A Study of Trade Liberalisation and Factor Mobility with a CGE Model of Australia and New Zealand

GANESH NANA
and
JACQUES POOT*

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Victoria University of Wellington, PO Box 600, Wellington, New Zealand
Institute of Socio-Economic Planning, University of Tsukuba, Tsukuba, Ibaraki 305, Japan

Abstract

Given the global trends of growing international economic integration and growing international migration flows, the possible linkages between these phenomena are of interest. Trade liberalisation is often seen as a means to reduce international migration pressures. However, such a view is based on the assumption that trade and migration are substitutes. Instead, many theoretical situations can be described where migration and trade are complements. This paper briefly summarises the main theories on this relationship and then moves on to the empirical evidence for Australasia.

Australia and New Zealand have close historical, cultural and economic ties. Citizens can move freely between the two countries. Trade between the two countries has also grown rapidly, particularly since the implementation of a 1983 free trade agreement. The impact of further removal of trade barriers vis-a-vis third countries on trans-Tasman trade and factor mobility, production sectors and the labour markets of both countries is assessed by means of simulations with a two-country multi-sectoral Computable General Equilibrium (CGE) model. The simulations show that removal of trade barriers at the Australasian border will lead to microeconomic adjustments which encourage labour migration from Australia to New Zealand, but professional worker migration and capital flows in the opposite direction. However, the impact of the sectoral and labour market adjustments on inter-country factor mobility is likely to be small and could be outweighed by the impact of concurrent macroeconomic policies and business cycle fluctuations.

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1. Introduction

The world has seen in recent decades a, not necessarily smoothly but undeniably persistent, trend of growing international economic integration through trade, information flows, diffusion of technological advances and migration. In total, about 100 million people live now outside their country of birth. Because there continue to be huge gaps in real incomes between countries, the potential for migration remains very strong and governments have been using the notion of trade as a substitute for migration as one of the reasons for advocating regional economic integration.1

For example, the assumed long-run effect of NAFTA on migration from Mexico to the USA played a role in concluding this agreement. Investments in Eastern Europe encouraged by governments of European Union countries are similarly motivated.

Although the concerns are primarily related to the case where countries are structurally quite different and the gap in the standard of living is wide, agreements about free trade and other forms of economic integration are often concluded between similar countries and the issue of how such agreements affect factor mobility is also of interest in this case. Australia and New Zealand provide a useful case study of the latter situation.

Australia and New Zealand have much in common due to their relative geographic proximity and shared colonial past.2 In 1901, the opportunity was there for New Zealand to join the Commonwealth along with the States of Australia. This opportunity was declined, but an agreement to permit free movement of citizens between the two which has been in place since the early 1920 is nonetheless a clear expression of the close historical, economic and cultural ties. Under the current Trans-Tasman Travel Agreement (TTTA), citizens of either country may freely settle in the other country. New Zealand extends this right effectively also to other permanent residents of Australia.

In contrast, this closeness did not guide external trade policies in the same way. The two self-governing countries became rather protectionist, especially after the Great Depression. But in the 1960s the two Governments acknowledged that a removal of trans-Tasman trade barriers would help develop stronger and more competitive manufacturing sectors and this led to the New Zealand-Australia Free Trade Agreement (the “original” NAFTA) in 1965. However, NAFTA was no free trade agreement at all, but instead a vague agreement to gradually remove trans-Tasman trade barriers within an unspecified time frame. Eventually,

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1. As for reasons why wage gaps are not reduced through capital mobility, one can point to a stronger incentive for labour to move than for capital to move due to variations between countries in riskiness of investments, market distortions and the externalities associated with human capital accumulation.

2. A wealth of comparative information about the two countries’ economies can be found in Edwards and Holmes (1994).
though, lack of progress with NAFTA provided the impetus for the concluding of the Australia-New Zealand Closer Economic Relations Trade Agreement (ANCERTA, or CER for short) of 1983. The original CER provided the schedule for the achievement of free trade by 1995, but a 1988 review led to a speeding up of the implementation and by 1990 virtually free trade in goods between the two countries had been achieved (Holmes (1991)). Although some barriers to trade in services and trans-Tasman investment have also been removed, and further moves towards a true single market are still on the agenda, some obstacles remain at present (for example in aviation and telecommunications), primarily due to a more cautious approach to liberalisation by Australia. The difference in attitudes towards completion of the single market is undoubtedly related to the slower pace of deregulation in the Australian economy and the observation that the benefits of CER have to date been reaped disproportionally by New Zealand.

This paper focuses on the impact of the TTTA and trade liberalisation on trans-Tasman migration and the Australasian labour market. The next section briefly reviews some of the standard theories which make some predictions about the relationship between trade and migration. This is followed by a brief review of earlier empirical work on trans-Tasman migration and the possible linkages with CER in Section 3 (see also Nana and Poot forthcoming).

An interesting question is what the impact of further removal of trade barriers at the common Australasian border would be for trans-Tasman trade and for the labour market of both countries. Section 4 describes a Computable General Equilibrium (CGE) model which can be used to address this question.

In Section 5 we report the results of simulations which show that the effects of extending CER to the bilateral removal of protection against imports from other countries are beneficial. However, our main concern is with the impact of such policies towards trade liberalisation on factor mobility. Various simulations are considered which differ in assumption about rigidities in factor prices or factor mobility. A direction for further research is suggested.

2. Trade and Migration in Theory

There are a wide range of theories of international trade, which not only make predictions about the volume of trade and the terms of trade, but also about factor prices in the trading countries. Surveys of such theories and the impact of trade on factor mobility, including migration, are given inter alia by Ruffin (1984), Razin and Sadka (1992) and Ethier (forthcoming). Here we will provide a brief summary of the main conclusions of this literature.

It is convenient to group the theories under two headings, namely those in which trade is due to comparative advantage in economies characterised by perfectly competitive markets
and theories in which trade takes place in the presence of economies of scale, externalities or imperfectly competitive markets.

Commencing with the theories of comparative advantage, we note that trade will lead to welfare gains when in autarky relative commodity prices are different. However, to consider the potential for migration between trading countries, we must consider the causes of comparative advantage.

