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Half billion dollar hole in Productivity Commission's modelling

Lateral Economics is today releasing analysis of a major technical error and other problems with the Productivity Commission's modelling of changes in automotive industry policy.

Reverse engineering the Commission's modelling but correcting for these problems confirms earlier modelling that further tariff cuts will hurt, not help the economy.

The analysis is by Professor Peter Dixon who is Australia's foremost academic practitioner of computable general equilibrium modelling. He has been involved with the Commission and its predecessors in general equilibrium modelling of the Australian economy almost from the outset of the Industries Assistance Commission over thirty years ago. Professor Dixon directed the construction of the model the Commission used in its simulations.

His findings are that the Commission:

- Made a major technical mistake in its interpretation of the investment effect of a cut in automotive tariffs. This error has the same effect as around four hundred million dollars materialising from nowhere at no cost to fund increased investment.

- Used an implausible specification of industries' elasticity of substitution between capital labour. The size of the investment response that remains after substituting a more plausible specification is one third of the result otherwise obtainable.

Correcting for the first problem reduces the Commission's estimated effects of automotive tariff cuts from an annual gain of $570-510 million to somewhere between an annual gain of $66 mil and loss of $26 mill. Correcting for the second problem produces net losses in all relevant scenarios of somewhere between $14 mil and $92 mil.

"Now we know that the PC's modelling supports leaving tariffs where they are. Given that it is the basis on which industry and trade policy decisions could be made, the Commission should immediately acknowledge the problems and rerun its modelling to better inform government decision making" said Dr Gruen.

"This would bring Commission back to the fold of evidence based policy making."

Lateral Economics has consistently argued that further unilateral reductions in car tariffs will harm the Australian economy. It has not argued against further reductions in tariffs in return for better access to other markets and has not commented on other assistance to the industry.

For further information Nicholas Gruen 03 9646 0553 and 0403 077 732.

Comments on the Productivity Commission's modelling of the economy-wide effects of future automotive assistance

by

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1. Correcting the Commission's analysis

The main conclusion in the Productivity Commission's latest report on automotive assistance, Productivity Commission (2008a), is expressed as follows:

"Indeed, the modelling consistently indicates that further reductions in automotive assistance, particularly tariffs, could be expected to yield net economy-wide benefits. The larger the reduction, the larger the gain to the wider community and economy."

Quantitatively, the Commission claims that:

"Relative to the economy, the estimated net impacts appear small. For example, the 'reference case' scenario R1, which models the scheduled reduction in the tariff to 5 per cent in 2010 and removal of ACIS by 2015, yields a 0.06 per cent gain in annual national output and a 0.06 per cent increase in the community's 'economic welfare' (as measured by real adjusted GNE). Nevertheless, these small percentages equate to around $600 million and $500 million respectively. Furthermore, they would accrue each year in perpetuity, and would be sizeable in present value terms."

In this note, I argue that the Commission's conclusions concerning the welfare effects of reductions in automotive assistance are based on a faulty interpretation of their modelling results. In fact, their results seem consistent with Dixon and Rimmer (2008) who find that proposed reductions in automotive tariffs from their present low levels would be likely to generate a small economy-wide loss in economic welfare.

The Commission's modelling suggests that cuts in automotive tariffs will, in the long run, generate an increase in the economy's capital stock. The main reason is probably that motor vehicles are an important part of Australia's capital stock. Thus, a

reduction in tariffs will reduce the cost of a unit of capital to most industries.[1] This will cause industries to substitute towards capital with a resulting increase in their capital/labour ratios. The Commission assumes that aggregate employment is unaffected in the long-run by changes in automotive assistance. With an increase in capital per unit of labour and no change in labour input, the economy experiences an increase in primary factor input. Cuts in tariffs also improve the allocation of capital and labour between economic activities, the efficiency effect. In the present case, the Commission finds that the efficiency effect is extremely small. With an increase in primary-factor input and a positive (although small) efficiency effect, there must be an overall increase in economy-wide output or GDP. To this point, the Commission's argument is *qualitatively* sound.

