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Working Paper

Trade and factor-market effects of New Zealand's reforms.
Report to the Foundation for Research Science and
Technology

NZ Trade Consortium Working Paper, No. 3

Provided in Cooperation with:

New Zealand Institute of Economic Research (NZIER), Wellington

Suggested Citation: Deardorff, Alan; Lattimore, Ralph (1999) : Trade and factor-market effects of New Zealand's reforms. Report to the Foundation for Research Science and Technology, NZ Trade Consortium Working Paper, No. 3, New Zealand Institute of Economic Research (NZIER), Wellington

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TRADE AND FACTOR-MARKET EFFECTS OF NEW ZEALAND'S REFORMS

Report to the Foundation for Research Science and Technology

Prepared by Alan Deardorff and Ralph Lattimore

NZ Trade Consortium Working Paper No. 3

June 1999

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SUMMARY

International trade protectionism is frequently supported on the assumption that importables provide more jobs for unskilled labour than does the exportable sector. This contention is questioned here by reference to the factor intensity of New Zealand trade. Exportables are found to be more intensive in the use of unqualified labour services, especially females. The paper examines these issues before and after the recent reforms with their associated trade changes and analyses these effects on the sectoral employment of labour, capital and land.

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I. BACKGROUND

Variants of the 'trade and wages' debate have existed in New Zealand for over 150 years in two distinct phases. Up until the 1960's, the dominant issue was whether import substitution would benefit unskilled labour and/or broaden employment opportunities in the labour force. This hypothesis was based on the presumption that net trade was dominated by land, technology and capital intensive agricultural products: basically a Stolper-Samuelson argument.

Beginning around the sixties, when New Zealand had a very strong import substitution regime, questions began to be raised about the efficiency and distributional effects of the policy. The trade dimensions of some arguments tended to emphasise the possibility that import substitution led to slower trade growth, slower economic growth and lower real wages than otherwise.

More recently, the widening distribution of income in New Zealand (Easton, 1996) and elsewhere (Slaughter, 1998) has led to a debate as to the role of trade in this phenomenon on the grounds that globalisation or trade liberalisation has lowered the real wage for unskilled workers but raised it for skilled workers.

One way to approach these issues is via factor intensities and trade. It might also be insightful to carry out the analysis in a country like New Zealand which has had significant trade policy change recently. Around 1981, New Zealand began dismantling its import substitution framework by initially tendering import licenses and then after 1984, removing export subsidies and remaining licenses and reducing tariffs. (Silverstone et al, 1996) The average nominal rate of protection for the importable sector was reduced from around 30 percent in 1984 to around 5 percent in 1998 with current intentions to move to free trade by 2006. This radical policy change environment provides an opportunity to examine changes in net trade resulting from revealed comparative advantage and to shed light on the issues surrounding the effects of trade on factor markets.

There has been a range of other changes as well. New Zealand's terms of trade have also changed in recent decades as a result of international market forces and changes in trade agreements affecting New Zealand. The entry of Britain into the European Economic Community constrained trade opportunities to the largest export market and reinforced the need for market diversification. This proceeded apace but was stimulated by the CER bilateral free trade agreement with Australia in 1983, the APEC agreement of 1989 and the first GATT round (Uruguay) to include agricultural liberalisation which concluded in 1994.

Accordingly, the decade from 1986 to 1996 ought to provide important evidence of the effects of trade on New Zealand factor markets. The domestic and trade policy changes brought about significant restructuring of industry in the tradeable sector and elsewhere through business

closures and reorientation with large numbers of workers laid off. The official unemployment rate rose from 4 percent in 1987 to nearly 11 percent in 1992.

The reform process was notable for the long policy induced recession that occurred from 1986 until 1993 with the real exchange rate appreciating strongly during the early part of the reform process. As a result, economic growth was very poor from 1987 until 1993 with three years in that period exhibiting negative real growth. The policy reforms also included major changes in education and social welfare policy that interacted with important social trends in lifestyles and social demographics. As the data will show, in this environment significant numbers of people took the opportunity to retrain in formal educational institutions and significant upskilling occurred, especially amongst women.

There were of course many other policy changes that accompanied the liberalization, including changes in monetary and fiscal policy, exchange rate management, and so forth, but it is our judgment that the policy changes listed above were the major ones to affect New Zealand's pattern of international trade and production, and therefore to affect the relative performance of the various factor markets in New Zealand, which are the focus of our study.

From 1993, economic growth rose to high levels for three years and then settled at more modest levels from 1996 to 1998. Unemployment fell to just over six percent by 1996 and remained at that level till 1998.

2. THEORETICAL FOUNDATIONS OF THE ANALYSIS

2.1 Two-Good Model

We begin by looking at what the simplest traditional international trade model, a two-good Heckscher-Ohlin (H-O) Model, can tell us about the likely effects of the policy changes listed above. We let the goods be an exportable, X , and an importable, Y . We will ask how the above policy changes would have altered production and trading possibilities in such a two-good economy, and how the resulting change in equilibrium might be reflected in domestic factor markets.

The 1980's trade liberalisation was not intended, initially, to take New Zealand all the way to free trade¹, but the drop in tariffs and the tariff equivalents of NTBs was so large that it seems reasonable to approximate it here as a move to free trade.

This is shown in panel (a) of Figure 1 as the removal of the distortions that kept domestic and world prices apart for both producers and consumers. As a result, production now moves from Q_1 to the point on the transformation curve that maximises the value of output, Q_2 , at world prices, P_0^w , while consumption also moves to a tangency with the new (due to increased value of production) world price line, C_2 . This considerably expands the volume of both exports and imports, shifting the offer curve in panel (b) outward.