The traditionally most commonly considered cause of comparative advantage is that of differences in factor endowments between countries. In this case, it is easy to show that migration and trade are substitutes. This idea is formalised in the Heckscher-Ohlin theory (see also e.g. Ohlin (1967)). With differences in factor endowments, different factor price ratios in autarky will lead to different relative output prices (as shown by Stolper and Samuelson's 1941 theorem) and there will be economic incentives for either trade or factor movement. In this situation, an opening up of the economies can lead to long run equilibrium either through commodity trade in which countries specialise in exporting the good which uses the abundant factor most intensively or, alternatively in which countries “export” the abundant factor and the comparative advantage disappears (see Mundell (1957) on the latter case).  

An alternative cause of differences in commodity price vectors in autarky is due to differences between countries in preferences. In this case, when factor endowments are identical but preferences differ, trade and migration are again substitutes. For example, a country which has a relatively higher desire for a labour intensive good will be characterised in autarky by a relatively higher price for this good and a higher real wage. Thus, in an open economy environment, it will either import the labour intensive good or permit inward labour migration. 

In contrast, differences in technology are likely to lead to complementarity of trade and migration (see e.g. Markusen (1983)). This can be easily seen by means of an example. Consider the case in which a country has a comparative advantage in the production of a labour intensive tradeable service (e.g. education) due to better information technology. This country is therefore likely to export the service, which will establish an international equilibrium output price ratio, but at this price ratio the relative factor prices will vary between countries. The real wage will be higher in the country with the technological advantage and inward labour migration is likely. Such migration will reinforce the comparative advantage and a growth in service exports combined with inward migration may be anticipated.

Razin and Sadka (1992) note in this context that a long-run stable and efficient allocation
of population in the presence of technological differences and externalities may nonetheless be feasible. Positive externalities of inward migration (e.g., increasing returns due to technological change and economies of scale) are counterbalanced by negative externalities resulting from the increasing scarcity of immobile resources and congestion effects.

A final cause of comparative advantage trade may be the presence of market distortions in the form of government intervention. Ethier (forthcoming) shows that there are no general conclusions regarding the relationship between trade and migration in this case. However, under certain circumstances it can be shown that a production distortion (e.g., such as an output subsidy) will lead to complementarity. The reason is that such a subsidy will make it likely that the subsidised good will be exported, but the relatively higher factor return to the factor used intensively in the production of this good will also encourage an inward flow of the production factor. In contrast, consumption distortions (such as an indirect tax) can be shown to lead under certain circumstances to substitution between trade and migration.

Moving away from the theories of comparative advantage in perfectly competitive markets, it can be shown that in the presence of economies of scale, externalities or imperfect competition, complementarity between migration and trade is likely (Markusen (1983)). If, for example, two countries are identical except for the size of the population and there are external economies of scale in the production of a good, the larger country is likely to export this good. At the same time, there will be a potential for an inflow of the factor used intensively in the production of the good as this factor will receive a higher return.

In summary we note that despite the conventional wisdom of migration and trade being substitutes, complementarity can manifest itself in many circumstances. However, in the cases of most interest internationally, such as general South-North migration there are large differences in factor endowments resulting in large differences in real wages which create the potential for mass migration. In such circumstances, the idea of migration and trade as long-run substitutes remains a valid perspective.

In the case of factor mobility in Australasia which will be discussed in the remainder of this paper, the similarity between the countries suggests that none of these theories individually may provide a powerful description of the patterns of trans-Tasman migration, or a prediction of the impact of further trade liberalisation vis-a-vis third countries. Consequently, a multi-sectoral multi-country general equilibrium model was used to assess the consequences of trade liberalisation quantitatively.

Finally, it should be noted that the theories above are primarily concerned with long-run equilibrium. Martin (forthcoming) notes that the short-run dynamics may be more important from the policy perspective. He argues that trade liberalisation is usually associated with "migration humps" due to the short-run structural adjustments in the economy generated by such a policy. Examples of such humps are the recent growth in Mexican-US migration.
following NAFTA and a brief but large influx of New Zealanders in Australia in the late 1980s during the implementation of CER.

3. The Trans-Tasman Migration and Trade Links

The movement of people between Australia and New Zealand has since the colonial days of the last century been an indicator of relative economic performance of the two countries. The net movement has tended to be in the direction of the country with the higher growth of real GDP per head (Poot (1993, p. 288)).

In the post-war period until the mid 1960s, the fluctuations in net trans-Tasman migration were relatively small and in most years the net movement was in the direction of New Zealand. Subsequently, commencing with the 1967 recession and until about 1991, trans-Tasman migration started to exhibit large fluctuations and the net movement was in most years in the direction of Australia. Since 1991, migration levels have been fairly low, but there continued to be net outflows to Australia (see James et al. (1995)).

Brosnan and Poot (1987) estimated an econometric model of 1950-85 trans-Tasman migration which identified the main determinants of the migration flows. First, overall mobility increased as the cost of trans-Tasman airfares declined in real terms. Secondly, given the age selectivity of migration with mobility rates being much higher among young adults, the post-war baby boom also contributed to the large volume of movement, particularly in the 1970s. Thirdly, waves of migration have tended to lead to waves of return migration as migrants are more mobile (i.e. more likely to move again) than non-migrants. For example, young people on working holidays of one year or longer are an obvious source of return migrants.

However, as noted earlier, changing relative economic conditions have been the primary force responsible for changes in the volume of gross migration and direction of net migration. The econometric model identified inflation, unemployment, real earnings and employment growth as significant factors. More recently, this model performed remarkably well at forecasting the wave of migration from New Zealand to Australia in the late 1980s, although the volume of movement was overestimated (Poot (1993, p. 296)).