I say qualitatively because in their modelling work the Commission's simulated increase in the economy's capital stock arising from cuts in automotive tariffs seems *quantitatively* too large. But before I develop that point in section 3, I will set out my main objection to the Commission's work.

The Commission measures the welfare implication of reductions in automotive assistance by the effect on what they call real adjusted GNE. This seems to be the deviation in GDP caused by the reduction in automotive assistance minus 0.2-times the deviation in investment.[2] The Commission deducts 0.2-times the investment deviation arguing that

> "*In a comparative-static model, it is difficult to account for the implications of changes in the capital stock that underlie the results. In this study, investment is interpreted as claims against future consumption. The additional capital requires an increase in investment. To the extent that some of this investment is financed by foreigners, only the part of investment relevant to Australian investors should be included in calculating the part of GNE that is relevant to measuring a change in the welfare of Australian residents. In the MMRF[3] database, 80 per cent of capital is assumed to be Australian owned. Australian-owned investment is funded by domestic savings while foreign-owned investment is funded by the trade deficit and foreign income flows (the current account deficit).*"

I think the Commission is confusing capital and investment. In using a comparative-static model to measure the welfare effects of a policy change, we should

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[1] The Commission isn't very explicit on the reasons for the long-run increase in capital. They mention the idea that industries gaining from tariff cuts (e.g. mining) happen to be more capital intensive than losing industries. Not mentioned by the Commission, but a factor that is also likely to be important, is the role of taxes in a model in which capital is elastically supplied while the supply of labour is inelastic. A tariff that affects the cost of either intermediate inputs or inputs to investment falls partly on capital. An impact effect of removing the tariff is an increase in the after-tax rate of return on capital. This may be partially or completely offset if the replacement of lost tariff revenue involves a substantial increase in taxes on capital income. However, I suspect that in the Commission's simulations revenue replacement falls mainly on (inelastically supplied) labour. In this case, a tariff cut must lead to a long-run increase in the economy's capital stock, the result obtained by the Commission.

[2] This interpretation doesn't line up very well with the Commission's description of their welfare measure given in Box 3.5 of their report. However, as we will see, it does seem to be consistent with the numerical results that they report.

[3] The model used by the Commission.

look at the effects on GDP net of the contribution to GDP of increased capital. Apart from some tax effects to be discussed shortly, capital's contribution to the increase in GDP should not be considered a welfare gain for the domestic economy. If the extra capital was financed by foreigners, then this contribution is owned by foreigners. If the extra capital was financed domestically, then this contribution must have been paid for by reduced domestic consumption: the neutral assumption being that the extra capital produces an additional future income stream that just offsets the cost of foregone consumption.

To try to make all this clear, I have reproduced some of the Commission's key results in Table 1 together with some additional calculations.

Rows 1 to 7 of the table are taken directly from the Commission's report. Row 8 translates row 1 into dollars by assuming that Australia's GNE is $1 trillion. This is representative of the Commission's method of reporting welfare effects.

Row 9 checks my understanding of the Commission's concept of real adjusted GNE. I calculated row 9 as:

row 9 = % deviation in GDP (row 2) – $0.2*S_I*$% deviation in investment (row 4)

where S_I is the investment share, assumed to be 20 per cent, in the expenditure measure of GDP. The close correspondence between rows 1 and 9 indicates that I have an adequate understanding of the Commission's concept.

Row 10 shows what I think is happening to aggregate capital stock in each simulation. The Commission does not report results for capital stock but states that:

"*investment moves in proportion with changes in the capital stock …*".