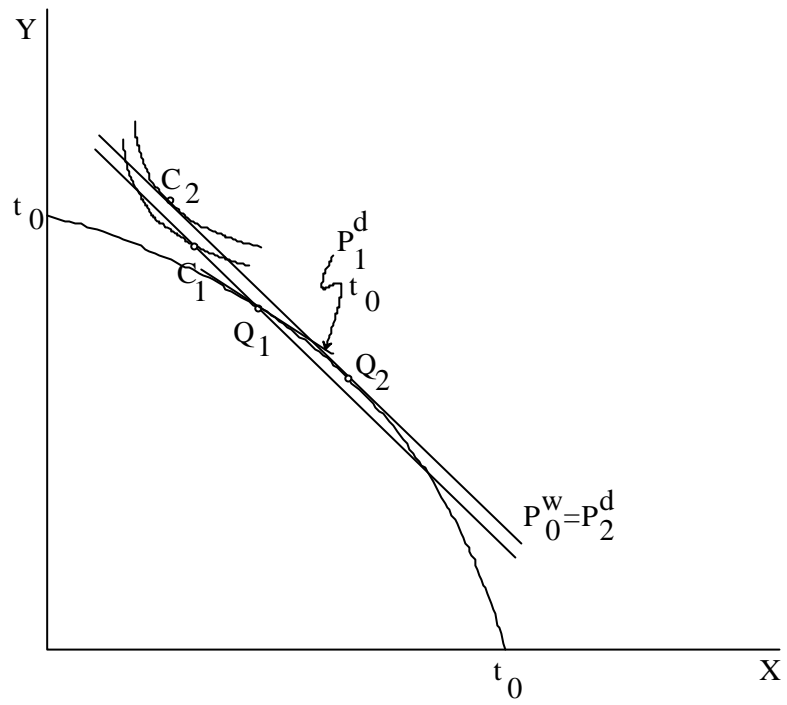
Domestic prices also change, of course. Figure 1a shows them getting steeper, from P_1^d to $P_2^d = P_0^w$. Therefore we also expect, in accord with the Stolper-Samuelson Theorem, that this liberalisation will now reverse the effect of lost British preferences on factor prices, raising the real return to the factor used intensively in the export industry and lowering the real return to the import competing factor.

Turning to factor markets, however, we get a decidedly mixed picture, even if we try to take the two-good, two-factor model fairly seriously. Assuming that we could identify what is the factor used intensively in exportables, it would have been helped by trade liberalisation depending on the technology of that particular sector. Similar effects hold in reverse for the factor used intensively in import competing sectors.

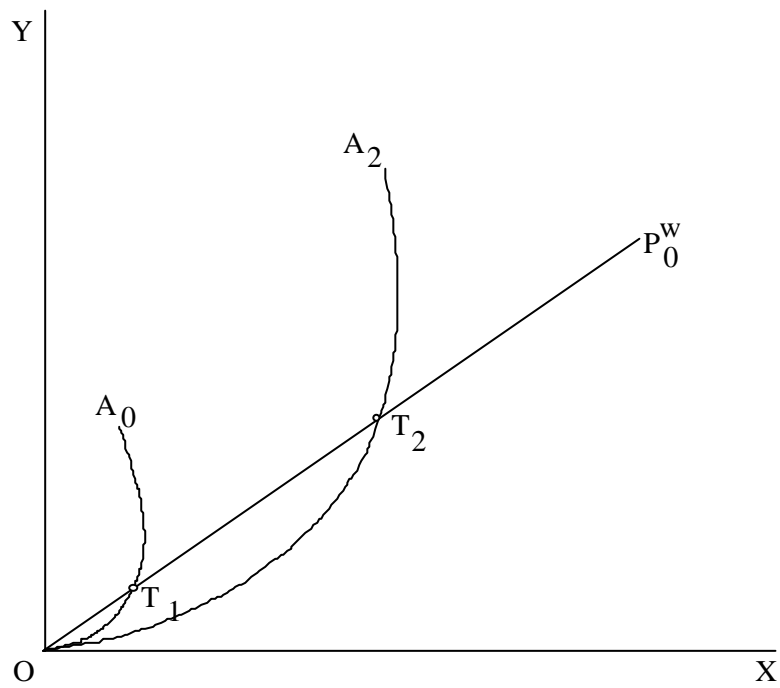
Matters are not that simple: realistically if we were to apply the 2x2 H-O model to the policies as we have just done, we would probably want to aggregate goods and perhaps factors differently for each step of the analysis. For example, following the 1984 reforms New Zealand's export sector was increasingly based on natural resource based products, and while some of the manufactured

¹Though free trade later became the stated goal in 1997 within the context of APEC.

Figure 1 Effects of trade liberalisation



a) Production and Consumption



b) Trade

products remained strong exports after liberalisation, some did not and other exports emerged as well. Therefore, while the two-sector model can be instructive for many purposes, it really does not take us far toward understanding what to expect in factor markets. We therefore turn to an alternative methodology for our more formal empirical analysis.

2.2 The Factor Content of Trade

In Deardorff and Staiger (1988) it was shown that the factor content of trade can be used under certain circumstances to infer the changes in factor prices that are in some sense associated with changes in trade. Leamer (1996) has stressed various limitations of this approach, but Deardorff (1997) has extended the model to some extent in response: sufficiently we believe that the factor content of trade remains a useful, if far from perfect, way of getting some information about the factor-market effects of trade. Here we will adapt part of Deardorff and Staiger's analysis with a view to making more precise what our measures of factor content in the remainder of the paper can tell us.

