Modelling the effects of mutual recognition of imputation credits

Technical Workshop Paper

Please note: this paper is only for use in connection with the technical workshop on MRIC, October 31, 2012.
Work in progress.

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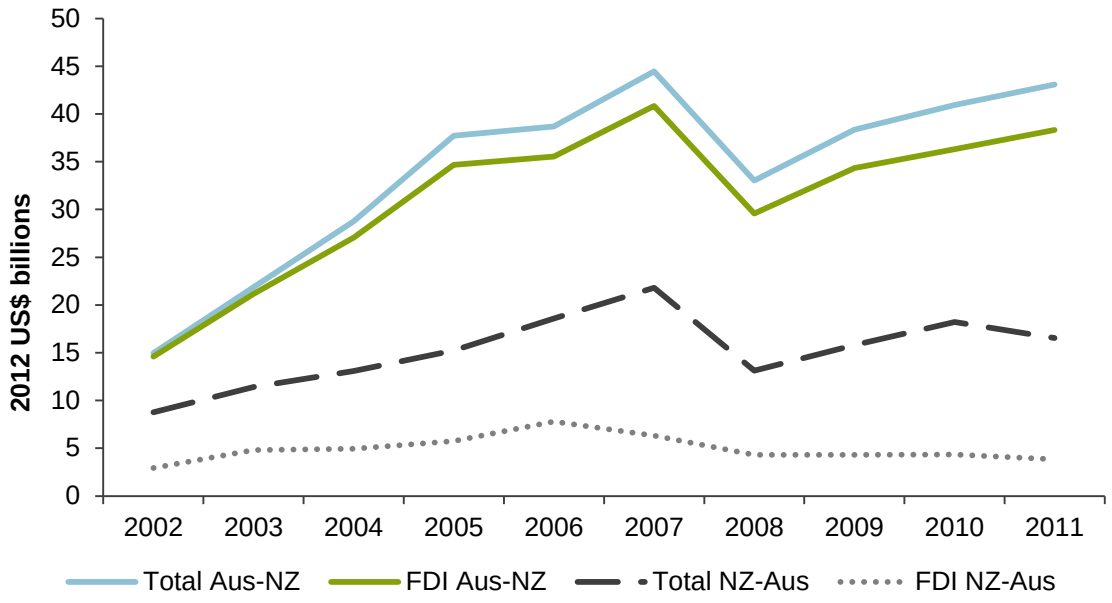
The SMRIC (Small MRIC) model is a small purpose-built model designed to analyse the main effects of introducing the mutual recognition of imputation credits (MRIC) between Australia and New Zealand. Its main purpose is to investigate the effects of varying assumptions about key parameter values on the potential quantity, efficiency and distributional effects associated with MRIC. This is done through a variety of illustrative simulations The framework builds on a standard production model as described by McDougall (1963), representing the behaviour of labour and capital owners in 3 countries (Australia, New Zealand and the Rest of the World) and incorporating the relevant features of the Australian and New Zealand company and personal income tax systems. The model is designed to estimate the potential allocative efficiency and distributional effects of MRIC under various assumptions about the substitutability of capital from different locations and access to global equity finance.

Trans-Tasman capital stocks have grown in real terms over the past 10 years (figure 1.1). Australian stocks have grown faster than the corresponding New Zealand stocks.

- Most Australian capital in New Zealand is classified as FDI, which represent 90 percent of New Zealand capital held by Australians, the remainder being classified as portfolio capital. This is consistent with Australian banks owning a large part of the New Zealand banking system and a significant Australian presence in other parts of New Zealand services, such as retail and telecommunications.
- Conversely, most New Zealand equity in Australia consists of portfolio investment, which grew until the global financial crisis. Over the past 10 years, FDI has fluctuated somewhat. These observations are consistent with New Zealand investment growing with the integration of financial markets, and Australian capital being part of a diversified New Zealand portfolio.

Figure 1.1 **Real bilateral equity FDI and total foreign equity capital stocks, 2002-11**[a]

2012 US$ billions[b]



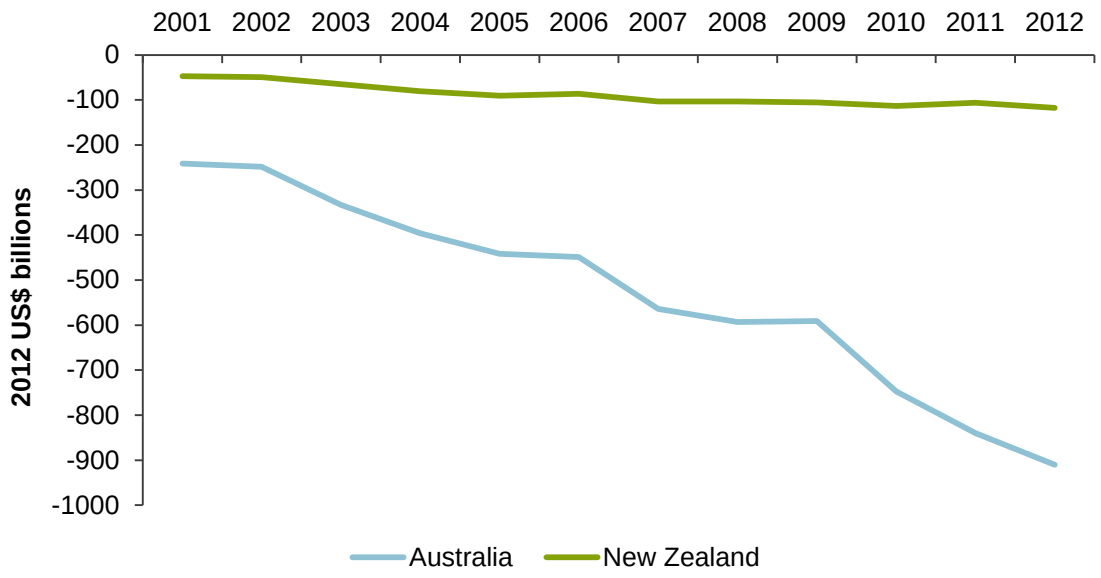
[a] The difference between total and FDI equity is accounted for by portfolio capital. [b] Converted to real 2012 US$ using market exchange rates.

Data source: ABS Cat no. 5352.0

International investment position statistics (figure 1.2) show that both New Zealand and Australia are net borrowers in international capital markets. Although Australia's external debt has increased markedly, it still accounts for a small part of global borrowing; in 2011, Australia's external debt accounted for approximately 2 percent of global borrowing. As small open economies, Australia and New Zealand are therefore likely to be price-takers in capital markets.

Figure 1.2 **Real net international investment position, 2001-12[a]**

2012 US$ billions[b]



a The net International investment position is the difference between a country's external financial assets and liabilities. **b** Converted to real 2012 US$ using market exchange rates.

Data source: ABS Cat no. 5352.0; SNZ (2012)

Despite the barrier represented by a lack of mutual recognition, a significant amount of trans-Tasman investment has occurred over the past ten years. The question is whether MRIC would have increased this, whether it would in the future, and at what costs. The SMRIC model is designed to explore these issues and the assumptions that are likely to affect efficiency and distributional effects.

The remainder of this paper is organised as follows:

- the model is introduced and parameterised; detailed model and data specifications are found in appendices A and B
- mechanisms and results are analysed for an illustrative case, and sensitivity analysis is conducted on crucial parameters for which little evidence is available; detailed results and sensitivity analysis are found in appendix C.

1.1 A small model to analyse the effects of MRIC

At a minimum, the model needs to model the behaviour of capital owners, owners of other inputs and producers and:

- identify any allocative efficiency gains
- identify any transfers between taxpayers, capital and labour
- offer the possibility of varying parameters such as the substitutability of inputs
- offer the possibility of varying the proportion of firms that have access to international equity finance.

The SMRIC model is designed around these requirements. It is based on the theoretical frameworks presented in McDougall (1963) and Sørensen and Johnson (2009). The model is detailed in appendix A.[1] The SMRIC model is developed for three economies: Australia, New Zealand and the rest of the world (ROW). It describes:

- the behaviour of consumer, investment and government demands in each economy, which are aggregated to maximise welfare subject to a budget constraint[2]
- the behaviour of firms, which are assumed to minimise costs subject to a production function
- the supplies of labour and capital in each economy, which are assumed to be fixed; this simplification is used to concentrate on the potential gains available from allocating capital across the destination economies
- how all markets clear:
  - capital markets clear, such that the supply of capital from each region is equal to the sum of demands for that capital around the world; returns to capital adjust to facilitate this
  - labour markets clear, within each country; wages adjust to facilitate this equilibrium
  - goods markets clear, such that the supply of output from each region equals the sum of domestic and export demands; output prices adjust to facilitate this.

1 The model is implemented using the GAMS software and is solved in levels.

2 For simplicity, consumer, investment and final demands are modelled as a single aggregate.

- all macro-economic identities, such that:
  - expenditure on goods (both domestically sourced and imported) in each economy is equal to the income that is generated by the economy's labour, its capital located in the domestic and destination economies and taxes on capital located domestically but owned by foreigners
  - gross domestic product equates on both the expenditure and income side, such that payments to factors used domestically equals the value of sales
  - balance of payments are satisfied, that is, any deficit in the balance on the current account matches payments in the income and capital accounts.

The model includes therefore three types of goods, one for each region. A representative firm combines capital with other inputs in each economy – these inputs will be referred to as labour in part of what follows. There are three types of heterogeneous capital; the degree of capital heterogeneity is governed by sets of elasticities that can be varied easily. This in effect controls the mobility of capital across the three regions.

On the demand for capital side, firm response to change in relative costs and investor responses to changes in relative costs are summarised by sets of elasticities.