In the R4 simulation, aggregate capital stock is held constant, yet investment declines by 0.006 per cent. I assume that the Commission's assumption in all simulations is that investment moves in proportion with changes in capital stock *in each industry*. In this case there can be small changes in the investment/capital ratio at the aggregate level reflecting different I/K ratios across industries in the initial database. In deducing what happens to the aggregate capital stock in R1, I assume that the aggregate I/K ratio decreases by 0.006 per cent (the same as in R4). In S2, I assume that the aggregate I/K ratio decreases by 0.005 per cent: the rearrangement of capital across industries would have been a little smaller in S2 than in R1 causing a slightly smaller decrease in the aggregate I/K ratio. R2 and R3 are a decomposition of R1 with much larger effects in R2 than in R3. I assume that the 0.006 per cent decrease in the aggregate I/K ratio from R1 is spread across R2 and R3 in the ratio 5 to 1, that is 0.005 to R2 and 0.001 to R3.

Row 11 checks my understanding of the Commission's GDP results. The entries in this row are calculated as:

row 11 = S_K*% deviation in capital (row 10) + efficiency effect (row 14)

where S_K is the capital share in the income measure of GDP. I assume that this share is 0.415, a reasonable estimate if we allocate indirect taxes proportionately between capital and labour. For simulations R1 and S2, I assume that the efficiency effect is 0.004 per

Table 1. Commission modelling results and additional calculations[*]

		R1	S2	R2	R3	R4
	Results reported by the Commission					
1	Real adjusted GNE	0.057	0.051	0.054	0.002	0.003
2	Real GDP	0.063	0.054	0.059	0.003	0.004
3	Real private and public consumption	0.002	-0.011	0.019	-0.018	-0.008
4	Real investment	0.136	0.118	0.130	0.006	-0.006
5	Export volumes	0.405	0.411	0.325	0.082	0.285
6	Import volumes	0.268	0.240	0.256	0.012	0.218
7	Terms of trade	-0.046	-0.084	-0.035	-0.011	-0.033
8	Commission's welfare effect ($m)	570	510	540	20	30
	Additional back-of-the-envelope calculations					
9	Check real adjusted GNE	0.057	0.049	0.053	0.003	0.004
10	Capital stock	0.142	0.123	0.135	0.007	0
11	Check GDP	0.063	0.055	0.059	0.004	0.004
12	Capital contribution to GDP	0.059	0.051	0.056	0.003	0.000
	Correcting the Commission's welfare measure					
13	Retained capital contribution	0.012	0.010	0.011	0.001	0.000
14	Efficiency effect	0.004	0.004	0.003	0.001	0.004
15	Terms-of-trade effect	-0.009	-0.017	-0.007	-0.002	-0.007
16	Corrected welfare measure, under Commission assumptions (% of GDP)	0.007	-0.003	0.007	-0.001	-0.003
17	Corrected welfare measure, under Commission assumptions ($m)	66	-26	72	-6	-26
	Further effects					
18	Revenue-replacement effect ($m)	-7	-7			
19	Cold-shower effect ($m)	7	7			
20	**Corrected welfare estimate ($m) *under Commission's assumptions***	**66**	**-26**			
21	**Corrected welfare estimate ($m)** *with realistic capital/labour flexibility*	**-14**	**-92**			

R1. Effects of cutting tariffs from 10% to 5% and eliminating ACIS. Export demand elasticities set at -10.

S2. Effects of cutting tariffs from 10% to 5% and eliminating ACIS. Export demand elasticities set at -5.

R2. Effects of cutting tariffs from 10% to 5% but retaining ACIS. Export demand elasticities set at -10.

R3. Effects of eliminating ACIS but maintaining tariffs at 10%. Export demand elasticities set at -10.

R4. Effects of cutting tariffs from 10% to 5% and eliminating ACIS, assuming no change in aggregate capital stock. Export demand elasticities set at -10.

[*] All results except those in rows 8 and 17 to 20 are percentage effects.

cent, the result for GDP from R4 in which capital and labour are held constant. I spread this efficiency effect between R2 and R3 in the ratio 3 to 1, that is 0.003 to R2 and 0.001 to R3. The close correspondence between rows 2 and 11 indicates that I have an adequate understanding of how the Commission's GDP results are generated.

Row 12 shows the capital contributions to the GDP increases, calculated as:

row 12 = S_K*% deviation in capital (row 10) .