The question we will ask is this: At any given time, to what extent did New Zealand's trade cause the prices of its factors to be different from what they would have been, at that time and under otherwise identical conditions, in autarky. That is, had trade been shut down completely so that New Zealand had to produce all its needs for itself, prices of factors would have been different, some higher and some lower presumably, in order to satisfy the country's demands for goods. These demands too would have been different than with trade, in response to the different prices of goods that would have followed from the different prices of factors. Taking all of this into account, then, we ask how New Zealand's actual trade altered factor prices compared to what they would have been in autarky. Repeating this process at different times, before and after the changes in policy discussed above, we will be able to compare how trade under the various policies affected factor prices.

This is not the same as asking how the policies themselves, and the changes in them, affected factor prices. We can only observe the trade that actually occurred, and this is sure to have changed for a whole list of reasons in addition to the policy changes. Most obviously, factor endowments grew over the period and this must have contributed to changes in trade. At the same time, technology was changing, and perhaps also New Zealand's consumers' tastes for goods. Finally, many other changes in policy also occurred, some as part of the program of liberalisation, others more incidentally, but any and all of these changes may have affected trade. We are not in a position in this modest study to disentangle all of these effects on trade and their effects on factor prices, and we will not attempt to do so. Rather, we simply look at the actual trade patterns at different points in time, patterns that resulted from everything that could

possibly matter for trade, and ask how these trade patterns changed factor prices relative to what they would have been in autarky at those same times. Our hope is that the times we have selected for which to make these calculations will be at least suggestive as regards the effects of the policies we have discussed above, since it seems plausible that these were among the more major changes to have affected trade over these periods.

Deardorff (1997) has derived the following relationship between factor quantities and factor prices in autarky for a country that produces and consumes an arbitrary number of goods using an arbitrary number of factors in constant elasticity of substitution (CES) production and utility functions with a common elasticity of substitution,

$$\mathbf{s} = 1 / \mathbf{e}.$$

$$w_i = C_i^e Y^e I^{e-1} v_i^{-e} \quad (1)$$

where w_i is the wage of factor I and v_i is its quantity. C_i is a constant, an index of the distribution parameters in the various CES functions, Y is national income, and I is a CES index of factor prices. Equation (1) says that in autarky the prices of factors are inversely related to their quantities, with an elasticity \mathbf{e} that is one over the elasticity of substitution. For example, labor economists have estimated the elasticity of factor substitution to be about 1.5.² If we take that elasticity to apply also to goods, then (1) suggests a factor price response of about two thirds of the proportional changes in quantities. In fact, for simplicity we will use the Cobb-Douglas version of (1) for most of our analysis, leaving it to the reader to scale the changes down by the fraction 2/3 if they wish, or to make any other adjustments that they think appropriate.

Equation (1) becomes useful when we draw on the result of Deardorff and Staiger (1988) that any trading equilibrium (with again arbitrary numbers of goods and factors and now also with arbitrary constant-returns-to-scale technologies and arbitrary barriers to trade) will have the same factor prices as what they call an “equivalent autarky equilibrium,” in which factor endowments are changed by the amounts of the factor content of trade and trade is then prohibited.³ Thus equation (1) can be used to compare not just two actual autarky equilibria, but also two equilibria with or without trade by constructing what the factor endowments in their equivalent autarky equilibria would have been.

² See Johnson and Stafford (1997).

³ This result also requires several other assumptions, such as perfect competition and the absence of domestic distortions, and perhaps most importantly that all goods be produced in the domestic economy. Leamer (1996) has rightly criticised this last assumption, and while Deardorff (1997) has made some progress in adapting the model to drop this assumption, we do not attempt to incorporate that extension here. Suffice it to say that he shows that assumption to be unnecessary for the Cobb-Douglas case that we apply here.

Consider then an economy with a vector of actual factor endowments $\bar{v} = \{\bar{v}_i\}$. Were that economy not to trade, its factor prices, $\bar{w} = \{\bar{w}_i\}$, would be given from (1) in the Cobb-Douglas case ($\mathbf{e} = \mathbf{1}$) by

$$\bar{w}_i = C_i \bar{Y} \bar{v}_i^{-1} \quad (2)$$

where

$$\bar{Y} = \sum_i \bar{w}_i \bar{v}_i = \bar{w} \bar{v}. \quad (3)$$

With trade, let $s = \{s_i\} = AT$ be the factor content of trade, a vector of positive and negative factor quantities derived from the vector of net trade (exports minus imports) in goods, T , by multiplying by the matrix A of factors employed in each industry per unit of output. Then following Deardorff and Staiger (1988), the factor prices, \tilde{w} , that prevail in that trading equilibrium will be the same as those that the same economy would have in autarky if factor endowments were altered by the factor content of trade, becoming $\tilde{v} = \bar{v} - s$. Thus, from (1), again with $\mathbf{e} = \mathbf{1}$,

$$\tilde{w}_i = C_i \tilde{Y} \tilde{v}_i^{-1} \quad (4)$$

where

$$\tilde{Y} = \sum_i \tilde{w}_i \tilde{v}_i = \tilde{w} \tilde{v} = \tilde{w}(\bar{v} - s) = \tilde{w} \bar{v} - S \quad (5)$$

and S is the trade surplus.¹

In order to compare factor prices in the trade equilibrium, \tilde{w} , with what they would have been in autarky, we take the ratio of (2) and (4). So as to compare relative factor prices rather than ones in some arbitrary numeraire, we normalise on the value of the factor endowments, setting $\bar{Y} = \bar{w} \bar{v} = \tilde{w} \bar{v} = \tilde{Y} + S$. The result is

$$\frac{\tilde{w}_i}{\bar{w}_i} = \frac{\tilde{Y} \bar{v}_i}{\bar{Y} \tilde{v}_i} = \frac{\bar{Y} - S}{\bar{Y}} \frac{\bar{v}_i}{\bar{v}_i - s_i} \quad (6)$$

or

$$\frac{\tilde{w}_i}{\bar{w}_i} = \frac{1 - \frac{S}{\bar{Y}}}{1 - \frac{s_i}{\bar{v}_i}} \quad (7)$$

That is, if trade is balanced ($S = 0$), then whether trade has raised or lowered a particular relative factor price compared to autarky depends simply on whether that factor's content of trade is positive or negative. If a factor is net-exported in content terms ($s_i > 0$), then the denominator on the right of (7) is less than one and $\tilde{w}_i > \bar{w}_i$. If trade is not balanced, then net trade in the factor must be compared to net trade overall in order to infer effects on relative

factor prices. For example, only if the net export of a factor relative to its endowment is greater than the country's trade surplus relative to national income will the factor's relative price be raised by trade.

