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**Impacts of Trade Liberalization on New Zealand's Agricultural  
Supply Response: A Counter Factual Analysis**

**Cagatay, S. and R. Lattimore**

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# **Impacts of Trade Liberalization on New Zealand's Agricultural Supply Response: A Counter Factual Analysis**

**Cagatay, S. and R. Lattimore<sup>1</sup>**

Beginning in the mid-1980s New Zealand underwent a comprehensive set of economic reforms, which were notable for their breadth and sequencing. The impacts of policy changes on the real exchange rate (RER) and resulting changes in the agricultural sector and related processing industries were the central issues in evaluating the benefits and the costs of the reforms. In this paper, a counter factual analysis was developed to analyze what would have been the supply response of agricultural industries if the sectoral order, sequence and timing of trade liberalization policies had been different from what actually occurred. In addition, the impact of "early" trade liberalization and a deferred capital market liberalization was also examined. Five structural equations explaining the real exchange rate for exportables (RERx), the agricultural capital stock, the supply of primary and processed agriculture and the total demand for exportable industries were estimated using an error correction model. Dynamic simulations were performed which involved three policy scenarios. The results indicated that both the sequence of trade and capital market liberalization and the sectoral sequence and timing of the liberalization policies were important in terms of increasing the agricultural supply response in the post-reform period.

**Keywords:** economic reform, real exchange rate, agricultural supply response

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## 1. Introduction

Beginning in the mid-1980s New Zealand underwent a comprehensive set of economic reforms which covered both micro and macroeconomic aspects of the economy including factor and product markets, public sector, international trade, money and finance markets. The reforms were brought as a policy measure against the deteriorating performance of the economy since the early-1970s, which was reflected particularly in the decreasing, volatile and low levels of real growth, increasing rate of unemployment and inflation, rising level of budget and current account deficits, and foreign debt. Consequently, the economic reform that was initiated in 1984 mainly aimed the stabilization of macroeconomic imbalances, elimination of distortions in incentives for structural adjustment, and liberalization and deregulation of markets to improve microeconomic efficiency (Valdes, 1993).

New Zealand's reform process was particularly remarkable for the speed and sequence of policy changes. The traditional policy sequence of "macroeconomic stabilization-microeconomic structural adjustment-financial market liberalization" was not followed in New Zealand. The reforms in capital and financial markets were the first to be made and were completed very quickly. The simultaneous changes in international trade and money markets were applied in a more gradual manner. These were followed by the industrial policies, public sector regulations both in expenditure and revenue policies and also by corporatizations. The labour market regulations came at the second half of the post-reform period, which was traditionally recommended to take place in the initial stage or simultaneously with structural adjustment of the industries (Bollard et al., 1996; Dalziel and Lattimore, 1998). Therefore, New Zealand's economic reforms followed a sequence that was quite contrary to the traditional policy sequence recommended by the literature.

During 1984-90, the New Zealand economy continued to deteriorate in spite of the fast and widely ranging policy shifts. The deterioration was reflected in the main macroeconomic indicators of the economy such as, low levels of real growth (1986-93 average less than 2 %); increasing and high rates of consumer price inflation (18 % in 1987); rising rate of unemployment (14.6 % in 1993). The deterioration was also reflected in the poor performance of the agriculture and related industries (exportables). In the initial stage of the reforms the agricultural sector was disadvantaged as withdrawal of agricultural support was occurred faster than in the non-agricultural sectors. This fact worsened the adjustment period for the sector, which resulted in a deterioration of the domestic terms of trade for agriculture and in a decline in farm incomes till 1989 (OECD, 1992). Following the decline in farm

incomes, land values decreased and interest rates increased, which consequently resulted in many farm bankruptcies. These developments also had discouraging impacts on farm investments. The reduction in input subsidies, farm incomes and high interest rates also restrained the demand for farm inputs and capital expenditures, which yielded a decrease in productivity.

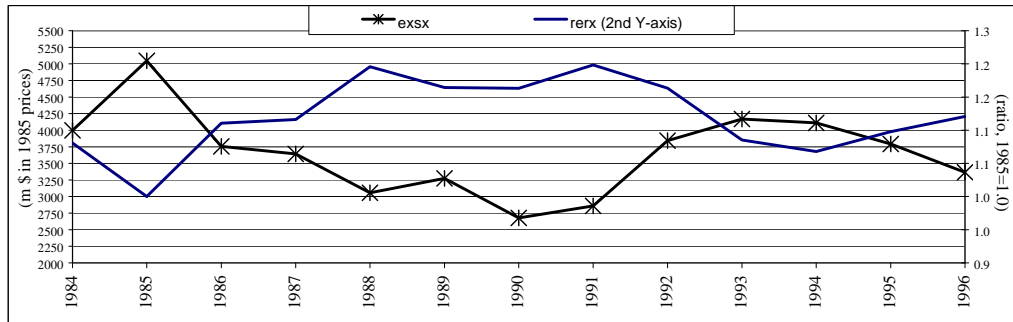
Many scholars including Bollard and Mayes (1993), Evans et al. (1996), Hansen and Margaritis (1993), Hazledine (2000), Massey (1995), Philpott (1986, 1990, 1999), Spencer (1990) and Wells (1990) since then stated that the economic performance of New Zealand in the post-reform period was dependent on the achievement of an adjustment path for the RER, which avoided destabilizing appreciation or depreciation. These scholars argued that the sequence of policy changes in the reform process resulted in a RER appreciation in the initial stage of the reform, which lasted until 1991, and in return the overvalued RER caused a contraction in real output. Moreover, Scrimgeour and Pasour (1996), Johnston and Frengley (1994) and Valdes (1993) attributed the worsened performance of the agricultural sector in the initial stage of the reforms more to the sequence of policy changes than reductions in agricultural assistance. By its definition, the RER embodies certain characteristics related to the performance of both domestic and international markets (Edwards, 1989). While RER affects allocation of resources, employment, production and consumption in the domestic markets, it affects trade flows and balance of payments through changes in sectoral and overall competitiveness. From this perspective, distortions to RER caused either by exogenous shocks or policy induced changes could result in important welfare costs to the economy and could increase and extend the adjustment costs (Edwards, 1987; 1992; Michaely et al., 1991).

