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The Impact of Changing Economic Conditions on the Australian Agricultural Sector

SECTION 1

In 1945 agriculture was a leading sector in the Australian economy. Since then the rural sector has declined in relative importance and has become increasingly dependent on other sectors of the economy. This trend is likely to continue. However, the last eight years have been a period of marked changes for Australian agriculture. Most agricultural commodities have experienced at least one full cycle of price boom and slump; the OPEC oil price rise of 1973 drastically changed fuel costs; high rates of inflation have exerted strong pressure on costs, and agriculture has had to "withstand" the development of minerals as a major new export industry during this period. It is not surprising that production has increased more slowly during the 1970s than during the previous two decades. There have also been pronounced changes in the product mix, resulting from, at various stages over the 1970s, wheat quotas, low sheep and wool prices, and low cattle prices.

During the commodity boom of 1973–74 the rural sector added to Australia's inflationary problems, whereas subsequent low beef prices helped lower the inflation rate. Owing to their inability to adjust their product price, farmers suffer a loss of competitive advantage at home when export prices rise more slowly than the inflation rate, and a loss of international competitiveness when Australia's inflation rate exceeds that of her trading partners. The traditional response to a cost-price squeeze has been to raise productivity through investment. By the 1970s many farmers were unwilling or unable to undertake such investment (both real and money farm incomes fell after 1973–74). Instead they allowed their capital to deteriorate and reduced factor input. By the late 1960s government agricultural policy aimed to make the rural sector responsive to changing market conditions and the emphasis was on structural adjustment. However, it can be argued that the rural sector suffered considerable pressure due to government measures to pursue national policy goals.

Gregory (1976) argues that the growth of the mineral industry relative to the rest of the economy had drastic implications for the rural sector because it resulted in higher costs for the entire economy due to competition for resources. This thesis has attracted considerable attention, centring on three aspects. Firstly, Gregory ignores any income effects of the investment which generates the increase in mining exports (Snape 1978). Secondly, the quantitative conclusions drawn by Gregory depend crucially on the supply elasticities used. Although available data are inadequate, Gregory did not allow sufficiently for the reduction in elasticities when moving from individual products to total agriculture. Thirdly, some of the assumptions employed restrict the generality of the analysis. In particular Gregory assumes that no policy adjustments other than exchange rate or tariff adjustment are used by the government. This is relevant to any policy application of the thesis.

A number of policy options are available to a government confronted by a large increase in exports. For example, increased exports remove the balance of payments constraint to growth so higher rates of growth should be attainable. To achieve these, imported capital and labour are required. Both use foreign reserves. Thus the level of foreign reserves need not increase, and adjustment problems outlined by Gregory need not occur. The conventional wisdom seems to be that the current structural problems, especially of the rural and labour-intensive manufacturing sectors, are basically a result of the mining boom of the late 1960s and 1970s. However, it is obvious that any structural problems are exacerbated by a recession. The economic development of recent years suggests an alternative view of the mineral boom. This development removed the balance of payments constraints on government policies. The additional export revenue provided an opportunity to introduce government policies while ignoring their balance of payments implications, and perhaps accentuating any emerging structural problems.

SECTION 2

The theoretical basis, structure and operation of the Institute Multi-Purpose Model (IMP) is described in Brain (1977). The model consists of eight modules, viz. main, demography, finance, energy-transport, industrial activity, international, Australian States, and agriculture. The prime role of the main module is to collect micro data obtained from the other modules and to translate these into traditional macro aggregates. The key inputs from the agricultural module into the other modules are farm product and income, rural exports, and agricultural commodity prices. From the main module, the agricultural module derives the exchange rate, general price level and wage levels. Data for real gross non-farm product and commodity consumption are also provided. Population data are obtained from the demography module.