2.3 Measuring the Factor Content of Trade

Once the factor content of trade has been measured, equation (7) can be implemented straightforwardly with easily accessible data on the trade balance and national income, plus somewhat more difficult to obtain data on factor endowments. Note however that the equation holds for each factor separately, so that it is not necessary to apply it for all factors if data for only some are available.

The factor content of trade was defined above as $s = \{s_i\} = AT$, or

$$s_i = \sum_j a_{ij} T_j \quad (8)$$

where a_{ij} is the quantity of factor I used per unit of output of good j . Both trade and input requirements are more easily gotten in terms of values of the goods, not quantities, and these are obtained by transforming (8) as

$$s_i = \sum_j \left(\frac{a_{ij}}{p_j} \right) (p_j T_j) \quad (8')$$

More difficult is the issue of intermediate inputs. Suppose that in addition to requiring the primary inputs a_{ij} , production of good j also requires intermediate inputs of itself and other produced goods, b_{kj} being the amount of good k used in production of a unit of good j . Letting $B = \{b_{kj}\}$ be the (square) matrix of intermediate input requirements, net output is only $(I - B)$ times gross output (with I an identity matrix), and the total primary factors needed to produce a unit of net output, including all intermediate inputs, is $A(I - B)^{-1}$. Thus we have the choice of measuring only the direct factor content of trade, $s = AT$, as in (8), or of allowing also for the indirect use of primary factors in producing inputs. In that case we have $s = A(I - B)^{-1}T$, or

$$s_i = \sum_k a_{ik} \sum_j \left\{ (I - B)^{-1} \right\}_{kj} T_j \quad (9)$$

This too can be transformed into value terms for easier application:

$$s_i = \sum_k \frac{a_{ik}}{p_k} \sum_j \left\{ (I - \mathbf{b})^{-1} \right\}_{kj} p_j T_j \quad (9')$$

where $\mathbf{b} = \{b_{kj}\} = \{p_k b_{kj} / p_j\}$ is the value of input k per unit value of output j .

3. EMPIRICAL ANALYSIS

The empirical analysis is conducted for two periods roughly corresponding to the period before the 1984 reforms had affected the structure of the economy and a period after major parts of the reforms are thought to have had effect. These periods are taken to be around the census years 1986 and 1996. Equation 9 was estimated for the earlier period using data from the 1987 input/output table and factor employment data mainly from the 1986 population census. The latter period employed the 1995 input/output table and factor employment data mainly from the 1996 population census. (No fully revised input-output tables are available between 1987 and 1995.) A 25 sector disaggregation of industry was employed. Capital employment are estimates of the capital stock from Philpott (1995a and b). Land data were taken from Bicknell et al (1997) and used for all sectors except agriculture. Agricultural sector land use data for 1986 and 1994 was taken from the agricultural censuses.

Labour inputs by industry of employment are available by sex and qualifications from Statistics New Zealand (1997). Labour endowments classified by highest qualification obtained are used because qualifications are “more likely to be exogenous with respect to output shares than occupational classifications” and “education is probably more closely related to skill than is occupation”, Harrigan (1997). At the same time, the use of highest qualification assumes that the qualifications correspond to elements of human capital that are valuable in the sectors in which they are employed. To the extent this assumption does not hold, the analysis could be subject to the “New York taxi driver with the Ph.D problem”.

Employment data was aggregated by sex into seven categories by highest qualification obtained, higher (or post-graduate) degrees, degrees, advanced vocational qualifications (including technicians and those with teaching and nursing diplomas), skill based vocational qualifications (including trade certificates), other tertiary qualifications (mainly bridging courses), school graduates with either school certificate, university entrance or the university bursary qualification and finally, employees whose highest qualification was less than school certificate (the year nine qualification). The latter group is referred to as having no qualifications.

There are two very large groups of employees with tertiary qualifications. The first is the advanced vocational group which comprises mainly teachers, nurses and technicians of all types. These people are employed in the obvious industries but there are large numbers of females from this category employed in agriculture, a major exportable. The second major tertiary grouping is the skill vocational group which comprises mainly builders, non-professional engineers, welders, electricians and plumbers etc. These employees are concentrated in construction but are also concentrated in the largest importable sector, fabricated metals.

Adjustments were made to employment in agriculture where there are large numbers of small farms which produce very small quantities of output. In this case total employment was scaled down to estimates of the total number of commercial farms (goods and services tax registered) derived from Fairweather (1997). These farms produce 95 percent of agricultural output. On this basis it is estimated that there were 65,000 and 61,000 commercial farms in 1986 and 1996 respectively. This procedure ignores small changes in the total farm area over the period. The total number of male farmers was constrained to commercial farm levels and the numbers in each other category of labour from the population census were scaled down proportionally. This procedure leaves out, what is thought to be, a small number of commercial farms run solely by females.

