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WHAT DOES MANUFACTURING PROTECTION COST FARMERS? A REVIEW OF SOME RECENT AUSTRALIAN CONTRIBUTIONS

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A method proposed by Clements and Sjaastad for measuring the effect of manufacturing protection on farmers' incomes is shown to be theoretically unsound, to use some inappropriate assumptions and to lead to overestimation. Even if corrected, the method seems inferior to estimating directly via ORANI the change in farm incomes which would occur when protection levels change. This is because the model contains detailed theoretical explanations of the price and quantity changes which determine changes in the relevant incomes and is calibrated using extensive empirical evidence about the behaviour of the prices and quantities in the Australian economy. Using ORANI and incorporating recently completed improvements to its agricultural data base, it is estimated that, in the short run, abolishing protection would increase farm incomes by about 17 per cent.

In a recent paper, Clements and Sjaastad (1984) give a theoretical explanation of how protecting an economy's import competing sector imposes a burden on its export sector. They also estimate the size of this burden for Australia. The National Farmers' Federation (1985) updated this calculation and extended the method to isolate the share of the burden which is borne by the farming sector. Conflicting with these estimates are computations made by officers of the Bureau of Agricultural Economics (Quiggin and Stoeckel 1982; Crowley and Martin 1982; Adams 1985) using the ORANI computable general equilibrium model. Estimates from ORANI indicate that the cost to farmers of protection is considerably lower than is implied by the method of Clements and Sjaastad. The National Farmers' Federation commissioned the Institute of Applied Economic and Social Research to resolve this difference. This present paper reports the results of the Institute's study.

The rest of the paper is organised as follows. The next section contains a discussion at a conceptual level of what is meant by exporters bearing the burden of protection. The conclusions of the discussion are related to the empirical method proposed by Clements and Sjaastad (1984) and the ORANI simulations favoured by the Bureau of Agricultural Economics. In the third section, the Clements–Sjaastad method is examined in detail. The best estimate using ORANI of the short-run cost to farmers of protection is then given. Some propositions originating in the Industries Assistance Commission are examined in the conclusion.

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The Concept to be Measured

The cost to exporters of protecting the import competing sector is defined as the extent to which incomes earned by exporters are reduced by the existence of protection. It is the purchasing power of exporters' incomes which is relevant, not the nominal value. Some problems exist as to what is an appropriate definition of exporters' income in this context. Imagine, for example, that labour were a homogeneous commodity (that is, that any hour's labour were equally suitable for use in import competing industries or in export industries) and that protection of the import competing sector creates no change in aggregate employment (that is, it merely increases employment in the import competing sector and reduces employment in the exporting sector by identical amounts). Should wages lost via the contraction of exporting be included as a reduction in exporters' income? In a world of full employment, the same labour as is displaced from exporting would, under the assumptions of this example, be absorbed by the expanding import competing sector. What is suggested by this example is that it might be more appropriate to count in the relevant definition of exporters' income only the income of fixed factors in the export sector, not the income of factors which could readily be transferred to other sectors. In the context of agriculture, this means that only income accruing in the form of rents on land, profits on capital and perhaps wages to owner-operators' labour and managerial services would be counted. The wages of hired labour would be excluded, although in a time of general unemployment the case for this is less persuasive.

The appropriate definition of exporters' income depends on whether the focus is on the long-run or the short-run effects of protection. Resources which are fixed factors in the short run may become variable in the long run. Capital is the obvious example.

Although these problems are important, they are not the crux of the discrepancy to be explained in this paper. It turns instead on how the income changes should be estimated given that a decision has been made about the appropriate income definition.

In principle, it is not at all difficult to see how one might proceed in measuring the change in exporters' income. Suppose, for example, that it is the change in net farm income as a consequence of the tariff which is to be measured. (Net farm income is defined as the return to farmers' land, capital and labour. The wages of hired labour are thus excluded.) To estimate the change in farmers' gross revenue, it would be necessary to consider how, if at all, the tariff affected the quantities of farm outputs and the prices at which they were sold. Next, from the change in gross revenue would be subtracted the change in the cost of purchased inputs (materials and hired labour), accounting for the effects of the tariff on both the quantities of inputs used and the prices of those inputs. This subtraction would yield the effect of the tariff on farmers' net nominal income. The final step would be to account for any changes in the prices of the commodities on which this net income typically is spent by farmers.