While economic growth in Australia in the post war period has been mostly higher and the ratio of New Zealand's GDP per capita over Australia's GDP per capita (in purchasing power terms) has been on a long-run downward trend, more important is that both countries found their standard of living slide relative to the OECD average. In purchasing power parity (PPP) terms, New Zealand's GDP per capita ranked sixth among OECD countries in the 1950s, compared with Australia's eighth place. By 1976, the two countries switched relative positions and by the late 1980s, these ranks had become 19th and 16th for New Zealand and
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Australia respectively. Nonetheless, from a global perspective, both countries are clearly among the highly developed nations and perform similarly in terms of many welfare indicators. The “gap” between the two may also be closing as New Zealand has outperformed Australia in recent years in terms of economic indicators such as unemployment, the government budget balance and GDP growth.

The process of trans-Tasman migration is therefore better interpreted as inter-regional population redistribution. An econometric model of a matrix of gross interregional migration in Australasia 1981-86 (with New Zealand being one of the regions) showed that there is a common labour market in that all flows responded to interregional differences in income and employment opportunities (Poot (1995)). However, trans-Tasman migration is not exactly internal migration. There are statistically significant differences in coefficients of migration determinants in this model between intra-Australian flows and trans-Tasman flows. Among the factors responsible for this are the differences between the two countries in tax and public expenditure policies, a different treatment of domestic vis-a-vis foreign qualifications and the gap between the nominal exchange rate and the PPP one.

In terms of trade, the image of trans-Tasman flows as interregional trade rather than international trade is also not entirely appropriate, despite that free merchandise trade was achieved by 1990. The export ratio of New Zealand is about 28 percent of GDP, undoubtedly lower than the ratio for the States of Australia when inter-State trade is included. Trade flows in the post-war period have also been rather unbalanced, at least until recently. Trans-Tasman exports in the 1950s were only about 2.8 percent of New Zealand’s exports, while imports from Australia accounted for 14.2 percent of New Zealand’s imports (Edwards and Holmes (1994, pp. 130-131)). Both export and import shares increased, but exports at a faster rate so that roughly balanced merchandise trade resulted in recent years. Australia now accounts for one fifth of New Zealand’s trade, while New Zealand accounts for 5 percent of Australian trade.

Migration and trade in Australasia do not represent flows within a single economy. The migration flows are probably more similar to internal migration than, for example, intra-European migration of European Union (EU) citizens, but we noted that they are behaviourally different from inter-State migration within Australia. Moreover, in terms of trade in services, investment and tax policy, the EU may be considered closer to the true single market than CER (Lloyd (1991, p. 24)).

Nonetheless, both in terms of migration and in terms of trade, the trans-Tasman flows have increased in importance during much of the post-war period. Since trans-Tasman migration and trans-Tasman trade shared a common upward trend for much of the post-war

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period, it may be tempting to suggest some causal link. There are many unrelated factors influencing one or the other, but one common factor has been the impact of major policy events in the United Kingdom. Australia became the predominant destination of PLT departures from New Zealand after the United Kingdom introduced controls on Commonwealth immigration in the 1960s (Farmer and Buetow (1993)). At the same time, the Common Market’s share of British trade increased significantly (an increase which preceded formal entry into the Market in 1973) and this had a strong impact on the direction of New Zealand exports.

The implementation of CER in the 1980s has had a positive impact on the New Zealand economy at the macro level. At the same time, emigration levels from New Zealand to Australia increased since the early 1980s until a peak in 1988. Subsequently, emigration declined to levels experienced in the early 1980s. Consequently, the recent slowdown in net migration in the direction of Australia is consistent with the view that trade and migration are substitutes in the long run, although one possible explanation for the New Zealand to Australia migration wave of the late 1980s is the presence of a “migration hump” resulting from trade liberalisation (see Section 2). The phasing in of CER and other measures of trade liberalisation and economic reforms did lead to significant economic restructuring and rising unemployment in New Zealand during the late 1980s.

A growing trade in services, such as professional consultancy services and tourism, and trans-Tasman investment may have also led to some labour mobility. There is little information on this. However, business and commerce professionals are over represented among New Zealand migrants to Australia aged 35 and over (Carmichael (1993, p. 124)). There is also some evidence that a disproportional share of Australian migrants to New Zealand in recent years are “contract migrants”. These are people who are transferees of Australian firms or hired on short-term contracts by New Zealand firms. For example, in the early 1980s some contract migrants were employed on the Government’s capital-intensive energy projects (the “Think Big” projects) and later there was a growing demand for professional workers in the business, finance and technology sectors created by extensive economic reforms and private and public sector restructuring (see also Poot (1993, p. 298)).

The stylised facts of long-run post-war economic growth in Australia and New Zealand are consistent with the conventional neoclassical models of migration. The average annual rate of real growth in GDP in New Zealand over the period 1950–93 was 2.7 percent and in Australia 4.0 percent. Given population growth of 1.4 percent in New Zealand and 1.9 percent in Australia, real income per head grew by approximately 1.3 percent and 2.1 percent respectively. As expected, net migration took place in the direction of the country with the higher rate of growth in real income per head.

We note also that part of the faster growth in Australia was due to a faster growth in
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capital per head, as more of GDP was devoted to investment in that country (except for 1973 -77). The data base of the Joani model described in the next section suggests that the 1986/87 capital-labour ratio in Australia was in PPP terms about 38 percent higher than in New Zealand.\textsuperscript{5} The lower capital-labour ratio in New Zealand indeed corresponded to a higher average rate of return to capital: 7.9 percent versus 5.6 percent respectively. Comparable data on earnings suggest that in PPP terms earnings per worker in 1986/87 were 17.5 percent higher in Australia.

With these stylised facts, the observed trans-Tasman flows make sense. As the Heckscher-Ohlin theory would suggest, Australia allocated relatively more resources to the more capital-intensive manufacturing and mining sectors. Manufactured goods do in fact account for a larger share of trade from Australia to New Zealand than vice versa (Edward and Holmes (1994, p. 152)).

Given the restrictions on trade, until CER, in some commodities where New Zealand would have had the comparative advantage, labour migration from the relatively labour abundant country can substitute for commodity trade. It could therefore be argued that the Australian trade barriers contributed to net migration from New Zealand to Australia. Similarly, although notoriously harder to measure reliably, the net flow of capital would have been in the direction of New Zealand, the country with the higher rate of return. Bollard (1987) noted that the levels of Australian investment in New Zealand were during the 1970s and 1980s much larger than vice-versa. However, capital flows have been restricted. Even at present, despite liberal policies on foreign investment in both countries, New Zealanders can not invest in Australia on the same terms as Australians.