The agricultural module distinguishes ten product groups, viz. wheat, other grains, sugar cane, other crops, wool, cattle, sheep, dairy, pigs and other livestock. For each product group the module includes equations for supply, average price received by farmers and, for the "homogeneous" product groups, stocks are treated as exogenous, and exports are derived as the residual from the total supply/total utilization identity. Supply and farmers price for total crops, total livestock and total agriculture are obtained by summation, or weighted averages as appropriate; gross value of production can then be calculated. To derive farm income, equations are estimated for a few aggregative groupings of costs; other minor items (such as farm interest taxes, stock valuation adjustment and farm income of companies) are treated as exogenous.

The equations in the agricultural module are estimated for the sample period 1948–49 to 1976–77 (or 1975–76 where data for the more recent year were unavailable). A full specification of the equations is given in Smith and Smith (1976).

Supply

$$SP_{it} = f(SP_{it-1}, FP_{it-1}, (FP_i/FP_j)_{t-1}, Y_{it}, I_{it-1}, X_{it-1})$$

where SP is planned supply of an agricultural commodity, FP is price, Y is a measure of technological progress, I is stocks of the commodity, X is exports of the commodity, i and j indicate different agricultural commodities and the subscripts t and t-l refer to current and previous farm years respectively.

Actual supply depends on planned supply (incorporating deliberate production changes where possible) and weather. By manipulation, the unobservable planned supply variable can be eliminated. The supply equation for a given product group will consist of the relevant variables from the general specification together with any factors specific to the product group. The lags specified above may not be relevant for cattle due to the longer production period.

The supply of wheat, other grains and sugar either adjusts within one production period or past supply has no influence on current supply. The partial adjustment approach was valid only for wool and pigs; for the remaining groups inclusion of lagged supply indicates only that farmers are guided in their production decisions by supply in previous periods.

As disaggregated time series of cost data for agricultural commodity groups are unavailable, price or relative price is used as a proxy for profitability in the supply equations. Only sugar supply (which is subject to quotas) is not directly affected by any price variable. There are strong interrelationships between the supply of wheat, wool, cattle and sheep and the prices of these four products. The joint production of wool and sheep meat tends to distort some of the price responses. For example, the negative wool/total meat price coefficient in the wool supply equation indicates a dominant short-run meat supply effect.

Following Powell and Guren (1966), indexes of deviations from trend yields or trends of animal deaths were used as indicators of weather conditions. These measures are related to basic weather factors in a non linear way and thus have a non linear effect on actual supply, in accordance with *a priori* expectations. A weather variable was found to influence the supply of all commodity groups except cattle and sheep meat. The failure to identify a significant weather effect on cattle supply may be due to data problems, and for sheep, to the problems of joint production.

Meaningful stocks data are unavailable for the composite groups. An inverse relationship between own stocks and supply was found only for wheat. The non-significance of this variable may be explained by wholesalers rather than growers holding stocks. Exports directly affect the supply of sheep meat, cattle and sugar. The supply equations indicate that any marked short-term increase in meat exports is achieved by slaughtering earlier, thus depleting future supplies.

Some specific factors affected supply decisions in particular product groups. Non-transferable wheat quotas (operative May 1969 until 1973–74) reduced wheat production, encouraged diversification into other grains and reduced farmers' ability to switch between sheep and wheat. Supply decisions concerning pigs and other livestock are influenced by real income per caput. A time trend was included in the wheat, other grains and sugar equations; fertilizer usage affects wheat and sugar supply but was not relevant to other product groups.

Farmers' Price

$$FP_{it} = f(SA_{it}, (FP_i/FP_j)_t, FP_{it-1}, X_i, XP_{it}, I_{it}, DP_t, W_t)$$

where X is the volume of exports, XP is the export price index, DP is real gross non-farm product per caput and W is weather. The prices of all commodity groups except wheat, are influenced directly or indirectly by supply. Only meat prices are influenced by own stocks, and the farmers' prices of wool, sugar and wheat and cattle are determined primarily internationally rather than by domestic availability. Export prices help explain farmers' prices for these commodities and for sheep, pigs and whole milk. Quantity exported affects the farmers' price of wool, sugar, wheat, cattle and sheep meat. Every commodity group price equation includes a price variable of some sort. The results also support the hypothesis that the prices of commodities which compete for the same resources are interrelated. Weather affects other grains, sugar, other crops and cattle prices. It appears that the effect of weather on price tends to be via quality changes with crop prices being depressed by poorer quality crops, while cattle prices increase as meat of a given quality becomes more expensive.