Table 1: Factor endowments, 1986 and 1996

Factor Units	1986		1996	
	Male	Female	Male	Female
Labour (no. of employees)				
Higher degrees	26,884	12,530	34,680	22,872
Degree	40,745	20,537	64,747	49,897
Adv. Technical	29,866	82,384	53,050	88,348
Skill Qual.	202,249	39,130	119,168	36,795
Other Tertiary	48,758	36,823	81,393	68,463
School Qual.	186,202	167,461	220,242	234,525
No Qual.	312,203	217,754	228,177	176,385
Total Labour	846,907	576,619	801,456	677,286
		Total		Total
Land (000 ha)		21,369		17,975
Capital ¹ (million \$)		199,446		237,932

Notes: (1) Real gross capital stock in 1982/83 prices

Source: derived from Statistics New Zealand (1997) for labour and see text for capital and land

Some changes in economic structure have taken place over the reform period. There has been a rapid upskilling of the labour force over the period, especially for women. This is shown by the data in Table 1. The number of employees without qualification has diminished 19 percent for females and 27 percent for males over the 1986-96 period. Correspondingly, there has been a 40 (18) percent increase in female (male) employees with school leaving certificates. The picture for tertiary qualifications is mixed. Employees with higher or undergraduate degrees have increased rapidly especially for females (83% for higher and 143% for undergraduate degrees). On the

other hand, what is classified as tertiary skill training has declined while so-called advanced tertiary diplomas have increased.

Table 2 : Net trade of New Zealand, \$ million

	1986 Net Trade	share of exports or imports-%	1996 Net Trade	share of exports or imports-%
Exportables				
Agriculture	873	10.17	1172	8.43
Fishing & Hunting	165	1.92	197	1.42
Forestry & Logging	34	0.40	619	4.45
Food, Beverages & Tobacco	4276	49.80	6762	48.62
Textiles, Apparel & Leather	595	6.93	266	1.92
Wood & Products	152	1.77	769	5.53
Electricity, Gas & Water	3	0.03	4	0.03
Construction	22	0.26	33	0.24
Trade, Restaurants & Hotels	1484	17.28	3524	25.33
Transport & Storage	453	5.28	182	1.31
Communications	225	2.62	58	0.42
Community, Social Services	198	2.31	192	1.38
Central Government	53	0.62	99	0.71
Local Government	6	0.07	2	0.01
Private Non-Profit	48	0.56	29	0.21
Importables				
Mining & Quarrying	-335	2.99	-632	3.75
Paper, Products & Printing	-49	0.44	-123	0.73
Chemicals, Petrol & Rubber	-2009	17.95	-2972	17.62
Non-Metallic	-27	0.24	-226	1.34
Minerals				
Basic Metals	-345	3.08	-235	1.39
Fabricated Metal	-4174	37.30	-7467	44.26
Products				
Other	-678	6.06	-225	1.33
Manufacturing				
Finance & Insurance	-3574	31.94	-4991	29.58
Total				
Exports	8587	100	13908	100
Imports	-11191	100	-16871	100
Net Trade	-2604		-2962	

Notes: (1) Imports of travel services in the I/O tables have been split between transport and storage (80%) and trade, restaurants and hotels (20%), Roger Thomas, pers. Comm.

Source: derived from the 1987 and 1995 input-output tables, statistics New Zealand.

Overall, these changes cannot be attributed to the reforms alone or even in a major way - social dynamics of a longer duration also appear to be at work.. Female participation rates in tertiary education and employment have been rising over a much longer timeframe and there have been major changes in household composition and lifestyle expectations that may have been accelerated by the reforms but are unlikely to have been caused by them.

The composition of New Zealand's net trade has also changed but less dramatically than for labour endowments, Table 2. On the exportable side New Zealand exports tend to be concentrated in natural resource based products (food and agricultural products, wood and fish) and travel services (hotels and air transport) with some contribution from textiles, apparel, leather and communications. On the importable side, New Zealand is a major net importer of fabricated metal products (machinery and equipment, cars, other vehicles and machine tools), chemicals and petroleum products, financial and insurance services and bauxite, phosphate rock (for fertiliser) and other mineral products. This pattern has not changed over the period as it reflects the country's strong comparative advantages in land and water based industries and its comparative disadvantage in long production run products like standardised cars where the small domestic market of 3.7 million people is limiting.

The shares of agriculture and food products and fish have declined somewhat but wood and forestry products have expanded rapidly as the tree plantings of the 60's and 70's have matured. The trade and transport share increases may be largely cyclical as imports of tourist services tend to follow the business cycle and this has a major effect on net trade. On the importable side the share of fabricated metal products has risen strongly with significant declines in net trade shares for finance and insurance, base metals and other manufacturing.

The economic reforms were probably only partly responsible for these changes. The composition of agricultural production did change as a result of the removal of sheep and wool production subsidies and the related substitution of beef and dairy cattle, plantation forests and other agricultural products. Import penetration in the importable sector increased markedly in the light manufacturing industries, car assembly, clothing, footwear, plastics and other consumer products. Interestingly, though, exports of elaborated manufactures (Other Manufacturing) also increased and this may be in short production run products which employed particular skill bases in New Zealand. The reform environment may also have stimulated the expansion of the large aluminium smelter at Bluff. However, forest planting, horticultural developments and the aluminium smelter were already expanding by 1984.

Factor intensities for exportables and importables are given in Table 3 with industry details given in the Appendix.

Table 3 : Weighted average of factor intensities – 1986 , 1996

		1986		1996	
		Exportables	Importables	Exportables	Importables
Capital/Labour	*10000	978.66	1161.66	1187.40	1725.08
Land/Labour	*1000	20.0	1.0	22.0	1.0
Labour-Male					
Higher Degree	% ¹	3.50	9.14	5.02	6.86
Degree	%	5.76	26.62	12.37	20.29
Adv. Technical	%	6.32	9.20	12.40	19.45
Skill Qual.	%	42.16	77.90	32.77	65.28
Other Tertiary	%	11.30	23.09	26.93	38.00
School Qual.	%	46.39	76.89	78.37	76.76
Labour-Female					
Higher Degree	% ²	1.64	2.17	3.67	4.14
Degree	%	3.54	5.89	11.06	13.66
Adv. Technical	%	14.56	9.97	16.80	15.75
Skill Qual.	%	11.13	17.65	10.63	10.99
Other Tertiary	%	10.23	15.01	25.04	26.07
School Qual.	%	55.67	77.19	98.05	103.39

Notes: (1) As percentage of total unqualified males.
(2) As percentage of total unqualified females.