Despite the large influx of New Zealanders onto the Australian labour market over the period 1965-1990, there is no evidence to suggest that this movement depressed Australian wages. Indeed, the purchasing power corrected earnings gap increased throughout this period after having been virtually zero for the previous two decades.\textsuperscript{6}

This observation is not surprising for two reasons. First, there is little empirical evidence that migrants impact on nominal wages at the macro level (see e. g. Junankar and Pope (1990)). Second, regional trade appears more effective than factor migration in equalising factor prices (Horiba and Kirkpatrick (1981)).

Beyond the standard two-good two-factor models which one can invoke to compare with the stylised facts, it is better to use a CGE model to assess the impact of trade policies on the macro economy, on industries and on factor markets. The next section describes such a

\textsuperscript{5} While the data base of the Joani model measures employment in both countries on a fulltime equivalent basis, we believe that the employment numbers are not fully comparable and that the gap in the capital-labour ratio quoted in the text may be an overestimate.

\textsuperscript{6} This statement is based on earnings data described in Poot (1993).
model, while the subsequent section considers the potential impact of CER on factor mobility.

4. The Joani Model

A CGE model is an effective tool to assess the microeconomic impact of trade policy changes. Both Australian and New Zealand researchers developed such CGE models in the 1970s, called Orani and Joanna respectively (see Dixon et al. (1982); Nana and Philpott (1983)). Both these models are multi-sectoral, input-output based, oriented towards comparative-static analysis, linear in growth rates and have common roots in Johansen's pioneering multi-sectoral model of economic growth (Johansen (1960)). They could therefore be combined into a two-country model referred to as Joani. The Joani model was first used to simulate the impact of full implementation of the CER agreement, based on the status quo in 1984/85 (Philpott and Nana (1988)). It was found that CER led to GDP and consumption gains for both countries. The gains to New Zealand were noticeably larger than those to Australia and led in New Zealand to some trade diversion in favour of trans-Tasman trade. The differential was due to, firstly, the greater importance of trans-Tasman trade in New Zealand's total trade and, secondly, the initially higher levels of protection in New Zealand which meant that CER induced a greater cost reduction (competitive gain) in that country. The actual outcomes have borne out the model predictions.

Subsequently, a new Joani model was generated with 1986/87 input-output data and 1990/91 trade and protection data. This model showed that, starting from a 1990/91 position, further intra-CER tariff reductions had no significant impact, as free trans-Tasman trade had already nearly been achieved (Nana et al. (1995)). However, the removal of tariffs vis-a-vis third countries resulted, as expected, in significant long-run consumption and employment benefits to both countries. Before discussing these results and the possible implications for factor mobility in the next section, we first provide an outline of the characteristics of the Joani model. A schematic outline of the model can be found in the Appendix.

The Joani model identifies three sources and destinations for each country's products, namely home, the trans-Tasman partner and the rest of the world. The model is purely neoclassical in nature: assumptions of cost minimisation for producers and utility maximisation for consumers form the basis of the simulation of agents' behaviour. Hence, relative price movements between the three sources trigger substitution towards the relatively cheaper source(s). Such a response, though, is limited by substitution elasticities which reflect either differing tastes and qualities of the goods, or technological constraints.

7. See Nana et al. (1995) for more detail.
8. The elasticity of substitution between goods from the three sources was set at 2.0 for New Zealand and at the weighted average of those in the constituent Orani sectors for Australia.
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The model identifies 22 production sectors in each country, each producing a single commodity. Inter-country links are modelled explicitly at this disaggregated level with relationships ensuring consistency in trans-Tasman trade volumes and prices for both countries. Furthermore, equality of demand and supply of each domestically produced commodity is imposed via a “market-clearing” condition.

Household consumption expenditure in each country is determined as a function of household income, which is principally derived from wages and profits. In addition to the substitution towards relatively cheaper source(s) of supply described above, price and income elasticities of demand ensure that the allocation of consumption expenditure between the various commodities is responsive to changes in relative prices and incomes in each country. Real government consumption and aggregate investment expenditure are assumed exogenous in both countries.

Output in each sector is produced by means of five different types of labour input (occupational categories) and capital. Each sector’s demand for labour and capital depends on the sector’s level of activity and the relative factor prices. Relative price-induced substitution between the six primary factors in each sector is based on the CRESH functional form. The total primary factor requirement is constrained by the gross output of each sector. The pairwise CRESH substitution elasticities were adapted from Higgs et al. (1981).

Aggregate real investment is allocated across sectors such that expected sectoral rates of return on this new investment are equalised in each country, where these expected rates of return are positively related to the current profit rate and inversely related to the price of new capital goods and the rate of growth in the capital stock. Investment expenditure in electricity, gas and water infrastructure, government social services and new house construction are set exogenously in both countries as such rate of return criteria are considered inappropriate in these cases.

Consistent with the neoclassical nature of the model, prices of domestically produced commodities are determined by the costs of production along with a “zero-pure profits” criterion. Prices of items imported (CIF value) into each country are therefore dependent on production costs in the country of origin, inter-country transport costs and the exchange rate. Allowing for tariffs (and tariff-equivalents of other protection measures) imposed by each country, the purchaser’s prices of the imports result.

Following the standard Walrasian general equilibrium property that only n-1 of n market
clearing equations are independent, a numeraire (exogenous price) must be chosen. World prices of traded goods (vis a vis Australian and New Zealand prices) act as the numeraire in the \textit{Joani} model. Since the model does not have a monetary sector, nominal exchange rates are also exogenous.

The model provides a picture of the state of the economy after it has reached a new general equilibrium following a particular exogenous shock, as compared with the status quo. Hence the model does not generate forecasts of the economy, but instead permits a short-run or long-run comparative static analysis.