Consumption. To avoid duplication of effort, it was decided to relate the consumption or apparent domestic utilisation of the various agricultural product groups to the relevant consumption categories estimated in the main module of the IMP model.

$$C_{it} = f(PCE_t, DP_t, TS_{it}, (FP_i/FP_j)_t, C_{it-1})$$

where C is the quantity of commodity i consumed in Australia, PCE is real personal consumption expenditure on the consumption category which includes commodity i, and TS is total supplies of commodity i. For wheat, wheat products, seed and stockfeed utilisation are distinguished. The consumption equations display a wide disparity in terms of variables included. Price effects were detected only in the consumption of meats. An income effect was identified in all consumption equations, except that for wheat products. It was not possible to construct a satisfactory equation for wheat for stockfeed, and this variable was treated as exogenous.

Costs. From the constant price data calculated for gross value of rural production at factor cost and the constant price data for gross farm product at market prices, a measure of production inputs at 1966–67 prices can be derived. However, stock valuation adjustment and net indirect taxes cannot be eliminated from the constant price data.

$$TPIA_t = f(SP_t, W_t)$$

where TPIA is the value of production inputs (in constant dollars). It was found, however, that unfavourable weather conditions did not significantly alter factor inputs, possibly due to the unsatisfactory nature of the variable.

$$PPIA_t = f(FP_t, PE_t, SA_t)$$

where PPIA is the price of production inputs, PE is the general price level and SA is actual supply. The value of production inputs at current prices can be calculated by multiplying the quantity of inputs by their price. Gross farm product at current or constant market prices can then be determined via an identity. Unfortunately no constant price data are available for other cost items. Consequently equations for depreciation and wages, net rent and interest paid have to be specified with the dependent variables in current prices.

$$WRI_t = f(SP_t, TPIA_t, WAGE_t)$$

where WRI is the value of wages, net rent and interest at current prices and WAGE is the general wage level. Depreciation allowances for the primary sector are determined in the main module and allowances for the farm sector account for over 97.5 per cent of these.

$$FADP_t = f(DPA)_t$$

where FADP and DPA are depreciation in the agricultural and primary sectors respectively. The regression results for the cost equations conformed to the above specification.

SECTION 3

Four sensitivity analyses are reported in this section. In the first scenario, the rate of inflation, as measured by both the Consumer Price Index and the implicit gross non-farm product deflator, was assumed to increase by one percentage point per annum. Reference has been made above to the lack of suitable cost data and the consequent necessity to use price variables rather than profitability variables in the supply equations. Accordingly, it is not surprising that the major effects of the increased rate of inflation are felt through increased farm costs. After ten years the price of production inputs are 7.7 per cent higher than in the base run, whilst the increase for wages, net rent and interest paid is 8.3 per cent higher. The higher rate of inflation could lead to a decline in the "real" prices of at least some food items (whether this happens or not will depend on the causes of the higher rate of inflation, and how it pervades the economic system). If this occurs, the model suggests that domestic consumption of beef and veal will increase slightly, leading to a slight increase in beef and veal production. Offsetting this will be a slight decline in wool and sheep meat production. The net result is a very small increase in the gross value of farm production. However, the influence of increased farm costs dominates, so that after ten years of higher inflation farm income declines by 10 per cent compared with the control solution.

In the second scenario, a hypothetical devaluation of 10 per cent is assumed to take place at the beginning of Year 1. If export prices are set in world markets, the immediate effect is to increase the export price of farm products in Australian dollars (refer below for further comment on this aspect). The higher export prices lead to higher farm prices. The effect is least on the price of other crops, as few commodities in this product group are exported, and greatest for wool and cattle and sheep meat, reflecting the importance of the overseas markets in determining prices, and the absence of home pricing schemes. Initially there is no effect on supply – this is a reflection of the basically pre-determined nature of supply. But even after a number of years, the effect on supply is minimal, with total agricultural supply (in quantity terms) increasing by only 0.5 per cent. Consequently the changes in the gross value of production of each product group closely reflect the changes in the farmers price for that product group. The increase in the total gross value of farm production over a number of years is just under 10 per cent, a fraction less than the percentage devaluation assumed.