Source: author s calculations.

Not surprisingly, exportables are much more land intensive than importables. Importables are more capital intensive than exportables and the margin has widened over the period. The labour position is more complex and somewhat surprising. The ratio of employees with qualifications to unqualified employees is higher for importables than exportables (with one exception) but the margin has narrowed over the period. For example, employees with higher degrees in the exportable sector (importable) constitute 3.5 (9.14) percent of unqualified employees in 1986. In other words, exportables are more intensive in the use of unqualified male and female labour services than importables.

These raw factor intensity data need to be interpreted with caution because they do not account for industry interdependencies. The fuller story based on the complete model is in the following section.

4. RESULTS

The patterns of factor intensities and net trade discussed above lead to the factor content of trade measures in Table 4. New Zealand appears to be a net exporter of land, capital and labour with lower qualifications and a net importer of highly qualified labour. Exports embody relatively large quantities of unqualified female and male labour services and land.

Table 4 : Factor content of trade, pre and post-reform

Factors	1986	1996
Labour-(M:male, F:female) (employees)		
Higher degree, M	-369	-1179
Higher degree, F	211	-8
Degree, M	-2991	-4879
Degree, F	-89	-789
Adv. Technical, M	1065	-1268
Adv. Technical, F	4354	2644
Skill Qual., M	-7007	-4547
Skill Qual., F	-543	387
Other Tertiary, M	-800	-566
Other Tertiary, F	-309	1428
School Qual., M	495	5028
School Qual., F	-1306	4262
No Qual., M	14356	11619
No Qual., F	9460	9708
Land (‘000 ha.)	8101	7022
Capital	3277	622

Source: *author's calculations.*

The changes in relative factor returns using equation 6, are given in Table 5 based on the change in the current account deficit from \$2.604 billion in 1987 to \$2.962 billion in 1995. The pattern is the same as in Table 4. Land, capital and lower qualified labour are relatively advantaged by trade compared to autarky: especially is that true for land where the relative advantage is around 60 percent in both time periods (1.65 in 1986 and 1.67 in 1996). The other factors included here with large relative improvements are males and females with few qualifications (no qualifications or school qualifications). Here the percentage improvement is from 7 percent for males and 7-8 percent for females (in the case of females, 1.07 in 1986 and 1.08 in 1996).

Furthermore, the relative trade advantage increases from 1986 to 1996 in all these cases. What can the changes between the periods be attributed to? The reforms entailed significant trade liberalisation. These effects can be attributed to the reforms to the extent that they dominated changes in market conditions and foreign market access via CER and the Uruguay GATT agreement. The GATT agreement only occurred in 1994 so probably had minor effects. CER

was important and Australia become New Zealand's major trading partner partly as a result of this agreement, but it was already a major partner before CER. There was a significant terms of trade rise over the period but the unilateral economic reforms are expected to be a dominant set of forces. We expect factors intensively employed in the exportable sector to benefit relative to the returns they would earn in autarky in each case. In this sense, unqualified labour and female labour benefited most.

The rental price of capital appears to fall relatively over the period. As shown in Table 5, capital returns are estimated to be 4 percent above their autarkic value in 1986 and 2 percent in 1996. This may be partly explained by the trends in the capital/labour ratios in Table 3. The capital/labour ratio of importables increased markedly relative to exportables from 1986 to 1996.

Table 5 : Changes in relative factor returns (\tilde{w}_i/w_i)

Factors	Relative Factor Prices				Change, %	
	1986		1996		1986-96	
	Male	Female	Male	Female	Male	Female
Higher degree	1.01	1.04	0.98	1.02	-3	-2
Degree	0.95	1.02	0.95	1.00	0	-2
Adv. Technical	1.06	1.08	0.99	1.05	-7	-3
Skill Qual.	0.99	1.01	0.98	1.03	-1	2
Other Tertiary	1.01	1.01	1.01	1.04	0	3
School Qual.	1.02	1.01	1.04	1.04	2	3
No Qual.	1.07	1.07	1.07	1.08	0	1
	Total		Total		Total	
Land	1.65		1.67		1	
Capital	1.04		1.02		-2	

Source: author calculations.

One surprising result here is that relatively qualified male labour was disadvantaged over the period. The factor set chosen includes all categories of labour, many forms of capital (plant, machinery and buildings) and land. We may refer to a relative factor return greater (less than) one as a factor with a comparative advantage (disadvantage). The reforms and world market changes appear to have reinforced New Zealand's comparative advantage in embodied unqualified and female labour services and its comparative disadvantage in embodied highly qualified male labour.

5. SUMMARY AND CONCLUSIONS

This analysis has used an adaptation of the standard Heckscher-Odlin trade model to estimate relative changes in factor rewards for land, labour and capital in New Zealand before and after the recent reforms involving trade and other policies. Over this period, 1986-96, a number of other events occurred that would likely influence the composition of trade and factor contents. However, the unilateral trade policy changes that formed part of the economic reforms are seen as very important if not the dominant driver of the changing factor content of trade. To this extent factor returns relative to autarky in each period can be compared and changes attributed mainly to the reforms: at least until more refined decomposition analysis is carried out.

