination markets. While New Zealand may operate an 'open' economy with few barriers to trade, it does not operate in an international trade environment that is equally so.

Therefore, on the basis of these results, it is doubtful that the response of these products in these markets to exchange rate changes will aid radically in altering the nation's current account position in the face of a changing New Zealand currency, *ceteris paribus*. It is inherent in all the products examined, that is for all but Leather goods, that in response to a rising dollar the impact on demand is somewhat less than positive and in real terms would appear as being a reduction in dollar returns to exporters.

In closing, while keeping in mind the small selection of products chosen and their diversity, the exchange rate does not then fully explain competitiveness,

²⁸ If the coefficient of exchange rate pass-through (β) = 1 then pass-through is nil. If (β) = 0 then pass-through is complete. If zero < (β) < one, then pass-through is partial.

demand or returns in the New Zealand context and most certainly within the assumptions of the model chosen to describe it.

Chapter 5

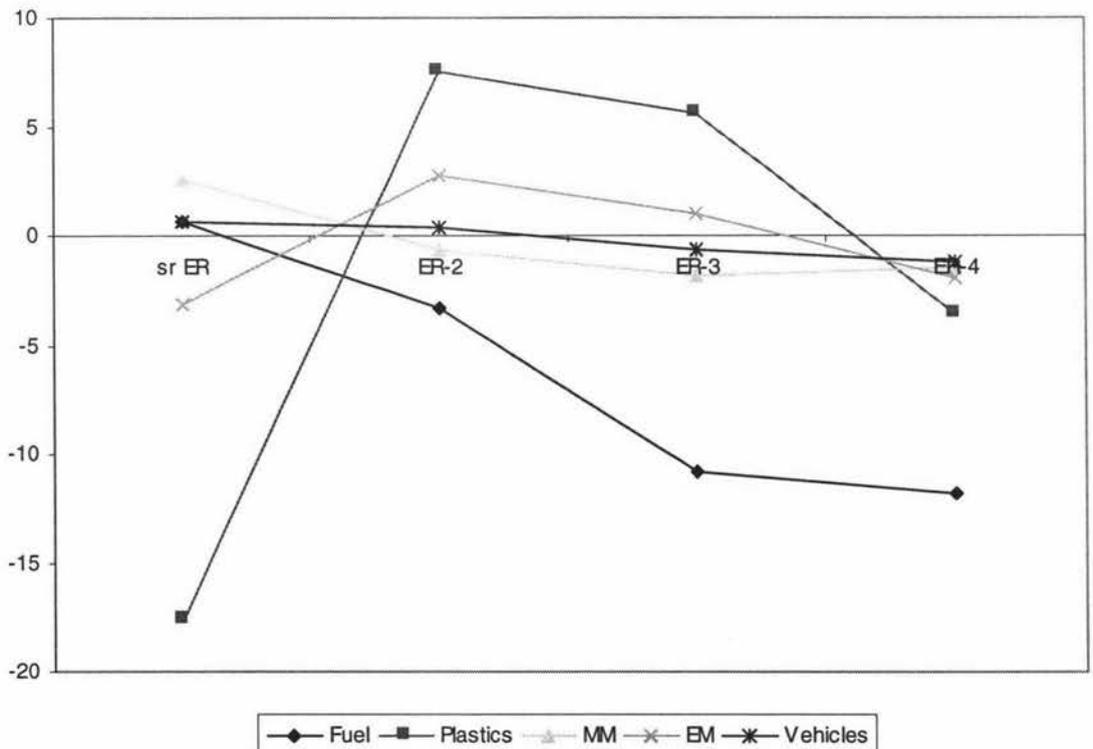
Empirical Findings and their Interpretation

5.1 Australia

Table 5.1 For Selected Imports of Australian Origin, the Results of Estimation for the Exchange Rate by a Distributed Lag Model

	Fuel	Plastics	MM	EM	Vehicles
Sr ER	0.608	-17.590	2.541	-3.098	0.687
(TR)	(0.121)	(-2.228)	(1.285)	(-2.627)	(0.349)
ER-2	-3.320	7.563	-0.621	2.709	0.362
(TR)	(-1.005)	(1.454)	(-0.477)	(1.654)	(0.134)
ER-3	-10.189	5.560	-1.810	1.041	-0.669
(TR)	(-4.902)	(1.699)	(-2.211)	(0.688)	(-0.269)
ER-4	-11.810	-3.620	-1.458	-1.922	-1.195
(TR)	(-4.097)	(-0.7973)	(-1.285)	(-2.07)7	(-0.784)
R^2	0.99	0.83	0.91	0.96	0.92
DW	2.048	2.305	2.4588	2.5397	2.1639
JB	1.115	0.300	4.668	0.377	0.983

Figure 5.1 For Selected Imports of Australian Origin the Results of Estimation for the Exchange Rate by a Distributed Lag Model