## 2. Problem Setting

In Figure 1, the relationship between RERx (2<sup>nd</sup> Y-axis) and real excess supply (domestic production - domestic consumption) of exportable industries in New Zealand is presented for the period 1984-96. It was observed that during the periods of RERx (defined as price of nontradables over exportables) appreciation and especially in the initial stage of the reforms (1985-88), the excess supply of exportables declined showing a decrease in real output produced and an increase in domestic demand. On the contrary, when RERx was depreciating, the excess supply increased showing an increase in produced exportables output and a decrease in domestic demand for exportables. This change in exportables' excess supply (or amount of domestic supply and demand) was mainly due to the shifting production and

consumption incentives in the domestic economy as a result of the changes in RERx (relative prices).

Figure 1: Excess Supply of Exportables and Real Exchange Rate for Exportables



The appreciation of the RERx or in general RER starting from 1985 was argued to be the result of various ongoing policies and new policy changes, including the increasing capital inflows into the country by the removal of controls on capital movements in the initial stage of the reforms. On the other hand, the gradual liberalization of the trade policies, particularly in importable industries, could add to the problem as it continued putting increasing pressure on the domestic prices. In the New Zealand case, trade liberalization was achieved very rapidly in the exportable industries (removal of export subsidies) but it took a long time in the importables (removal of import tariffs). The literature on the New Zealand economic reforms provides the information on the discussions about the effect of increasing capital inflows and trade liberalization on the level of total and particularly exportables output. However, there are only very limited number of empirical studies that identify the fundamental determinants of the real exchange rate in New Zealand, and, that search for the impact of an alternative policy setting to the actual reform, on the short-term adjustment costs.

The literature on policy sequencing highlights three key issues to be considered in terms of policy sequence and timing during an economic reform process. These are: the order of liberalization of the current and capital account of the balance of payments, the order of macroeconomic stabilization and structural adjustment (both domestic and border measures), and the sectoral order of liberalization of the trade account (Corbo and Fischer, 1995). In this study, a policy analysis was achieved to evaluate the impacts of three alternative policy settings hypothesized as counter-factual to the economic reform in New Zealand. In the first policy scenario, in order to avoid the RERx appreciation, trade liberalization was brought forward and completed rapidly while removal of controls on capital flows were deferred until the trade liberalization policies became effective. In the second and third scenarios, a change in the sectoral order of trade liberalization and a change in the degree of liberalization among

sectors were simulated in order to see whether there was a need to provide promotion for the exportable industries to increase the output produced.

### **3. Theoretical Framework**

The econometric model estimated in this research was based on the Swan-Salter (Salter, 1959; Swan, 1960) two-sector dependent economy model, which was extended by Dornbusch (1974) into three sectors. The model is about a stylized economy where consumption and production are aggregated into tradable and nontradable goods and tradable goods are separated into exportable and importable industries. The country is a small, open one in the international markets and a price taker in relative price of tradable goods. The relative prices of the exportable and importables in terms of nontradables are flexible to allow market-clearing in nontraded goods and this provides the internal equilibrium condition for the economy. The budget constraint of the economy implements the external equilibrium by equalizing total income and expenditures. In this economy RER plays the crucial role in achieving the equilibrium condition. Any exogenous or policy induced changes in RER can result in an internal and external disequilibrium, as RERs determine the incentives for consumption and production between exportable, importable and nontradable goods.

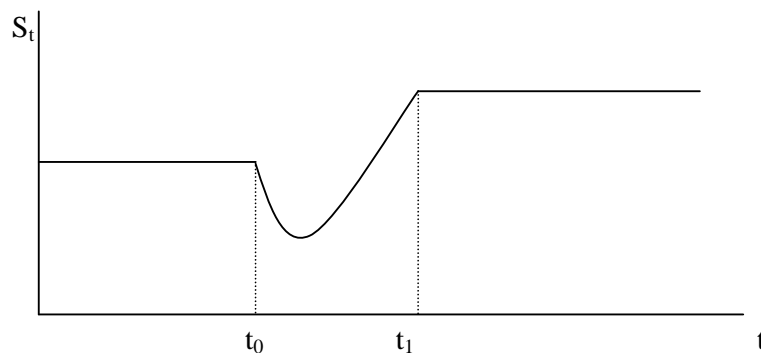
Edwards (1989) defines the exogenous and policy determined factors that shift RERs and result in a disequilibrium in the economy as RER fundamentals. He groups those fundamentals into supply and demand side factors. Hinkle and Montiel (1999) summarize a vast empirical literature, which provides the single-equation estimates of RER as a function of demand and/or supply side factors. The supply side fundamentals mostly focus on the differences among factor productivity levels and/or growth levels between countries, productivity differences among tradable and nontradable industries, changing resource base of the countries, differences in factor endowments and other variables that proxy for technological developments as the explanatory factors. The demand side fundamentals mostly focus on the changes in the external terms of trade, the share of government consumption in GDP, the openness of the trade regime, the trade policies that effect domestic prices, the severity of capital controls and capital inflows, the nominal exchange rate, and excess of money growth over GDP as the explanatory factors.