While in principle this process is straightforward, the details of its implementation are very complex, depending on numerous assumptions about how the economy works and on the ability to

manipulate, in line with those assumptions, large amounts of data reflecting the actual operation of the economy. For example, it might be assumed that the imposition of a tariff on an import at a rate of 10 per cent would directly increase the domestic market price of the import by 10 per cent. The effect of such a rise in the import price on the price of the domestically produced import competing good depends on how close a substitute the domestic good is for the import. Only if the two are perfect substitutes (that is, perceived by purchasers as essentially *identical* commodities) is it legitimate to make the assumption, common in international trade theory, that the price of the domestic good would also rise by 10 per cent. Observations of the Australian economy (Alaouze 1976, 1977; Alaouze, Marsden and Zeitsch 1977) indicate firmly that, at operational levels of commodity aggregation, domestic consumers regard imports and their domestic equivalents as much less than perfectly substitutable. The implication for the current example would be that the price of the domestic good would rise by substantially less than 10 per cent following the imposition of a 10 per cent tariff. The effects of these rises in the prices of imports and importables on other prices in the domestic economy, especially the prices of non-traded goods, will depend crucially on how the labour market is assumed to work, in particular on the extent to which money wages rise in response to increases in the cost of living. All these price changes generated directly and indirectly by protection will have implications for farmers' production costs and for the nominal costs of farmers' final purchases. To quantify these requires extensive information about farm input structures and the allocation of farmers' final expenditure.

The advantage of using an economic model such as ORANI for the assessment of the cost to exporters of protection is that it proceeds, exactly as described above, to project directly the income effects of protection. At each stage, explicit assumptions are made about the crucial theoretical and empirical details, for example, the elasticities of substitution between imports and domestic output, the degree to which wages are indexed to the consumer price index, the technology of industries' production processes and the expenditure patterns of final consumers. By contrast, competing methods are inferior proxies for these calculations. This is illustrated in the following section.

The Clements–Sjaastad Calculation

Clements and Sjaastad (1984) provide a simple theoretical interpretation of how protection taxes exporters by reducing their real incomes. They point out that protection increases the prices of commodities and/or labour which exporters buy (either as inputs to their production processes or as final purchases) relative to the prices of the exportables which they sell. The argument is developed in terms of an economy in which three types of goods are produced, namely, importables, exportables and home goods (that is, goods which are not traded internationally). The argument is at its simplest when importables are thought of as used domestically only in final demand (not as intermediate inputs) and exportables as entirely exported. These simplifications are, however, in no way essential. Home goods are

assumed to be highly labour intensive services and their prices are therefore closely related to the domestic wage.

What affects exporters' incomes in this economy is the movement of the exportables' price relative to the price of home goods. Similarly, the incomes of domestic producers of importables depend on movements in the price of importables relative to the price of home goods. Clements and Sjaastad (1984) point out that import restrictions increase the price of importables relative to the price of exportables. In fact, they assume that the restrictions increase the prices of imports and domestically produced importables by the same percentage (that is, that the two are perfect substitutes) and that the price of exportables remains constant (that is, that exporters face perfectly elastic foreign demand curves). Again, these simplifications are not essential to the basic theoretical argument and, in fact, as will be demonstrated, their use in the subsequent empirical calculations is a source of error.

The movement of the price of home goods relative to the prices of importables and exportables depends on how easily resources can be reallocated between the production of home goods and either of the tradable categories. If importables use essentially the same inputs as home goods, then the price of the latter must follow the price of importables very closely. That is, when the price of importables rises following the imposition of import restrictions, resources will tend to flow out of home goods production and into the production of importables (because the latter is now more profitable). This reduces the supply of home goods and raises their price. On the other hand, if home goods and exportables are produced using essentially the same inputs, then any tendency for the price of home goods to rise as a consequence of protection will be met by a reallocation of resources from the production of exportables to the production of home goods. This increases the supply of home goods and holds their price down.