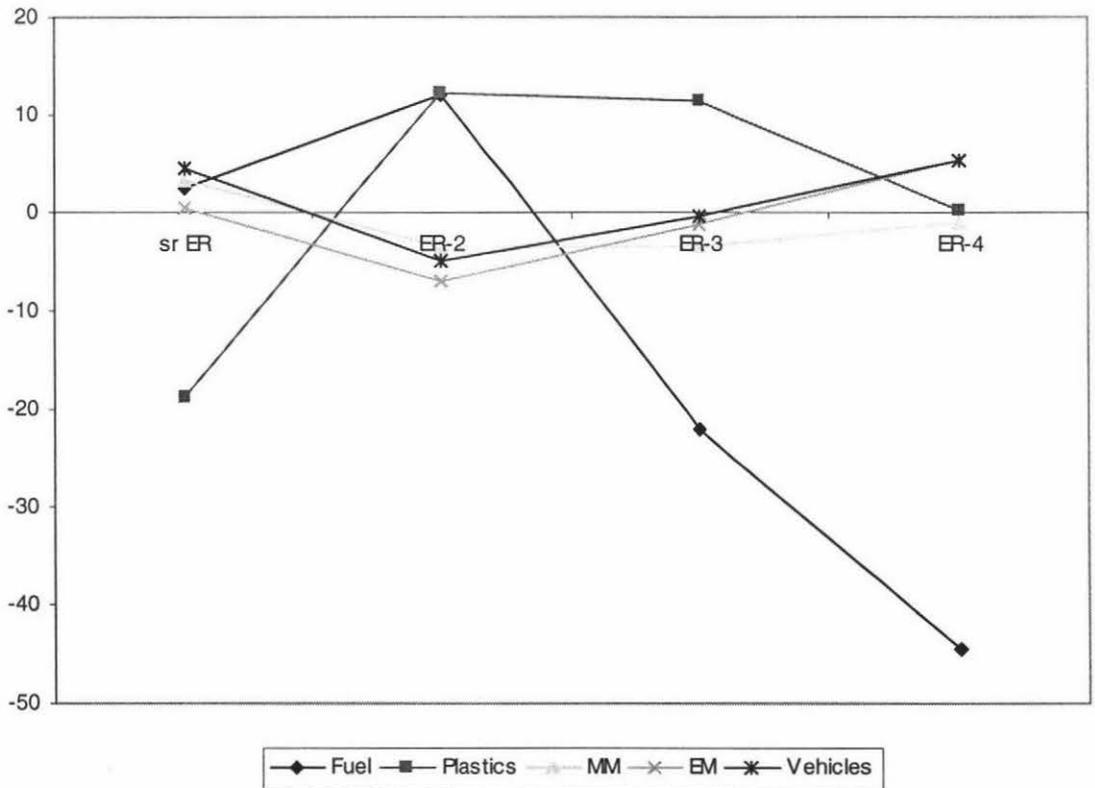


5.2 Japan

Table 5.2 For Selected Imports of Japanese Origin, the Results of Estimation for the Exchange Rate by a Distributed Lag Model

Sr ER	Fuel	Plastics	MM	EM	Vehicles
	2.364	-18.779	3.210	0.489	4.388
(TR)	(0.337)	(-2.627)	(1.786)	(0.160)	(1.820)
ER-2	12.042	12.227	-3.518	-6.928	-4.857
(TR)	(2.191)	(2.181)	(-2.496)	(-2.902)	(-1.563)
ER-3	-21.973	11.412	-3.502	-1.174	-0.476
(TR)	(-5.265)	(2.681)	(-3.273)	(-0.648)	(-0.123)
ER-4	-44.411	0.196	-0.933	5.289	5.239
(TR)	(-9.603)	(0.041)	(-0.787)	(2.633)	(2.447)
R^2	0.99	0.59	0.84	0.85	0.93
DW	2.455	2.162	2.883	2.504	2.440
JB	1.051	0.093	0.618	0.418	0.698

Figure 5.2 For Selected Imports of Japanese Origin, the Results of Estimation for the Exchange Rate by a Distributed Lag Model

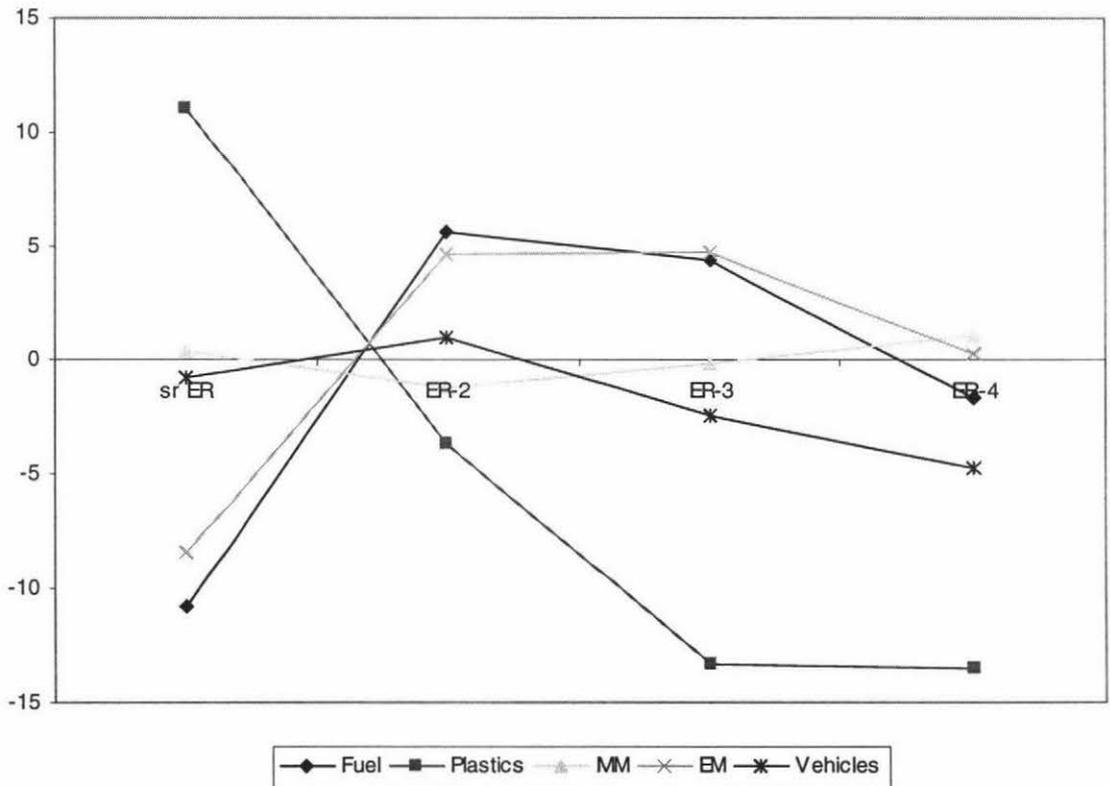


5.3 United Kingdom

Table 5.3 For Selected Imports of the United Kingdom the Results of Estimation for the Exchange Rate by a Distributed Lag Model

	Fuel	Plastics	MM	EM	Vehicles
Sr ER	-10.798	11.028	0.318	-8.399	-0.748
(TR)	(-2.397)	(0.754)	(0.251)	(-2.501)	(-0.418)
ER-2	5.580	-3.7155	-1.196	4.659	0.924
(TR)	(1.549)	(-0.317)	(-1.178)	(1.735)	(0.646)
ER-3	4.427	-13.320	-0.162	4.707	-2.421
(TR)	(1.945)	(-1.802)	(-0.253)	(2.774)	(-2.682)
ER-4	-1.639	-13.508	1.031	0.301	-4.744
(TR)	(-0.559)	(-1.419)	(1.249)	(0.138)	(-4.080)
R^2	0.99	0.50	0.86	0.61	0.73
DW	1.6061	2.354	2.104	2.066	1.992
JB	0.260	7.346	0.337	8.679	0.404