Firm responsiveness to changes in relative input costs is summarised in a set of substitution elasticities. The structure of substitution nests and the values assumed for each elasticity (figure 1.3) produces the own- and cross-price elasticities that summarises firms' responses. This production structure, along with the optimisation problem generates all the derived demands that are required to analyse the allocation of inputs in production and the demands and supplies required to estimate changes in welfare and real incomes. In particular, it generates the declining marginal product of capital schedule shown in McDougall (1963) through the fixed amount of labour in each economy. The demands for capital in a region r can be thought of as being generated by :

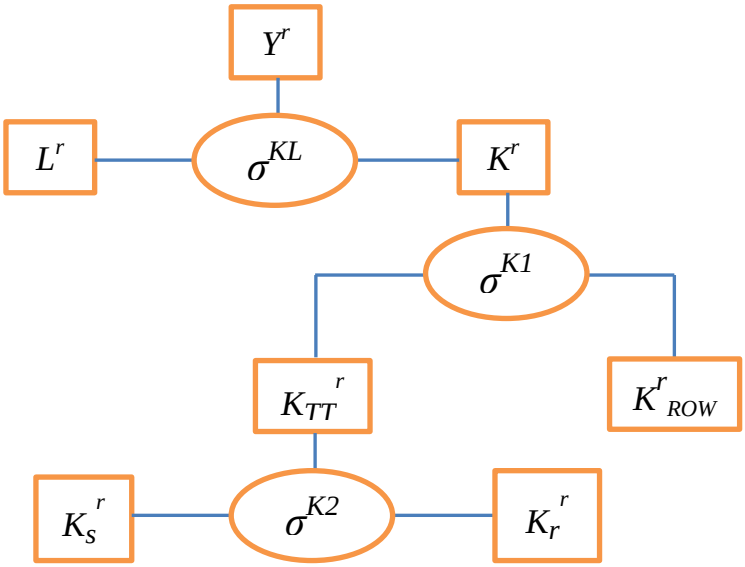
$$Y^r = f(L^r, K^r)$$

$$K^r = g(K_r^r, K_s^r, K_{ROW}^r)$$

where Y^r is output from region r, $L^r$and K^r are the labour and capital used in region r; K_s^r is the capital used in region r that is supplied by region s, the trans-Tasman partner, and K_r^r indicates capital supplied by domestic owners of capital. This structure is summarised in figure 1.3.

Figure 3 **Substitution structures in production**[a]

For region *r*



a See adjoining text for details.

On the supply of capital side, two types of firms are represented:

1. firms that are assumed to have access to international equity, and for whom MRIC is unlikely to reduce the cost of capital. This is modelled by relatively high substitution elasticities between domestic and ROW capital.
2. firms that are assumed not to have access to international equity, for which MRIC is likely to reduce the cost of capital.

This is modelled by varying the elasticity with which capital owners are willing to substitute their supply between Australia, New Zealand, and the rest of the world (noted ε later) .

- When the share of firms with access to international capital markets is large, capital owners from the rest of the world are willing to supply the trans-Tasman economies with as much capital as required at an effectively fixed global rate of return (given the large scale of global capital markets, compared to the levels of trans-Tasman demands). When this is the case, trans-Tasman firms already obtain as much global capital as they require, and recognising imputation credits does not increase their demand for capital, since the price of global capital does not change. This corresponds to an elasticity of transformation of zero, consistent with no opportunities for further capital reallocation.

- When the share of firms with access to international capital markets is small, reducing the cost of trans-Tasman capital provides opportunities for increased returns by reallocating capital across the Tasman. This corresponds to a high elasticity of transformation, which provides opportunities for further capital reallocation.

Elasticity values between these extremes are equivalent to assuming different shares of the firm that have and do not have access to foreign equity.

Finally, the budget constraints and market equilibrium conditions ensure that there are no 'leaks' in the system.

A few comments on the model

The SMRIC model is comparative static and is used to answer questions of allocation. A comparative dynamic model would be required to answer dynamic questions, such as the potential effects of MRIC on savings and investment rates. That said, the complexity of a dynamic model would obscure the basic allocation mechanisms.

The SMRIC model is based on a simple consistent and transparent framework, which makes explanation of the results straight-forward and intuitive, and enables the exploration of a range of assumptions. In particular, the model is designed to quantify changes in relevant measures of efficiency, welfare and incomes for Australia, New Zealand, and the trans-Tasman economy as a whole as a result of changes in MRIC policy.

The modelling presented in this paper is exploratory and experimental, designed to illustrate the relative magnitude and distribution of impacts. Any benefits abstract from more complex interactions associated with broader tax policy beyond the two instruments contained in the model (personal income tax and company tax). In particular, the model abstracts from any interaction between imputation credits and other parts of the Australian and New Zealand tax systems. For example, there is a capital gains tax in Australia but not in New Zealand. To the extent that this interacts differentially with imputation credits and MRIC, these interactions are ignored. Also, any means currently available to mitigate the effects of double-taxation (such as 'triangulation') are ignored. To the extent that these means are effective, model results could overestimate the impacts of MRIC.

Data

The model is parameterised primarily with national accounts and balance of payments data sourced from the ABS and SNZ; additional data were sourced from the ANZEA database.[3] Trans-Tasman foreign investment data were sourced from NZIER-CIE (2012). Taxes were calculated with tax rates sourced from the ATO and IRD.[4] The Australian and New Zealand macro data are closely related to official statistics. Bilateral payments are based on shares from ANZEA, ABS and SNZ. Data for the rest of the world are largely sourced from the ANZEA database.

Table 1.1 summarises the basic macro-economic identities for each economy. All data are specified in US$ for the sake of consistency and simplicity. A$ and NZ$ values and sources are found in appendix B. The data show that in 2010:

- the New Zealand economy was about one ninth of the size of the Australian economy; the ROW was more than 60 times greater than the Australian economy
- around 48 percent of New Zealand's foreign corporate capital income was earned in Australia; 18 percent of Australia's foreign corporate capital income was earned in New Zealand
- returns to corporate capital accounted for about 15 per cent of GDP in Australia and New Zealand, slightly more than in the ROW (40 per cent)
- New Zealand capital owners accounted for 3 percent of foreign corporate capital income generated in Australia; Australian capital owners accounted for 58 percent of foreign corporate capital income generated in New Zealand

[3] The ANZEA database was developed in the context of the broader Strengthening trans-Tasman economic integration project. It is built from the publicly available GTAP database and bilateral capital ownership data available from CEPII. Further details area available from Draft Supplementary Paper E, available at: http://transtasman-review.pc.gov.au/study/discussion-draft . The GTAP database is a global database that supports a global model trade. The GTAP database consists of bilaterally consistent merchandise and services (mode 1) trade flows and consistent input-output tables from more than 100 countries. Version 7 database was used for this project; the original base year of 2004 was updated to 2010. It is available at https://www.gtap.agecon.purdue.edu//

[4] A possible alternative is to calibrate on effective tax revenues. That said, results are not affected substantially by this approximation.

Table 1.1 **Basic macroeconomic relationships**

2010 US$m

	Australia	*New Zealand*	*Rest of the World*
Balance of Payments[a]			
Exports	252,948	37,221	257,713
Imports	239,405	35,280	273,197
Trade balance	**13,543**	**1,941**	**-15,484**
Corporate capital income received from o/seas (pre-tax)	20,771	2,098	40,169
Corporate capital income paid to o/seas owners (pre-tax)	-38,277	-7,185	-17,576
Revenue from company tax on foreign capital	8,833	1,572	1,598
Company tax paid o/seas	-2,424	-345	-9,234
Net debt, net remittances, net investment flows[b]	-2,446	1,919	528
Total payments	**-13,543**	**-1,941**	**15,484**
Income and expenditure			
Labour, land income, other taxes and non-corporate capital income	1,023,366	113,743	66,103,272
Domestic corporate capital income	143,468	12,411	10,595,672
Foreign corporate capital income (trans-Tasman)[c]	3,274	848	
Foreign corporate capital income (other)[d]	15,073	906	30,935
Revenue from company tax on foreign capital	8,833	1,572	1,598
Net debt, net remittances, net investment flows[b]	-2,446	1,919	528
Gross National Income	**1,191,568**	**131,398**	**76,732,004**
Consumption of domestic production	952,163	96,118	76,458,807
Consumption of imports	239,405	35,280	273,197
Gross National Expenditure	**1,191,568**	**131,398**	**76,732,004**
Gross domestic product (GDP)[a]			
Consumption, Investment, Government spending	1,191,568	131,398	76,732,004
Exports	252,948	37,221	257,713
Imports	239,405	35,280	273,197
GDP (Expenditure side)	**1,205,111**	**133,339**	**76,716,520**
Specific factor income (including taxes)	1,023,366	113,743	66,103,272
Corporate capital income (including taxes)	181,745	19,596	10,613,248
GDP (Income side)	**1,205,111**	**133,339**	**76,716,520**

[a] Balance of payments and trade figures in the Rest of the World column refer to payments and flows between the Rest of the World and Australia and New Zealand. [b] This item used as a balancing item and therefore does not correspond to official data. It aggregates items from the income and capital accounts. [c] Trans-Tasman foreign capital income refers to foreign capital income that is earned in one trans-Tasman country and accrues to the other trans-Tasman country. [d] This represents gross income after tax received as capital income from overseas. Payments to overseas equity and debt are accounted for in the balance of payments as capital income paid to o/seas owners (pre-tax).

Sources: detailed in Appendix B.

- For both Australia and New Zealand, capital incomes sent overseas exceeded capital incomes received from overseas.

The SMRIC model requires a certain number of parameters. These are listed in table 1.2 along with ranges of values, since the model was developed to illustrate the role of assumptions in producing various allocative gains and transfer outcomes. In section 1.3, the following scenario is described in detail: (i) substitution between inputs (σ^{KL}, σ^{K1} and σ^{K2} in figure 1.3) are all set at 0.85; (ii) substitutability between destinations by capital suppliers (ε). Sensitivity analysis is conducted around this scenario, using the values in table 1.2.