The quantity of production inputs used increases slightly (by about 0.5 per cent) reflecting the small increase in the quantity of agricultural production. The price of production inputs is influenced by both the implicit gross non-farm product deflator and by farm prices. Thus the price of production inputs exhibits little change in the first two years, but then increases and eventually reaches a level about 8 per cent higher than in the control solution. Wages, net rent and interest paid also increase, reflecting the higher wage levels after the devaluation. However, each item of costs increases by less than the gross value of farm production. Consequently farm income increases proportionately more than the gross value of farm production. Even so, the effect on farm income is greatest in Year 2, when it is 18 per cent greater than in the control solution. The effect of rising costs then gradually erodes some of the benefits, but ten years after the devaluation farm income is still over 12 per cent greater than in the control solution. The effects of the devaluation on the quantities exported are quite small, reflecting the small effects of the devaluation on the quantities produced. However, the value of agricultural exports increases markedly, reflecting the higher prices (in Australian currency) caused by the devaluation.

Obviously the effects of exchange rate changes on Australian agriculture depend to a large degree on whether the Australian export prices change to the full extent of the change in the exchange rate. It is generally accepted that wool is the only agricultural commodity of which Australia is a dominant supplier. Assuming that only 50 per cent of the exchange rate change "flows on" to the Australian wool price, there will be very little effect on the supply responses. However, the increases after ten years in gross value of farm production and farm income as a result of a 10 per cent devaluation are reduced by under 1 and over 1 percentage point respectively.

The third scenario considers a sustained increase in the volume of mineral exports. The macro economic implications of this and the following scenario are considered in Brain and Gray (1977). The increase in mining exports, compared to the control solution, results in a revaluation of the exchange rate, little change in real gross non-farm product and a small increase in personal consumption (in this analysis the importation of extra capital and labour was not considered). Over a ten year period the exchange rate is revalued by 5 per cent (compared to the control solution). This leads to lower farmer prices than would otherwise prevail. The increased consumption expenditure encourages a small (about 1 per cent) expansion in cattle production; other supply responses are negligible. After ten years of extra mineral exports, the gross value of farm production is about 3 per cent lower than in the control solution. Farm costs change only slightly so farm income declines by 8 per cent.

The fourth scenario considers a sustained increase in the prices of mineral exports, the price increases giving the same improvement in exports as resulted from the increased quantity of mineral exports considered in the previous scenario. The improved terms of trade for minerals leads to a faster rate of revaluation of the exchange rate, a very slight fall in real gross non-farm product, and larger increases in personal consumption. After ten years the exchange rate is 7 per cent higher than in the control solution. This leads to lower farmer prices than would otherwise prevail. The increased consumption expenditure encourages both sheep and cattle production to expand by about 2 per cent. After ten years of higher mineral prices, the gross value of farm production is 5 per cent lower than in the control solution. Again, prices hardly change so farm costs change only slightly. Consequently farm income declines by 13 per cent.

SECTION 4

The sensitivity analyses reported in the previous section reveal that the Australian agricultural sector is very sensitive to changes in both the exchange rate and the rate of inflation. Australia revalued against most currencies by considerable amounts between December 1972 and September 1974 and during most of the 1970s Australia also experienced rapid inflation. It is not surprising then that there arose considerable concern that Australian farmers were suffering severe reductions in their overseas competitiveness. Miller (1976) states: "After adjustment for changes in input prices and exchange rates, $100 earned by the Australian grain grower in the late 1960s is now worth only $50. For the North American grain producer, his $100 is now worth $70." A comparison between the index of prices paid by farmers in Australia and the United States over the decade to 1977 shows that while Australian prices paid rose slightly faster before 1970, between 1970 and 1974 the position was reversed. However, after 1974 Australian prices paid rose much faster so that while the Australian index was about 2 per cent less than that of the US in 1974, by 1977 it was nearly 24 per cent higher. Exchange rate adjustments more than offset the advantage gained by Australian farmers due to a slower rate of inflation between 1972 and 1974. However, while Australian prices paid continued to rise much faster than those of US farmers, in 1976 and 1977 exchange rate movements improved the relative position of Australian farmers.