Figure 5.3 For Selected Imports of the United Kingdom the Results of Estimation for the Exchange Rate by a Distributed Lag Model

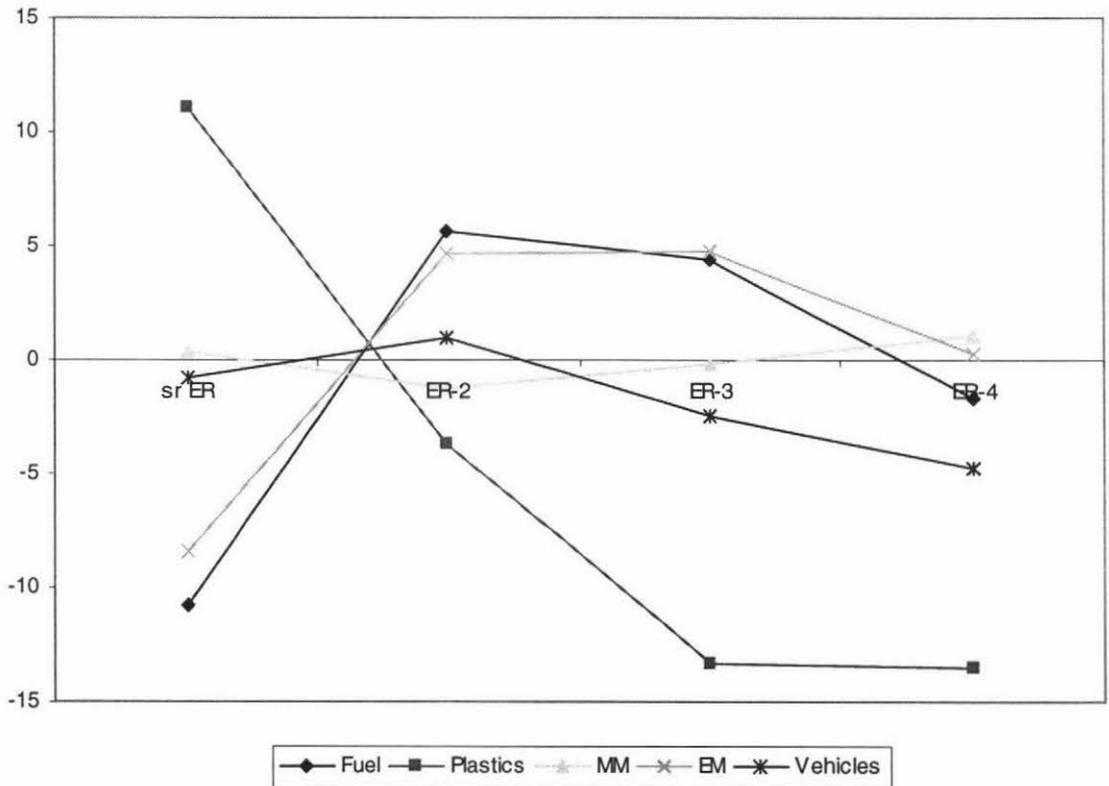


5.4 United States of America

Table 5.4 For Selected Imports of the United States of America the Results of Estimation for the Exchange Rate by a Distributed Lag Model

	Fuel	Plastics	MM	EM	Vehicles
Sr ER	8.158	-25.159	-3.797	3.375	-1.874
(TR)	(1.304)	(-1.691)	(-1.427)	(1.614)	(-0.801)
ER-2	4.285	10.050	-3.618	2.655	1.137
(TR)	(0.916)	(0.904)	(-1.820)	(1.700)	(0.651)
ER-3	-6.270	8.238	0.872	-0.428	0.536
(TR)	(-3.169)	(1.752)	(1.037)	(-0.648)	(0.726)
ER-4	-11.652	-3.982	3.978	-2.454	-0.800
(TR)	(-3.113)	(-0.447)	(2.498)	(-1.962)	(-0.572)
R^2	0.99	0.46	0.79	0.94	0.96
DW	1.512	2.782	1.936	2.250	2.143
JB	2.220	1.409	2.200	0.067	0.014

Figure 5.4 For Selected Imports of the United States of America the Results of Estimation for the Exchange Rate by a Distributed Lag Model



5.5 Aggregate

Table 5.5 For Selected Imports using Aggregated Data, the Results of Estimation for the Exchange Rate by a Distributed Lag Model

	Fuel	Plastics	MM	EM	Vehicles
Sr ER	30.263	-8.016	-0.937	-3.189	-1.527
(TR)	(3.792)	(-0.666)	(-0.493)	(-1.278)	(-0.824)
ER-2	0.909	0.672	0.573	1.313	1.239
(TR)	(0.168)	(0.082)	(0.445)	(0.776)	(0.986)
ER-3	-14.730	0.198	0.906	3.098	1.364
(TR)	(-5.410)	(0.048)	(1.399)	(3.638)	(2.158)
ER-4	0.513	-2.378	0.552	2.536	0.426
(TR)	(-3.163)	(-0.323)	(0.475)	(1.662)	(0.375)
R ²	0.99	0.56	0.89	0.90	0.93
DW	1.871	2.427	2.034	2.431	2.768
JB	0.262	2.256	1.990	1.345	0.656

Figure 5.5 For Selected Imports using Aggregated data, the Results of Estimation for the Exchange Rate by a Distributed Lag Model