In the context of this theoretical model, the effects of various fundamentals on RERs can arise through two channels. First, a domestic trade policy or an exogenous shock on the external terms of trade may alter the given prices of tradable industries and relative prices in terms of nontradables. In return, this change may result in an increase (decrease) in the

demand for nontradables and cause nontradable prices to rise (decrease). Secondly, various domestic policies may directly cause an increase (decrease) in the demand for nontradables and this can yield nontradable prices to rise (decrease). The prices of tradable goods can only be affected by direct trade policies or by exogenous shocks and the changing demand for tradable industries cannot alter their price, as the country under consideration is a small one in the international markets and the tradable prices are given to the country. Because of this the domestic monetary, fiscal demand management policies and/or capital market policies may exert influence only on nontradable prices through the change in demand for nontradables.

The effects of RERx changes on the exportables output, which in New Zealand is mostly composed of livestock-based agriculture, are evaluated by employing Jarvis's (1974; 1986) "perverse" slaughter response model. Jarvis considers producers as portfolio managers who seek the optimal combination of livestock to complement their other capital assets, given existing production conditions such as prices, costs, technology and expectations. Livestock are both consumption and capital goods in his model which can be slaughtered for meat and hides or can be used as productive assets to convert feed into additional animals (calves) and into milk, draft powder, manure, hides, a store of value, etc. From this perspective, the producers are expected to retain livestock as long as their capital value (in production) exceeds their slaughter value. Because the livestock are the major input into their own production, the fixed supply of animals at any moment creates a trade-off between the amount supplied to consumers and the retention of cattle in the form of investment. Figure 2 shows the supply response of the livestock sector to price changes.

Figure 2: Supply Response of the Livestock Sector to a Price Increase



Source: Adapted from Jarvis (1974).

In the figure, when prices increase at time  $t_0$  producers postpone slaughter by a few months (which can be 3-4 years depending on the type of livestock), until the animal's rate of weight gain declines, but during this period aggregate slaughter is reduced. At the new optimal slaughter age, however, meat supply is greater than it would have been. In the



“perverse” slaughter response case the number of animals slaughtered decreases/increases when the price of meat increases/decreases and this decision affects the short and long-run supply of meat.

#### 4. Empirical Framework

Based upon the findings of theoretical framework, the real exchange rate for exportables was estimated to find out the fundamental determinants of *rerx* in New Zealand. The impacts of changes in *rerx* were analyzed by estimating the output and demand functions for exportables. The output of primary agricultural exportable industries was determined at two stages. At the first stage, a capital stock function for primary agricultural exportables, which was specified as a function of *rerx*, lagged values of capital stock and soil moisture deficit was estimated. At the second stage, the output of primary agricultural industries was specified as a function of *rerx*, agricultural capital stock and soil moisture deficit. Soil moisture deficit was found to be statistically significant in terms of determining the agricultural supply response in various studies<sup>2</sup> in the literature. The output of primary processing exportable industries was defined as a function of *rerx*, an adjustment lag and a time trend variable. The trend variable was introduced mainly to pick up the impacts of long lags in the production of forestry industry. The total demand for exportables was estimated as a function of the *rerx* and real income created in the economy. The annual data of the period 1960-96 was used in the estimations. The estimations were carried out by the ordinary least squares (OLS) technique using Engle and Granger’s (1987) 2-step error correction model (ECM) framework. The ECM framework was preferred initially as it provided the short-run information and long-run adjustment coefficient.

In order to avoid spurious correlation problem some pre-testing work was carried out, prior to estimation. The variables were checked for non-stationarity<sup>3</sup> with the appropriate test procedures and were found to be integrated of order 1, I(1). A second concern was whether there was a long-term relationship (cointegration) between the variables as proposed by the relevant theories. To find out, cointegration tests were carried on the static versions of the equations and some evidence<sup>4</sup> of a long-term relationship was found between the variables in

<sup>2</sup> See Grundy et al., (1988) and SriRamaratnam and Reynolds (1990).

<sup>3</sup> See Appendix Table 1 for the results of Dickey-Fuller and Augmented Dickey-Fuller (DF-ADF) tests.

<sup>4</sup> See Appendix Table 1 for the results of DF-ADF and cointegrating Durbin-Watson (CIDW) tests and for the coefficients of the short-run disequilibrium error obtained at the second step of the ECM framework. Short-run estimations results were not presented as it was not the main focus of the research. In each equation the null hypothesis of non-cointegration was not rejected by ADF test, however it was rejected at 0.01 level by CIDW

each equation. Accordingly, an error correction model (ECM) was applied to each equation in which the variables were proved to be cointegrated.

#### Estimation Results-Long-Run

$$rerx_t = 1.09 + 0.15dpr + 0.003grm3_t + 0.46gcon_t + 0.008ncpfg_t + 0.22tot_t + 0.09nprot_t + e1_t \quad (1)$$

$$cslx_t = 7.45 + 0.37cslx_{t-1} - 0.89rerx_t - 0.10moavg_t + e2_t \quad (2)$$

$$spax_t = 1.86 + 0.45cslx_{t-4} + 0.30rerx_t - 0.27moavg_t + e3_t \quad (3)$$

$$snpx_t = 4.06 + 0.27snpx_{t-1} - 0.24rerx_t + 0.01time + e4_t \quad (4)$$

$$dx_t = -6.45 + 0.63dx_{t-1} + 0.65rerx_t + 1.13rinc_t + e5_t \quad (5)$$

#### Estimation Results-Short-Run

$$\Delta rerx_t = 0.65\Delta gcon_t + 0.008\Delta ncpfg_t + 0.16\Delta tot_t - 0.85rerxlrrs_{t-1} + e6_t \quad (6)$$