More formally, Clements and Sjaastad (1984) state:

$$(1) \quad d = wt + (1 - w)s$$

where d, t and s are the proportional changes in the prices of home goods, importables and exportables, respectively. The parameter w reflects the degree of substitutability in production between home goods and tradables. In particular, the first example from the previous paragraph is represented by setting $w = 1$ so that equation (1) implies $d = t$. The second example requires $w = 0$, implying $d = s$. Manipulating (1), it is clear that:

$$(2) \quad (d - s)/(t - s) = w$$

and

$$(3) \quad (t - d)/(t - s) = 1 - w$$

Equation (2) shows clearly that w reflects the extent to which the price of home goods increases as the price of importables increases following protection. A value of 0.5 for w indicates, for example, that the price of home goods moves half way up the gap between the price of importables

and the price of exportables which is opened up by protection.

Clements and Sjaastad (1984) report empirical estimates of w derived from two methods. Regression analysis yields $w=0.7$ for Australia (details of the regressions are not given in the paper). Results from ORANI, which they report, indicate $w=0.82$, which they interpret as confirming that the regression result is approximately correct.

To this point, the Clements–Sjaastad (1984) argument is unexceptionable. Note, however, that it is all based on movements in relative *prices*. They next introduce an unexplained jump in the analysis by asserting that the cost to exporters of protection can be estimated by applying their estimate of w to the consumer tax equivalent of the protective system. (This is the tax revenue which would be raised by the consumer tax necessary to raise the domestic prices of imports and domestically produced importables by the same amount as the rise induced by protection.) No detailed justification of this proposition is given.

It is not at all clear that the consumer tax equivalent is the relevant measure of the total cost of protection in this context. This is not to say that the consumer tax equivalent of protection is totally irrelevant to the question in hand. It could be used to calculate the increase in the price of importables and thus to estimate the cost of protection to exporters in a way which is consistent with the theoretical framework of Clements and Sjaastad (1984). A formal exposition of the necessary calculation may serve to highlight the errors in the calculation which Clements and Sjaastad actually performed.

In view of the definition of the consumer tax equivalent of protection, the protection induced proportional rise in the price of importables can be defined as:

$$(4) \quad t = C/(V_m + V_i)$$

where C is the consumer tax equivalent and V_m and V_i are the values of imports and domestically produced importables at world prices, respectively. Combining (4) with equation (1) and the assumption that the price of exportables is unaffected by protection (that is, $s=0$), the proportional rise in the price of home goods is:

$$(5) \quad d = wC/(V_m + V_i)$$

What are the effects of these price rises on exporters' incomes? Retaining the simplifying assumption that only home goods are used as inputs in exporters' production processes, then the increase in exporters' total costs (ΔF) is given by:

$$(6) \quad \begin{aligned} \Delta F &= dX_e \\ &= wCX_e/(V_m + V_i) \end{aligned}$$

where X_e is the quantity of home goods used as inputs by the exporters. Ignoring induced changes in exporters' activity levels, equation (6) could be interpreted as the reduction in exporters' nominal incomes attributable to protection. To estimate the real income effect, it would be necessary to deflate the nominal income change using an index

showing the effect of protection on the price of the bundle of final goods typically purchased by exporters. The simplest case is that in which exporters consume only home goods. Exporters' real income (Y_r) can then be defined as:

$$(7) \quad Y_r = Y/D$$

where D is the price of home goods. Then the real income change (ΔY_r) is:

$$(8) \quad \Delta Y_r = \Delta Y - Y\Delta D$$

where in deriving (8), units have been chosen such that the protection-free price of home goods is unity. Using (6) (recall that $\Delta Y = -\Delta F$) and (5), equation (8) reduces to:

$$(9) \quad \Delta Y_r = -wC(X_e + Y)/(V_m + V_i)$$

Expression (9) conforms to intuition. The term $wC/(V_m + V_i)$ represents the increase in the price of home goods. This decreases exporters' real incomes because it increases their nominal costs and reduces the purchasing power of their net incomes.