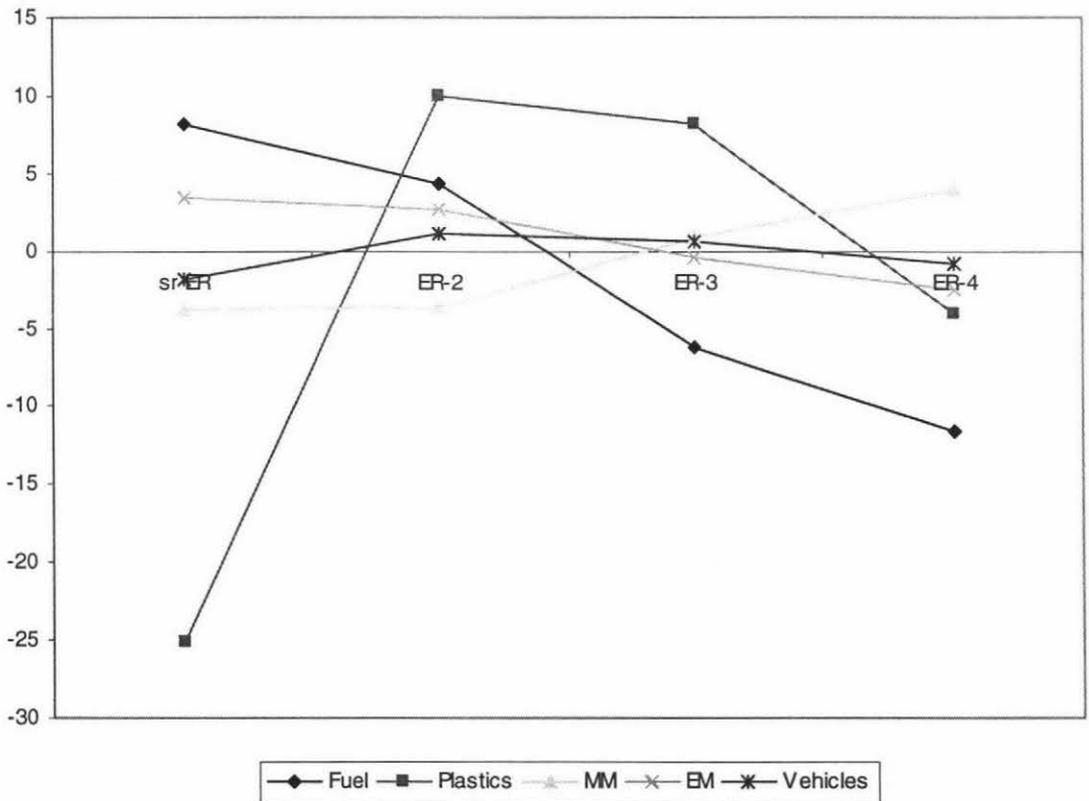


Figure 5.6 For Selected Imports using aggregated data, the plotted logarithmic Values of the Exchange rate against the five imported products

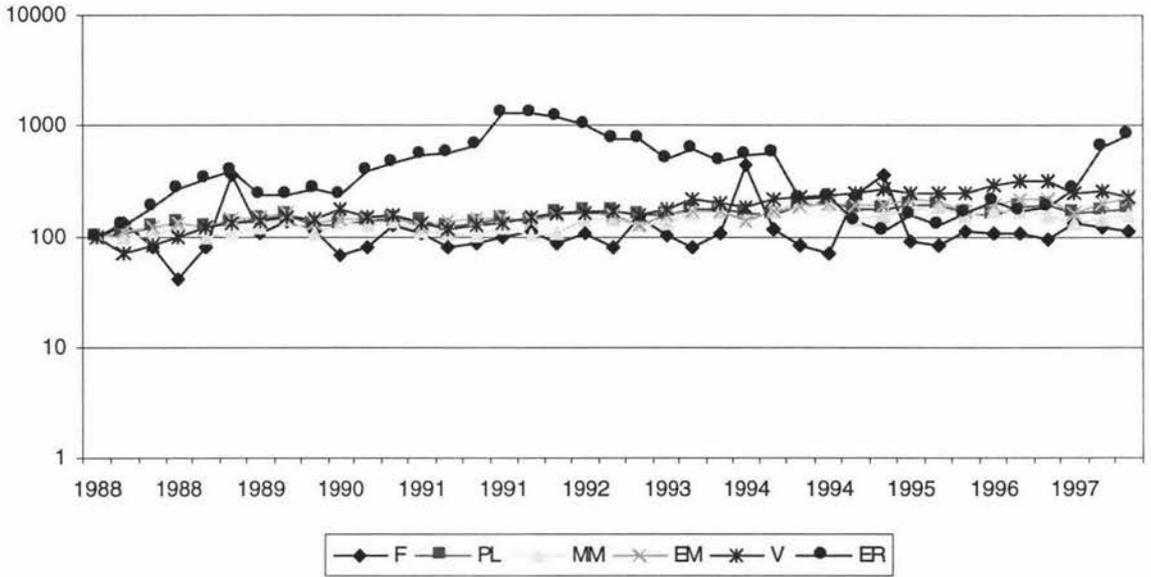
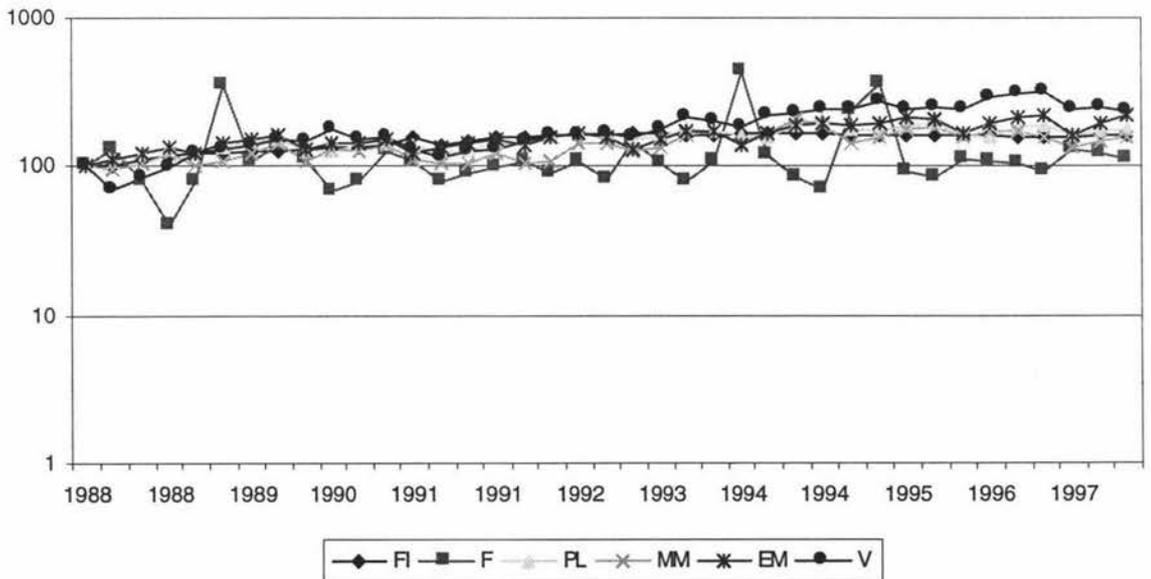


