MAUREEN KILKENNY* AND SHERMAN ROBINSON**

Modelling the Removal of Production Incentive Distortions in the US Agricultural Sector

INTRODUCTION

Recent international efforts to bring agriculture under the GATT have led to a great deal of work seeking to measure the size and impact of policy interventions in the agricultural sector. If trade negotiators are to bargain over the removal of such policies, then it is necessary to develop indicators which can be used to monitor any agreement. The general approach has been to develop *ad valorem* indicators such as producer and consumer subsidy equivalents (PSEs and CSEs) to measure the net value to producers and consumers of all agricultural programmes. Modellers also use these *ad valorem* indicators to measure incentives distortions faced by producers and consumers, without considering quantitative restrictions explicitly, which we argue is potentially misleading.

In this paper, we show how the complex set of domestic and trade- related agricultural policies in the US, can be stylized and modelled without resorting to *ad valorem* equivalents. We use a computable general equilibrium (CGE) model as a simulation laboratory, with two alternative specifications of agricultural programmes: (1) summarizing them using only *ad valorem* subsidy equivalents, and (2) incorporating policy instruments explicitly. We then compare the two model variants in a set of experiments that assess the economy-wide impact of removal of components of US agricultural support programmes by 1991. Our empirical results indicate that it is always important to account for the direct impact of quantitative restrictions.

EXPLICIT INSTRUMENTS VERSUS AD VALOREM EQUIVALENTS

The common approach to measuring agricultural intervention is to estimate the tariff, tax and subsidy equivalents of the various programmes, many of which involve quantitative controls, income subsidies, support prices, and non-tariff trade barriers.[1] The majority of the programmes are not easily represented by price wedges alone. Table 1 summarizes the five major types of US agricultural programme. Of these, only export subsidies are actually paid in *ad valorem* form.

*Economic Research Service, USDA
** Department of Agriculture and Resource Economics, University of California at Berkeley.

The first programme – deficiency payments – involves payments that depend on the difference between market (or loan) prices and a specified target price to participating farmers. The rate of subsidy, as well as the budgetary outlay, varies inversely with the underlying market price. Thus, the effect on incentives of policy changes that will result in changes in both target and market prices cannot be captured with a uniform *ad valorem* wedge. The acreage set-aside requirements associated with deficiency payments and non-recourse loans raise domestic prices by reducing supplies on the market. This programme is even more difficult to represent *ad valorem*, since although the increased market price represents a subsidy, the constraint on land use is effectively a tax. Finally, policies which seek to support market prices through stock accumulation depend on the gap between the loan rate and the market price, and the *ad valorem* equivalent will vary inversely with the market price.

In the US, as in most developed countries, domestic farmers are protected by binding quotas against competitive imports. An import quota scheme is only locally approximated by a tariff equivalent, and it is also necessary to specify the amount and the recipients of the quota rents. With quantity controls, the rents depend on the difference between the endogenous domestic market price and the world price. The effect on incentives of a policy that will change domestic and/or world prices cannot be captured with a uniform *ad valorem* tariff.

TABLE 1 *Summary of major US agricultural support programmes*

Programme	*Objective*	*Instrument(s)*	*Incidence*
Deficiency payments	support farm income	target price	raise returns to factors in agriculture, increase government expenditure
Acreage restrictions	reduce farm surpluses	set-aside rate	reduce output or induce factor substitution
Non-recourse loans	support market price subsidize farm credit	stock accumulation loan rate	stabilize market price, increase government expenditure
Import quotas	support domestic price quota		raise price of imports, reduce imports, generate rents
Export subsidies	reduce excess supplies	in-kind subsidies	increase volume of exports, reduce stocks

THE COMPUTABLE GENERAL EQUILIBRIUM MODEL

The basic CGE model used for the analysis is in the tradition of models for the analysis of trade policy (Dervis, de Melo and Robinson, 1982). The model equations describe the behaviour of the various economic agents in the markets for factors, commodities and investable funds. It is neoclassical and Walrasian in spirit, solving for a set of relative prices, including the real exchange rate, that

achieve full employment, flow equilibrium in all markets. The GNP deflator is chosen as numeraire and is normalized to one in the calibration year (1982). The GNP deflator in the 1986 base is at its actual value and it is fixed in the forward projections to 1991. Thus, all 1991 nominal magnitudes solved in the model can be interpreted as being roughly in 1986 prices. The model is described in greater detail in Robinson, Kilkenny and Adelman (1988).