$$\Delta cslx_t = -1.14\Delta rerx_t - 0.10\Delta moavg_t - 0.42cslxlrrs_{t-1} + e7_t \quad (7)$$

$$\Delta spax_t = 0.16\Delta cslx_{t-4} - 0.12\Delta moavg_t - 0.77spaxlrrs_{t-1} + e8_t \quad (8)$$

$$\Delta snpx_t = -0.08\Delta rerx_t + 0.02\Delta time - 0.50snpxlrrs_{t-1} + e9_t \quad (9)$$

$$\Delta dx_t = 1.14\Delta rerx_t + 1.51\Delta rinc_t - 0.63dxlrrs_{t-1} + e10_t \quad (10)$$

Values in parentheses are calculated t-values.

\*: significant at 0.01 significance level      \*\*: significant at 0.05 significance level

\*\*\*: significant at 0.10 significance level      `: not significant at 0.10 significance level

Variable definitions:

*cslx*: real capital stock value of livestock

*dpr*: intercept dummy for regulated pre-reform period

*dx*: demand for exportables

*gcon*: real final government consumption expenditure

*grm3*: annual growth rate of real money supply

*moavg*: number of soil moisture deficit days

*ncpfg*: net capital flow over GDP

*nprot*: net protection coefficient

*rerx*: real exchange rate for exportables

*rinc*: real income

*spax*, *snpx*: real output of primary agriculture and primary processing exportables

*time*: time trend

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test. Also, the adjustment variables in short-run estimations were found to be significant. Depending on these it was decided to carry on the analysis based on the results of CIDW tests.

*tot*: international terms of trade

All the equations were estimated in double-log form and the goodness of fit measures, diagnostic test results and calculated elasticities were presented in appendix Table 2 and 3. The test results did not indicate any specific econometric problem. However, the overall explanatory power of the *cslx* and *spax* was low compared to the other equations, which might be due to the short sample size. A few points have to be mentioned concerning the specified equations. First, an intercept dummy variable (*dpr*) that was designed to measure the impact of the pre-reform regulated period and separated the time period into pre- and post-reform period (before and after 1984) was introduced to the *rerx* function and was found to be statistically significant at 1 % significance level. This showed that in the pre-reform period of regulated economy the *rerx* was overvalued. Second, the output of exportable industries was estimated in two separate equations including output of primary agricultural (*spax*) and primary processing exportables (*snpax*). *Spax* was estimated with a partial adjustment lag. This partial adjustment became a gestation lag of four years for livestock capital, *cslx*. This was the required period for livestock to become productive. Third, the positive relationship between *rerx* and *spax* was anticipated based on the Jarvis's (1974) "perverse" livestock supply response. At time  $t$ , while the increasing exportable prices caused an increase in the capital stock (*cslx*) because of anticipated future revenues, it caused a temporary fall in primary exportables output (*spax*) because of the delayed slaughters. However, after a certain time period such as  $t+4$  in this case, the rising exportable prices resulted in an increase in *spax*. Lastly, a trend variable in *snpax* function was also included to pick up the effects of long lags in the production of forestry and fishing sectors, and it was found to be statistically significant at 1 % significance level.

According to the results of long-run estimations, real government consumption expenditures was found to have the largest impact on *rerx* behaviour. A 1 % increase in *gcon* resulted in 0.46 % appreciation of the *rerx*. The second most effective policy variable was the net protection coefficient. The elasticity of *rerx* with respect to changes in *nprot* was found to be 0.09. The growth of excess money supply and capital inflows were found to be statistically significant but had less impact on the variation of *rerx*. In the short-run however, the changes in government consumption expenditures was only found to have significant impact on *rerx*. In the long-run estimations all the variables had the a priori expected signs. The relative price elasticities of primary and primary processing exportable industries were found to be around 0.30 and relative price elasticity of demand was found to be 1.76. The demand for exportable industries was found to be perfectly elastic with respect to changes in income level. The

overall explanatory power of the long-run estimations was found to be better compared to the short-run estimations. On the other hand, the short-run adjustment coefficients were found to be statistically significant, which showed that there was an adjustment process that prevents errors becoming larger in the long-run.

#### 4. Policy Analysis

In the context of the applied econometric model and used policy instruments in this research, the reform process can be summarized as in Table 1.

Table 1: Actual Policy Sequence and Timing

Policy Instrument	Timing-Sequence	Policy Variable
Capital market policy (financial liberalization)	1 <sup>st</sup> sub-period, 1984-85	<i>ncpfg</i>
Fiscal (expenditure cut) policy (macroeconomic stabilization)	1 <sup>st</sup> sub-period, 1984-85	<i>gcon</i>
Trade (tariff/subsidy cut) policy (structural adjustment)		
(tariff cut) Importables	whole period, 1984-96	<i>nprot</i>
(subsidy cut) Exportables	1 <sup>st</sup> sub-period, 1984-85	<i>nprot</i>
Monetary (tightening) policy (macroeconomic stabilization)	2 <sup>nd</sup> sub-period 1987-89	<i>m3</i>
Fiscal (expenditure cut) policy (macroeconomic stabilization)	3 <sup>rd</sup> sub-period 1991-92	<i>gcon</i>