Table 1.2 **Parameters used in SMRIC**

	Values
Substitutability between destinations by capital suppliers (ε)	0, 1, 2, 25, ∞
Substitution between capital sources (σ^{K1}, σ^{K2})**a**	0, 0.85, 5.00
Substitution between labour and capital σ^{KL} **a**	0.85

a See figure 1.3 for role of these parameters in the production structure.

The substitutability between labour and capital (σ^{KL}) is held constant in all simulations. Low values for the elasticity of substitution between capital from different sources (σ^{K1}, σ^{K2}) translate into vertical demands for capital in each country and mean that firms are not very responsive to changes in the cost of capital that they face. The high value for the elasticity of substitution between capital from different sources (5.00) means that a change in the cost of capital induces firms to increase their demand for the cheaper capital.

Scenarios

MRIC aims to improve price signals and efficiency in trans-Tasman investment by removing double taxation of distributed earnings. At present, domestic owners of capital in Australia and New Zealand receive a personal income tax credit for company tax already paid on capital incomes they receive. This creates a distortion away from trans-Tasman investment and in favour of domestic investment. Recognition of imputation credits means that all domestic factors employed within an economy face the same taxation – the income tax rate.

Mutual recognition of imputation credits is the combination of two policies — Australian recognition of New Zealand imputation credits; and New Zealand

recognition of Australian imputation credits. Given the relative shares of foreign capital in each economy, the shares of trans-Tasman capital in total foreign capital, and the disparate tax rates, the efficiency, welfare, and transfer implications in each economy are likely to differ.

The analysis is conducted with three scenarios to provide a better understanding of the effects of MRIC:

1. Australian recognition of New Zealand imputation credits
2. New Zealand recognition of Australian imputation credits
3. Mutual recognition of trans-Tasman imputation credits.

The recognition of imputation credits is modelled as an income tax credit in the source country.[5,6] Post-tax disposable incomes were increased by the amount of tax already paid in the destination country. This increase in income was financed by a reduction in government revenues in the source country.

1.2 Model results

Illustrative estimates of the impacts of trans-Tasman imputation credit recognition policies on the Australian, New Zealand and trans-Tasman economy are shown for three simulations to enable a clear understanding of the roles of different magnitudes on MRIC; the three simulations are: Australian recognition of New Zealand credits; New Zealand recognition of Australian credits and mutual recognition of trans-Tasman credits. More detailed results and sensitivity analysis are contained in appendix C. Results are analysed in stages: the effects of Australia recognising imputation credits received on returns to capital invested in New Zealand are analysed first; the converse is analysed next, followed by the effects of mutual recognition.

5 In this paper the source country refers to the country from which the capital is sourced, that is, the country of residence of the owner of the capital. The destination country refers to the country in which the stock of productive capital is located. Thus part of the capital income generated as GDP in the destination country is repatriated to the source country as part of its GNI.

6 In Australia, it is possible to receive a refund for imputation credits. In New Zealand, credits are treated as a credit against future liabilities. This is unlikely to have a significant impact on the results, given that the model is not dynamic and the relatively small number of individuals affected. To the extent that refunds are not available in New Zealand, the model results could overstate the impacts of MRIC.

Real GDP is used as an indicator of production: it moves in line with the movement of capital across economies. Real GNI (gross national income) measures changes in income: it accounts for all changes in incomes and transfers across economies. Welfare changes are measured as compensating variation, that is, the amount of income required to compensate consumers for the change modelled.

Australian recognition of New Zealand imputation credits

Abstracting from any price or quantity responses, Australian recognition of New Zealand imputation credits causes the Australian government to recognise $917 million worth of taxes paid in New Zealand. This accrues to Australian owners of capital that is located in New Zealand in the form of increased post-tax returns. As part of this 'first round' effect, there are no changes in investment or capital stock, national outputs and incomes remain fixed for both countries in aggregate, and there is a simple transfer from Australian taxpayers to Australian capital owners.

Behavioural responses complicate this story; these effects are reported in table 3. The increase in post-tax returns to Australian capital located in New Zealand causes Australian capital owners to reallocate their supply of capital toward New Zealand and away from Australia and the rest of the world. This increased supply decreases the productivity of capital and its returns in New Zealand, following the decreasing marginal product of capital schedule. This Australian-owned capital stock in New Zealand increases by US$ 773 million. The total stock of capital in New Zealand expands by $US 798 million, while the capital stock used in Australia contracts by $US 738 million.

Australia's domestically-sourced capital contraction is partially offset by an inflow of capital from overseas. The increase in the rate of return on Australian capital causes Australian firms to substitute away from domestically sourced capital, and towards Rest of the World capital. However, this increase in demand for Rest of the World capital offsets only partially by Australia's overall capital contraction. The net effect is a small decrease in capital demanded from the rest of the rest of the world by Australia, by $US 19 million.

Table 3 **Impacts of Australian recognition of New Zealand imputation credits[a,b]**

Change US$m, 2012

	Trans-Tasman	*Australia*	*New Zealand*
Labour and land income accruing to households after tax[c]	**175**	**-504**	**679**
Returns to domestically owned and used capital accruing to households after tax	**69**	**6**	**63**
Imputation credits granted for foreign capital taxes	**1133**	**1133**	**0**
Returns to domestically owned capital used overseas accruing to households after tax	**-175**	**-177**	**2**
used in Australia	1	n.a.	1
used in New Zealand	-187	-187	n.a.
used in the Rest of the World	10	10	1
Taxes on personal income	**-1108**	**-1471**	**364**
Total tax collected on personal income	-186	-552	366
imputation credits granted for domestic company tax	212	214	-3
imputation credits granted for foreign company tax	-1133	-1133	0
Company taxes levied on foreign capital used domestically	**2**	**-221**	**223**
Australian owned	2	-214	217
New Zealand owned	1	-1	3
Rest of the World owned	-2	-6	4
***Gross National Income*[d]**	**96**	**-1234**	**1331**
Gross Domestic Product	**73**	**-930**	**1004**

[a] The elasticity of substitution between labour and capital and the elasticity of substitution between capital from different sources are both set to 0.85. [b] The results contained in this table are a reproduction of components of more detailed national accounting results presented in Appendix C, tables C3.1, C3.2 and C3.3. [c] Region-specific inputs assumed to be in fixed supply. [d] Gross National Income (GNI) is the sum of the bolded values in the table.

Source: Commission estimates.

The shift in capital from Australia to New Zealand has several effects.

1. The post-tax returns to Australian-owners of New Zealand capital increase. The consequent increase in supply and decrease in productivity moderates the initial effect. Due to the increased returns, some Australian capital relocates to New Zealand, putting downward pressure on the domestic returns to capital (despite the increase in the rate of return). The net impact on post-tax payments to Australian-owned capital after recognition of the imputation credits is US$ 956 million.
2. Returns to labour in New Zealand increase. With the inflow of Australian capital, the New Zealand economy expands. With this expansion, New Zealand firms increase their demand for labour. Since labour in each country is

assumed to be fixed, the returns to New Zealand labour improve. The net increase in payments to New Zealand labour is US$ 679 million.

3. Returns to labour in Australia decrease. As the stock of capital in Australia contracts, firms decrease their demand for labour. Since labour is in fixed supply, labour productivity and wages decrease. This decreases the net payments to Australian labour by US$ 504 million.
4. The increased value of Australian-owned capital stock in New Zealand increases New Zealand company tax revenue from that capital. Australian income tax revenue decreases by the amount of tax credits. Australian company tax revenues decrease as capital from Australia moves to more productive and higher return use in New Zealand.
5. The increased level of labour income in the New Zealand economy increases New Zealand revenue from income tax. The decrease in payments to Australian labour further reduces Australian income tax revenue. The net increase in New Zealand tax revenue is US$ 587 million, and the net decrease in Australian tax revenue is US$ 1693 million.
6. The cost of production in New Zealand (as measured by the GDP deflator) decreases by 0.06 per cent.

The net impacts of these responses are:

- an expansion in New Zealand GDP. The increased rate of return to Australian capital owners causes a movement of capital away from Australia and into New Zealand.
- an expansion in New Zealand GNI. When the capital stock cannot relocate, Australian recognition of imputation credits results in a one-for-one transfer from governments to capital owners (with no impact on GNI or GDP). However, when capital is able to relocate, part of the income accrues to New Zealanders. Returns to Australian capital owners increase, but not by as much as the foregone tax revenue. The increase in incomes then accrues to New Zealand labour (as GDP expands), the New Zealand government (as additional tax is collected on the increased inflow of Australian capital, and on the increased New Zealand labour income). These two factors drive the increase in New Zealand GNI.
- a net contraction in Australian GNI and GDP; while returns to owners of Australian capital in New Zealand increase, this is offset by large reductions in tax revenue and payments to labour
- a small increase in trans-Tasman GDP and GNI. The overall GNI expansion of US$ 96 million is about 7 per cent of the size of the gains that accrue to New Zealand.

There is a small net increase in trans-Tasman GNI ($US 96 million) as a result of the policy. This small gain is caused by the tension between the efficiency gains resulting from the removal of double taxation, and the neutrality losses with respect to the rest of the world. On the one hand, making all New Zealand capital incomes (both domestically and from Australia) face the same marginal tax rate ensures capital supply is allocated efficiently between Australia and New Zealand. On the other hand, granting imputation credits to investments in Australia creates a distorting preference for Australia in favour of the rest of the world. While the result is an increase in incomes to New Zealand capital owners, more of this comes from tax transfers than from efficiency enhancements, resulting in a net loss.