Figure 5.7 For Selected Imports using aggregated data, the plotted logarithmic Values of the *FI* variable against the five imported products



5.6 General Analysis

An overall inspection of the early estimation results indicates that the mark-up model as expressed in the theoretical section would be unable to enlighten us with regard to the time-series nature of the data generated from the New Zealand dynamic. The restrictive pass-through model does not adequately explain the behaviour of the product range selected for this study. This finding is based on the fact that the estimated coefficients are, in almost all cases, greater than unity.

Restrictive runs of the model found in all cases complete pass-through in the immediate short term, making nonsensical any lagged approach superfluous to the analysis, especially as the endpoint restrictions were artificially forcing a fit. Thus, the distributed lag model was run unrestricted in line with the traditional mark-up model of Hooper & Mann (1989), Menon (1995), King & Steele (1998) and Kenny & McGettigan (1998).

Analysis of the data on a basis such as equation 3.1 (page 48) leads to a similar finding, viz complete pass-through for these selected products in the first quarter²⁹. It needs to be remembered also when considering these results that two of the products selected, Mineral Fuel and Plastics are products that belong to a market that is oligopolistic by virtue of their production, supply and control environments, which make them operate virtually in a single integrated world market.

There is an indication that something other than the explanatory variables selected for the study is responsible for the price movements, or rather the lack of them, particularly in those product markets. This would certainly prescribe caution in reading anything into a result produced in regard to Fuel and Plastics. It is in the area of these two products, Mineral Fuel and Plastics that very large seemingly nonsensical results have been obtained in most estimation runs.

²⁹

The results of this analysis (equation 3.0) and other estimations are available from the author on request.

The resulting exchange rate findings for the estimations run in regard to this study³⁰ determine that the results discussed below are for the short term. Those products not mentioned in relation to significance tests were found to be not significant within the postulated relationship for that specific product price.

Australia:

For the products imported from Australia, pass-through was found to be incomplete for Fuel and Vehicles but complete for Plastics, Mechanical Machinery and Electrical Machinery. All products are positively correlated to the exchange rate movements with the exception of plastics and Electrical Machinery. The *T* tests³¹ suggested the significance of associated production costs in New Zealand for fuel, Electrical Machinery being sensitive to competition from substitute products, exchange rate changes and levels of foreign demand internationally.

A strengthening/weakening of the New Zealand dollar does not result in profit margin changes for those products exhibiting complete pass-through. The product in which Australia has a clear dominance in supply is mineral fuel, and they have a position second only to Japan for that of Motor Vehicles. These are the two products that did not attain complete pass-through in the very short term and needed slightly longer than one quarter to achieve it.

The positive correlation reported for all goods would indicate that in an environment of a strengthening New Zealand dollar these selected imports from Australia do not reduce in price. It does not necessarily equate to the opposite effect given a weakening trade weighted dollar.

³⁰ The results of this analysis are available upon request to the author.

³¹ The results of this analysis are available upon request to the author.

Japan:

All products have complete pass-through in the short run except electrical machinery, which has incomplete pass-through. A positive correlation to the exchange rate is the norm with plastics - the only negatively correlated product from Japan. Fuel prices from Japan are, according to the T tests, dependent also upon foreign costs of production, demand for fuel internationally and importantly that of New Zealand demand. The price of substitutes, New Zealand demand and the cost of production, impacts upon mechanical machinery, but it is only New Zealand demand that affects Electrical Machinery. The significant finding for Vehicles was as expected, it being affected by the price of substitute products.

The more than complete pass-through for all products excepting Electrical Machinery suggests no profit squeezing being attempted in the face of adverse exchange rate changes. Japan lacks clear market dominance for all products excepting Motor Vehicles but it still puts up prices when the new Zealand dollar strengthens and reduces prices when it weakens. An interesting finding, indicating perhaps the level of global competition facing Motor Vehicles which makes them keen to maintain market share in even small markets.

United Kingdom:

Mineral fuel products, electrical machinery and vehicles are all negatively correlated with the exchange rate. It is only for plastics and Mechanical Machinery that a positive correlation is exhibited. It suggests complete pass-through for all products except for this country's vehicles and mechanical machinery, for which there is incomplete pass-through. Mineral Fuel products imported from the United Kingdom are sensitive to the level of demand they face internationally and less so by the level of demand within New Zealand. Finally, Electrical Machinery depends on international demand.

The United Kingdom has no significant market share at all relative to the other nations selected but does with respect to the multitude of other exporting nations to New Zealand. Its negative correlation for goods prices and the exchange rate is, as expected. The two products that are positively correlated go against this trend but fall into line with all products by exhibiting a rapid and more than complete pass-through response.

United States of America:

Mineral Fuel and Electrical Machinery products are positively correlated with the exchange rate and plastics, Mechanical Machinery and Vehicles are negatively correlated. All products are complete for pass-through purposes. For significance testing, the price of substitute products is the key finding, with some interest in the costs of production locally for Mineral Fuel products. International demand impacts on Mechanical Machinery, and the price of substitutes for Electrical Machinery.

The correlation matrix is evenly split between positive and negative values. The United States does have a numerical superiority in the supply of Mechanical Machinery, Electrical Machinery and is only just edged out by Australia for Plastics and articles thereof. Therefore in these areas they do assume dominance in the market. Given the market dominance, the fact that there is full and rapid pass-through naturally reflects on the nature of the market they serve and the nature of the goods they supply.