The apparent decline in the competitive position of the Australian farmer over the period from 1967 does not represent a reversal of trend. How, then, were Australian farmers able to continue producing? The critical variable is relative farm income. Australian and US farm income, both at current value and at constant 1967 prices (that is, deflated by consumer prices), was compared. Although the ratio fluctuated, it displayed no statistically significant trend. This suggests that the indexes of prices paid and prices received by farmers do not satisfactorily indicate what is happening. Maybe the weighting of the components of the index of prices paid is no longer representative, at least for the Australian producer. Farmers may have offset the effects of rising input prices either by cutting back on those inputs or by producing more efficiently. Even a reweighted index may fail to satisfactorily account for changes in resource usage if farmers significantly alter their usage of items which are not or cannot be fully included in the index of prices paid.

Surely any productivity gains available to Australian producers will also be available to American producers. Thus, differential productivity gains seem an unlikely explanation of the relative movements in the ratio of prices paid and received by farmers. However, as the level of farm technology has been consistently higher in the US, further increases are relatively more difficult to achieve. This suggests that any productivity gains by Australian farmers are a catching up process.

The other possibility and perhaps the most likely one, is that Australian farmers are more easily able to switch between products in response to changing market conditions than the more highly specialised American farmers. Australian farmers produce basically three commodities: wheat, wool and meat, and few if any farmers produce only one commodity. Thus, if wheat prices rise farmers may increase their acreage of wheat and cut back on the number of livestock carried. American farmers lack this flexibility partly due to climatic conditions and also as sheep play a much less significant role in US agriculture. This reduces flexibility by removing the option to switch between meat and wool production as market conditions change.

SECTION 5

Econometric models can be used to project key economic variables, as in Section 3 of this paper. However, these projections are only conditional statements indicating what would happen if the variables followed a specified trend or pattern. There are some limitations to the usefulness of the projections due to the structure of the model. For example, it is not disaggregated by region and consequently regional effects cannot be ascertained.

No projected profitability variables are available for the simulated events. A major explanatory variable in supply equations should be relative profitability. However, as already stated, no product disaggregated time series of cost data are available. Consequently it has been necessary to use price or relative price variables instead. During the 1960s when inflation was only moderate, prices were usually reasonable proxies for profitability. However, in recent years the rate of inflation has increased markedly. Further there have been substantial disparities in the rate of increase in the prices of the various agricultural inputs. This has altered the relative profitability of different agricultural products. Under these circumstances prices are not a satisfactory proxy for profits. Inability to adequately account for profitability changes means that simulations with the existing model can yield clearly implausible results. For example, with relatively stable product prices, failure to take account of rapidly rising costs results in a prediction of stable or increased product supply, rather than a contraction of supply. A project to develop suitable cost data for each product group was initiated by the authors in 1976 and preliminary results are now becoming available.

Australian farmers are heavily dependent on the overseas market. At present the agricultural module treats variables associated with the overseas sector as exogenous and the supply of exports is the excess of Australian supply over demand. A project is currently underway to model overseas influences on Australian agriculture to enable more useful projections of market demand and a better understanding of the impact of export quantities and prices.

CONCLUSION

This paper has explored the impact on the Australian economy of certain events affecting the agricultural sector, using an econometric model. Despite the limitations and difficulties mentioned, this approach enables a better understanding of the flow-on effects associated with the events analysed. It enables a critical evaluation of the conventional wisdom regarding these events, and should directly aid the development of more appropriate policies to deal effectively with undesirable aspects of these events should they occur in the future.