Rows 13 to 17 show how I think the Commission should have calculated welfare effects. In my welfare calculations I assume that additional capital is financed by foreigners[4] and that the income generated by this capital is taxed at the rate of 20 per cent. Thus in row 13 I allow 20 per cent of the capital contribution to GDP (row 12) to be retained as a welfare gain to the domestic economy. The efficiency effect is also a welfare gain, row 14. Deterioration in the terms of trade imparts a welfare loss. This is shown in row 15 where I assume that exports are 20 per cent of GDP and I translate the terms-of-trade effects in row 7 into equivalent losses in GDP by multiplying by 0.2. Row 16 shows the sum of rows 13 to 15. This is the corrected welfare measure as a per cent of GDP. Row 17 converts row 16 into $ million.

On the basis of Table 1, I think that the Commission has strongly overestimated the welfare benefits of reduced automotive assistance. With their preferred export-demand elasticities of -10, my estimate of the welfare gain implied by their R1 simulation is $66 million, rather than $570 million.

As argued in Dixon and Rimmer (2008), I think that the evidence on export-demand elasticities favours values such as -5, not -10. Consequently, I prefer the Commission's S2 simulation to their R1 simulation. For the S2 simulation, my estimate of the welfare effect implied by the Commission's modelling is a loss of $26 million, rather than a gain of $510 million.

2. Other effects

Two factors that the Commission's modelling omits are the revenue-replacement effect and the cold-shower effect.

Revenue-replacement effect

On my calculations, reducing tariffs on automotive products from 10 per cent to 5 per cent would cost the government about $0.65 billion in revenue. Eliminating ACIS payments would save about $0.5 billion, leaving a loss in net revenue of $0.15 billion.[5] In their modelling, the Commission implicitly assumed that net changes in revenue are

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[4] The argument is more complicated if the additional capital was financed domestically. However, the tax effect still operates: the stream of earnings from additional capital not only compensates the investor for foregone consumption but also gives a return to the government.

[5] The Commission's calculations (Productivity Commission 2008b) give a loss in tariff revenue of only $0.35 billion. In combination with the elimination of ACIS, this gives a net revenue gain of $0.15 billion. In trying to clarify the issue of the tariff loss ($650 million versus $350 million) I received considerable assistance from Patrick Jomini. However, in the end I was unable to resolve the difference, so without much confidence I have retained my original calculation. From the point of view of Table 1, the issue is not of major importance.

offset in a way that causes no further *net* welfare-affecting distortions beyond those concerned with the allocation of resources between export and import-competing activities. They ignored distorting effects of tariffs, the ACIS subsidies and offsetting tax changes on incentives to work (labour-leisure choice) and on resource-consuming avoidance and evasion activities.

Ignoring these distorting effects would be justified if we could be confident that the distortion-reducing effect of raising $x less net revenue from automotive assistance is exactly offset by the distortion-increasing effect of raising $x more revenue via the replacement tax. However, we cannot be confident about this.

The most likely source of revenue replacement is income tax: with a reduction in automotive assistance, future cuts in income-tax rates are likely to be a little smaller than otherwise. As explained in Dixon and Rimmer (2008), the dead-weight loss associated with collecting a dollar of income tax may be quite high, say 20 cents. Conservatively, Dixon and Rimmer assumed that, apart from trade effects, the dead-weight loss associated with collecting a dollar of motor-vehicle tariff revenue is only 5 cents less than that associated with collecting a dollar of income tax. If the net loss of revenue from cutting automotive tariffs and eliminating ACIS is $0.15 billion, as I have calculated, then on the 5-cent assumption there is a revenue-replacement welfare loss of $7.5 million a year. This is the figure shown in row 18 of Table 1.

Cold-shower effect

The cold-shower hypothesis is that resources (capital and labour) in import-competing industries are used more productively if tariffs are low than if they are high. It is difficult to set out a formal behavioural model that supports this hypothesis. Nevertheless, it seems plausible that exposure to import competition could induce an industry to improve its management practices, to produce commodities more in line with customer preferences, to modernize its production processes, and to become generally more amenable to innovative ideas.