Aggregate Results:

Between them, the four countries chosen and the selected products, cumulatively account for 82% of all Vehicle imports, 54% of all Electrical Machinery, 60% of Mechanical Machinery, 60% of Plastics and 40% of Mineral Fuel imports.

The only product positively correlated with the exchange rate change is Mineral Fuel products, all others are negatively correlated. Pass-

through is complete for all products. Mineral Fuel prices are seen to depend on the degree of competition and the foreign cost structures in relation to their demand internationally. Production costs in New Zealand impact significantly on electrical machinery prices as they do also for vehicle prices.

The price responses following exchange rate changes are more straight forward - when the dollar strengthens, dollar prices fall, and when it weakens, dollar prices rise, something not evidenced in the country specific results.

Distributed Lag Graphs:

The pattern exhibited by all of the graphical outputs was, as expected, given a first differenced, lagged four periods, polynomial of the third order and finished off with an end-point restriction. The magnitude of the variance stands out for fuel and plastics, as does the starting point or rather the size of early pass-through. There is a very high level of pass-through achieved for fuel and plastics by the second quarter. For the other products analysed, the end-point position at the fourth lag appears either at a similar position to its starting point or at a similar value but with a changed sign.

Aggregate Data Graphs:

There is evidence in both graphs of a rising price trend for all imported production and consumption inputs. It is a long-run observation for both, with the product prices neither following nor sharply opposing the plotted exchange rate data. The exchange rate of itself has strengthened over the period of the study, again on a long-run basis. Import product prices do not track the exchange rate in the short run but are in line with the overall trend.

The *FI* variable describes the impact of international (home/abroad) demand factors facing foreign exporters to New Zealand. The variable is plotted against the import product prices with the result that the overall

trend is again a rising one for all. Volatility is apparent in fuel prices only, with all others tracking neatly in a group. This is both a short-run, and a long-run event.

5.7 Discussion of Results

For the findings reported here, there is an acknowledgement that, on an individual country basis, the results and their interpretation are not fully supportive of theoretical postulates. The general finding of this study, using the aggregate results, is that the stated hypothesis (page 2) is found to hold for New Zealand. That is, New Zealand obeys the standard small country assumptions of international trade theory, and that the response, or rather the speed of the response, is extremely efficient for the products selected for this study. Crucially, the aggregate findings support the conclusion that the hypothesis is accepted in statistical terms.

On the basis of the aggregate findings, the position is that, when the trade-weighted exchange rate strengthens, the New Zealand importers of production inputs required by industry do neither decrease nor increase real prices accordingly, but instead accept reduced real returns, sometimes in excess of the exchange rate movement. The reverse is the case for a weakening dollar, there being an increase in real returns, resulting from a cost-plus style pricing system.

For Mineral Fuels and related products, there is an asymmetry of response with indications for increasing prices, again with something in excess of the exchange rate movement. Or, to put it another way, these results reflect the fact that import prices even in the short-run change by significantly more than 100%. The visible result of this overall long-run behaviour is reflected in the trend of rising import prices illustrated in Fig (5.6) on page 63.

This finding is something that, according to Mann (1986) should not be occurring as the globalisation and the opening-up of economies should lead to a lower pass-through and lower profit margins. But what the results find, is more in line with the comments of Fischer (1989) viz. That a small open economy can expect a higher level of pass-through, perhaps a complete one.

The results here in this study have shown that the full (100%+) effect on import prices of a change in the exchange rate are felt within the first quarter. This contrasts with an Australian study suggesting that there are lags although they rarely extend beyond two quarters (Menon 1995).

This study using industry specific data suggests that, over the last nine years 1988 to 1997, the exchange rate changes, on the basis of econometric analysis have given conflicting signals regarding the behaviour of import product prices and the profit margins for foreign suppliers. It can be said that there has been little or no absorption of exchange rate changes except in exceptionally competitive product markets or in markets where an exporting nation has a significant advantage or disadvantage in a particular product. The true nature of industry behaviour is, as described above, a long-term real increase in returns to foreign exporters.

Results produced after estimation of the bilateral data found incomplete pass-through and did exhibit some absorption possibilities. Such products are: electrical goods from Japan, competing against those of the rest of the Asian economies, Motor Vehicles in which it has market dominance. Likewise, Australia operates in a highly competitive market for Motor Vehicles and Fuel, in which they are significant exporters. Mechanical Machinery imports from UK are also considered to be in a competitive market, but one that is dominated by imports from US, and UK has the added geographical disadvantage to consider. This type of result though is a common finding for disaggregated studies of manufactured goods (Lee 1997).

What the aggregate study has shown is that, for our four chosen nations, in the mineral fuels and related products sector there is an important relationship to the changing cost structures facing foreign producers. That is, the scale of operations of the producers in relation to greater world demand for their products and their ability or desire to change in the short run. Highlighted also is the importance of market structure and market share (Dornbusch 1987, Lee 1997). There is also an indication of the importance, in the short-run, of domestic competition locally within the New Zealand market. This conclusion builds on the evidence of Yang (1997) that market structure matters in international price transmissions.

Another of the key findings in regard to Electrical Machinery relates to the costs associated with the New Zealand production dynamic, that is, the costs faced by local manufacturers and maybe also the distributors rather than importers. This last dependency, that for domestic distributors is also intrinsic in the pricing of imported cars into New Zealand.

The Australian position as expounded by Dywer & Lam (1995) has it that the domestic cost variations for inputs supposedly have less influence on importers' mark-up than changes in landed import prices. This implies that importers will view changes in their domestic costs as permanent and therefore decide that product prices need to reflect this. The opposite is the case for changes in the over-the-docks prices that are believed to be reflecting a nation's volatile exchange rate, as these can be viewed as transitory only and subject to change. The aggregate findings for Electrical Machinery and Motor Vehicles suggest that this may well be the case for New Zealand also.

Within the current theories of continuing globalisation, there is now supposed to be an established trend that has producers and exporters viewing the world as a single market place. Mann (1986) and Fischer (1989) commented on this behaviour. Nonetheless, if there is to be a

price to pay then it need only be minimal, something insurable through efficient hedging operations. This is the very point that Mann (1986) supports, suggesting that these concepts should result in smaller long-run pass-through of exchange rate changes to import prices, a view that is not borne out here.