REFERENCES

Brain, P.J. (1977) "The Institute Multi-Purpose Model: An Outline", *Australian Economic Review*, 3rd Quarter, pp. 47–64.
Brain, P.J. and Gray, B.S. "The Australian Manufacturing Sector and the Economy – 1990", paper presented to the Conference on Trade, Growth and Structural Change in an Open Economy, Salamander Bay, Australia, November 1977.
Gregory, R.G. (1976) "Some Implications of the Growth of the Mining Sector", *Australian Journal of Agricultural Economics*, 20(2), pp. 71–91.
Miller, G. (1976) "Intersectoral Competition and Rural Prosperity", *Australian Economic Review*, 4th Quarter, pp. 29–38.
Powell, A.A. and Guren, F.H. (1966) "Problems in Aggregate Agricultural Supply Analysis", *Review of Marketing and Agricultural Economics*, Vol. 34, Nos. 3 and 4, September and December.
Smith, A.W. and Smith, Rhonda, L. (1976) "A Model of the Australian Farm Sector: A Progress Report", *Economic Record*, pp. 462–482.
Snape, R.H. (1977) "Effects of Mineral Development on the Economy", *Australian Journal of Agricultural Economics*, 21(3).

SELECTED EQUATIONS FROM THE AGRICULTURAL MODULE

(A full listing of the model is available from the authors upon request)

The figures in brackets under the coefficients are standard errors. R2 denotes the coefficient of determination adjusted for degrees of freedom ($\bar{R}^2$), DW denotes the Durbin-Watson statistic and m denotes the m-statistic.

Supply – Wheat SCWT $M (1968/71 Prices)

SCWT = –1179.598 – 0.01171WF(T–1) + 4.2250WWTY + 5.3732TIME + 9.4005WFER +
(0.0079) (0.783) (3.742) (2.695)
28.4051FPWT(T–2)/FPCC(T–2) – 0.7934WTQU
(14.896) (0.400)
R2 = 0.851 DW = 1.43 m = 1.087 ν = 21

Supply – Other Grains SCOG $M (1968/71 Prices)

SCOG = –197.505 + 6.7235TIME
(0.419)
+ 35.8353FPOG(T–1)/FPWT(T–1)
(22.835)
+ 2.7844WOGY – 1.1622WWTY + 0.2897WTQU
(0.537) (0.481) (0.103)
R2 = 0.955 DW = 1.85 m = 1.07 ν = 22

Supply – Wool SCWL $M (1968/71 Prices)

SCWL = 252.261 – 0.7798WSLD + 0.7340SCWL(T–1) – 9.8195FPWL(T–1)/FPCS(T–1)
(0.218) (0.085) (7.444)
R2 = 0.911 DW = 2.01 m = 0.116 ν = 24

Supply – Cattle SCCC $M (1968/71 Prices)

SCCC = –80.6600 + 1.1122SCCC(T–1) – 0.3955XQCC(T–1) + 0.2217XQCC(T–3) +
(0.240) (0.230) (0.114)
184.7825FPCC(T–3)/FPSL(T–3) – 169.7823FPCC(T–1)/FPWT(T–1) +
(115.510) (62.079)
166.6513FPCC(T–3)/FPWT(T–3)
(102.475)
R2 = 0.955 DW = 2.69 m = 2.24 ν = 21

Supply – Sheep and Lambs SCSL $M (1968/71 Prices)

SCSL = –14.738 + 0.7793SCSL(T–1) – 0.2351XQSL(T–1) + 0.0802WTQU
(0.136) (0.067) (0.080)
+ 47.5619FPWT(T–1)/FPWL(T–1) + 67.7043FPCC/FPWL
(8.391) (10.463)
R2 = 0.945 DW = 1.94 m = 0.47 ν = 22

Farmers' Price – Wheat FPWT (1968/71 = 1000)