There are ten sectors producing commodities for domestic use and for export: three agricultural sectors, five industrial sectors and two service sectors. The sectors are roughly categorized by trade shares. There are three primary factors of production: labour, capital and agricultural land. The aggregate supplies of labour and capital are assumed fixed, but both factors are assumed to be freely mobile among sectors. Land is supplied to meet demand in one variant of the model, but is exogenously specified in the other. Value added in all sectors is generated by Cobb-Douglas production functions. Intermediate input demands are given by fixed input-output coefficients.

The agents who receive income and demand goods are: households, government, capital account and the rest of the world. The model determines only flow equilibria and does not include any assets or asset markets. Households are categorized by income class, own capital and land, and receive income from wages, profits, rents and government transfers. They pay taxes and save according to fixed average saving rates and then allocate their consumption expenditure according to a simple linear expenditure system. Investment is savings. In effect, there is a loanable funds market which gathers saving from all sources (private, government and foreign) and allocates them to the purchase of investment goods. Foreign savings are given exogenously in the base run and projection, but are endogenous in the experiments. Government savings (or deficits) are determined endogenously, given non-agricultural programme government expenditure and endogenously determined revenue. In addition, government stocking of 'grains' is a function of the ratio of the loan rate to the market price.

The 'rest of the world' is characterized very simply. The US is assumed to be a 'small country' in import and non-agricultural export markets. For two agricultural sectors, world export demand is a function of endogenously determined US export prices relative to exogenous world prices. An Armington assumption is evoked to distinguish domestic from foreign goods. Consumers purchase composite commodities which are constant elasticities of substitution aggregates of the imported and domestically produced good. Producers in each sector supply a composite commodity which has to be transformed in order to be shifted between domestic and export markets. The sectoral composite output is a constant elasticity of transformation aggregate of exports and domestic-market goods. In the base projection to 1991, the balance of trade was specified exogenously and the model solved for the equilibrium real exchange rate. In all experiments, the exchange rate is fixed exogenously and the model solves for the equilibrium value of the balance of trade (foreign savings).

Producers make supply decisions based on the value-added price, gross of subsidies and net of indirect taxes and the cost of intermediate inputs. Gross returns are based on the 'signal price'. The signal price is determined by target prices or subsidies relative to the market clearing price: $TP = PX^* (1 + PIE)$. When deficiency payments provide support to agricultural producers, the target price

TP is given, and the subsidy rate PIE (the 'producer incentive equivalent') is determined endogenously along with the market clearing price PX. When there are no distorting policies, PIE is zero and the signal price is the market price. A sector whose relative value-added price rises – whether due to an increase in PX and/or PIE or due to a decrease in taxes and/or intermediate input prices – will tend to pull resources away from other sectors.

Two types of quantitative restrictions in agriculture are included in the model: land set-asides and import rationing. Land set-asides are represented by a constrained land supply function, with 3.0 and 12.4 per cent of harvested crop acreage constrained out of production in 1982 and 1986 respectively. In the model variant in which this function is not perfectly inelastic, acreage is brought in or out of production to maintain its rate of return relative to the 1986 rate of return. Import rationing is specified for 'dairy and meat' and 'other agriculture'. In the base year (1982) consumers are assumed to have been rationed to half their desired import demands at existing prices. The assumption on 'half' comes from the degree of import relief specified under Section 22 of the US Agricultural Adjustment Act.

EXPERIMENTAL RESULTS

Changes in agricultural policy in industrialized countries have a direct impact on only a small part of the entire economy. In the US, agriculture accounts for about 2–3 per cent of the labour force and GNP, so one would not expect major shocks to GNP or factor returns to arise from changes in agricultural policy. However, indirect effects may be large. Agricultural exports make a substantial contribution to the US balance of trade, and expenditures on agricultural programmes equalled about 18 per cent of the government deficit in 1986. Swings in the two deficits affect the structure of trade and aggregate investment, with concomitant effects on the structure of production. Given our macro closure, any increase in foreign or government savings will stimulate the demand for investment goods.

