Productivity Commission Model

There are many things I like a lot about the Productivity Commission Model. It is fairly transparent which makes it as easy as practicable to work out what is driving results. Like any model, it abstracts from reality. It is useful to do so as simply as possible without leaving out critically important features of the real world. The model attempts to do so.

It shares with Hamish's and my little diagrammatic model the defect that it is focused on a very confined set of comparative static effects and ignores possibly wider effects including dynamic effects that can be very important.

But it goes considerably further than our model in attempting to put numbers on some of the key sizes of gains and losses in the economy. To do so it assumes a fixed stock of capital and labour in each of three regions: Australia, New Zealand and the Rest of the World. This seems sensible as a first cut way of analysing things. I also like the separate and systematic working through of the effects of Australia giving credits for New Zealand taxes, the effects of New Zealand giving credits for Australian taxes and mutual recognition.

I note that the paper is described on page 8 as "exploratory and experimental". But there are a few things I don't fully understand or which I think are problematic. I suspect these may be driving the dramatic results on income transfers in the paper and be producing unrealistic results. This is obviously very important. Different models are all suggesting gains to Australasia as a whole from mutual recognition. But obviously income transfers anywhere like those being estimated in the Productivity Commission paper would make mutual recognition difficult to advance.

The key concerns/questions with the model are as follows:

- The specification of capital;
- Interpretation of Sorensen and Johnson;
- A corollary of the Sorensen and Johnson proposition and an implausible outflow of capital from Australia.

1. The specification of capital

The model assumes that production in each region is effectively produced by a single competitive firm which uses capital from each of the three regions. Capital provided from each of these regions is different and potentially has different marginal products. This seems to me to be unrealistic. I would have thought that there is nothing special about capital flowing from New Zealand, Australia or any other country. Companies would combine this and their capital stock would be a simple sum of the capital received from each region.

The model has capital for a region r K^r being a function of the levels of capital supplies from each of the three regions. If K_s^r is capital in region *r* from region *s*, then the paper has

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

where *s* and *r* denote Australia and New Zealand.

Two issues arise here. Consider investment into New Zealand. How we have wanted to model things is to have Australian firms using Australian and New Zealand and potentially rest of world capital but producing something using a technology that is

different from that of New Zealand firms operating in New Zealand and vice versa for Australian. This creates a model where we can have two-way capital flows despite the tax disadvantage. In our simple model we had New Zealand firms with New Zealand capital and Australian firms with Australian capital operating in New Zealand.

If we are allowing firms to have access to capital from the different regions, I would have thought that if an Australian firm operating in New Zealand has a high marginal product of capital, this would be a high marginal product not only on its Australian capital but also on its New Zealand and rest of world capital.

The paper talks about substitution elasticities between different forms of capital but I am not sure why capital is not perfectly substitutable. I would have wanted to write that if any firms have access to more than one type of capital, the forms of capital should be added together to find their capital stock so $K^r = K_r^r + K_s^r + K_{ROW}^r$.

On page 13 the paper talks about Australian recognition of imputation credits leading to Australian capital in New Zealand increasing by US$773 million and the total capital stock increasing by US$798 million. I am perplexed as to why New Zealand's capital stock increases by more than the extra Australian capital stock. Is the odd specification of capital in the paper meaning that additional capital from Australia adds to the marginal product of capital from New Zealand and the Rest of the World? If so, this sounds to me to be quite implausible.

There is a very important and unrealistic consequence of the model. Additional capital brought in from Australia as a result of Australia providing credits for New Zealand taxes lowers the rate of return on all Australian capital invested into New Zealand but not (as far as I am aware) on capital from New Zealand or the rest of the world invested into New Zealand. Think about what this means in practice. It means that the extra capital that Woolworths brings in lowers the rate of return on the capital that NAB has invested in the BNZ and the rate of return on the capital that Telstra has invested but not the return on other New Zealand capital (including Kiwibank, Deutsche Bank, or Telecom NZ). This seems likely to provide a very exaggerated estimate to Australia of the costs of providing credits for New Zealand taxes.

2. Interpretation of Sorensen and Johnson

The paper says on page 23 "The share of firms in the economy that have access to international 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 change in the level of capital."

Let us talk through the Sorensen and Johnson result. Suppose that residents in the large rest of the world require a 7% rate of return on the capital net of any Australian company tax. This means that the supply of capital to Australia is perfectly elastic. If Australia levies a 30% company tax rate, the pre-tax rate of return for firms with access to international capital markets will be bid up to 10%. Whether Australia has a classical or an imputation system will not affect the quantum of capital stock for these firms (at least in a first order analysis). It will just affect the after-tax rate of return on the savings of Australian residents when they invest into Australian companies.

One has to be very careful about jumping from this analysis to any conclusion that imputation will have no effect for these firms on their cost of capital on trans-Tasman investments. On page 7, the paper says "When this is the case [i.e., access to international capital markets is large], 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."

In the top line of Table 7 on page 24 where $\varepsilon = 0.00$ and Australian firms have open access to international capital markets we find no change to New Zealand GDP in New Zealand if Australia recognises New Zealand imputation credits.

This seems to me to be wrong.