Table 4 **Impacts of New Zealand recognition of Australian imputation credits[a,b]**

Change US$m, 2012

	Trans-Tasman	*Australia*	*New Zealand*
Labour and land income accruing to households after tax[c]	**-21**	**154**	**-175**
Returns to domestically owned and used capital accruing to households after tax	**24**	**19**	**6**
Imputation credits granted for foreign capital taxes	**314**	**0**	**314**
Returns to domestically owned capital used overseas accruing to households after tax	**-67**	**-3**	**-64**
used in Australia	-66	n.a.	-66
used in New Zealand	-3	-3	n.a.
used in the Rest of the World	3	0	2
Taxes on personal income	**-240**	**137**	**-376**
Total tax collected on personal income	24	139	-115
imputation credits granted for domestic company tax	50	-2	52
imputation credits granted for foreign company tax	-314	0	-314
Company taxes levied on foreign capital used domestically	**8**	**64**	**-55**
Australian owned	1	2	-2
New Zealand owned	7	59	-52
Rest of the World owned	1	2	-1
Gross National Income[d]	19	370	-351
Gross Domestic Product	**17**	**282**	**-265**

[a] The elasticity of substitution between labour and capital and the elasticity of substitution between capital from different sources are both set to 0.85. [b] The results contained in this table are a reproduction of components of more detailed national accounting results presented in Appendix C, tables C4.1, C4.2 and C4.3. [c] Region-specific inputs assumed to be in fixed supply. [d] Gross National Income (GNI) is the sum of the bolded values in the table.

Source: Commission estimates.

New Zealand recognition of Australian imputation credits

The drivers of the results for New Zealand recognising Australian imputation credits are the same as those identified in the Australian case. The effects are smaller because New Zealand capital plays a smaller role in the Australian economy: foreign capital in Australia comes mainly from the ROW. Thus, additional capital from New Zealand does not decrease Australian costs of production by much. The value of imputation credits recognised in Australia would be US$ 254 million.

Increased returns to New Zealand-owned capital in Australia increase Australia's capital stock by US$ 212 million, and decrease New Zealand's capital stock by US$ 197 million.

The net movement of capital toward Australia causes:

1. A net increase in post-tax payments to New Zealand-owned Australian capital of US$ 249 million
2. A net increase in payments to Australian labour of US$ 154 million.
3. A net decreases in payments to New Zealand labour of US$ 175 million.
4. A net increase in Australian tax revenue of US$ 200 million,
5. A net decrease in New Zealand tax revenue of US$ 431 million.
6. Negligible impact on the cost of production in Australia, and a 0.01 per cent increase in New Zealand's cost of production.

New Zealand recognising Australian imputation credits produces a transfer of income of around US$ 351 million from New Zealand to Australia. From a trans-Tasman perspective, there is a US$ 19 million increase in income. Trans-Tasman GDP increases by US$ 17 million.

Table 5 **Impacts of mutual recognition of trans-Tasman imputation credits[a,b]**

Change US$m, 2012

	Trans-Tasman	*Australia*	*New Zealand*
Labour and land income accruing to households after tax[c]	**153**	**-350**	**504**
Returns to domestically owned and used capital accruing to households after tax	**93**	**25**	**69**
Imputation credits granted for foreign capital taxes	**1443**	**1131**	**312**
Returns to domestically owned capital used overseas accruing to households after tax	**-241**	**-179**	**-62**
used in Australia	-65	n.a.	-65
used in New Zealand	-189	-189	n.a.
used in the Rest of the World	13	10	3
Taxes on personal income	**-1344**	**-1333**	**-11**
Total tax collected on personal income	-162	-413	251
imputation credits granted for domestic company tax	261	212	49
imputation credits granted for foreign company tax	-1443	-1131	-312
Company taxes levied on foreign capital used domestically	**10**	**-158**	**168**
Australian owned	3	-212	214
New Zealand owned	8	57	-49
Rest of the World owned	-1	-4	3
Gross National Income[d]	**115**	**-865**	**980**
Gross Domestic Product	**90**	**-649**	**739**

[a] The elasticity of substitution between labour and capital and the elasticity of substitution between capital from different sources are both set to 0.85. [b] The results contained in this table are a reproduction of components of more detailed national accounting results presented in Appendix C, tables C5.1, C5.2 and C5.3. [c] Region-specific inputs assumed to be in fixed supply. [d] Gross National Income (GNI) is the sum of the bolded values in the table.

Source: Commission estimates.

The results of the previous simulation are almost additive. With MRIC, the effects of Australian recognition of New Zealand imputation credits dominate. There is a net transfer of income from Australia to New Zealand (Australia lose US$ 865 million in GNI, and New Zealand gains US$ 980 million) and trans-Tasman output increases (US$ 115 million).

The impact of MRIC between Australia and New Zealand are:

- A net increase in capital in New Zealand of $602 million, and a net contraction of capital in Australia of US$ 527 million
- A net increase in returns to Australian- and New Zealand-owned overseas capital of US$ 952 million and US$ 250 million respectively.

- A net increase in payments to New Zealand labour of US$ 504 million, and a net decrease of payments to Australian labour of US$ 350 million.
- A net decrease in Australian tax revenue of US$ 1491 million and a net increase in New Zealand tax revenue of US$ 157 million.

Sensitivity of model results

Sensitivity analysis centres on four parameters:

1. the ease with which firms substitute between capital from different origins in their production processes in response to the cost of capital
2. the ease with which capital owners reallocate their capital across the world in response to changes in post-tax returns to capital.
3. The share of firms in the economy that give dividends to their shareholders and are thus effected by imputation credit policies.

The flexibility of the SMRIC model allows all parameters to be varied simultaneously. This enables exploration the kinds of assumptions required to reproduce alternative results. Box 1 illustrates the assumptions required to reproduce the NZIER-CIE results contained in the ANZLF submission.

Box 1 **An interpretation of results from the NZIER-CIE study**

The SMRIC model can be used to approximate the behaviour represented in, and results produced with other models. As part of the ANZLF submission (sub. 58), NZIER-CIE (2012) used the CIE-G-Cubed model to model the economy-wide effects of MRIC. The CIE-G-Cubed model is a dynamic global CGE model with a structure that is similar to that of the SMRIC model, with more country and industry disaggregation.

MRIC was represented with two exogenous shocks:

- a reduction in tax revenues (which is offset by an endogenous increase in broad-based taxes), and
- an increase in the post-tax rate of return on trans-Tasman capital (which is akin to a shift in the supplies of trans-Tasman capital).

These shocks proxy imputation credits which are not explicitly in the model. In reality, the amount of revenue foregone is not fixed: it varies with both the level and value of capital sent to the trans-Tasman partner. Further, the improvement in the rate of return to capital used overseas (and reduction in the rental rate in the destination) is an endogenous capital supply-demand response to the imputation credits received by the capital owner.

The main assumptions underlying central case in the NZIER-CIE study were incorporated into the SMRIC model:

1. 50 per cent of firms offer dividends (with the remainder capitalising profits)
2. 20 per cent of Australian equities in New Zealand are in super funds (and are taxed at a rate of 15 per cent)
3. capital owners face the highest personal income tax rate in their home country (46.5 per cent in Australia, and 33 per cent in New Zealand)
4. Domestic-foreign capital substitution elasticities in the demand for capital were set at 1 (they are set between 0.5-1.5 across industries in the NZIER-CIE study), and foreign-foreign capital substitution elasticities were assumed to be twice the domestic-foreign elasticity
5. Governments impose direct taxes on household income to ensure that the policy is revenue neutral for fixed government expenditure as a share of GDP.

(continued)

Box 1 An interpretation of results from the NZIER-CIE study (continued)

In the core SMRIC results (tables 3, 4 and 5) the impacts of Australia recognising New Zealand imputation credits are much larger than the converse. This dominates the MRIC scenario. Australia's net capital loss to New Zealand results in a GDP contraction, and reductions in the domestic returns to labour cause a net contraction in real consumption. This is largely driven by two factors: New Zealand's relatively intensive use of Australian-owned capital in production (relative to Australia's use of New Zealand-owned capital); and the common values used for capital supply elasticities across regions.

Reproducing the main feature of the NZIER-CIE results – that is, net gains for both countries resulting from MRIC (fist part of the table below) – is possible by differentiating the reactions to changes in returns of capital owners in Australia and New Zealand, and reducing New Zealand's ability to absorb Australian capital by:

- constraining Australia's willingness to send capital to New Zealand and
- increasing New Zealand's willingness to send capital to Australia (Australia is given a trans-Tasman supply substitution elasticity of 1, while New Zealand is assigned a value of 3.5).

Table NZIER-CIE and SMRIC model results for similar assumptions

Changes US$m, 2012

	Real GDP		*Real Consumption*		*Net government revenue*	
	Aus	*Nzl*	*Aus*	*Nzl*	*Aus*	*Nzl*
NZIER-CIE results						
Net present value to 2030 (NZ$m)	2200	3100	4400	2600	0	0
Average annual value (NZ$m)[a]	168	237	336	199	0	0
Average annual value (US$m)[b]	**139**	**196**	**278**	**165**	**0**	**0**
SMRIC results						
NZIER-CIE assumptions (US$m)	**153**	**195**	**192**	**141**	**0**	**0**

a. based on a discount rate of 5 per cent, extrapolating the distribution of results presented in the ANZLF submission**. b.** based on a NZD-USD exchange rate of 0.8288.

Source: Commission estimates; ANZLF sub. 58

Capital substitution elasticity assumptions

Table 6 shows a summary of the impact of imputation credit recognition under a range of capital substitution elasticity assumptions.

Table 6 **Impacts of imputation credit modelling under a range of capital substitutability assumptions**

Change US$m, 2012

	Trans-Tasman			*Australia*			*New Zealand*		
σ	*Real GDP*	*Real GNI*	*Value of imputation credits recognised*[a]	*Real GDP*	*Real GNI*	*Value of imputation credits recognised*	*Real GDP*	*Real GNI*	*Value of imputation credits recognised*
Australian recognition of New Zealand imputation credits									
0.00	0	0	-819	0	0	-819[b]	0	0	0
0.85	157	84	-1133	-747	-1042	-1133	904	1126	0
5.00	883	-2	-1276	-1259	-1637	-1276	2141	1635	0
New Zealand recognition of Australian imputation credits									
0.00	0	0	-259	0	0	0	0	0	-259[c]
0.85	42	16	-314	243	300	0	-201	-284	-314
5.00	119	29	-338	560	498	0	-441	-469	-338
Mutual recognition of imputation credits									
0.00	0	0	-1078	0	0	-819	0	0	-259
0.85	199	100	-1447	-504	-742	-1133	703	842	-314
5.00	1002	27	-1614	-698	-1139	-1276	1701	1166	-338

[a] The value of imputation credits is not the total change in revenue collected. It abstracts from endogenous changes in personal income tax and capital tax collections, brought about by changes in returns and stocks of capital, and changes in labour incomes. [b] This value is equivalent to the 'Potential revenue lost' figure presented in the NZIER-CIE shock calculations (table 8 in NZIER-CIE 2012), based on an exchange rate of 0.8288. [c] This value is equivalent to the 'Potential revenue lost' figure presented in the NZIER-CIE shock calculations (table 11 in NZIER-CIE 2012) based on an exchange rate of 0.8288

Source: Commission estimates.