The two versions of the model, '*Ad valorem*' and '*Explicit*,' are calibrated using detailed sectoral data for 1982 and benchmarked for 1986 according to available macroeconomic data. We project both versions to 1991 under a base macro scenario, assuming that the agricultural policies remain in effect. For the '*Explicit*' version, this means that the target price, loan, and set-aside rates are set to the 1990 level as stipulated in the provisions of the US Food Security Act of 1985; the import quotas remain at the present levels; and the export subsidies continue at the observed 1986 *ad valorem* rates (USDA 1987). In the *Ad valorem* version, the output subsidies, import tariffs, and export subsidies are set at the PIE rates determined endogenously in the 1986 base run of the '*Explicit*' model. These PIE rates are thus locally equivalent *ad valorem* measures of the distorting intervention in agricultural sectors in 1986.

Both base runs for 1991 are solved assuming the same rates of growth in exogenous variables over the five years. In particular, total factor productivity is assumed to increase by 8 per cent, the labour supply grows by 6 per cent, and the aggregate capital stock increased by about 12 per cent (consistent with savings up 15.6 per cent less costs of retiring government debt) over the period.

Real nonagricultural programme government spending remains at 1986 levels. Government transfers to households and enterprises increase at the same rate as the labour supply. The balance of trade (foreign savings) drops to US $16.2 billion (from US $107.0 billion in 1986).[2] We assume that the export demand curve for 'services' shift out by 15 per cent, and the import demand curve for manufactures and services both shift out by around 10 per cent. The trade deficit is thus projected to decrease along with the government deficit. To accomplish this, the exchange rate devalues by about 20 per cent from the 1986 level.

Figures 1 to 4 compare the two model results for 1986 with actual data and with one another for the experiments. We present three experiments: (1) 'Land', in which the set-aside constraints on land are relaxed, while maintaining all other aspects of the programmes; (2) 'Border', in which only the border measures are terminated; and (3) 'Unilateral', which includes terminating the deficiency payment and government stocking schemes in addition to relaxing the land and border measures. The two models provide quite different results for the same experiments for key variables: import volumes, domestic producer returns, GNP, and government subsidy expenditures.

Terminating border measures results in increased dairy product and sugar imports. This experiment using an '*ad valorem*' model amounts to dropping the tariff equivalent of quotas to zero. In the 'explicit' model, consumers are also allowed to 'get back on their demand curves'. The '*ad valorem*' model estimates 33 per cent less of an increase in 'dairy' imports, and 39 per cent less of an increase in 'other agriculture' imports than the 'explicit' model. This leads to upward bias in the domestic prices for 'dairy' and 'other agriculture' in the '*ad valorem*' model.

The first five bars in Figure 1 show the gross returns per bushel for participat-