The empirical method used by Clements and Sjaastad (1984) takes the product wC alone as the measure of the cost of protection to exporters. It is now evident that this must be an overestimate. The economy's balance-of-payments constraint implies that, in the long run, $(X_e + Y)$ will be approximately equal to V_m, that is, the gross value of exports will be approximately equal to the value of imports at world prices. Hence, so long as importables are produced domestically, the ratio $(X_e + Y)/(V_m + V_i)$ must be less than unity.

Apart from this theoretical error in implementing their method, Clements and Sjaastad (1984) adopt some inappropriate assumptions which compound their overestimation. They use estimates from the Industries Assistance Commission (1980) of the consumer tax equivalent of protection. These are founded explicitly on the assumption that the prices of domestically produced importables rise by the same percentage as the percentage increase in import prices generated by protection. This conflicts with available Australian evidence. The ORANI simulations reported by Clements and Sjaastad, for example, indicate that a 49 per cent increase in protection rates is necessary to increase the average price of domestically produced importables by 5 per cent. With an average protection rate of about 26 per cent, an increase in import prices of about 10 per cent is implied. The explanation is that ORANI incorporates econometric evidence from Alaouze (1977) and Alaouze, Marsden and Zeitsch (1977) which incidates that the elasticity of substitution between imports and domestic output is typically of the order of 2.0, not infinity.

The same ORANI simulations suggest that the price of exportables would rise by just over 1 per cent following a 49 per cent increase in protection. This is because the foreign elasticities of demand for Australian exports (especially wool) are not infinite. Hence a contraction of exports, such as is induced by protection, leads to

an increase in export prices. In their empirical calculation, Clements and Sjaastad (1984) assume that export prices are unaffected by protection.

Rather than attempting to correct the proxy method of Clements and Sjaastad (1984) in line with the discussion above, much more reliable results could be expected from the use of the ORANI model. Correction of the proxy method would in any case require evidence from the ORANI projections and data, for example, on the share of purchased inputs in the total value of exportables and the extent to which the prices of importables and exportables rise when protection raises import prices.

Estimates from ORANI

Estimates of the effect on farmers' incomes of the manufacturing protection system can best be made using an economic model like ORANI which works at a suitably disaggregated level and includes explicit assumptions about the detailed working of the economy which are crucial to the issue. The exact magnitude of the estimates provided by the model will depend on the data used. The current data base for ORANI is based on input–output data from the Australian Bureau of Statistics (1983) referring to 1977–78 and incorporates the results of a major project aimed at refining the agricultural data (see Higgs 1985). Both Quiggin and Stoeckel (1982) and Crowley and Martin (1982) used earlier versions of the ORANI data. Adams (1985) used the current version.

Table 1 contains projections, using the current data, of the effects on farm incomes of abolishing protection against imports. This includes any import protection currently enjoyed by agricultural industries and assumes there is no change in governments' direct support policies for agriculture. The table contains two columns. Projections for real factor incomes in the rural industries are recorded in column I. Real factor income is defined as the sum of the values, deflated by the consumer price index, of the wages of hired labour and the returns to farmers' capital, land, own labour and management skills. Column II contains projections for the real return to the farmers' own inputs, that is, the wages of hired labour have been excluded. In computing column II, it is assumed that all changes in rural employment consequent on the change in protection are met by changes in hired labour. That is, if total employment in an industry rises by 10 per cent and hired workers account for half the workforce, a 20 per cent increase in the employment of hired workers is assumed. The projections all refer to the short run (about two years after abolition of the tariff protection) and assume that the capital and land stocks used in the rural industries remain constant. It is also assumed that wage rates are fully indexed to the consumer price index and that aggregate domestic absorption (consumption, investment and government spending) remain fixed in real terms.