In the reform process, financial liberalization (removal of controls on all prices and capital flow) was the first to be applied and completed. The regulations in this area were completed at the end of 1985 (1<sup>st</sup> sub-period 1984-85). The impacts of these policies were reflected in the econometric model by using the policy variable *ncpfg* (net capital flow over gross domestic product). Macroeconomic stabilization policies (mainly fiscal and monetary policies) followed the regulations in financial markets and these were applied in various sub-periods. The econometric model incorporated stabilization policies by focusing on the government's expenditure policies on the fiscal side and monetary expansion on the monetary side, and these were reflected by the variables *gcon* (real government consumption expenditure) and *m3* (real money supply or growth rate of real money supply). While government's expenditure cuts were completed at two stages, 1<sup>st</sup> sub-period 1984-85 and 3<sup>rd</sup> sub-period 1991-92, monetary tightening was applied during 1987-89, 2<sup>nd</sup> sub-period. Structural adjustment policies (mainly industrial regulations and trade policies) were completed in two different time periods. The liberalization in the exportable industries (removal of export subsidies) was achieved at the 1<sup>st</sup> sub-period and completed rapidly, however liberalization of the importable industries (removal of import tariffs) was applied

gradually during the whole period between 1984-96. The trade policies were integrated to the econometric model by the variable *nprot* (net protection coefficient: import tariffs - export subsidies (%)).

In order to run the policy scenarios the dynamic deterministic simulation method was applied in two steps. At the first step, in order to see the performance of the model, control runs were simulated and the outcomes were compared with the actual historical data. At the second step, policy shocks were applied to the actual values of the exogenous variables and the outcomes were compared with the control-run solutions. In order to obtain the historical dynamic response, the predicted (solution) values obtained for each year were used instead of the actual data. The performance of the model (simulation fit) was evaluated by utilizing whole system procedures which included the control of "tracking performance" and the tests of root-mean-square (rms) simulation percent error, mean simulation percent error (mse), and Theil's inequality coefficient (U) (Pindyck and Rubinfeld, 1991). The test results indicated a successful simulation fit.

#### *4.1. Scenario 1: First Trade Liberalization then Capital Market Liberalization*

The disputes on the order of trade and capital market liberalization were examined in Scenario I. Frenkel (1982), Edwards (1987), and McKinnon (1991) argue that free capital inflows at the initial stage of reform can result in temporary appreciation of RER, which can cause unnecessary switches of productive resources among industries. In order to avoid this and the offsetting effects of RER appreciation on the success of trade liberalization, they recommend a delay in capital market liberalization till trade liberalization policies become effective. Therefore, in Scenario I the counterfactual of "what would have been the outcomes of economic reform, if the capital market liberalization had been postponed till the trade liberalization policies were applied?" was simulated. Trade liberalization policies were assumed to be applied in the initial stage and completed in 1987. Based on this, the policies that removed the restrictions on international capital flow into the country were delayed until the trade policy changes became effective. As it would take four years for trade liberalization policies to become effective on the exportable industries because of the gestation lag, capital market policy changes took place in 1992.

#### *4.2. Scenario 2a: Variations in Sectoral Timing of Trade Liberalization- Gradual Removal of Export Subsidies*

The aim of this scenario was to see whether there was a need to continue supporting exportable industries, during the liberalization of importables, to expand exportables output. Two alternative counter-factual scenarios were prepared. In the first scenario all the policy changes, except the export subsidy cuts, were kept in the same sequence and applied with the same timing as they were actually applied as seen in Table 1. However, the export subsidy cuts were assumed to be applied and completed gradually between 1984-96 with an annual average decreasing rate of 2.5 %, instead of the big-bang liberalization applied in 1984-85. The 2.5 % annual decreasing rate was the actual rate applied to liberalize import tariffs during the reforms. Therefore, it was assumed that both exportable and importable industries were liberalized with the same timing and sequence compared to the overall reform package.

#### *4.3. Scenario 2b: Variations in Sectoral Timing of Trade Liberalization- Fast Removal of Import Tariffs and Gradual Removal of Export Subsidies*

In the second scenario, all the policy changes were left as they occurred in the first scenario, but this time a big-bang import tariff reduction was applied initially and completed in two years (1984-86) instead of the gradual reduction. Therefore in this scenario, the actual timing of trade liberalization was reversed by applying a gradual liberalization in exportables and a big-bang type liberalization in importables.

#### *Simulation Results*

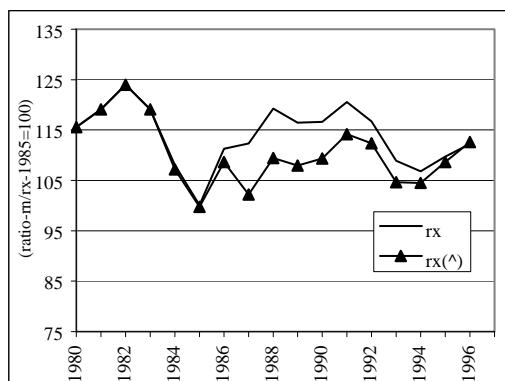
The removal of almost 80 % of the total protection on both exportable and importable industries in the initial stages (1985-87) caused a depreciation in the *rerx*, Figure 3. The depreciation compared to the actual *rerx* continued till 1992 as the effect of protection on *rerx* was avoided for the whole period. In 1992 a further depreciation was experienced which was due to the effects of second stage cuts in government expenditures. Because of the same reason the effects of capital inflows in 1992 on *rerx* was also offset. In Figures 4 and 5, the effect of a gradual export subsidy decrease on the *rerx* was presented. While in Figure 4, the speed of tariff removal was left as it was actually occurred, in Figure 5 the tariffs were removed in the initial stages. The difference between the two scenarios was reflected in the amount of net protection. While in scenario 2a, the net protection fell down gradually because of the same amount of decrease in protection of both industries, in scenario 2b the net protection was still high because of the high export subsidies compared to the ongoing import tariffs. Based on this, the lower net protection rate in scenario 2a, resulted in a more stable

and continuous depreciation in *rerx* from 1984 onwards compared to the actual level and to scenario 2b.