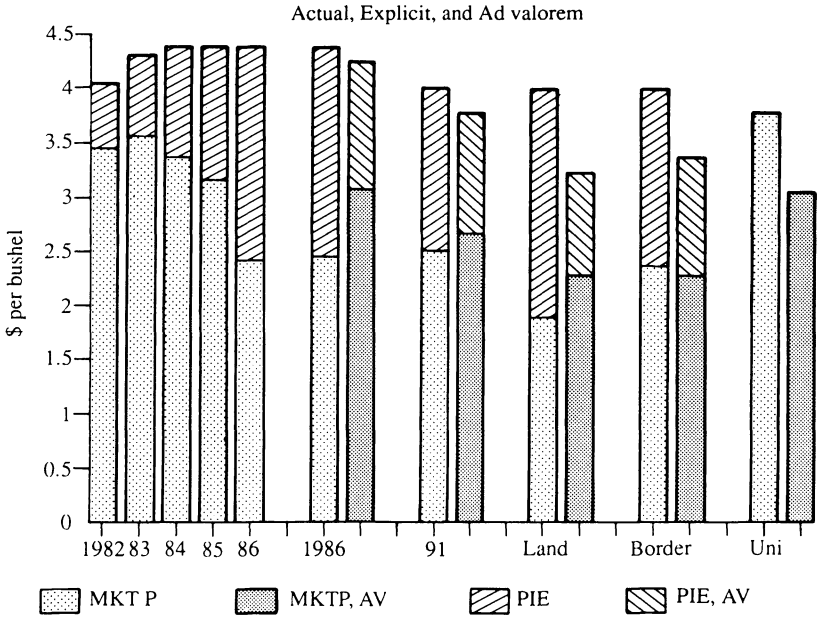

FIGURE 1 *Wheat prices and subsidies*

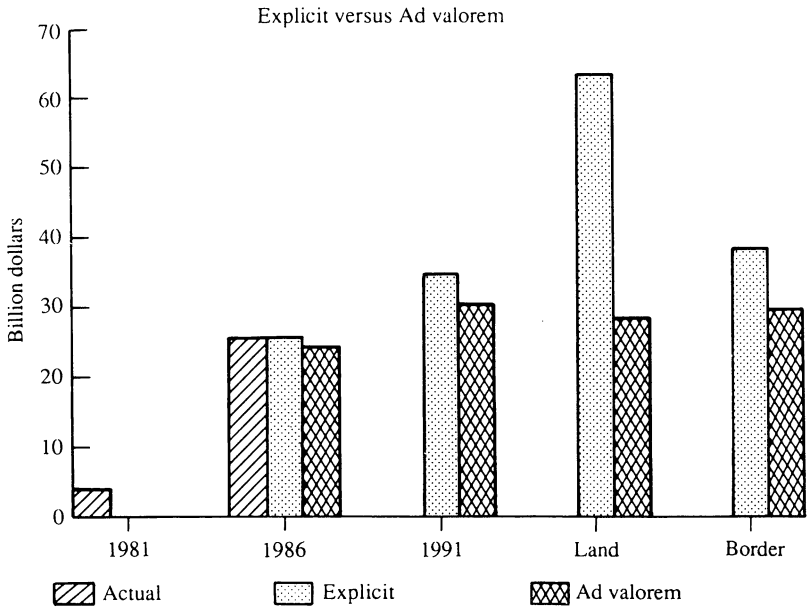

FIGURE 2 *Agricultural programme expenditures*

ing wheat farmers from 1982 through 1986. The model has only an aggregate grains sector, so we are assuming that our model results hold for wheat for the last ten bars in the figure. During this period, the market price of wheat in the US fell by 30 per cent, while the target price increased only 8 per cent, so the rate of subsidy increased from 15 per cent to 45 per cent per gross unit value. Using the 'explicit' model, the solutions for trade, output, prices and government stock accumulation (not shown) closely match observed 1986 values. Using the '*ad valorem*' model generates observed output and trade levels by design, but does not provide as good an estimate of the prices in 1986 as the 'explicit' model.

In projecting to 1991, the two models differ in the estimated signal prices as well as market prices. The signal price in the 'explicit' model tops out at the stipulated target price. The '*ad valorem*' signal price is lower and the market price is higher than in the 'explicit' version. Thus, the deficiency payment is lower in the '*ad valorem*' version. With the lower deficiency payments, the estimated outlays on agricultural subsidy programmes are also lower.

Figure 2 shows the differences between the two versions in projecting budgetary impacts. The 'explicit' model projects agricultural programme expenditures in 1991 to be US $34.8 billion (1986 dollars) while the '*ad valorem*' model projects US $30.7 billion. The differences in estimated programme payments are most striking in the 'Land' and 'Border' experiments. If producers bring land into production and increase supply at given target prices, or imported supplies increase with the removal of border constraints, one would expect market clearing prices to fall. The difference between the market and target price widens and the budget exposure increases. These are the results obtained with