The estimates of the short-run effect of protection on farm incomes reported in Table 1 suggest that without protection the total real income (deflated by the consumer price index) accruing to primary factors employed in rural industries (that is, land, capital and all labour) would rise by 17.2 per cent. Excluding hired labour, the percentage rise in real income accruing to land, capital and farmers' own labour inputs is

TABLE 1

Short-run Effects on Farm Incomes of a 100 Per Cent Across-the-board Reduction in Protection Against Imports

Industry	Projected percentage change in	
	I. Real factor income[a]	II. Real return to farm[b]
Pastoral zone	16.6	18.0
Wheat–sheep zone	18.4	17.8
High-rainfall zone	20.1	18.0
Northern beef	37.2	38.1
Milk cattle and pigs	9.6	8.0
Other farming (sugar cane, fruit and nuts)	23.0	21.9
Other farming (vegetables, cotton, oilseeds and tobacco)	3.3	3.6
Poultry	14.0	13.3
All agriculture	17.2	16.8

[a] This includes returns to land, capital, owner-operators' labour and the wages of hired labour.
[b] This excludes the wages of hired labour.

projected to be 16.8 per cent. Applying these percentages to recent Australian Bureau of Statistics (1984) estimates of the value of farm income in 1983–84 implies that the rise in total factor returns would be about $1.5 billion (1983–84 prices) and the rise in the return to farmers' own inputs about $1.25 billion.

As intuition suggests, it is the industries which are most heavily dependent on exports which, according to ORANI, suffer the most severe declines in income on account of protection. Thus the three mixed farming zones (which specialise in production of wool, grains and cattle), the northern beef industry and the 'other farming' industry specialising in the production of exportables (mainly sugar) are the industries projected to gain most strongly from the abolition of protection. Of these, northern beef is projected to have most to gain from protection reform. A detailed explanation of the results for northern beef is given in the next paragraph. For further details of the results see Higgs (1986).

Northern beef is an extremely export oriented industry, almost all of its output being exported after processing (slaughtering) in a very labour-intensive meat products industry. Of each dollar's worth of beef exported, about 50 cents is accounted for by value added in the processing industry and the remainder by the value of beef delivered to the processor. Of the latter 50 cents, about 30 cents is accounted for by farmers' intermediate costs and about 20 cents by value added in the northern beef industry itself. In the simulation reported in Table 1, wages are indexed to the consumer price index. It is a good approximation to assume that both the costs of meat processing (mainly labour) and the beef growers' intermediate costs change at the same rate as the consumer price index. The value of beef exported to the world market, on the other hand, is unaffected by changes in domestic protection policy. In the simulation, the abolition of protection is projected to reduce the consumer price index by about 10 per cent.

Hence, for each dollar's worth of beef exported, processing costs fall to 45 cents and beef growers' intermediate costs fall to 27 cents. This means that value added in the northern beef industry rises to 28 cents (100 − 45 − 27) for each dollar's worth of beef exported. This represents an increase of about 40 per cent, which is very close to the projection in Table 1.

Conclusion

It is clear that the method used by Clements and Sjaastad (1984) yielded an overestimate of the extent to which protection against imports reduces farmers' incomes. The use of a fixed share (the parameter w estimated by Clements and Sjaastad) of the commodity tax equivalent of the tariff as an indicator of the exporters' burden is theoretically unwarranted. In addition the estimate of the consumer tax equivalent used in the calculation overstates the extent to which protection raises prices of domestically produced importables. Finally, no allowance is made for the effects on world prices of changes in quantities exported by Australia. (This is likely to be particularly important for wool.)

Direct estimation of the relevant income effects via a detailed economic model such as ORANI is a more reliable method for analysing these effects of protection. With the latest available data, the estimate from ORANI is that the short-run effects of abolishing protection would be to increase real net farm incomes by about 17 per cent.

As has been pointed out by the Industries Assistance Commission (IAC 1985; Zeitsch 1983), the ORANI-based evidence cited by the Bureau of Agricultural Economics, as well as that reported in this paper, refers only to short-run consequences. Long-run specifications of ORANI under development at the IMPACT Centre (Horridge 1985) might be expected to produce estimates of the long-run consequences for farmers of protection that are less severe. The main reason is that the short-run simulations suggest a small move to surplus in the trade balance following the abolition of protection. In the longer run, this move to surplus would be offset by expansion of domestic aggregate demand and real exchange rate appreciation. These long-run adjustments would be unfavourable to export industries, thus offsetting part of the short-run gains from the reduction in protection.

A final point to be made about the long run is that as additional time is allowed to elapse, the proportion of resources used in agriculture which can be shifted to other uses increases. As a consequence, perhaps the long-run effect of protection on agriculture ought to be assessed in terms of the effects on agricultural land values only.

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