As expected, returns to land are significantly advantaged relative to autarky because land is intensively used in the exportable sector in New Zealand both directly from the large agricultural sector and indirectly via the large agricultural product processing industries - food and textiles. This advantage for land returns increases only very slightly from 65 percent in 1986 to 67 percent in 1996. To a lesser extent labour also benefits from trade relative to autarky; especially unqualified female labour where its return relative to autarky was 7 percent higher in 1986 rising to 8 percent higher in 1996 after trade liberalisation. More generally relative factor rewards for unqualified labour and labour with only school qualifications appear to benefit most from trade. Male labour with degrees are relatively worse off through trade because they are concentrated in industries which are major importables.

The implications of these results for the labour market, especially, are important. Even after the rapid upskilling of the labour force to 1996, 56 (61) percent of the male (female) labour force have either only school qualifications or no qualifications, Table 1. These workers are intensively employed in the exportable sector as opposed to importables. Their factor rewards relative to autarky appear to have improved with freer trade since 1986.

The 1986 results shed some light on the objectives of the import substitution strategy regarding employment. One of the objectives of this policy from 1938-84 was to increase the diversity of jobs that were available to the community on the grounds that the strong comparative advantage in land based activities would result in narrow employment opportunities for the community as a whole. By 1986, the importable sector supported by trade barriers, was both more capital intensive than the exportable sector and more intensive in all categories of higher labour skills than exportables. For example, importable production employed 9 percent males (of unqualified employees) with higher degrees whereas the exportable sector employed only 3.5 percent.

At the same time the employment diversity goals of the import substitution strategy stimulated the development of major importables like metal fabrication which was intensive in its use of skill qualified labour. This category of labour comprised the largest group of employees, other than unqualified labour, in 1986, Table 1. This group had nearly halved by 1996 as the tradeable sector shed labour during the early phases of the economic reforms. Part of this change may, however, be the result of academic creep: the reclassification or reorganisation of qualifications without essentially changing the value of the qualification. For example, changing an 2 year skill diploma to a three year advanced diploma with little added value.

The results do not lend support to the hypothesis that trade has contributed to a worsening the distribution of income for employed workers in recent decades (but leaves open the broader question of the effects of the whole reform package on unemployment). The results suggest that trade liberalisation, trade agreements and improved market access over the decade 1986-96 might have actually improved the distribution in the sense of raising relative returns to employees with lower qualifications and, presumably, lower wages. One clue to the distributional issue shown in Table 3 is the intensity of the non-traded goods sector in highly qualified employees. The export sector is intensive in the use of female employees. The relatively high incidence of female poverty points to explanations of increasing income disparities unrelated to the trade issue. However, that is the subject of future research.

These results also bear on recent discussions regarding the appropriate phasing of remaining tariffs beyond 2000 as part of the 1998 Tariff Review. These results suggest that a slower reduction in tariffs would tend to benefit more highly qualified male employees but disadvantage all other categories of labour particularly unqualified male and female labour. A faster reduction in tariffs might, by contrast, tend to benefit labour, particularly those with lower qualifications. Such a result would add weight to the middle class capture thesis.

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APPENDIX A: FACTOR INTENSITIES

Table A1: Factor Intensities-1986

	K/L *10000	Ln/L ratio	Male						Female					
			High/N %	Deg/N %	Adv/N %	Skill/N %	OT/N %	School/N %	High/N %	Deg/N %	Adv/N %	Skill/N %	OT/N %	School/N %
Exportables														
Agriculture	2075	0.19	1.94	4.17	8.41	22.53	7.11	47.54	1.72	4.21	33.47	9.58	9.62	58.97
Fishing & Hunting	757	0.00	1.61	2.87	3.58	40.86	58.78	30.47	1.22	7.32	24.39	12.20	17.07	52.44
Forestry & Logging	737	0.17	2.80	5.12	2.06	27.69	8.86	35.86	6.10	7.93	15.24	19.51	9.76	75.61
Food, Beverages & Tobacco	962	0.00	1.65	3.60	4.70	30.63	7.33	32.76	0.79	2.25	6.44	8.45	6.58	45.56
Textiles, Apparel & Leather	368	0.00	2.14	4.57	4.70	40.94	8.89	43.72	0.43	0.87	4.01	7.51	5.26	31.24
Wood & Products	547	0.00	0.92	1.83	1.60	49.96	5.42	37.95	0.81	1.75	9.99	11.47	10.53	57.49
Electricity, Gas & Water	11355	0.01	3.48	11.45	2.54	141.88	27.68	47.61	1.38	8.26	10.09	27.52	19.27	119.27
Construction	302	0.00	1.36	3.73	2.13	101.68	8.25	40.99	1.33	2.88	17.75	17.46	14.79	73.59
Trade, Restaurants & Hotels	469	0.00	3.69	7.71	7.14	61.55	15.59	76.00	1.19	2.80	11.06	11.12	11.92	64.45
Transport & Storage	1774	0.00	1.26	3.14	2.75	40.78	18.27	41.94	2.06	5.52	18.18	29.33	30.30	109.82
Communications	935	0.00	2.71	11.96	2.82	160.10	22.97	111.40	0.80	2.60	7.62	15.82	18.84	88.82
Community, Social Services	113	0.00	56.44	45.18	47.00	90.15	19.51	58.17	22.60	29.67	157.40	27.93	28.32	76.99
Central Government	4175	0.00	28.06	36.05	22.49	91.44	45.38	158.31	17.49	28.21	31.70	48.86	29.83	179.68
Local Government	5268	0.00	28.03	36.04	22.52	91.47	45.33	158.27	17.53	28.17	31.74	48.85	29.79	179.74
Private Non-Profit	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Weighted Average	978.66	0.02	3.50	5.76	6.32	42.16	11.30	46.39	1.64	3.54	14.56	11.13	10.23	55.67
Importables														
Mining & Quarrying	4487	0.01	4.09	8.40	1.88	39.78	15.80	29.61	2.82	8.45	12.68	35.21	18.31	88.73
Paper, Products & Printing	1045	0.00	4.97	8.32	5.48	90.52	12.67	60.75	4.04	6.12	12.00	18.82	15.26	73.69
Chemicals, Petrol & Rubber	1983	0.00	5.72	13.44	5.68	55.46	12.61	50.06	1.96	5.02	8.00	13.53	10.25	50.69
Non-Metallic Minerals	961	0.00	1.82	4.48	3.44	35.06	6.56	34.03	3.41	5.80	20.48	13.99	12.97	73.72
Basic Metals	3472	0.00	3.20	8.16	4.13	62.19	9.09	38.53	2.29	5.34	11.45	21.37	15.27	71.76
Fabricated Metal Products	422	0.00	2.05	5.51	3.26	92.00	12.00	49.86	0.91	2.00	7.08	10.08	9.42	53.38
Other Manufacturing	489	0.00	2.96	6.99	6.18	57.26	11.83	63.98	0.71	1.89	7.09	8.51	8.75	47.28
Finance & Insurance	1155	0.00	45.16	140.76	40.16	93.15	90.01	243.04	7.24	21.99	23.02	49.00	43.96	214.89
Weighted Average	1161.66	0.001	9.14	26.62	9.20	77.90	23.09	76.89	2.17	5.89	9.97	17.65	15.01	77.19