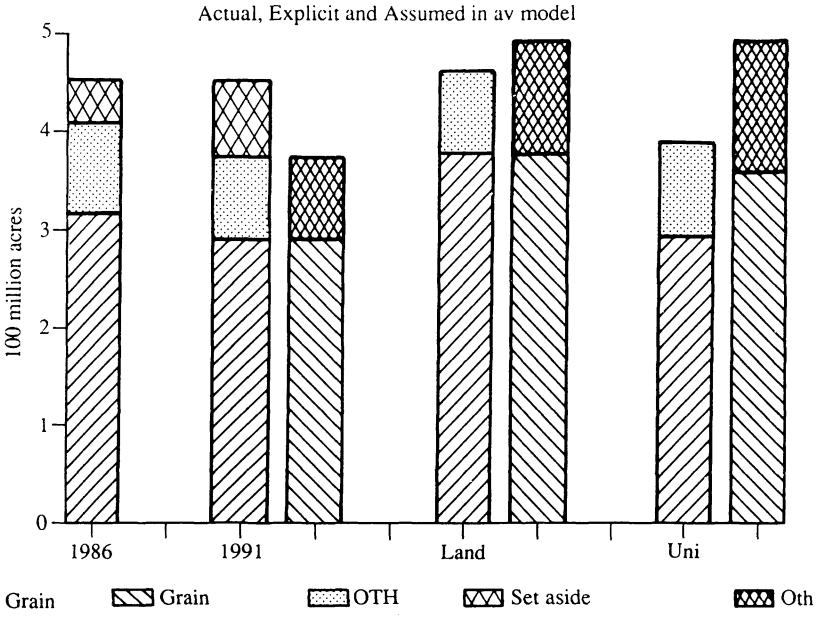

FIGURE 3 *Agricultural land*

the 'explicit' model. In contrast, the '*ad valorem*' model incorrectly estimates lower programme expenditures for both of the experiments, since the fixed rate of subsidy is applied to the lower market price. The differences are significant.

The two models also differ in their GNP projections, which affects tax revenue and the budget deficit. The difference in GNP is largely due to land in production. In the 'land' experiment, acreage is allowed to increase over 1991. Total GNP is US $10–11 billion higher using the '*ad valorem*' model where total land supply is fixed higher than the endogenous level of land in the 'explicit' model.[3] Figure 3 compares the models and the land allocations among experiments. In the 'explicit' model, land enters production only if it can earn a return comparable to the 1986 rate of return. All land set-aside in the 1991 base solution, and then some, enters into programme crop production, with little change in the allocation to 'other agriculture'. In the 'Unilateral' experiment, the decrease in returns signals a decrease in total land.

In the '*ad valorem*' version of the model, land supply is set exogenously, according to estimates from a partial equilibrium model (Salathe *et al.* 1982). Given the intersectoral reallocation of capital and labour in the general equilibrium model, the partial equilibrium results probably overstate the adjustment inland. The marginal value product of land falls by 8.4 per cent (relative to 1986) in the 'explicit' model, compared to a fall of 30.9 per cent in the '*ad valorem*' version. In addition to these differences in land values, misspecification of land use in agriculture cascades into errors in the estimates of labour and capital employed in agriculture, affecting the structure of production economy-wide.

ECONOMY-WIDE IMPLICATIONS OF AGRICULTURAL LIBERALIZATION

In analysing the economy-wide implications of agricultural liberalization. we focus on results from the 'explicit' model only. Table 2 presents various aggregate results. The models embody pre-existing distortions so we are comparing among second-best solutions in all the experiments. The first three rows of the table give GNP results. GNP increases in all three experiments, indicating that there are efficiency gains from agricultural liberalization. In the 'Land' experiment, the gain is US $2.7 billion which results largely from increased land in production. In the 'Unilateral' experiment, the gain is US $8.9 billion, even though land in production declines. The efficiency gains from factor reallocation overpower the decline in land use.[4] In the 'Border' experiment, the gain is only US $0.5 billion, indicating the relative unimportance of border policies.

The government deficit increases under the 'Land' experiment, reflecting the increased deficiency payments. The drain on savings causes lower aggregate investment, only partially offset by increased savings due to GNP growth. In the 'Unilateral' experiment, the deficit is reduced by US $25.9 billion, while growth-spurred savings and investment increase by US $36.1 billion.

The experiments yield changes in the trade balance, largely due to changes in the agricultural sectors. Net exports in the 'Land' experiment are US $13.0 billion higher than in the 1991 base, due to US $15.6 billion higher agricultural exports. In the 'Border' scenario (in which quotas and export subsidies are terminated), nonagricultural exports expand while agricultural imports increase, resulting in a net export decline of US $3.5 billion. Finally, agricultural export earnings fall by US $14.4 billion in the 'Unilateral' experiment. Since prices of foreign agricultural exports remain low (by assumption), US exports are not competitive in world markets. The bottom line is absorption: the sum of consumption, government, and investment demand. Changes in absorption follow changes in the trade balance and increases in GNP. For example, in the 'Unilateral' experiment, total absorption rises by US $23.7, of which US $8.9 is due to the increase in GNP and US $15.8 is net imports.