When capital is not substitutable (σ=0.01), each country's demands for capital are vertical and there is no investment response to the modelled decrease in the cost of capital and MRIC produces purely domestic transfers. As a result, there are very small output changes in both countries. The tax reduction results in an increase in the after-tax return to capital in each source country. Assuming that $1 of government revenue equals $1 of consumer welfare, and since all transfers are occurring within a country, the net welfare impact of the policy is zero.

When capital is substitutable (σ=0.85), the policy impacts both economies. Output and income expand in the destination country (as the amount of capital located in

the destination country and wages increase) and contracts in the source country (as the amount of capital located in the source country and wages decrease). Tax revenues in the source country contract. Part of this revenue accrues to owners of foreign capital as increased rates of return, part accrues to foreign labour as higher wages, and part accrues to the government in the destination country as increased tax revenues (from increased income tax, and additional company tax on the capital inflow).

When capital is highly substitutable (σ=5), each country's demand for capital is nearly perfectly elastic with respect to the cost of capital, and capital from the source country can easily displace capital in the destination country. This causes a much larger movement of capital from the source country to the destination country. The higher rate of substitution between capital sources reduces the returns to capital, but provides larger increases in the real wage in the destination country. When capital substitution elasticities are very large:

- the reduction in domestic capital income in the destination country can offset the increase in the returns to labour, resulting in a net GNI reduction for the destination country.
- the increased returns to capital in the source country to can offset the labour income and tax revenue reductions, resulting in a net GNI improvement for the source country.

In this way, capital substitutability assumptions can have a significant impact on the distribution of income gains between the two countries.

Share of capital users that can easily substitute to global capital

The share of firms in the economy that have access to international equity to procure capital has an impact on the results. As observed in Sorensen and Johnson, since these firms already have access to an (effectively) unlimited supply of capital at the world rate of return, imputation credits do not affect their cost of capital. The fixed world price causes large changes in the share of capital that is procured from trans-Tasman sources, without any overall change in the level of capital used.

Table 7 shows a summary of the impact of imputation credit recognition policies as the share of firms with access to global credit markets was changed.

Table 7 **Impacts of imputation credit modelling as the availability of international capital is increased**

Change US$m, 2012

	Trans-Tasman			*Australia*			*New Zealand*		
ε	*Real GDP*	*Real GNI*	*Value of imputation credits recognised*[a]	*Real GDP*	*Real GNI*	*Value of imputation credits recognised*	*Real GDP*	*Real GNI*	*Value of imputation credits recognised*
Australian recognition of New Zealand imputation credits									
0	0	0	-819	0	0	-819	0	0	0
1	110	47	-978	-368	-520	-978	478	567	0
2	132	61	-1030	-494	-694	-1030	626	755	0
25	155	81	-1121	-718	-1002	-1121	873	1083	0
∞	157	84	-1133	-747	-1042	-1133	904	1126	0
New Zealand recognition of Australian imputation credits									
0	0	0	-259	0	0	0	0	0	-259
1	28	7	-287	128	151	0	-100	-144	-287
2	34	10	-296	168	201	0	-134	-191	-296
25	41	16	-312	234	289	0	-193	-273	-312
∞	42	16	-314	243	300	0	-201	-284	-314
Mutual recognition of imputation credits									
0	0	0	-1078	0	0	-819	0	0	-259
1	138	54	-1265	-240	-369	-978	378	423	-287
2	166	71	-1327	-326	-493	-1030	492	564	-296
25	196	97	-1434	-484	-713	-1121	680	810	-312
∞	199	100	-1447	-504	-742	-1133	703	842	-314

a. The value of imputation credits is not the total change in revenue collected. It abstracts from endogenous changes in personal income tax and capital tax collections, brought about by changes in returns and stocks of capital, and changes in labour incomes

Source: Commission estimates.

When the share of firms with access to international credit markets is large, imputation credit policies largely result in domestic transfers from governments to owners of capital. There is a small transfer from Rest of the World capital owners in favour of capital owners in the source, trans-Tasman country as large firms increase their share of lower cost local capital, before their total returns adjust to the world rate. There is a small increase in output in the source country due to the increased capital income, which leads to a larger proportion of domestic consumption than when the income was received by the Rest of the World.

When the share of firms with access to international credit markets is small, the impact of imputation credit policies is much larger. Firms in the destination country — without fixed price, highly substitutable global capital — increase their demand

for capital from the source, trans-Tasman country. This causes large reductions in the domestic capital stock in the source country (as the capital moves to the trans-Tasman partner when the post-tax returns have now improved). As in the base case, this increases returns to capital owners in the source country, but is accompanied by a decrease in tax revenue and labour incomes (as the economy contracts). The destination country benefits from increased labour and tax incomes, offset by declines in capital incomes from competing domestic capital.

Share of companies issuing dividends

The greater the share of companies offering dividends, the larger the impacts of imputation credits policies (in terms of output, income, and revenue impacts). Table 8 shows a summary of the impacts of imputation credits policies under a range of assumptions about the proportion of companies offering dividends.

Table 8 **Impacts of imputation credit modelling as the share of companies offering dividends is increased**

Change US$m, 2012

	Trans-Tasman			*Australia*			*New Zealand*		
Share (%)	*Real GDP*	*Real GNI*	*Value of imputation credits recognised*[a]	*Real GDP*	*Real GNI*	*Value of imputation credits recognised*	*Real GDP*	*Real GNI*	*Value of imputation credits recognised*
Australian recognition of New Zealand imputation credits									
0	0	0	0	0	0	0	0	0	0
25	52	18	-245	-157	-222	-245	209	240	0
50	96	38	-511	-332	-467	-511	428	505	0
75	133	59	-806	-527	-739	-806	660	798	0
100	157	84	-1133	-747	-1042	-1133	904	1126	0
New Zealand recognition of Australian imputation credits									
0	0	0	0	0	0	0	0	0	0
25	14	3	-63	56	64	0	-42	-61	-63
50	26	7	-135	116	135	0	-90	-128	-135
75	36	11	-218	178	213	0	-142	-202	-218
100	42	16	-314	243	300	0	-201	-284	-314
Mutual recognition of imputation credits									
0	0	0	0	0	0	0	0	0	0
25	66	21	-308	-101	-158	-245	167	179	-63
50	122	45	-646	-216	-332	-511	338	377	-135
75	169	70	-1025	-349	-526	-806	518	596	-218
100	199	100	-1447	-504	-742	-1133	703	842	-314

a. The value of imputation credits is not the total change in revenue collected. It abstracts from endogenous changes in personal income tax and capital tax collections, brought about by changes in returns and stocks of capital, and changes in labour incomes

Source: Commission estimates.

Companies that do not offer dividends receive no benefit from imputation credit recognition policies. As the share of companies that retain profits increases, the smaller the impact trans-Tasman imputation credit recognition policies have on the total after tax returns to all capital.

1.3 Summary

This paper operationalizes a simple theoretical model to analyse the effects of MRIC. The model is parameterised for Australia, New Zealand and a ROW region.

Results are especially sensitive to changes in the assumed substitutability of capital across regions and to the share of firms that have access to international equity:

- If MRIC is assumed not to produce any behavioural response and does not result in any reallocation of capital across the Tasman – that is, the static effects of MRIC – all transfers occur within an economy, from taxpayers to owners of capital.
  - this requires Australia and New Zealand to recognise of imputation credits valued at US$ 917 million and US$ 254 million respectively
- There is a lot of uncertainty about the likely magnitude of behavioural responses. For this reason, sensitivity analysis was conducted on the main parameters that drive the results. In this summary, orders of magnitude are based on central values of these parameters.
- If MRIC induces owners of capital in Australia and New Zealand to reallocate their capital across the Tasman (and across the world) toward higher productivity uses, trans-Tasman GDP increases. That said, there is a net increase in capital and GDP in New Zealand (an increase of nearly US$740 million) and a net decrease in capital located in Australia and Australian GDP (a decrease of about US$ 650).
- The increase in capital in New Zealand increases the productivity of labour (and other inputs), increasing their returns by about US$ 500 million. With net decrease in Australian capital, the productivity of labour (and other inputs) decreases in Australia – their returns decrease about US$ 350 million.
- The marginal effects of the reallocation of capital are accompanied by significant transfers that are based on the much larger infra-marginal quantities of capital.
  - The net decreases in tax revenues amount to about US$ 1500 million in Australia. New Zealand gains nearly US$ 160 million in additional revenue

Appendix A: Model structure

The SMRIC model includes three regions — Australia, New Zealand and the Rest of the World. Each region produces a unique type of output (seeking to minimise the cost of production) using four factors of production: a factor that is assumed not to relocate (aggregate labour); and 3 region-specific sourced factors that are internationally substitutable (capital). Capital owners substitute supply between regions based on a constant elasticity of transformation, subject to a fixed total capital supply. There are two types of firms in each country: firms that have access to global equity finance and firms that do not. Regional output is a fixed-proportion combination of the output of both firm types.

Incomes from factors less taxes on returns in the destination region (such as payroll for labour, and company tax for capital) accrue to the owners of the factors, and this income is then subject to the personal tax rate in the source region. The residual disposable income can be spent on consumption. Each region has final demands for each of the three types of output, substituting between them based on relative prices.