In addition, the increased openness of the New Zealand environment should have, through increased competition, led to the permanent erosion of some profit margins for imports, and again to a more prolonged delay in pass-through following a depreciation of the dollar. This result is not supported by the findings of the present study.

Findings of incomplete pass-through are a common occurrence, found across a broad range of countries, and those that exhibit complete pass-through are according to Menon (1995), at best rare. Our estimates of essentially complete pass-through are then at odds with evidence available for other small open economies. Mareno (1989) has pass-through at 58% for Korea and 74% for Taiwan. Athukorola and Menon (1994) record a 75% pass-through for Swedish manufactured exports. Menon (1995) with regard to Australia finds incomplete pass-through and a rejection of the small country assumption of international price-taking behaviour for imports. Krenin (1977) finds that pass-through tends to vary inversely with the size of the country. While Khosla and Teranishi (1989) find that pass-through is very low for the smaller economies such as Indonesia and the Philippines.

Generally speaking, import prices for New Zealand appear to adjust quite quickly to exchange rate change. Across individual industries, the results for aggregate import prices suggest that exchange rate changes during the complete sample period were on average fully passed through to import prices. The dynamics appear to be relatively simple, with lags in the price adjustments extending only to one quarter. As already mentioned, even for the Australian studies such as Menon (1995), lags rarely extend beyond two quarters.

The mention of New Zealand introduces the work of Winkelmann (1996). That study produced results considered a confirmation of the findings described herein of incomplete pass-through for some products and complete for others. Winkelmann explains her results as a response based on profit maximising of importers; price discriminating firms operating in segmented markets; with nominal exchange rate changes radically able to alter not just the relative prices of traded goods but also the general price level.

Products selected in Winkelmann's study were not of the same specific nature as those used for this study, and they concentrated essentially upon bilateral trade with Germany. However the fundamentals are still suggestive of the response exhibited in this study, of profit maximising, with price discriminating exporters operating in a small less industrialised open economy. An economy that is very reliant on agriculturally based exports, does have a dependence on the importation of 'necessities' which usually have a low elasticity of demand and an environment of little domestic competition.

In the latest New Zealand study, two Otago University academics King & Steel (1998) find that pass-through is complete, but that the overall speed of adjustment is slow. This is a finding contradicted by those of this study. Their other contribution is that they believe cost changes and depreciations are rapidly passed through to import prices but the benefits of appreciations are slow to show themselves. This would suggest foreign exporters to New Zealand are dominant in the particular markets they are supplying and are therefore quick to act when profits or market share are threatened but are happy to allow their margins to increase when the NZ dollar rises in value. This is a conclusion of this paper that is supported by the findings of Winkelmann (1996).

For an overseas viewpoint, Kenny & McGettigan (1998), when estimating pass-through for Ireland, feel that findings of incomplete pass-through of studies such as Menon's (1995) may be incorrect and

even biased downward. A more plausible estimate they suggest may be obtained by other means, in their case by allowing for two cointegrating relationships. Their results from this initiative find for a more complete pass-through than most previous studies as they consider that they have taken better account of the time-series nature of the data. This is essentially something specifically managed here in this study, the accounting for time series data, with the result of complete pass-through being realised and with little or no lag involvement.

Chapter 6

Conclusion and Policy Implications

6.1 Export Update

With regard to the completed export update, the key findings are that the T values indicated a significance of the ER variable, but the coefficients of the other associated variables did not exhibit any independent influence over export prices. Exporters essentially are concerned with maintaining prices constant in foreign currency terms by accommodating movements in the exchange rate via their profit margins.

For Wood, Paper and Aluminium there were increased product returns as a result of increasing levels of foreign income in destination markets and not as a direct result of currency movements. The Dairy products market saw foreign income and the price of substitutes as significant factors, while textiles showed significance only for the exchange rate variable.

The estimated exchange rate coefficients are very similar to those estimated by Chatterjee and Gani (1994) although they exhibit a stronger response. All of the T ratios for the exchange rate regressor are higher than those found by Chatterjee & Gani's (1994) study. There was, though, evidence of a fundamental change in the behavioural responses of Carpet, Wood and Paper from the 1994 study results, as illustrated by a change in the direction of movements as indicated by the signs on the coefficients (see Table 4.1, pg. 53).

In conclusion, exchange rate changes impact via the profit margins but not in the total per unit returns for export products. The exchange rate changes for all products are, for all intents and purposes, assumed completely passed-through. Accompanying this is the lagged result, indicating the completion of pass-through rather rapidly, if not "instantly".

The results therefore find firstly for the stated hypothesis, and they suggest that it is highly unlikely that any of these industries are able to exert much influence in setting prices in the destination markets studied. This signifies an inability to increase greatly the level of sales on the basis of competitiveness that is derived from product prices alone (via exchange rate movements). Foreign demand for these products is also something that is just considered as given.

6.2 The Importation of Selected Production Inputs

What is described here in relation to the recorded result confirms the oligopolistic nature of the relevant markets. In all of the countries examined in this study, foreign exporters are quantity leaders in dollar terms in at least one of the products under study, and, together, they control a significant share of the market for many of New Zealand's key production and consumption inputs. The exception is the United Kingdom, for whom the market shares have continued to decline in New Zealand.

Based on the findings of this study, a long-term and sustained exchange rate strengthening as is exhibited in Figure (5.6) page 63, would not have any real effect on the prices of imported inputs in the production process. Such a result would not be evidenced in terms of real import prices falling; neither would the demand change markedly as suggested by the Reserve Bank (1998).

In the short run situation there may be some profit margin squeezing by importers, although this is doubtful. Reduced real returns more likely. Any such result, if it occurs, will not benefit the purchasers of the imported production and consumption inputs, for even in the relatively short-run, there has been complete pass-through.

The rationale for this is that New Zealand has few domestic substitutes for these imported products most if not all of which are 'necessities'

rather than 'luxuries', and when, combined with the characteristics of size and the primary nature of the commodities, there is little sensitivity to changing prices.

Therefore the assumptions that were stated in Chapter 3 (page 26/27) are, from the results generated, found to hold. There can be no denying the evidence that it is something other than the New Zealand exchange rate movements (in relation to the nations from which it imports) that are responsible for the behaviour of the prices of specific inputs in the production and consumption process.