Although agriculture employs only 2–3 per cent of labour force, there are noticeable changes in the pattern of employment by sector across experiments. Figure 4 shows the results. In the 'Land' experiment, labour is pushed out of the investment goods sectors due to decreased aggregate investment and drawn into agriculture to complement the increased land. In the 'Border' experiment, agricultural labour shifts from the once protected 'other agriculture' and 'dairy' sectors into 'grains', complementing the shift of land into 'grains'. In 'Unilateral', reduced returns to factors in the food and fibre system push labour out, while increased aggregate savings pulls labour into the investment goods sectors. The pattern in output and exports are the same as the pattern of employment.

Table 3 shows the changes in the sectoral distribution of income. The termination of all agricultural subsidy programmes ('Unilateral') results in a 24.6 per cent decline in income in the 'grains' sector relative to the 1991 base level of income, of which 58 per cent originally came from subsidies. Clearly, price increases offset some of the lost programme support, while other sectors in the economy share in the adjustment. The 'light consumer' goods sector suffers a 2.4

TABLE 2 *Real macroeconomic aggregates (billions of 1982 dollars)*

	Base 1986	Base 1991	Experiment values: Land	Border	Unilateral	Difference from 1991 base run: Land	Border	Unilateral
GNP								
Total	3711.7	4120.8	4123.5	4121.3	4129.6	2.7	0.5	8.9
Agric.	43.5	38.1	62.5	36.1	28.8	24.4	–2.0	–9.3
Non-ag.	3668.1	4082.6	4061.0	4085.1	4100.8	–21.6	2.5	18.2
Government Deficit								
Total	–147.9	–7.0	–35.3	–10.0	18.9	–28.2	–3.0	25.9
Investment								
Total	629.0	716.6	685.7	717.0	752.8	–30.9	0.3	36.1
Consumption								
Total	2482.9	2724.3	2737.6	2726.9	2706.9	13.3	2.6	–17.4
Agric.	27.9	30.0	31.2	30.5	29.3	1.2	0.6	–0.6
Non-ag.	2455.0	2694.4	2706.5	2696.4	2677.6	12.1	2.1	–16.8
Net Exports								
Total	–155.7	–65.6	–52.6	–69.0	–81.3	13.0	–3.5	–15.8
Agric.	10.8	14.8	30.5	11.3	0.5	15.6	–3.6	–14.4
Non-ag.	–166.5	–80.4	–83.0	–80.3	–81.8	–2.6	0.1	–1.4
Absorption								
Total	3867.2	4185.8	4176.6	4189.6	4209.5	–9.2	3.9	23.7
Agric.	42.9	34.5	44.1	35.9	39.0	9.6	1.5	4.5
Non-ag.	3824.4	4151.3	4132.5	4153.7	4170.5	–18.8	2.4	19.2