I think the hypothesis makes most sense in a non-linear form, the idea being that there are diminishing returns to import penetration in imposing competitive discipline on an import-competing industry. It is reasonable to suppose that when imports take their first 20 per cent of the domestic market, then this encroachment will cause much greater reforms among domestic producers than when imports take the next 20 per cent. The first 20 per cent will eliminate the most easily removed slack practices by domestic producers, making further reforms to meet import competition successively more difficult.

Dixon and Rimmer (2008, page 31) specify an equation that relates the cold-shower effect for an industry to the square of its nominal rate of tariff assistance. Using this non-linear equation and assuming that the industry's value added (or resource use) is $6 billion, I calculate that the cold-shower welfare gain of halving the tariff is $7 million (row 19 of Table 1). This small gain is consistent with the assumption that cold-shower effects must be small for industries in which tariffs are already low and import-penetration is extensive.

3. Capital/labour flexibility

As mentioned in section 1, I think that the Commission's modelling exaggerates the increase in the economy's capital stock arising from cuts in automotive assistance. They assumed that industries operate with an elasticity of substitution between capital and labour of 0.5. This implies considerable flexibility in capital/labour ratios. Among other things it implies that industries respond in the short run (when capital is fixed) to a one per cent increase in real wage rates by reducing their labour input by about 1.5 per cent. A more realistic number is 0.5 per cent, see for example the econometric estimates of the short-run elasticity of demand for labour by Debelle and Vickery (1998). In my own modelling I set the capital/labour substitution elasticity at 0.15, implying an elasticity of demand for labour of about -0.5, consistent with econometric evidence.

In the present context, this lower value, 0.15, for the capital/labour substitution elasticity implies that the long-run expansion in the economy's capital stock arising from cuts in automotive assistance would be about a third of the expansion estimated by the Commission. This means that the Commission's estimate of the effect on GDP (which is almost entirely a result of their simulated increase in capital) would come down by about two thirds, from around $600 million to $200 million. However, as I have explained, the effect on GDP is not a good measure of the effect of the proposed cuts in assistance on the overall economic welfare of Australians. The only part of the GDP increase arising from extra capital that is relevant for welfare is the tax component of about 20 per cent.

In Table 1, I accepted the Commission's estimate of the increase in the economy's capital stock and estimated that the welfare gain (from the 20 per cent tax take) as 0.012 per cent in the R1 simulation and 0.010 per cent in the S2 simulation (row 13). With what I consider a realistic assumption about capital/labour substitution elasticities, these two numbers would be reduced by two thirds to about 0.004 and 0.003. With these adjustments, the corrected welfare measures in row 16 become -0.001 per cent and -0.010 per cent. As shown in row 21, in dollar terms the welfare estimates now become -$14 million and -$92 million. These numbers are broadly consistent with the calculations in Dixon and Rimmer (2008).

4. Concluding remarks

The Commission reported welfare gains of between $500 million and $600 million a year from cutting automotive tariffs to 5 per cent and eliminating the ACIS scheme. Table 1 suggests that on their assumptions, they should have reported gains in the range -$26 million to $66 million (row 20). As mentioned earlier, I prefer the export-demand elasticity assumptions made in the Commission's S2 simulation (export-demand elasticities of -5) to those in their R1 simulation (export-demand elasticities of -10). Thus I think the estimate of -$26 million a year is more credible than that of $66 million a year.

As explained in section 3, the Commission built into their modelling what I consider to be an unrealistically high level of capital/labour flexibility. When a more realistic assumption on capital/labour flexibility is introduced, the corrected welfare range turns entirely negative: -$14 million a year to -$92 million a year (row 21).

However, these are tiny numbers in the context of the whole economy, and in a situation involving both positive and negative effects (all of which are simulated with error) we probably should conclude that the welfare effect is indistinguishable from zero.

References

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