The remainder of this appendix documents the key variables and equations in the SMRIC model.

The following letters represent sets in the model:

1. r,s,t: region in which output is produced
2. i,j: region from which an input is sourced
3. c: region in which output is consumed

The following terms are parameters in the model:

1. $\theta l(r)$: CES parameter, share of labour in total cost in r
2. $\theta k(r)$: CES parameter, share of all capital in total cost in r
3. $\theta tt(r)$: CES parameter, share all trans-Tasman capital in total capital cost in r
4. $\theta row(r)$: CES parameter, share Rest of the World capital in total capital cost in r
5. $\theta aus(r)$: CES parameter, share Australian capital in total trans-Tasman capital cost in r
6. $\theta nzl(r)$: CES parameter, share New Zealand capital in total trans-Tasman capital cost in r

7. $\sigma_{LK}(r)$: Substitution elasticity between labour and top-level capital composite in r
8. $\sigma_{RoW}(r)$: Substitution elasticity between trans-Tasman capital composite and Rest of the World capital in r
9. $\sigma_{TT}(r)$: Substitution elasticity between Australian and New Zealand sourced capital in r
10. $\sigma_{KS}(i)$: Capital supply substitution elasticity between regions
11. $plbar(r)$: initial price of labour in r
12. $pkbar(i,r)$: initial price of capital in r sourced from i
13. $p2bar(r)$: initial price of capital composite (Rest of the World and trans-Tasman) in r
14. $p3bar(r)$: initial price of trans-Tasman capital composite (
15. $qcbar(c)$: initial level of output in c
16. $qlbar(r)$: initial labour endowment in region r
17. $qkbar(i,r)$: initial labour endowment, owned by i used in r
18. $\gamma(r) = 1 - \sigma(r)$, where $\sigma(r)$ is the elasticity of substitution between inputs in r
19. $tK(i,r)$: taxes on capital used in r sourced from i, accruing to i
20. $tL(r)$: taxes on labour used in r
21. $tY(r)$: income taxes in r
22. $tC(r,c)$: consumption taxes on r consumed in c, accruing to c
23. $\alpha(r,c)$: Cobb-Douglas consumption parameter for good r consumed in c

The following terms are variables in the model:

1. $Cost(r)$: total cost of production in region r
2. $Cost1(r)$: unit cost of input composite in region r
3. $Cost2(r)$: unit cost of capital composite in region r
4. $Cost3(r)$: unit cost of trans-Tasman capital composite in region r
5. $XRoW(r)$: demand for capital sourced from the Rest of the World used in r
6. $XAus(r)$: demand for capital sourced from Australia used in r
7. $XNzl(r)$: demand for capital sourced from New Zealand used in r
8. $PlD(r)$: wage rate (incl. tax) in region r
9. $PlS(r)$: wage rate (post tax) in region r

10. $QlD(r)$: quantity of labour demanded in region r
11. $PkD(i,r)$: rental rate of capital sourced from i used in r
12. $PkS(i,r)$: post-tax return to capital owned in i supplied to r
13. $QkD(i,r)$: demand for capital sourced from i used in r
14. $QkS(i,r)$: demand for capital sourced from i used in r
15. $PoD(r,c)$: price of output r consumed in region c
16. $PoS(r)$: price of supply in region r
17. $QoD(r,c)$: quantity of output r demanded in region c
18. $QoS(r)$: total quantity of output r
19. $Y(c)$: total incomes in region c
20. $Yd(c)$: disposable household income in region c
21. $Yg(c)$: government revenues in region c

Production side

Firms in region r minimise their cost of production (by sourcing inputs from region i) subject to a constant elasticity of substitution (CES) production function. Based on this optimisation problem, the first order conditions imply cost and input demand functions. Cost functions are nest with three levels: level 1 governs the substitutability between labour and capital; level 2 the substitutability between trans-Tasman capital and rest of the world capital; and level 3 the substitutability between Australian and New Zealand sourced capital.

$$Cost(r) = QoS(r).Cost1(r)$$

$$Cost1(r) = \left[\theta l(r)\left(\frac{PlD(r)}{plbar(r)}\right)^{1-\sigma_{LK}(r)} + \theta k(r)\left(\frac{Cost2(r)}{p2bar(r)}\right)^{1-\sigma_{LK}(r)}\right]^{\frac{1}{1-\sigma_{LK}(r)}}$$

$$Cost2(r) = \left[\theta tt(r)\left(\frac{Cost3(r)}{p3bar(r)}\right)^{1-\sigma_{RoW}(r)} + \theta row(r)\left(\frac{PkD('RoW',r)}{pkbar('RoW',r)}\right)^{1-\sigma_{RoW}(r)}\right]^{\frac{1}{1-\sigma_{RoW}(r)}}$$

$$Cost3(r) = \left[\theta aus(r)\left(\frac{PkD('Aus',r)}{pkbar('Aus',r)}\right)^{1-\sigma_{TT}(r)} + \theta nzl(r)\left(\frac{PkD('Nzl',r)}{pkbar('Nzl',r)}\right)^{1-\sigma_{TT}(r)}\right]^{\frac{1}{1-\sigma_{TT}(r)}}$$

$$QlD(r) = \frac{QoS(r)}{\sum_c qcbar(c)}.\left(\frac{PlD(r)}{plbar(r)}\right)^{-\sigma_{LK}(r)} \times Cost1(r)^{\sigma_{LK}(r)}$$

$$XRoW(r) = \frac{QoS(r)}{\sum_c qcbar(c)}.\left(\frac{PkD('RoW',r)}{pkbar('RoW',r)}\right)^{-\sigma_{RoW}(r)} \times Cost1(f,r)^{\sigma_{LK}(r)} \times Cost2(r)^{\sigma_{RoW}(r)-\sigma_{LK}(r)}$$

$$XAus(r) = \frac{QoS(r)}{\sum_c qcbar(c)}.\left(\frac{PkD('Aus',r)}{pkbar('Aus',r)}\right)^{-\sigma_{TT}(f,r)} \times Cost1(r)^{\sigma_{LK}(r)} \times Cost2(r)^{\sigma_{RoW}(r)-\sigma_{LK}(r)} \times Cost3(r)^{\sigma_{TT}(r)-\sigma_{RoW}(r)}$$

$$XNzl(r) = \frac{QoS(r)}{\sum_c qcbar(c)}.\left(\frac{PkD('Nzl',r)}{pkbar('Nzl',r)}\right)^{-\sigma_{TT}(f,r)} \times Cost1(r)^{\sigma_{LK}(r)} \times Cost2(r)^{\sigma_{RoW}(r)-\sigma_{LK}(r)} \times Cost3(r)^{\sigma_{TT}(r)-\sigma_{RoW}(r)}$$

$$QkD(i,r) = XAus(r)|_{i=Aus} + XNzl(r)|_{i=Nzl} + XRoW(r)|_{i=RoW}$$

Factor supply prices (the post-tax return on capital, and post-tax wage) are defined as the demand prices (the rental rate of capital, and the wage) less taxes:

$$PkS(i,r) = PkD(i,r).(1 - tK(i,r))$$

$$PlS(i) = PlD(r).(1 - tL(r))$$

The supply of output is determined such that suppliers from region r meet the sum of demands from all regions C. Output is region specific. Output in each country is a fixed proportions combination of large and small firm output. The market clearing condition determines the level of output:

$$QoS(r) = \sum_c QoD(r,c)$$

Factor supply side

The market clearing conditions between the demand and supply sides for each factor determine the price.

Labour factor supplies are determined by national capacity constraints. Labour is fixed by country.

$$QlD(r) = qlbar(r)$$

Global capital supplies are governed by a constant elasticity of supply functional firm. Capital owners in each region are assumed to maximise the return to their investment by allocating a fixed capital stock globally. Changing the elasticity adjusts the preference capital owners have for particular regions. In the extreme cases, (1) capital owners decide between regions based solely on rates of return, without preference for particular regions and (2) capital owners desire a fixed portfolio share (reflecting a globally diverse portfolio) of their capital in each region. This is consistent with capital suppliers exhibiting a preference for certain countries on the basis of risk, governance, regulatory arrangements or firm sizes (consistent S&J).

$$QkD(i,r) = QkS(i,r)$$

$$QkS(i,r) = \frac{(\sum_s qkbar(i,s))\left(\frac{kbar(i,r)}{\sum_s qkbar(i,s)}\right)\left(\frac{PkS(i,r)}{pkbar(i,r) - taxk(i,r)}\right)^{\sigma_{KS}(i)-1}}{\sum_t \left[\left(\frac{kbar(i,t)}{\sum_s qkbar(i,s)}\right)\left(\frac{PkS(i,t)}{pkbar(i,t) - taxk(i,t)}\right)^{\sigma_{KS}(i)-1}\right]}$$

Consumption side

Consumers maximise their CES utility subject to a constrained budget. For the purposes of this simplified example, consumers are treated as having a Cobb–Douglas utility function. The first order conditions imply final demands:

$$QoD(r,c) = \frac{\alpha(r,c).Y(c)}{PoD(r,c)}$$

The supply price is defined as the demand price less consumption taxes:

$$PoS(r) = PoD(r,c).(1 - tC(r,c))$$

National income is the sum of household income and government revenue, such that:

$$Y(c) = Yd(c) + Yg(c)$$

$$Yd(c) = (1 - tY(c)).\left(\sum_{f} PlD(c).QlD(c) + \sum_{r} PkD(c,r).Qkd(c,r) - \sum_{r} tK(c,r).Pkd(c,r).Qkd(c,r)\right)$$

$$Yg(c) = \frac{tY(c)}{1 - tY(c)}.Yd(c) + \sum_{f,i} tK(i,c).Pkd(i,c).Qkd(i,c)$$

Suppliers are assumed not to make any rents, such that:

$$PoS(r).QoS(r) = Cost(r)$$

Appendix B: Data and sources

The model has been calibrated from a range of sources. All data collected are for 2010.