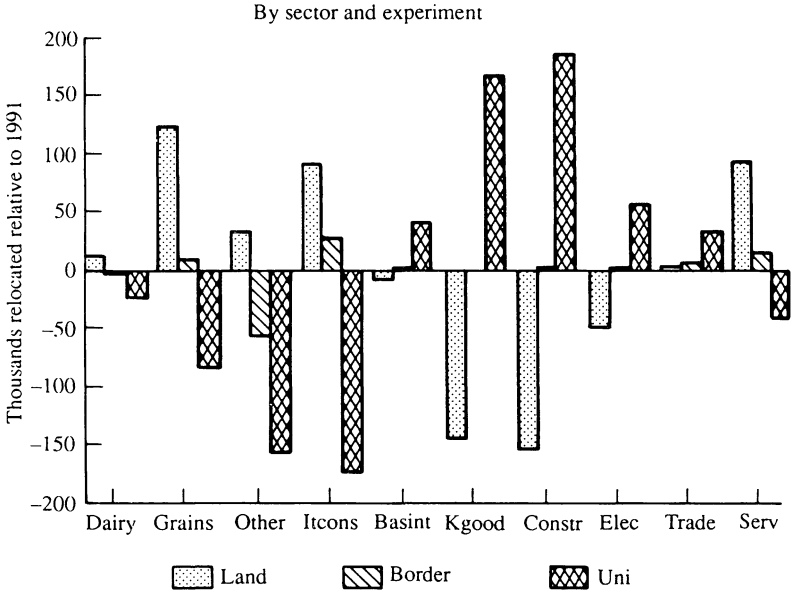

FIGURE 4 *Labour relocation*

per cent drop in net income. This results from the cost-price squeeze: the costs of intermediate goods from the agricultural sectors increase, while the price of competing light consumer good imports decrease once quotas are relaxed. Aggregate savings and investment increase so that the investment goods sectors are winners. Overall, real GNP growth offsets part of the US $34 billion loss in subsidies from the government, so that aggregate net sectoral income falls by only US $25.9 billion.[5]

SUMMARY

We show that the *ad valorem* modelling approach is often not a good substitute for explicit modelling of agricultural programmes. First, the *ad valorem* approach tends to underestimate the costs of deficiency payments for policy changes that reduce the market price. In the actual programme, the rate of subsidy and the budgetary outlay vary inversely with the underlying market price. Given the importance of estimating budgetary exposure in policy analysis, it is necessary to model the programmes explicitly. Second, it is important to capture import rationing correctly in the base model, specifying how far consumers are forced off their demand curves. Otherwise, the impact on trade volumes and domestic prices of the removal of import quotas will be understated. In countries which rely on import rationing (such as Japan), these effects are dramatic. Finally, policy changes affect incentives to employ land and thus the level of land in crop production should be modelled endogenously.

TABLE 3 *Net Sector income*

	1986	1991	Experiment: Land	Experiment: Border	Experiment: Unilateral	Experiment: Land	Experiment: Border	Experiment: Unilateral
			Billions of 1986 dollars				% change from 1991 base run	
Dairy	23.5	25.9	26.6	25.6	24.4	3.0	–0.8	–5.7
Grains	40.2	44.7	60.9	46.1	33.7	36.1	3.0	–24.6
Other Agriculture	31.8	38.1	39.5	36.0	32.2	3.7	–5.5	–15.4
Light cons	277.0	315.0	319.7	316.2	307.4	1.5	0.4	–2.4
Basic intmd	379.9	426.4	427.9	426.8	427.2	0.3	0.1	0.2
Capital goods	214.9	263.1	258.5	263.3	268.6	–1.7	0.1	2.1
Construction	201.6	240.9	235.6	241.2	247.5	–2.2	0.1	2.7
Electronics	80.8	94.0	93.3	94.1	94.8	–0.7	0.1	0.9
Trade	617.5	688.4	691.5	689.0	686.5	0.5	0.1	–0.3
Services	2050.0	2216.8	2230.5	2218.7	2205.4	0.6	0.1	–0.5
Total	3917.1	4353.3	4384.1	4357.0	4327.6	0.7	0.1	–0.6

Developed country governments rarely intervene in their agricultural sectors by using *ad valorem* subsidies or taxes. This fact alone is sufficient to motivate modelling the actual intervention. The subtle but equally important issue is whether or not 'explicit' modelling is necessary for policy analysis. Our comparison of two models and various experiments indicates that explicit modelling is important for the analysis of phased and/or partial liberalization. For the analysis of complete liberalization, the *ad valorem* equivalent approach provides reasonable results if quantitative restrictions are handled correctly.

Our analysis of the economy-wide impact of unilateral liberalization by the US is optimistic. Efficiency gains in GNP amount to US $9 billion. The estimated change in GNP using the CGE model in which agricultural policies are represented by both price distortions and quantitative restrictions is more conservative than when distortions are represented by *ad valorem* equivalents and quantitative measures (particularly land controls) are modelled too simplistically. Domestic agricultural prices strengthen enough to offset some of the lost subsidy income. However, the offset is not enough to bring the agricultural sectors back to their income levels under the programmes.

NOTES

[1]See, for example, Tyers and Anderson (1987) and Hertel *et al.* (1988).