5. Trade Liberalisation and Factor Mobility

In this section we shall consider the possible impact on the factor markets of Australia and New Zealand of a extension of CER to a jointly agreed reduction of tariffs on imports from the rest of the world to zero. Crucial in this type of modelling is the choice of exogenous variables, referred to as the "closure" of the model. Some of these represent the quantitative policy shocks which are under investigation, others are assumed unaffected by the policy shock under consideration and are therefore set equal to zero ("no change"). In this study the trade policy shock is explored under various alternative closures. These alternatives represent different assumptions with respect to the price and/or quantity adjustment in the factor markets. However, these have all in common an assumed exogeneity of nominal exchange rates, world prices, real world income, real government consumption expenditure and real trans-Tasman transport margins. All simulations are concerned with the long run in which individual sectors can adjust their capital stock such that sectoral rates of return relativities remain as they were before the introduction of the trade policy shock.

The macro-economic implications computed by means of the \textit{Joani} CGE model are reported in Table 1. This table shows that all runs have in common, as expected, a welfare gain in both countries in terms of growth in real private consumption following the removal of external trade barriers. Another result common to all but two simulations is that the trade liberalisation generates a slight divergence in income per worker between the two countries in terms of the change in real GDP per worker, with Australia benefiting more than New Zealand. Furthermore, in all simulations both countries increase their trade with the rest of the world, as expected. Moreover, all simulations show that the trade flow from New Zealand to Australia declines. However, the sign of the change in the trade flow from Australia to New Zealand depends on the choice of model closure.

Looking at each simulation in more detail, the closure in Run 1 assumes independent (ie country-specific) factor markets as well as an absence of labour shortages. The removal of protection in such an environment results in increased employment of all occupations. This
Table 1: Macroeconomic Aggregates (% changes)

<table>
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<tr>
<th></th>
<th>Run 1</th>
<th>Run 2</th>
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<td>Real GDP</td>
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<td>0.7</td>
<td>0.6</td>
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<td>-0.1</td>
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<tr>
<td>Real pvt consump</td>
<td>3.3</td>
<td>2.0</td>
<td>2.3</td>
<td>2.1</td>
<td>1.2</td>
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<tr>
<td>Labour employment</td>
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<td>0</td>
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<td>2.0</td>
<td>-0.4</td>
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<td>Capital stock</td>
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<td>to Aus</td>
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<td>-2.2</td>
<td>-2.8</td>
<td>-2.5</td>
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<td>to RoW</td>
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<td>3.8</td>
<td>4.7</td>
<td>6.1</td>
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<tr>
<td>Total</td>
<td>6.4</td>
<td>2.6</td>
<td>3.4</td>
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<td>from Aus</td>
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<td>2.7</td>
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<td>from RoW</td>
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<td>5.8</td>
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Notes:
In the case of the trade Balance of Payments (BoP), the figure reported is the absolute change as % of GDP.
The entry of 0% (no change) for exogenous variables is indicated in bold-type.
### Table 2: Output and Factor Markets (% changes)

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<th></th>
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<th>Run 3</th>
<th>Run 4</th>
<th>Run 5</th>
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<td>L, P1</td>
<td>L, P1</td>
<td>L, P1</td>
<td>L, P1</td>
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<td>-1.7</td>
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<td>-0.4</td>
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<td>L, P1</td>
<td>L, P1</td>
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<td>-0.9</td>
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</tbody>
</table>

**Note:** The entry of 0% (no change) for exogenous variables is indicated in bold-type.

**Abbreviations for the Occupational Classification:**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>PRF</td>
<td>Professional Workers</td>
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<tr>
<td>SKW</td>
<td>Skilled White Collar Workers (managers, administrators and para-professionals)</td>
</tr>
<tr>
<td>SKB</td>
<td>Skilled Blue Collar Workers (persons in metal, electrical, building and others trades)</td>
</tr>
<tr>
<td>SUW</td>
<td>Semi-skilled and Unskilled White Collar Workers (clerks, salespersons and personal services providers)</td>
</tr>
<tr>
<td>SUB</td>
<td>Semi-skilled and Unskilled Blue Collar Workers (plant and machine operators, drivers, labourers and rural workers)</td>
</tr>
</tbody>
</table>
can be seen from Table 2. With respect to the labour market, Table 2 reports changes in employment ($L$) and the occupational wages ($P_1$).

The overall strong Australasian expansion follows from the improvement in price competitiveness in both countries vis-a-vis the rest of the world as imported inputs become cheaper. The expansion is therefore most pronounced in the export-oriented sectors. Domestic consumption benefits from the increase in household incomes following increased employment.

Although sectoral results (not presented in Table 2) show that the move to free trade reduces, as expected, employment in previously protected sectors, this does not outweigh the expansionary effects resulting from the improvement of competitiveness. Resources are reallocated to the primary sector and to trade, transportation and communication services. The growth in such services is partly induced by the growth in international trade. The textiles and fabricated metal product sectors undergo sharp contractions in activity (the latter includes the motor vehicle assembly industry in both countries).

Comparing the effects in the factor markets in the two countries, Table 2 shows that employment in Run 1 increases a little more in New Zealand, while the demand for capital rises more in Australia (where the rate of return on capital increases more, see Table 1). These outcomes reflect, in part, the relative factor intensities and differences in the sectoral structure between the two. For example, the labour intensity of the agricultural sector in New Zealand is greater than in Australia (with a labour share in value added of 68 percent compared with 54 percent respectively). Furthermore, the agricultural sector accounts for over 8 percent of total employment in New Zealand, but only 2 percent in Australia. This helps slant New Zealand’s increase in the demand for production factors more towards labour compared to its CER partner. On the other hand, the contraction in the textiles sector is much greater in Australia and this sector is more labour intensive compared to its New Zealand counterpart. This contributes to the lower increase in employment in Australia.