- Aggregate consumption ,labour income and non-corporate capital returns were obtained from Australian and New Zealand national accounts. Rest of the World values were obtained from the GTAP 7.0 database and scaled to 2010 values using the change in Australian and New Zealand values between 2004 and 2010.
- Australian exports and imports were taken from the national accounts data from the ABS. These values were then apportioned between New Zealand and Rest of the World using ABS merchandise trade data, to derive trans-Tasman trade and Australian-Rest of the World trade flows. This implicitly assumes that services trade flows mimic total merchandise trade flows. Trade flows between New Zealand and Rest of the World were derived by subtracting the previously calculated Australia-New Zealand flows from total New Zealand export and import values (obtained from Statistics New Zealand (SNZ) national accounts).
- Australian and New Zealand total corporate capital income were taken from CIE-NZIER. Total returns to trans-Tasman and ROW corporate capital were also taken from CIE-NZIER.
- Company tax rates were obtained from the Australian Taxation Office and the New Zealand Inland Revenue Department. Rest of the World company tax rates were assumed to be 10 percent respectively.
- Rest of the World corporate capital income was calculated by applying the share of corporate capital incomes in GDP in the ANZEA database to value of GDP.

Australian and New Zealand data were converted to 2010 US$ millions using market exchange rates.

All statistical discrepancies reported by statistical agencies were added to large aggregates; for example labour income or consumption. This means that their potential impacts on results is minimised.

Database values and sources for Australia, New Zealand and Rest of the World are presented in tables 1, 2 and 3. These data were adjusted to ensure consistency with the real economy.

Table 9 **Database values and sources, Australia**

	Database value	*Database value*	*Sources*
	2010 US$ millions	2010 A$ millions [a]	
Labour cost (including taxes), land and other capital income	1 023 366	1 149 850	ABS national accounts, ABS statistical discrepancy included
Corporate capital returns (After-tax)			
Australia owned	143 468	161 199	CIE-NZIER
New Zealand owned	848	952	CIE-NZIER
Rest of the World owned	28 596	32 131	CIE-NZIER
Corporate capital taxes levied on			
Australia owned	0	0	Assumed
New Zealand owned	254	286	ATO, CIE-NZIER
Rest of the World owned	8 579	9 639	ATO, CIE-NZIER
GDP (total)	1 205 111	1 354 057	
Australian consumption	1 191 568	1 338 840	ABS national accounts, ABS statistical discrepancy included
Exports to New Zealand	8 762	9 845	ABS national accounts, ABS merchandise trade (by country)
Exports to ROW	244 185	274 365	ABS national accounts, ABS merchandise trade (by country)
Imports from New Zealand	8 209	9 224	ABS national accounts, ABS merchandise trade (by country)
Imports from ROW	231 195	259 770	ABS national accounts, ABS merchandise trade (by country)
GDP (total)	1 205 111	1 354 057	

[a] One 2010 A$ is equal to 0.89 2010 US$.

Source: Commission estimates.

Table 10 **Database values and sources, New Zealand**

	Database value	*Database value*	*Sources*
	2010 US$ millions	2010 NZ$ millions [a]	
Labour cost (including taxes), land and other capital income	113 743	160 202	SNZ national accounts
Corporate capital returns (After-tax)			
New Zealand owned	12 411	17 481	CIE-NZIER
Australia owned	3 274	4 612	CIE-NZIER
Rest of the World owned	2 339	3 294	CIE-NZIER
Corporate capital taxes levied on			
New Zealand owned	0	0	Assumed
Australia owned	917	1,291	New Zealand IRD tax data, CIE-NZIER
Rest of the World owned	655	922	New Zealand IRD tax data, CIE-NZIER
GDP	133 339	187 801	
New Zealand consumption	131 398	185 068	SNZ national accounts, SNZ statistical discrepancy included
Exports to Australia	8 209	11 562	ABS national accounts ABS merchandise trade (by country) data
Exports to ROW	29 012	40 862	SNZ national accounts, remainder after exports to Australia subtracted
Imports from Australia	8 762	12 341	ABS national accounts, ABS merchandise trade (by country) data
Imports from ROW	26 518	37 349	SNZ national accounts, remainder after imports to Australia subtracted
GDP	133 339	187 801	

[a] One 2010 NZ$ is equal to 0.71 2010 US$.

Source: Commission estimates.

Table 11 **Database values and sources, Rest of the World**

	Database value	*Sources*
	2010 US$ millions	
Labour cost (including taxes), land and other capital income	66 103 272	ANZEA database, ROW GDP (expenditure side)
Corporate capital returns (After-tax)		
Rest of the World owned	10 595 672	ABS national accounts
Australia owned	15 073	ABS national accounts, ABS international investment position data
New Zealand owned	906	ABS national accounts, ABS international investment position data
Corporate capital taxes levied on		
Rest of the World owned	0	ABS national accounts
Australia owned	1 507	ABS national accounts, ABS international investment position data
New Zealand owned	91	ABS national accounts ABS international investment position data
GDP	76 716 520	
Rest of the World consumption	76 732 004	ANZEA database, ABS and SNZ national accounts
Exports to Australia	231 195	ABS national accounts ABS merchandise trade (by country) data
Exports to New Zealand	26 518	SNZ national accounts, remainder after exports to Australia subtracted
Imports from Australia	244 185	ABS national accounts, ABS merchandise trade (by country) data
Imports from New Zealand	29 012	SNZ national accounts, remainder after imports to Australia subtracted
GDP	76 716 520	

Source: Commission estimates.

Appendix C: Detailed model results

Australian recognition of New Zealand imputation credits

Table C3.1 **Disaggregated impacts on gross national income and expenditure[a]**

Change US$m, 2012

	Trans-Tasman	*Australia*	*New Zealand*	*Rest of the World*
Labour and land income accruing to households after tax[b]	**175**	**-504**	**679**	**-49**
Returns to domestically owned and used capital accruing to households after tax	**69**	**6**	**63**	**-7**
Imputation credits granted for foreign capital taxes	**1133**	**1133**	**0**	**0**
Returns to domestically owned capital used overseas accruing to households after tax	**-175**	**-177**	**2**	**-3**
used in Australia	1	n.a.	1	-14
used in New Zealand	-187	-187	n.a.	11
used in the Rest of the World	10	10	1	n.a.
Taxes on personal income	**-1108**	**-1471**	**364**	**-25**
Total tax collected on personal income	-186	-552	366	-25
credits granted for domestic company tax	212	214	-3	0
credits granted for foreign company tax	-1133	-1133	0	0
Company taxes levied on foreign capital used domestically	**2**	**-221**	**223**	**-6**
Australian owned	2	-214	217	-6
New Zealand owned	1	-1	3	0
Rest of the World owned	-2	-6	4	0
Gross National Income	**96**	**-1234**	**1331**	**-91**
Consumption of domestic production	**2**	**-1009**	**1011**	**-90**
Consumption of imports	**94**	**-225**	**319**	**0**
from Australia	79	n.a.	79	0
from New Zealand	-8	-8	n.a.	0
from the Rest of the World	23	-217	240	n.a.
Gross National Expenditure	**96**	**-1234**	**1331**	**-90**

a The elasticity of substitution between labour and capital and the elasticity of substitution between capital from different sources are both set to 0.85. **b** Region-specific inputs assumed to be in fixed supply.

Source: Commission estimates.

Table C3.2 **Disaggregated impacts on the trade balance and total factor payments[a]**

Change US$m, 2012

	Trans-Tasman	*Australia*	*New Zealand*	*Rest of the World*
Exports	**71**	**79**	**-8**	**23**
to Australia	-8	n.a.	-8	-217
to New Zealand	79	79	n.a.	240
to the Rest of the World	0	0	0	n.a.
Imports	**94**	**-225**	**319**	**0**
from Australia	79	n.a.	79	0
from New Zealand	-8	-8	n.a.	0
from the Rest of the World	23	-217	240	n.a.
Trade balance	**-23**	**304**	**-327**	**23**
	0			
Capital income received from o/seas including foreign taxes	**-110**	**-111**	**1**	**-6**
from Australia	0	n.a.	0	-25
from New Zealand	-123	-123	n.a.	20
from the Rest of the World	12	11	1	n.a.
Capital income paid to o/seas owners including domestic taxes	**-128**	**-25**	**-103**	**12**
to Australia	-123	n.a.	-123	11
to New Zealand	0	0	n.a.	1
to the Rest of the World	-6	-25	20	n.a.
Company tax collected from foreign-owned capital incomes earned domestically	**214**	**-7**	**221**	**-6**
Australian owned	217	n.a.	217	-6
New Zealand owned	-1	-1	n.a.	0
Rest of the World owned	-2	-6	4	n.a.
Company tax paid from domestically owned capital incomes earned overseas	**209**	**211**	**-2**	**-2**
in Australia	-1	n.a.	-1	-6
in New Zealand	217	217	n.a.	4
in the Rest of the World	-6	-6	0	n.a.
Total factor payments	**23**	**-304**	**327**	**-23**

a The elasticity of substitution between labour and capital and the elasticity of substitution between capital from different sources are both set to 0.85. **b** Region-specific inputs assumed to be in fixed supply.

Source: Commission estimates.

Table C3.3 **Impacts on gross domestic product from the expenditure and income sides[a]**

Change US$m, 2012

	Trans-Tasman	*Australia*	*New Zealand*	*Rest of the World*
Consumption, Investment, Government spending	**96**	**-1234**	**1331**	**-90**
Exports	**71**	**79**	**-8**	**23**
Imports	**94**	**-225**	**319**	**0**
GDP (Expenditure side)	**73**	**-930**	**1004**	**-67**
Specific factor income (including taxes)	**96**	**-916**	**1013**	**-70**
Capital income (including taxes)	**-23**	**-14**	**-9**	**2**
Australian owned	-111	11	-123	11
New Zealand owned	94	0	94	1
Rest of the World owned	-6	-25	20	-10
GDP (Income side)	**73**	**-930**	**1004**	**-68**

a The elasticity of substitution between labour and capital and the elasticity of substitution between capital from different sources are both set to 0.85. **b** Region-specific inputs assumed to be in fixed supply.