[2]The 'balance of trade' follows US national income and product accounting conventions and equals the balance on current account.

[3]In the two experiments with no change in land supply ('border' and the 1991 base), GNP is slightly higher in the 'explicit' model (US $3.0 and US $1.4 billion). This is due to 'second best' reallocations of factors across the experiments.

[4]Compare these results, for example, with Whalley and Wigle (1988) who find GNP gains arising entirely from exogenously specified increases in the land use.

[5]These numbers are nominal, in 1986 prices. Note that sectoral income includes subsidies and is different from sectoral value added, which excludes transfers.

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DISCUSSION OPENING – GLENN P. JENKINS

This paper sets out to answer two questions using a CGE model of the US economy. First, for this type of simulation exercise, does it matter if the US agricultural policies are modelled correctly rather than simply approximated by *ad valorem* taxes and subsidies? Second, what are the economy-wide resource shifts between sectors and the efficiency gains of different agricultural policy changes?

The second question is of greater economic interest. As for the first, it should not be a surprise that one would get very different results if a price floor is modelled as an *ad valorem* subsidy or if a quantitative restriction on the use of land is modelled as an *ad valorem* tax. I do not find such exercises very illuminating. It is heartening, however, to see that the builders of this CGE model have recognised that a profound difference in the results of simulations can occur when marginal values of parameters and distortions are used rather than their initial average values. In determining the changes in economic welfare arising from these changes in policies, it would be interesting to know if the authors were able to use the marginal values of other important distortions, such as for example, the various taxes that apply to the value added of capital and the marginal rates of personal income taxation that would apply to changes in personal income. The incremental changes in income generated in the agriculture sector are likely to be subject to lower rates of income and sales tax relative to most other industries, hence, a significant component of the change in economic welfare that arises when resources are shifted between the agricultural and the industrial sectors is likely to be caused by differences in marginal tax rates applicable to the different sectors.

In the paper the authors have not indicated whether they have treated all land as being homogeneous. Is the 3.0 and 12.4 per cent of harvested crop acreage that is assumed to be out of production in 1982 and 1986, respectively, simply a physical area measure of the land set-aside? It would seem that the set-aside policy gives farmers an incentive not to cultivate their less productive acreage, as well as to try to substitute other factors of production for land.

Turning to the second question, the authors have considered three options for agricultural policy reform: (a) the land set-aside policy is abolished; (b) import quotas and export subsidies are eliminated; and (c) the unilateral option – where all agricultural support schemes including deficiency payments, acreage restrictions, non-recourse loans, import quotas and export subsidies are all eliminated.

From these simulations the authors find that the net economic benefit, as measured by changes in GNP, is rather small from removing either the land restrictions alone or the import quotas and export subsidies alone. It is only when these distortions are removed along with the rest (as in the unilateral option) that significant benefits are realized.

If this model included the marginal efficiency cost of raising government revenues, the removal of the set-aside rules could result in an estimated economic loss. Removal of this policy has an estimated impact on the deficit of US $28.2 billion in 1991, while the gain in GNP is only US $2.7 billion. Hence, if the marginal administrative and compliance costs of raising the government revenues to finance this increased deficit was more than 10 per cent of the additional

revenues required, the overall economic welfare of the economy could be improved by retaining the land set-aside policy.

This brings me to my last point. Everyone who has attempted to build and use such a CGE model is well aware of the extreme sensitivity of such results to alternative 'reasonable' assumptions of the parameter values and the model's specification. Rather than give only one result from the many simulations that have been carried out, the results would be much more useful to policy makers if the range of outcomes (with perhaps a probability distribution) could be provided for 'reasonable' or 'likely' parameter values. A single observation from a 'simulation laboratory' is hardly a credible input into policy making process when there are large standard errors around both the parameter estimates and the model's specification. In the field of project appraisal the profession has learned (the hard way) that in an *ex anté* appraisal there is no such thing as a unique rate of return nor a single prospective net present value for an investment. At best, we have a range of outcomes that have different probabilities associated with them. Furthermore, such a 'picture' is a lot more helpful to decision makers than a single 'most likely' outcome. I believe this lesson is equally transferable to the CGE policy simulation field.