The increasing price of capital relative to labour leads to substitution effects of which the size depends on the CRESH substitution elasticities. These elasticities are such that of the five types of labour, the SKW category is most substitutable for capital while, at the other end of the spectrum PRF and SUB are the least interchangeable with capital. Table 2 shows that the demand for SKW rises relatively more in both countries, while the relatively high substitutability of SKB is insufficient to offset the effect of the contraction in the fabricated metals sector. Moreover, the outcome for SUB is consistent with its low substitutability, compounded by influences in the textiles sector. The results for PRF in New Zealand reflect, in part, its low substitutability. Despite its low substitutability, the SUW category still benefits from expansion in the trade services sector of both countries.

Run 2 assumes no change in available inputs, which leaves only effects attributable to
relative price movements. Note that not only aggregate employment has been assumed unchanged, but also by occupation. The consequent shifts in occupational wage relativities (listed as the Pl's in Table 2) provide a further indication of the differences in the impact across sectors of the removal of tariffs.

For example, the reduced demand for semi-and unskilled blue collar (SUB) workers as reflected in the reduction in their wage rate (Table 2) can be traced, in large part to the contraction of the textiles sector. Similarly, the result for the skilled blue collar (SKB) category is primarily related to the contraction of the fabricated metal products sector. In contrast, the positive outcome for the semi-skilled and unskilled white collar (SUW) category can be associated with the expanding trade services sector in response to growing international trade and rising domestic consumption expenditure fuelled by rising real wages.12

The main employers of professional (PRF) labour are the private and public services sectors in both countries. While these sectors are largely driven by similar influences in each country, PRF relative wages decline more in New Zealand than in Australia. This difference is due to shifts in the commodity composition of the consumption basket. Consumer spending in New Zealand shifts away from relatively labour-intensive services as their price relative to goods increases reflecting, in turn, the increase in the real price of labour. In contrast, there is in Australia a relatively larger shift to capital (as noted earlier) and, consequently, a smaller movement in the real price of labour. Hence the consumption basket in Australia does not shift against service commodities and the demand for PRF does not experience as great a decline as in New Zealand.

Given the overall primary factor demand and price movements in Run 2, a general equilibrium solution subject to a single overall constraint on aggregate employment in Australasia, allocated such that the change in the real wage rate is equalised between the two countries, would yield an increase in labour employed in New Zealand and a reduction in Australia. These results are shown in Table 1 in the simulation labelled Run 3. The increase in employment in New Zealand is 0.7 percent and consequently (employment in Australia being 4.7 times that in New Zealand) Australian employment decreases by 0.1 percent.

Note that it is here assumed that labour will move freely such as to offset any potential change in the real wage relativity between the two countries. No behavioural equation for migration is specified. Also, the absorption of the migrants in the trans-Tasman economy is assumed to be immediate: no behavioural differences between migrants and the locally born are incorporated in the model. The latter assumption is not unrealistic given that, among Australian immigrants, the New Zealanders are the closest to the Australians in terms of economic characteristics (e.g. Carmichael (1993, p. 215)).

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12. This sector incorporates wholesale and retail trade, restaurants and hotels.
A Study of Trade Liberalisation and Factor Mobility with a CGE Model of Australia and New Zealand

The real wage increases in Run 3 in both countries by 1.5 percent, where "real" is defined here relative to consumer prices. The higher level of protection in Australia compared to New Zealand leads to a greater fall in prices when tariffs are removed. This explains the larger decline in the nominal price of labour in Australia shown in Table 2.

In parallel to Run 3, Run 4 starts from that labelled Run 1 with the assumption of unchanged real wage rates in each country. However, the change in the rates of return to capital across the two economies are equalised given a single overall constraint on the available aggregate Australasian physical capital resources. Noting that Run 1 showed that the rate of return in Australia would rise by more than in New Zealand, this new simulation should a priori result in capital increasing in the former (and consequently declining in the latter) in response to the removal of trade barriers.

This is indeed what occurs in Run 4. Table 1 shows that the rate of return rises by just under 7 percent in both countries. As can be seen from both Tables 1 and 2, nearly 1.4 percent less capital gets allocated to New Zealand which is equivalent to an inflow of 0.3 percent of capital in Australia.13 Not surprisingly, there is a noticeable reduction, from that recorded in Run 1, in the expansion in New Zealand and a slight increase in that across the Tasman. Nevertheless there remains, in both countries, a positive (aggregate) expansion effect from the removal of protection.

In Run 3 it was assumed that total Australasian employment was fixed, but this pool of labour could be freely allocated across the two countries and across the five occupational groups. Hence, occupational mobility was perfect. At the other extreme, employment by occupation in Run 2 was assumed fixed in each country. The final two runs in Tables 1 and 2 represent intermediate cases in which the Australasian labour market is assumed segment-ed (no inter-group occupational mobility), but within each group labour can be reallocated across the two countries (through geographical mobility).

In Run 5, this reallocation of labour is such that the change in the real occupational wage (the nominal change corrected for the change in the CPI) is equalised across the two countries. Thus, in Table 2 there is a constant difference between the percentage change in the occupational wages in Australia and New Zealand. The New Zealand nominal wage in each occupational group increases by 0.7 percent more than in Australia, which is the difference in the growth of the CPIs (−2.0 and −2.7 percent respectively, see Table 1). In Run 6, the nominal occupational wages themselves equalise across the two countries. This can be seen directly from Table 2. The assumption of fixed overall resources removes the expansionary effect at the aggregate CER level in Runs 5 and 6 in the same way as it did in Run 2.

13. It should be noted that the model implicitly assumes that the income flowing from this foreign-sourced capital is not repatriated. Instead, part of it will be spent in the local economy.
In both cases we find that the overall scarcity of labour increases the aggregate real wage in both countries, but in Run 5 more in New Zealand and vice versa in Run 6. These differences are caused by the direction of the reallocation of labour. In Run 5, more labour is allocated to Australia (i.e. becoming scarcer in New Zealand) and again vice versa in Run 6. In Run 5, labour and capital move both from New Zealand to Australia (suggesting a complementarity relationship between trade and migration), while in Run 6 they move in opposite direction (suggesting substitutability).