In Table 2 the impacts of *rerx* derived under alternative scenarios on the agricultural capital stock, total demand for exportables and output of primary and processing exportables were shown. It was observed that the removal of import tariffs and export subsidies, in general, caused an increase (decrease) in exportable output (demand) by changing the production and consumption incentives in the domestic market via the depreciation of *rerx*. The output increase in primary exportables appeared late in the process because of the long lags in the production structure. However, the output increase for the primary processing exportables was through the whole period. The total demand for exportable industries fell throughout the process because of the rising exportable prices. At this step it can be concluded that a decrease in the net industrial protection resulted in depreciation of the *rerx* and in return this depreciation increased the exportable production.

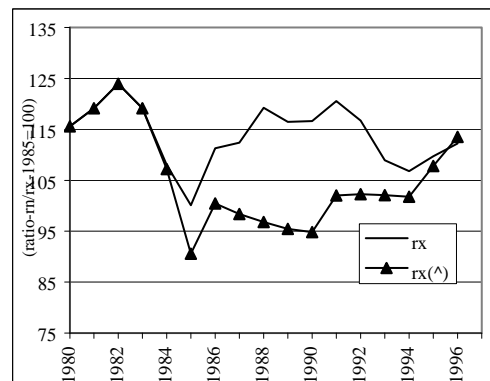
Scenario 1

Figure 3: Control and Simulated Values of *rx*



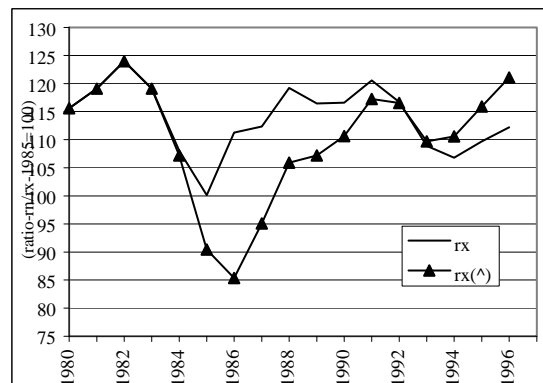
Scenario 2a

Figure 4: Control and Simulated Values of *rx*



Scenario 2b

Figure 5: Control and Simulated Values of *rx*



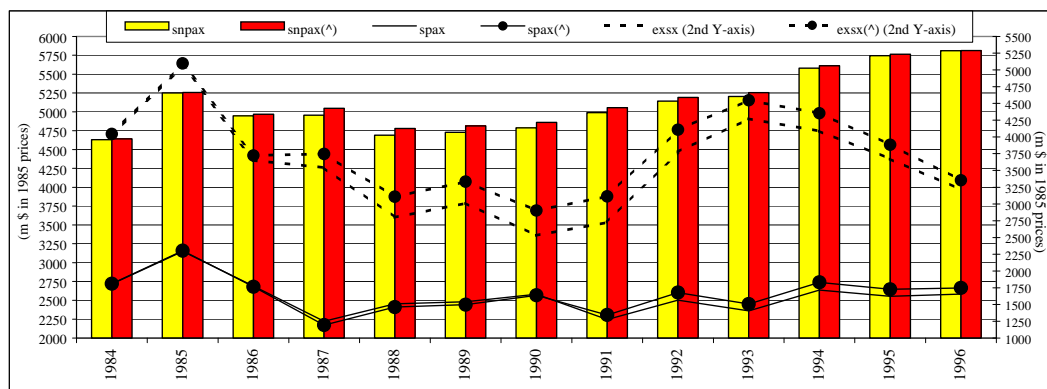
However, the difference among the scenarios appeared in the new trends that output and demand levels followed. In New Zealand case, it was observed that a gradual removal of industrial protection measures (scenario 2a) resulted in a more stable and continuous increase in capital stock of primary agricultural sector and output of primary processing industries. Based on the stableness in capital stock increase, the increase in primary agricultural output was also more stable compared to other scenarios. The gradual decrease in net protection also yielded a bigger increase in output compared to the big-bang type trade liberalization. This showed that a continued export promotion could have decreased the adjustment costs in exportable industries. On the other hand, only a gradual decrease in export subsidies (scenario 2b) would not yield a stable and continuous increase in capital stock and output of exportable industries.

Table 2: Comparison of Simulation Outcomes

	Increase with respect to Control Values(-%)											
	Capital Stock of Primary Agriculture			Primary Agricultural Output			Output of Primary Processing Exportables			Demand for Exportables		
	S1	S2a	S2b	S1	S2a	S2b	S1	S2a	S2b	S1	S2a	S2b
1984	1.4	1.4	1.4	-0.2	-0.2	-0.2	0.1	0.1	0.1	-0.2	-2.9	-2.9
1985	1.3	10.3	10.5	0.3	-2.4	-2.5	0.1	1.8	1.9	-0.5	-8.2	-8.3
1986	3.1	14.0	31.8	-0.6	-2.8	-7.2	0.4	2.1	5.1	-0.8	-10.8	-16.3
1987	10.5	18.6	28.8	-2.6	-3.7	-4.6	1.7	2.8	3.9	-4.3	-14.1	-18.4
1988	12.4	28.6	22.4	-2.2	-5.5	-3.1	1.8	4.3	2.9	-5.4	-18.1	-17.8
1989	12.2	31.3	16.4	-1.9	-1.8	1.6	1.7	4.4	2.1	-6.0	-20.1	-16.3
1990	10.9	33.3	11.3	-0.9	-0.8	10.2	1.5	4.6	1.4	-6.8	-22.2	-14.7
1991	9.5	29.4	7.0	2.3	2.1	10.0	1.2	3.8	0.7	-6.2	-21.7	-12.5
1992	7.4	24.1	3.1	3.5	6.6	8.4	0.9	3.1	0.2	-4.5	-19.5	-9.7
1993	6.8	15.1	1.0	3.5	9.8	6.5	0.9	1.7	-0.1	-4.1	-16.5	-8.4
1994	4.9	10.4	-2.3	3.6	11.0	5.4	0.5	1.2	-0.7	-3.0	-13.7	-6.5
1995	3.1	5.8	-5.1	3.2	10.4	4.1	0.3	0.6	-1.1	-0.9	-10.3	-3.9
1996	1.3	1.5	-7.9	2.8	9.5	3.2	0.0	-0.1	-1.5	0.6	-7.5	-1.8