All other variables investigated exhibited low or non-existent significance, but, upon taking the aggregate imports, individual price data and plotting it alongside the *FI* variables' response over time, a strong upward trend and an interactive response were apparent. This suggests that the greater, macro-level-demand factors do more to influence prices than changing exchange rates.

The individual country studies resulted in somewhat conflicting responses, but a closer examination of the products and their relationships with and to New Zealand did indicate the soundness of the overall results, if not those for the overall coefficient values themselves. Variables that proved significant did so as a result of the very factors that are a part of the oligopolistic behaviour and the small country paradigm which are important in economic theory. Some examples are: the type of good, luxuries or necessities; market share and dominance; distance to markets, world demand for products; the costs associated with scale economies; the potential for competition within the destination markets; and the internal economic wellbeing of importing nations.

In the light of the findings, it is apparent that a small country cannot transmit its own economic behaviour out to its trading partners. A small nation is totally dependent under given assumptions upon its trading partners and the world economy.

The distinctive outcomes of this study are the following:

- ✓ Account is taken of the time-series nature of the data.
- ✓ The number of small country studies has increased.
- ✓ Real prices are used in the investigation of exchange rate pass-through.
- ✓ The number of exchange rate pass-through studies for the New Zealand has increased.
- ✓ It is an extension of the bilateral disaggregated approach to exchange rate pass-through study.

With the final result, that the stated hypothesis; that small country assumptions (for manufactured imports) hold for New Zealand; that in the long-run all exchange rate changes are fully passed-through, is not disproved.

6.3 Conclusion

Research can be confusing and many in the field can make the mistake of looking for and expecting an answer when, all along, the very best that could be hoped for was more questions. Therefore, if more questions are the ultimate anticipated result of research should not the search be for the right question all along? This implies that, if the right questions are found, then the answers can be looked for with greater confidence.

The questions arising out of the study are:

1. Does New Zealand follow accepted international economic theoretic presumptions concerning its trading behaviour as a small country?

2. Is pass-through of exchange rates to prices fully completed in the long run?

It must be remembered that the nation under study is a small less industrialised, open, economy – one that is very reliant on agriculturally based exports and one that relies on the importation of necessities with low elasticity of demand within an environment that has little domestic competition for these products.

It would be easy to say in conclusion something like “*given the NZ condition, the relevant factors of industrial organisation existing within an imperfectly competitive environment are dictating the degree of, and the speed of response for exchange rate pass-through as per the accepted economic theory*”. But...the questions presenting themselves after completion of the project are:

1. How do prices of specific inputs in the production and consumption process respond to movements in the exchange rate?
2. Is the exchange rate the key variable in any dependency?
3. Is the standard internationally accepted models used for analysis valid in relation to the New Zealand dynamic?
4. Does a distributed lag model adequately take account of the time-series nature of the data?

As stated in the Results & Discussion Section, there is every confidence in the findings supporting the original hypothesis - the questions that have been answered as they present themselves are these. On an aggregate basis: Yes, most product prices do respond according to accepted theory, the hypothesis was not disproved. No, the key variable is not the New Zealand (bilateral) exchange rate nor that of a trade weighted one. Standard accepted mark-up models do not adequately

explain the New Zealand context, and a distributed lag model is a start, not an end.

Ultimately, still further questions arise:

1. Does the behaviour that we have tabulated and graphed have any significant effect on the terms of trade?
2. Through a management of the exchange rate, and therefore, by implication and extension, is there the ability to fundamentally alter the terms of trade?

Does it have the potential to improve New Zealand's economic position as a result? An answer to the terms of trade question is theoretically yes but in reality no. The answer to all these questions on the basis of this result is *No*.

For the export update section of this study, the results produced raise doubt that the product responses in their specific destination markets, for a given exchange rate change, would, in the face of a depreciating or appreciating currency, have the ability to alter the nation's export earnings, *ceteris paribus*. There would be no change in competitiveness and no increase in world demand.

With this result in mind, it then falls upon the work done in relation to the importation of five specific inputs in the production and consumption process to make comments of a similar nature. Again, the hypothesis was not disproved, pass-through was found to be complete and rapid, Where this was not the case, there was pass-through in the second quarter. Small country assumptions were found to be relevant. The prices of these products are of course outside the control of New Zealand policy makers and traders. The linkages are far more complex and interactive.

It can be deduced from the theoretical postulates that on the basis of the aggregate results, demand for imports does not fall as the exchange rate weakens against our trading partners, nor does a strengthened dollar result in cheaper imports (for the products analysed).

Therefore, any policy implications that arise from the result generated suggest that, as the dynamic presently maintained in New Zealand of an 'open' economy, sustained as it is by the small country assumptions (page. 26/27), is continued, then the flexible exchange rate regime will always be a stable one.

This implies that it does not pay to manipulate the exchange rate. This study's findings confirm that such manipulations would not be to the long-term advantage of the New Zealander economy. In fact, New Zealand is unable to affect its terms of trade.

6.4 Further Research

There is ample scope to further analyse the existing data, and specifically, the results generated in this study with regard to the bilateral work done on Australia, Japan, UK and the US.

A longer period of study could also be chosen for the aggregate data, and with this extension, an auto regressive moving average process tried in the interest of producing a more technically robust result. A less restrictive model could be utilised in conjunction with the use of a vector auto-regressive method of estimation.

Such methods would fully utilise the potential of an extended data set and provide a differing approach to dealing with time-series anomalies. A more responsive model than the traditional mark-up version of international literature is recommended for further study, a model that does have the ability to better include the unique details of the New Zealand dynamic.

For further research, the selected product range could be extended to encompass less significant and mainstream products. A firm study of the behaviour that is exhibited here would be of value, and, following that, the second stage of pass-through from the border to importers and distributors can be researched.

As a further extension the domestic end, the final consumer price should be investigated with an eye to the domestic inflationary aspects of exchange rate pass-through. What this achieves is the completion of the process, for it is in these final stages that some very important findings in relation to the inflationary aspects of exchange rate movements can be analysed.

The findings of such a study can contribute usefully to the debate concerning the methods used to maintain price stability in New Zealand.

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