Which of these two model closures is the more plausible depends on migration behaviour. There is some evidence in the migration literature of some money illusion (for given exchange rates), since migrants may not be well informed about the purchasing power of wages and, instead, base migration decision primarily on wage offers and employment opportunities (see e.g. Brosnan and Poot (1987)). In this case, Run 6 may be a better indicator of the direction of the reallocation of labour which one may expect following the removal of trade barriers.

Run 6 reinforces the findings of the previous simulations. Namely, the removal of protection is encouraging Australia to become relatively even more capital intensive and New Zealand to become relatively more labour intensive. This is in concordance with the price of capital rising relative to that of labour by 2.0 percent in New Zealand, but by only 0.3 percent in Australia (Table 2). The occupational structure is consistent with previous simulations with, as before, employment of skilled and unskilled white collar workers growing, while the contractions in the fabricated metals and textiles sectors dominate the outcomes for the two blue collar categories.

Model run 6 generates outcomes for factor demand and price and output shifts at the sectoral level which are reported in Table 3. Comparing the two countries, the sectoral shifts relative to the change in aggregate output are qualitatively similar in many sectors. However, there are four sectors which become relatively more important in Australia but less important in New Zealand. They are Chemicals, Petroleum and Plastics, Non-Metallic Mineral Products, Building and Construction and Private Services. In Australia, the contraction in the textiles and fabricated metals sectors would be equivalent to a loss of nearly 1 percent in Australia-wide employment.

These Joani model experiments indicate that the removal of protection vis-a-vis third countries can have both substitution and expansionary effects on the two CER economies depending on the choice of a closure for the model with respect to the factor markets. Put another way, the outcome hinges on whether price adjustments or quantity adjustments prevail. Furthermore, the distinction between the factor markets clearing at the individual country level or at the aggregate CER level is also of prime importance.

Thus, constrained by a fixed Australasian “pool” of labour and capital, the model
Table 3  Sectoral Output, Factor Employment and Prices in Run 6 (% changes)

<table>
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<tr>
<th></th>
<th>Outp</th>
<th>PRF</th>
<th>SKW</th>
<th>SKB</th>
<th>SUW</th>
<th>SUB</th>
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<th>Capitl</th>
<th>Price</th>
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Note: The entry of 0% (no change) for exogenous variables is indicated in bold-type.
Abbreviations for the Sectoral Classification:
AGR: Agriculture
FIS: Fishing & Hunting
LOG: Logging & Forestry
MIN: Mining & Quarrying
FBT: Food, Beverages & Tobacco
TEX: Textiles, Apparel & Leather
WOD: Wood & Wood Products
PAP: Paper, Printing & Publishing
CHE: Chemicals, Petroleum & Plastic
NON: Non-Metallic Mineral Products
BAS: Basic Metal Products
FAB: Fabricated Metal Products
OTH: Other Manufacturing
EGW: Electricity, Gas & Water
BUI: Building & Construction
TDE: Trade, Restaurants & Hotels
TRN: Transport & Storage
COM: Communications
FIN: Finance, Insurance & Real Estate
OWN: Ownership of Owner-Occupied Dwellings
PRI: Private Services
PUB: Public Services

simulations show the New Zealand economy as becoming more labour intensive and the
Australian economy as becoming more capital intensive. Such trade liberalisation may
courage some movement of labour to New Zealand and of capital to Australia.

Amongst the labour types, the two white collar categories benefit from the gains to
competitiveness vis-a-vis the rest of the world and the subsequent rise in household consump-
tion. On the other hand, however, the two blue collar categories endure the direct effects of
the contraction in the previously protected sectors. One feature arising out of this analysis
is the differential impact on the professional labour category between the two countries
resulting from the relative shift in the price of labour intensive consumption commodities.

In terms of magnitudes, however, the positive outcomes for some of the occupational
categories are not large in the sense that they would exhaust the available labour supply
within each country. It is difficult, therefore, to see the possible microeconomic reallocation
gains from protection removal as inducing large net trans-Tasman shifts of labour of a
particular occupational type.

One notable exception is the category of professional workers. Run 6 shows a decline of
employment of this group in New Zealand by 0.4 percent and an increase in Australia by 0.1
percent. In Run 5, these percentage changes are twice as large. It is therefore plausible that
a further removal of protection at the common external border will lead to trans-Tasman
investment in Australia by New Zealand firms (in response to the relatively greater capital
requirements there) and a further net movement of professional workers in the same
direction.

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Further reductions in the real cost of migration with sharply declining costs of transportation, communication and information may well encourage a continuation of the notable gross labour movements between the two countries. Policy shifts towards free trade would also encourage significant intra-country inter-sectoral and inter-occupational changes. The largest changes in the demand for labour, however, occur in the simulation where the expansion effect has not been "diluted" (i.e. abundant labour resources are assumed present). This is demonstrated most clearly by the first simulation presented above (Run 1). Such employment changes may of course also encourage trans-Tasman migration. This would reinforce the past experience of the two countries that trans-Tasman migration flows have been predominantly influenced by the relative macroeconomic health of the two economies.

A severe limitation of the analysis carried out in this paper is the focus on long-run comparative statics. Consequently, issues such as increasing returns due to technological change or economies of scale are not taken into account. Nor has capital accumulation been modelled in a way which was consistent with forward looking behaviour of the entrepreneurs. Both in Australia and New Zealand, new CGE models have been developed which are dynamic and incorporate forward looking behaviour of consumers and producers (Malakellis (1993); Nana (1995)). Such models face considerable technical difficulties, but it may be possible in due course to contemplate a more refined study of the long-run impact of further Australasian trade liberalisation on trans-Tasman trade and factor mobility by means of a dynamic version of joani which takes these issues into account.

References


Ethier, W., forthcoming, Theories about trade liberalisation and migration : Substitutes or complements? in P. J. Lloyd and L. S. Williams (eds), International Trade and Migration in the APEC Region, Chapter 3, Oxford University Press, Oxford.