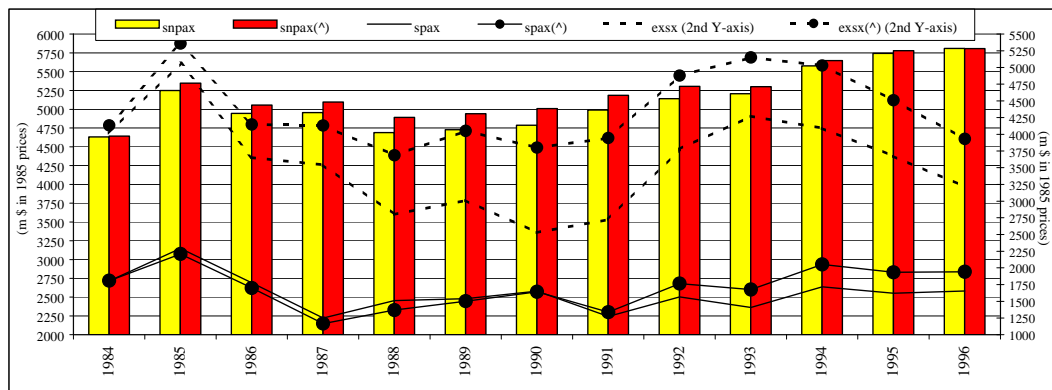
Based on the impacts on exportables production and demand the excess supply amount in the economy was higher and continues under scenario 2a, which involved a gradual liberalization in both exportable and importable industries, Figures 6, 7, 8.

Scenario 1

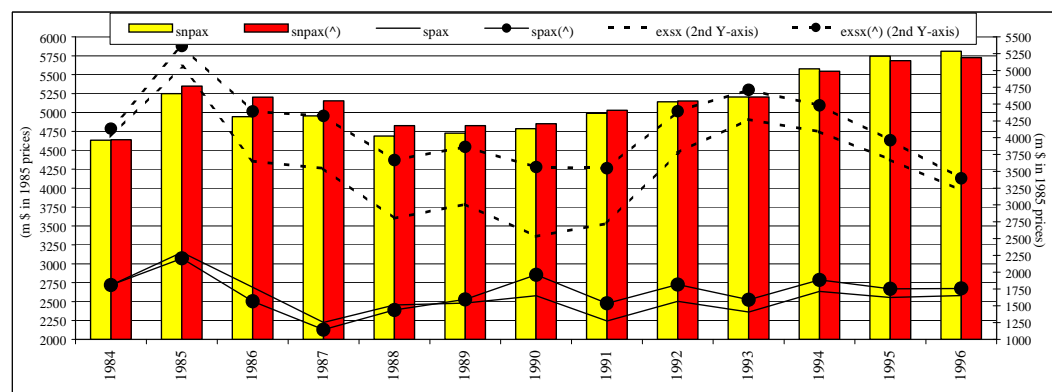
Figure 6: Control and Simulated Values of  $spax$ ,  $snpax$ ,  $exsx$ 



Scenario 2a

Figure 7: Control and Simulated Values of  $spax$ ,  $snpax$ ,  $exsx$ 

Scenario 2b

Figure 7: Control and Simulated Values of  $spax$ ,  $snpax$ ,  $exsx$ 

## 5. Conclusion

In this paper an econometric model was developed to determine the fundamentals of real exchange rate for exportable industries in New Zealand and also to estimate the impacts of real exchange rate shifts on the exportables output and demand levels. A policy analysis was achieved to see the impacts of alternative policy settings, which were set with different sequence and timing compared to what was actually applied. It was found that, in the context of this econometric model and policy coverage, the removal of controls on financial capital movement didn't have significant impacts on  $rerx$ . Trade liberalization was found to increase the level of exportables output produced in the economy. In addition, it was found that in order to have a sustainable increase in exportables output and excess supply, a gradual liberalization in both exportable and importable industries could be preferable to a big-bang type liberalization.