FPWT = 23.9275 + 0.0710FPWL(T–1) + 0.0316XQWT + 7.0157XPCL
(0.063) (0.013) (0.777)
R2 = 0.870 DW = 1.46 m = 1.20 ν = 24

Farmers' Price – Other Grains FPOG (1968/71 = 1000)

FPOG = 615.111 + 0.563FPWT – 4.195WOGY
(0.086) (1.729)
– 403.968FPOG(T–1)/FPWL(T–1) + 0.624FPOG(T–1)
(103.155) (0.108)
R2 = 0.911 DW = 1.78 m = 0.20 ν = 23

Farmers' Price – Wool FPWL (1968/71 = 1000)

FPWL = 24.803 + 13.5791XPWL – 0.1674XQWL
(0.371) (0.126)
R2 = 0.983 DW = 2.18 m = 0.53 ν = 25

Farmers' Price – Cattle FPCC (1968/71 = 1000)

FPCC = 389.720 + 0.5118WSLD – 5.8391IFBV(T–1)/IFML(T–1) – 1.1831SCCC +
(0.360) (4.057) (0.141)
1.4238XVCC + 7.2360XPMT
(0.494) (0.855)
R2 = 0.961 DW = 0.92 m = 3.45 ν = 22

Farmers' Price – Sheep and Lambs FPSL (1968/71 = 1000)

FPSL = 1155.834 – 13.4411IFML(T–1) – 12.8657SCSL + 0.3393FPCC + 2.0961XQSL –
(6.081) (1.706) (0.240) (0.900)
62.6982FPWL/FPCC + 162.5449FPWL/FPWT + 12.1283XPMT
(38.091) (89.109) (1.543)
R2 = 0.941 DW = 2.03 m = 0.55 ν = 20

List of other variables used in the above equations

FPCS	Farmers Price – Cattle and Sheep	Index 1968/71 = 1000
IFBV	Stocks – Frozen Meat in cold stores – Beef + Veal	Th. Tonnes
IFML	Stocks – Frozen Meat in cold stores – Mutton + Lamb	Th. Tonnes
IWF	Stocks – Wheat + Flour	Th. Tonnes
TIME	Time	Number 1948/49 = 1
XQCC	Exports – Quantity – Beef and Veal	Th. Tonnes
XQSL	Exports – Quantity – Mutton and Lamb	Th. Tonnes
XQWL	Exports – Quantity – Wool	Mill. Kg.
XQWT	Exports – Quantity – Wheat and Flour Years Ended Nov. 30	Th. Tonnes
XVCC	Exports – Real value – Beef and Veal	$M 1959/60 Prices
WFER	Wheat – Fertiliser per Hectare	Kg. per hectare
WOGY	Weather-deviations from trend–Other Grains Yield	Index Base 100
WSLD	Weather-deviations from trend–Sheep deaths	Index Base 100
WTQU	Wheat Quotas (Reciprocal of quota in tonnes* 1000000)	Number
WWTY	Weather-deviations from Trend–Wheat Yield	Index Base 100
XPCL	Export Price Index – Cereals	Index 1959/60 = 100
XPMT	Export Price Index – Meat	Index 1959/60 = 100
XPWL	Export Price Index – Wool	Index 1959/60 = 100

DISCUSSION

The authors replied to the various points raised in the discussion* as follows:

In our model, export prices are exogenous. However, export quantities, which are determined from the supply/utilisation identity, are endogenous, depending on both output and apparent domestic utilisation.

We feel that our inability to detect the influence of weather conditions on cattle and sheep output is due to the lack of adequate measures of weather conditions. Our measures of weather conditions are product specific, and it is for these two product groups that we have had the greatest problems in deriving satisfactory measures.

The lack of suitable cost data has been commented on in our paper. We believe this has its greatest effect on specific products. The aggregate farm income estimates should be reasonable. However, estimates of the net income (or revenue) of each of the product groups cannot be made.

The estimation period ends at the financial year 1976/77 (i.e. July 1976 to June 1977). This was the latest generally available data at the time the paper was written.

* No report of the discussion was, unfortunately, received by the editor.