A Study of Trade Liberalisation and Factor Mobility with a CGE Model of Australia and New Zealand


**Appendix**

A Schematic Outline of the Joani Equations

Notes:

i) The set of equations given below exist for each both Australia and New Zealand. For clarity, country superscripts have been omitted.

ii) All variables refer to vectors with elements for each of the individual sectors and/or commodities, except that **bold** signifies aggregate or economy-wide variable, while *underlined italic* signifies the equivalent variable relating to the CER partner's economy.

iii) d=domestic, c=CER partner, and r=rest of world

**Equations for each country**

Demands for goods

Intermediate

\[ A = f_a(Q) \]

\[ A_d = f_{ad}(A, P_d, P_c, P_r, \sigma) \]

\[ A_c = f_{ac}(A, P_d, P_c, P_r, \sigma) \]
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\[ A_r = f_{ar}(A, P_d, P_c, P_r, \sigma) \]

Consumption
\[ C = f_{cy}(Y) \]
\[ C = f_i(C, \epsilon) \]
\[ C_d = f_{cd}(C, P_d, P_c, P_r, \sigma, \eta) \]
\[ C_c = f_{cc}(C, P_d, P_c, P_r, \sigma, \eta) \]
\[ C_r = f_{cr}(C, P_d, P_c, P_r, \sigma, \eta) \]

Investment
\[ I = f_i(P_k, P_d, R) \]
\[ I = \sum I \]
\[ I_d = f_{id}(I, P_d, P_c, P_r, \sigma) \]
\[ I_c = f_{ic}(I, P_d, P_c, P_r, \sigma) \]
\[ I_r = f_{ir}(I, P_d, P_c, P_r, \sigma) \]

Other final demands
\[ O_d = f_{od}(O, P_d, P_c, P_r, \sigma) \]
\[ O_c = f_{oc}(O, P_d, P_c, P_r, \sigma) \]
\[ O_r = f_{or}(O, P_d, P_c, P_r, \sigma) \]

Exports
\[ E_c = A_c + C_c + I_c + O_c \]
\[ E_r = f_e(P_d, P_c, P_w, \phi_r, \lambda, \sigma_r) \]

Demands for factors
Labour
\[ L = f_l(Q, P_k, P_1, \sigma_l) \]
Capital
\[ K = f_k(Q, P_k, P_1, \sigma_k) \]

Price formation
Domestic goods
\[ P_d = f_p(P_c, P_r, P_1, P_k) \]
Imported goods
\[ P_c = \phi_c P_d (1 + T_c) \]
\[ P_r = \phi_r P_w (1 + T_r) \]
Factors
\[ P_1 = b \ P_1 \]
\[ P_k = f_{pk}(l, K, K, P_d) \]

Market clearing
Domestic goods
\[ Q = A_d + C_d + I_d + O_d + E_c + E_r \]
Imported goods
\[ M_c = A_c + C_c + I_c + O_c \]
\[ M_r = A_r + C_r + I_r + O_r \]
Factors
\[ L = \sum L \]
\[ \Sigma K = K \]

Other
Household income
\[ Y = f_y(P_1, L, P_k, K) \]
Exchange rate
\[ \phi_c = \phi_r / \phi_r \]
Trade BoP
\[ B_c = \sum(E_c P_d) - \sum(M_c \phi_c P_d) \]
\[ B_r = \sum(E_r P_d) - \sum(M_r \phi_r P_w) \]
GDP
\[ GDP = C + I + O + \sum(E_c + E_r) - \sum(M_c + M_r) \]
A Study of Trade Liberalisation and Factor Mobility with a CGE Model of Australia and New Zealand

**Variables (for each country)**

- $Q$: Real gross output
- $A$: Demand for intermediate inputs
- $A_d$: Demand for intermediate inputs produced domestically
- $A_c$: Demand for intermediate inputs imported from CER partner
- $A_r$: Demand for intermediate inputs imported from rest of world
- $C$: Demand for consumption commodities
- $C_d$: Demand for consumption commodities produced domestically
- $C_c$: Demand for consumption commodities imported from CER partner
- $C_r$: Demand for consumption commodities imported from rest of world
- $I$: Demand for investment goods
- $I_d$: Demand for investment goods produced domestically
- $I_c$: Demand for investment goods imported from CER partner
- $I_r$: Demand for investment goods imported from rest of world
- $O_d$: Demand for goods for other final demand produced domestically
- $O_c$: Demand for goods for other final demand imported from CER partner
- $O_r$: Demand for goods for other final demand imported from rest of world
- $E_c$: Demand for export commodities to go to CER partner
- $E_r$: Demand for export commodities to go to rest of world
- $M_c$: Imports from CER partner
- $M_r$: Imports from rest of world
- $L$: Demand for labour
- $K$: Demand for capital
- $C$: Aggregate consumption expenditure
- $I$: Aggregate investment expenditure
- $O$: Other final demand expenditure
- $B_c$: Trade balance of payments with CER partner
- $B_r$: Trade balance of payments with rest of world
- $GDP$: Real GDP
- $Y$: Total household income
- $R$: Economy-wide rate of return on capital
- $L$: Total labour employed
- $K$: Aggregate capital stock
- $P_d$: Price of domestically produced good
- $P_c$: Purchasers' price of imported good from CER partner
- $P_r$: Purchasers' price of imported good from rest of world
- $T_c$: Tariff equivalent on imported good from CER partner
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\[ T_r \text{ Tariff equivalent on imported good from rest of world} \]
\[ \phi_c \text{ Exchange rate with CER partner ($domestic$/CER) } \]
\[ \phi_r \text{ Exchange rate with rest of world ($domestic$/world) } \]
\[ P_l \text{ Price of labour} \]
\[ P_k \text{ Price of capital} \]
\[ P_l \text{ Economy-wide price of labour} \]

**Parameters (for each country)**

- \( b \) Sectoral relativities in price of labour
- \( \sigma \) Substitution elasticity between goods from different sources of supply
- \( \sigma_i \) Elasticity of substitution between capital and labour in production
- \( \varepsilon \) Elasticity of consumption commodity demand with respect to total consumer expenditure
- \( \eta \) Price elasticity of consumption commodity demand

**Items common to both countries**

- \( P_w \) World price of competing commodities
- \( \lambda \) Rest of world export elasticity of demand
- \( \sigma_e \) Elasticity of substitution in exports between CER goods