Legend: K, L, Ln: capital, labour and land respectively. High, Deg, Adv, Skill, OT, School and N refer to the labour categories in Table 1.

Table A2: Factor Intensities-1996

	K/L *10000	Ln/L ratio	Male						Female					
			High/N %	Deg/N %	Adv/N %	Skill/N %	OT/N %	School/N %	High/N %	Deg/N %	Adv/N %	Skill/N %	OT/N %	School/N %
Exportables														
Agriculture	2012	0.16	2.58	8.15	14.14	20.37	19.18	70.23	3.27	10.27	34.08	14.07	26.69	106.16
Fishing & Hunting	990	0.00	3.27	6.32	5.45	45.75	30.72	51.20	4.69	7.81	14.06	10.16	28.13	90.63
Forestry & Logging	848	0.19	3.72	9.61	9.85	15.83	33.60	53.15	8.70	19.25	23.60	16.77	32.92	109.32
Food, Beverages & Tobacco	1474	0.00	2.64	8.58	8.61	23.72	20.53	54.47	2.38	8.57	9.44	7.35	19.27	74.35
Textiles, Apparel & Leather	581	0.00	2.28	9.32	9.61	23.77	25.98	64.34	0.95	3.96	7.03	4.81	15.27	48.48
Wood & Products	633	0.00	1.18	4.88	5.78	49.30	28.37	63.48	1.91	7.63	14.89	11.45	26.53	105.34
Electricity, Gas & Water	23926	0.02	17.94	45.96	48.65	149.78	48.43	73.54	12.90	39.52	31.45	33.87	43.55	207.26
Construction	283	0.00	1.45	5.23	11.96	91.76	38.85	65.56	2.96	9.30	23.83	20.00	32.87	144.17
Trade, Restaurants & Hotels	496	0.00	6.24	18.75	17.27	50.19	38.12	132.67	3.22	11.45	16.26	11.82	29.95	132.23
Transport & Storage	1831	0.00	2.40	7.66	15.24	29.23	23.04	64.24	5.11	24.07	40.30	28.96	63.93	184.81
Communications	2833	0.00	10.74	29.23	20.69	72.27	32.22	131.34	5.20	17.80	11.37	11.89	28.19	133.66
Community, Social Services	151	0.00	83.34	74.24	62.30	59.28	50.40	99.35	31.12	52.05	129.79	34.20	52.60	110.44
Central Government	4442	0.00	52.13	72.33	60.99	70.71	60.78	218.13	44.02	71.75	79.47	42.19	59.85	227.83
Local Government	5447	0.00	52.17	72.38	61.02	70.74	60.73	218.09	44.04	71.80	79.45	42.19	59.89	227.87
Private Non-Profit	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Weighted Average	1187.40	0.02	5.02	12.37	12.40	32.77	26.93	78.37	3.67	11.06	16.80	10.63	25.04	98.05
Importables														
Mining & Quarrying	8401	0.02	8.06	9.98	6.83	36.95	22.59	38.88	12.00	24.00	20.00	12.00	26.00	116.00
Paper, Products & Printing	1614	0.00	6.00	13.74	13.51	75.83	39.78	88.18	5.82	17.46	19.44	17.67	33.47	126.40
Chemicals, Petrol & Rubber	2938	0.00	7.55	20.42	18.83	38.43	27.71	72.61	5.01	15.56	16.10	9.20	25.98	86.06
Non-Metallic Minerals	1580	0.00	1.99	7.85	9.46	24.03	20.30	50.44	3.87	13.55	30.32	12.26	31.61	118.06
Basic Metals	5104	0.00	4.22	12.97	13.88	50.83	26.24	55.05	7.58	25.76	18.18	12.12	30.30	148.48
Fabricated Metal Products	637	0.00	4.01	13.39	18.35	79.93	42.93	74.83	2.20	9.13	12.96	10.13	23.79	99.12
Other Manufacturing	388	0.00	3.25	10.95	14.50	52.96	36.09	91.72	3.29	7.00	16.46	8.64	23.87	89.71
Finance & Insurance	1362	0.00	61.15	187.32	79.48	71.81	64.93	223.00	19.85	64.59	47.93	37.13	63.81	261.96
Weighted Average	1725.08	0.001	6.86	20.29	19.45	65.28	38.00	76.76	4.14	13.66	15.75	10.99	26.07	103.39

Legend: Table A1 op cit.