To take a simple story. Suppose we have a firm which is initially funded with only Australian capital. Suppose this is from Australian individuals taxed at a rate of 45%. It invests in both Australia and New Zealand and fully distributes its profits. Suppose that it has $1 billion of capital and has invested half in New Zealand where it is earning a 13.9% pre-tax rate of return (and 10% net-of-NZ-company-tax rate of return). It has invested half in Australia where it is earning a 10% pre-tax rate of return. In either case its Australian shareholders receive a 5.5% net-of-personal-tax rate of return.

Now it decides it wants to raise an additional $1 billion of capital to undertake further investments. Suppose all of this is to be raised from non-residents who demand a 7% net-of-Australian-company-tax rate of return on their capital. If further investments in Australia earned 10%, these would obviously be marginal both for the foreigners providing the extra capital and also for existing Australian shareholders. Now consider investments in New Zealand. Suppose that these earn 9.7% pre-tax in New Zealand and 7% net of New Zealand company tax. No company tax would be paid in Australia so again these would be marginal for investors from the rest of the world. I am not absolutely sure but the paper seems to be saying that because these investments would be marginal from the point of view of the marginal foreign investors, they would be marginal for the Australian firm.

This is not correct. Australian shareholders would object. They would end up with receiving a rate of return of only 3.9% on investments into New Zealand. They would find that their dividends were becoming only partially franked because of this investment so they are worse off than they were before the additional capital was raised and invested in New Zealand. Under our imputation arrangements all shareholders end up receiving a pro-rata share of the profits of companies. Thus, new investments will need to satisfy not only new shareholders but also existing shareholders.

In the example outlined above, a consequence of the lack of mutual recognition is that there will be conflicting views between Australian and foreign shareholders about when investment across the Tasman is a good idea. How these will be resolved is uncertain. But it seems most unlikely that existing Australian shareholders will not react adversely if Australian firms were to invest into New Zealand and earn only similar pre-tax rates of return to what could be obtained in Australia. This is because their dividends would be becoming only partially imputed.

The bottom line is that the absence of mutual recognition is still likely to have important effects on the cost of capital on trans-Tasman investments even for firms with access to international capital markets. It would be helpful to have details of how the cost of capital would be affected both for companies with and those without access to international capital markets. This would make the model more transparent still.

3. A Corollary to the Sorensen and Johnson Proposition and an Implausible Net Outflow of Capital from Australia

Go back to page 13 and the paper's comments on the effects of Australian recognition of New Zealand imputation credits. Here we have Australian-owned capital stock in New Zealand increasing by $773 million. The paper says that overall capital stock used in Australia contracts by US$738 million. Thus, there is a tiny bit of inbound extra investment into Australia from the rest of the world which offsets the capital that Australia has sent to New Zealand but this is truly tiny.

This seems markedly at odds with the Sorensen and Johnson insight. If Australian firms have open access to international capital markets (and I would suspect that the large majority of FDI into New Zealand is from large Australian firms with considerable access to international capital markets) and, if the supply of capital were perfectly elastic, there should not be any reduction in the Australian capital stock. The capital that flows to New Zealand should be offset by an equal and opposite capital flow into Australian from the rest of the world.

Thus, if the reduction in capital stock in Australia is driving the model's results and leading to assumptions that mutual recognition is having a major effect on driving down factor incomes in Australia, this seems to be most implausible. I suspect that it is the specification of capital in the model that may be producing this odd result. If Australia recognises New Zealand imputation credits, this may cause Woolworths to invest more into New Zealand and less in Australia and have an initial impact in driving up the marginal product of capital in Australia. But assuming Woolworths has access to international capital markets, I would have assumed that this causes capital to flow in from other countries until the marginal product of capital is back to what foreigners demand. In the model as I understand it, however, any additional capital flowing in from abroad will lower the returns for foreign shareholders in Woolworths but not for Australian or New Zealand shareholders in the same firm. Is this why we can get such as large change in the Australian capital stock?

Concluding Comments

While the Productivity Commission model's is a transparent way of attempting to quantify the effects of mutual recognition, there are a number of features that may lead to it providing unrealistic results.

In interpreting it, it would have been helpful to me to have reported in the tables how the different shocks affect capital stocks from each of the regions in each of the other three regions and rates of return on the various forms of capital. I would also be interested in finding out why when Australia provides recognition of New Zealand credits, New Zealand capital climbs by more than the inflow of capital from Australia.

Would it be possible to modify the model to allow for production by Australian firms in New Zealand to be heterogeneous from production by New Zealand firms in New Zealand and vice versa. Is there a plausible reason why we should be treating production in New Zealand as taking place effectively by a single firm receiving capital from different regions with different productivities?

There are a few other more minor issues I have not followed. For example, I do not follow the initial paragraph on page 16.

One final issue of interest is Box 1 on pages 20-21. My understanding is that this is saying that the income transfers from Australia that the Australian Productivity Commission model finds are a consequence of assuming that there are symmetric

substitution elasticities. By assuming a substitution supply elasticity of 1 for Australian investment into New Zealand and of 3.5 for New Zealand investment into Australia, the model estimates broadly similar effects on Australia and NZ GDP and real consumption to the NZIER/CIE model. In particular, there are gains for both countries. While of course it is difficult to pin down exactly what assumptions to be making, it would seem to me that some asymmetry in this direction is entirely plausible given differences in the investment flows between the two countries. Australian investment into New Zealand is largely FDI and New Zealand investment into Australia is largely FPI, and there is likely to be much more substitutability of FPI than FDI.

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