Source: Commission estimates.

New Zealand recognition of Australian imputation credits

Table C4.1 **Disaggregated impacts on gross national income and expenditure[a]**

Change US$m, 2012

	Trans-Tasman	*Australia*	*New Zealand*	*Rest of the World*
Labour and land income accruing to households after tax[b]	**-21**	**154**	**-175**	**-14**
Returns to domestically owned and used capital accruing to households after tax	**24**	**19**	**6**	**0**
Imputation credits granted for foreign capital taxes	**314**	**0**	**314**	**0**
Returns to domestically owned capital used overseas accruing to households after tax	**-67**	**-3**	**-64**	**1**
used in Australia	-66	n.a.	-66	4
used in New Zealand	-3	-3	n.a.	-3
used in the Rest of the World	3	0	2	n.a.
Taxes on personal income	**-240**	**137**	**-376**	**-5**
Total tax collected on personal income	24	139	-115	-5
credits granted for domestic company tax	50	-2	52	0
credits granted for foreign company tax	-314	0	-314	0
Company taxes levied on foreign capital used domestically	**8**	**64**	**-55**	**-1**
Australian owned	1	2	-2	0
New Zealand owned	7	59	-52	-1
Rest of the World owned	1	2	-1	0
Gross National Income	**19**	**370**	**-351**	**-19**
Consumption of domestic production	**36**	**303**	**-267**	**-20**
Consumption of imports	**-17**	**67**	**-84**	**0**
from Australia	-21	n.a.	-21	0
from New Zealand	2	2	n.a.	0
from the Rest of the World	2	65	-63	n.a.
Gross National Expenditure	**19**	**370**	**-351**	**-20**

a The elasticity of substitution between labour and capital and the elasticity of substitution between capital from different sources are both set to 0.85. **b** Region-specific inputs assumed to be in fixed supply.

Source: Commission estimates.

Table C4.2 **Disaggregated impacts on the trade balance and total factor payments[a]**

Change US$m, 2012

	Trans-Tasman	*Australia*	*New Zealand*	*Rest of the World*
Exports	**-19**	**-21**	**2**	**2**
to Australia	2	n.a.	2	65
to New Zealand	-21	-21	n.a.	-63
to the Rest of the World	0	0	0	n.a.
Imports	**-17**	**67**	**-84**	**0**
from Australia	-21	n.a.	-21	0
from New Zealand	2	2	n.a.	0
from the Rest of the World	2	65	-63	n.a.
Trade balance	**-2**	**-88**	**87**	**2**
	0			
Capital income received from o/seas including foreign taxes	**-44**	**-7**	**-38**	**3**
from Australia	-40	n.a.	-40	8
from New Zealand	-7	-7	n.a.	-5
from the Rest of the World	3	0	2	n.a.
Capital income paid to o/seas owners including domestic taxes	**-44**	**-32**	**-12**	**3**
to Australia	-7	n.a.	-7	0
to New Zealand	-40	-40	n.a.	2
to the Rest of the World	3	8	-5	n.a.
Company tax collected from foreign-owned capital incomes earned domestically	**58**	**61**	**-3**	**-1**
Australian owned	-2	n.a.	-2	0
New Zealand owned	59	59	n.a.	-1
Rest of the World owned	1	2	-1	n.a.
Company tax paid from domestically owned capital incomes earned overseas	**56**	**-2**	**58**	**1**
in Australia	59	n.a.	59	2
in New Zealand	-2	-2	n.a.	-1
in the Rest of the World	-1	0	-1	n.a.
Total factor payments	**2**	**88**	**-87**	**-2**

a The elasticity of substitution between labour and capital and the elasticity of substitution between capital from different sources are both set to 0.85. **b** Region-specific inputs assumed to be in fixed supply.

Source: Commission estimates.

Table C4.3 **Impacts on gross domestic product from the expenditure and income sides[a]**

Change US$m, 2012

	Trans-Tasman	*Australia*	*New Zealand*	*Rest of the World*
Consumption, Investment, Government spending	**19**	**370**	**-351**	**-20**
Exports	**-19**	**-21**	**2**	**2**
Imports	**-17**	**67**	**-84**	**0**
GDP (Expenditure side)	**17**	**282**	**-265**	**-18**
Specific factor income (including taxes)	**19**	**280**	**-261**	**-20**
Capital income (including taxes)	**-2**	**2**	**-4**	**3**
Australian owned	27	34	-7	0
New Zealand owned	-31	-40	9	2
Rest of the World owned	3	8	-5	0
GDP (Income side)	**17**	**282**	**-265**	**-17**

a The elasticity of substitution between labour and capital and the elasticity of substitution between capital from different sources are both set to 0.85. **b** Region-specific inputs assumed to be in fixed supply.

Source: Commission estimates.

Mutual recognition of trans-Tasman imputation credits

Table C5.1 **Disaggregated impacts on gross national income and expenditure[a]**

Change US$m, 2012

	Trans-Tasman	*Australia*	*New Zealand*	*Rest of the World*
Labour and land income accruing to households after tax[b]	**153**	**-350**	**504**	**-56**
Returns to domestically owned and used capital accruing to households after tax	**93**	**25**	**69**	**-7**
Imputation credits granted for foreign capital taxes	**1443**	**1131**	**312**	**0**
Returns to domestically owned capital used overseas accruing to households after tax	**-241**	**-179**	**-62**	**-2**
used in Australia	-65	n.a.	-65	-9
used in New Zealand	-189	-189	n.a.	8
used in the Rest of the World	13	10	3	n.a.
Taxes on personal income	**-1344**	**-1333**	**-11**	**-28**
Total tax collected on personal income	-162	-413	251	-28
credits granted for domestic company tax	261	212	49	0
credits granted for foreign company tax	-1443	-1131	-312	0
Company taxes levied on foreign capital used domestically	**10**	**-158**	**168**	**-8**
Australian owned	3	-212	214	-6
New Zealand owned	8	57	-49	-2
Rest of the World owned	-1	-4	3	0
Gross National Income	**115**	**-865**	**980**	**-100**
Consumption of domestic production	**37**	**-707**	**745**	**-110**
Consumption of imports	**77**	**-158**	**235**	**0**
from Australia	58	n.a.	58	0
from New Zealand	-5	-5	n.a.	0
from the Rest of the World	24	-152	177	n.a.
Gross National Expenditure	**115**	**-865**	**980**	**-110**

a The elasticity of substitution between labour and capital and the elasticity of substitution between capital from different sources are both set to 0.85. **b** Region-specific inputs assumed to be in fixed supply.

Source: Commission estimates.

Table C5.2 **Disaggregated impacts on the trade balance and total factor payments[a]**

Change US$m, 2012

	Trans-Tasman	*Australia*	*New Zealand*	*Rest of the World*
Exports	**53**	**58**	**-5**	**24**
to Australia	-5	n.a.	-5	-152
to New Zealand	58	58	n.a.	177
to the Rest of the World	0	0	0	n.a.
Imports	**77**	**-158**	**235**	**0**
from Australia	58	n.a.	58	0
from New Zealand	-5	-5	n.a.	0
from the Rest of the World	24	-152	177	n.a.
Trade balance	**-25**	**216**	**-240**	**25**
	0			
Capital income received from o/seas including foreign taxes	**-154**	**-118**	**-36**	**-3**
from Australia	-39	n.a.	-39	-18
from New Zealand	-130	-130	n.a.	15
from the Rest of the World	15	12	3	n.a.
Capital income paid to o/seas owners including domestic taxes	**-172**	**-57**	**-115**	**15**
to Australia	-130	n.a.	-130	12
to New Zealand	-39	-39	n.a.	3
to the Rest of the World	-3	-18	15	n.a.
Company tax collected from foreign-owned capital incomes earned domestically	**271**	**53**	**218**	**-8**
Australian owned	214	n.a.	214	-6
New Zealand owned	57	57	n.a.	-2
Rest of the World owned	-1	-4	3	n.a.
Company tax paid from domestically owned capital incomes earned overseas	**264**	**208**	**56**	**-1**
in Australia	57	n.a.	57	-4
in New Zealand	214	214	n.a.	3
in the Rest of the World	-8	-6	-2	n.a.
Total factor payments	**25**	**-216**	**240**	**-25**

a The elasticity of substitution between labour and capital and the elasticity of substitution between capital from different sources are both set to 0.85. **b** Region-specific inputs assumed to be in fixed supply.

Source: Commission estimates.

Table C5.3 **Impacts on gross domestic product from the expenditure and income sides[a]**

Change US$m, 2012

	Trans-Tasman	*Australia*	*New Zealand*	*Rest of the World*
Consumption, Investment, Government spending	**115**	**-865**	**980**	**-110**
Exports	**53**	**58**	**-5**	**24**
Imports	**77**	**-158**	**235**	**0**
GDP (Expenditure side)	**90**	**-649**	**739**	**-86**
Specific factor income (including taxes)	**115**	**-637**	**752**	**-80**
Capital income (including taxes)	**-25**	**-12**	**-12**	**5**
Australian owned	-85	45	-130	12
New Zealand owned	63	-39	102	3
Rest of the World owned	-3	-18	15	-10
GDP (Income side)	**90**	**-649**	**739**	**-75**

a The elasticity of substitution between labour and capital and the elasticity of substitution between capital from different sources are both set to 0.85. **b** Region-specific inputs assumed to be in fixed supply.

Source: Commission estimates.

References

McDougall, G.D.A. 1960, 'The Benefits and Costs of Private Investment from Abroad: A Theoretical Approach', *Economic Record*, vol. 36 iss. 73, pp. 13–35, Australia.

Sorensen, P B. 2009, 'Australia's future tax system', Taxing Capital Income: Options for Reform in Australia, pp.179–235.