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## Appendix

Table 1: Time Series Properties of the Variables and Equations

Stationarity Tests at Levels									
	Time	DF	ADF(1)	ADF(2)	ADF(3)	ADF(4)	ADF(5)	$\tau_{t-1}$	
rerx <sub>t</sub>				-1.927					-2.950
grm3 <sub>t</sub>						-1.444			-2.945
gcon <sub>t</sub>				-2.814					-2.956
ncpfg <sub>t</sub>							-2.233		-2.950
tot <sub>t</sub>			-2.914						-2.950
nprot <sub>t</sub> <sup>2</sup>	-3.267						-1.945		-2.959
cslx <sub>t</sub>					-2.813				-2.947
moavg <sub>t</sub>							-1.940		-3.562
spax <sub>t</sub>					-0.403				-2.980
snpax <sub>t</sub> <sup>2</sup>	3.891		-2.824						-2.963
dx <sub>t</sub>		-2.831							-2.945
rinc <sub>t</sub>			-2.188						-2.947
Stationarity Tests at First Differences									
	DF	ADF(1)	ADF(2)	ADF(3)	ADF(4)	ADF(5)	$\tau_{t-1}^3$		
d <sup>5</sup> rerx <sub>t</sub>		-6.525							-2.950
dgrm3 <sub>t</sub>	-7.914								-2.947
dgcon <sub>t</sub>		-6.375							-2.950
dncpfg <sub>t</sub>						-3.233			-2.963
dtot <sub>t</sub>		-5.741							-2.950
dnprot <sub>t</sub>					-3.624				-3.562
dcslx <sub>t</sub>				-3.301					-2.985
dmoavg <sub>t</sub>	-8.657								-2.950
dspax <sub>t</sub>			-6.013						-2.953
dsnpx <sub>t</sub>		-6.077							-3.547
ddx <sub>t</sub>	-7.027								-2.947
drinc <sub>t</sub>	-4.740								-2.947
Cointegration Test Results									
	CIDW	DF	ADF(1)	ADF(2)	ADF(3)	ADF(4)	$\tau_{d-1}$		
rerx <sub>t</sub>	1.603	-3.703							-5.331
cslx <sub>t</sub>	1.624	-2.860							-4.084
spax <sub>t</sub>	1.546	-3.901							-4.725
snpx <sub>t</sub>	1.368			-5.759					-4.112
dx <sub>t</sub>	2.479	-2.311							-4.171
Critical values for CIDW <sup>6</sup> : % 1: 0.511 % 5: 0.386 % 10: 0.322									

<sup>1,3,4</sup>: DF and ADF 95% critical values were obtained from Pesaran and Pesaran, (1997).

<sup>2</sup>: The 95% critical values for testing deterministic trend was -2.85, (Dickey and Fuller, 1981, p. 1062).

<sup>5</sup>: "d" is used for showing the first difference of the variable.

<sup>6</sup>: Critical values for CIDW test were obtained from Gujarati, (1995).

Table 2: Long-Run and Short-Run Goodness of Fit and Estimation Diagnostics

Long-Run								
	Sample period	Adj. R <sup>2</sup>	S.E.	F-stat	F <sup>*</sup>	F <sup>**</sup>	Chi <sup>2</sup> 2 <sup>***</sup>	
rerx <sub>t</sub>	1968-96	0.75	0.04	(6,22) 15.26	(1,21) 0.68	(1,21) 5.49	1.40	
cslx <sub>t</sub>	1970-96	0.20	0.15	(3,23) 3.15	(1,22) 2.48	(1,22) 0.09	2.53	
spax <sub>t</sub>	1977-96	0.36	0.12	(3,16) 4.53	(1,15) 0.35	(1,15) 0.47	0.99	
snpax <sub>t</sub>	1964-96	0.92	0.05	(3,29) 118.21	(1,28) 3.42	(1,28) 0.23	0.62	
dx <sub>t</sub>	1975-96	0.53	0.12	(3,18) 8.89	(1,17) 2.59	(1,17) 0.53	1.16	
Short-Run								
	Sample period	Adj. R <sup>2**</sup>	S.E.	F-stat	F <sup>*</sup>	F <sup>**</sup>	Chi <sup>2</sup> 2 <sup>***</sup>	
d*rerx <sub>t</sub>	1969-96	0.64	0.04	(5,22) 10.45	(1,21) 4.20	(1,21) 0.00	1.51	
dcslx <sub>t</sub>	1971-96	0.36	0.15	(2,23) 7.92	(1,22) 0.54	(1,22) 0.43	0.93	
dspax <sub>t</sub>	1978-96	0.57	0.09	(2,16) 13.13	(1,15) 0.13	(1,15) 0.00	0.15	
dsnpax <sub>t</sub>	1965-96	0.19	0.04	(2,29) 4.70	(1,28) 1.90	(1,28) 0.58	0.58	
ddx <sub>t</sub>	1976-96	0.45	0.11	(2,18) 9.08	(1,17) 2.62	(1,17) 0.01	1.85	
*: 1 % constant growth per year.								
`: Lagrange multiplier test of residual serial correlation.								
`: Ramsey's RESET test using the square of the fitted values.								
`: Based on a test of skewness and kurtosis of residuals.								

Table 3: Long-Run and Short-Run Elasticities

Long-Run Elasticities						Short-Run Elasticities					
Exogenous variables	rerx <sub>t</sub>	spax <sub>t</sub>	snpax <sub>t</sub>	cslx <sub>t</sub>	dxt	Exogenous variables	d*rerxt	dcslx <sub>t</sub>	dspax <sub>t</sub>	dsnpax <sub>t</sub>	ddxt
clsx <sub>t-4</sub>		0.45				dclsxt-4			0.16		
gcon <sub>t</sub>	0.46					dgcont	0.65				
grm3 <sub>t</sub>	0.01					dmoavgt		-0.10	-0.12		
moavgt		-0.27		-0.16		dncpfgt	0.008				
ncpfgt	0.01					drinct					1.51
nprot <sub>t</sub>	0.09					drerxt		-1.14		-0.08	1.14
rerx <sub>t</sub>		0.30	-0.33	-1.41	1.76	dtime				0.02	
rinc <sub>t</sub>					3.05	dtott	0.16				
time			0.01*								
tot <sub>t</sub>	0.22					*: "d" is used for showing the first difference of the variable.					