SOME ASPECTS OF THE SUPPLY OF AGRICULTURAL PRODUCTS

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The subject of this paper is farmers' reaction to price changes; or putting it more generally what I want to discuss is how does the supply of agricultural products change when prices vary?

My excuse for addressing myself to this subject is that while there are a good many references to it in the textbooks and in the literature,[1] there appears to be lacking a discussion which lists in a methodical way the principal considerations that bear on this question.

This is what I shall try to do here. In doing so there is no need to break new ground; a good many of the relevant aspects have been discussed in different contexts by agricultural economists, and on the remaining ones all that is needed is to apply to agricultural problems some concepts long familiar to economists in other fields.

In this type of discussion three assumptions are of importance. In the first instance it is difficult to make progress with the analysis unless one assumes that farmers act on the whole rationally, dividing their time between work and leisure in response to the changing rewards to be derived from each; and in deploying the resources at their disposal so as to yield the greatest income, taking account of both short and long term considerations; and in making their choice between present and possible future income.[2]

Secondly, uncertainty about the course of future events introduces complications into the manner in which farmers respond to events generally and to price changes in particular. These complications will be assumed away in the first instance for the purpose of general

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[1] Cf esp. M. M. Cassels—"Supply and Price," *Jnl. of Farm Econ.*, April, 1933. Galbraith and Black—"Maintenance of Agricultural Production in Depression," *Jnl. of Pol. Econ.*, June, 1938. D. Gale Johnson—"The Nature of the Supply Function for Agricultural Products," *American Economic Review*, Sept., 1950. C. Gislason—"The Aggregate Supply of Farm Products," *Jnl. of Farm Econ.*, 1952. T. W. Schultz—*The Economic Organization of Agriculture*, Chapt. 14, McGraw-Hill Book Co., 1953—"Reflection on Agricultural Production, Output and Supply," *Jnl. of Farm Econ.*, May, 1956. Willard and Butz—"Output Responses of Farm Firms," *Jnl. of Farm Econ.*, Nov., 1951. W. W. Cochrane—"Supply Relations on Agriculture," *Jnl. of Farm Econ.*, Dec., 1955. Earl O. Heady—"The Supply of U.S. Farm Products under Conditions of Full Employment," *American Econ. Rev.*, May, 1955. B. J. Bowlen—"Wheat Supply Functions," *Jnl. of Farm Econ.*, Dec., 1955. Farnsworth & Jones—"Response of Wheat Growers to Price Changes," *Econ. Jnl.*, June, 1956. K. O. Campbell—"The Role of Prices and Investment on Agricultural Expansion," *Australian Quarterly*, Dec., 1952. "Supply Prospects for Wool"—*Wool and the Australian Economy*, Economic Papers No. 10, Economic Society of Australia & New Zealand, 1954.

[2] For an exposition of a contrary viewpoint—viz. that farmers aim at maximising technological efficiency rather than income—see J. M. Brewster and H. L. Parsons, *Jnl. of Farm Econ.*, 1946, p. 938.

discussion; explicit reference will be made to them in specific instances where necessary. Thirdly, problems raised by technological change will be left to one side except for some specific mentions.

There are two sources of price changes of special interest to our discussion:

1. The situation where the price of one agricultural commodity changes relatively to the price of others.
2. The situation of an agricultural slump (or boom) where agricultural prices as a whole change relatively to non-agricultural.

To begin with, we shall confine ourselves to the first case. In the process of studying it we will find that the considerations relevant to the broader problem will easily fall into place.

There are four main types of decisions the farmer has to make when confronted with a fall in the price of a product (A) which he produces.

1. Should he vary his output of commodity A (e.g. by producing less of it) and should he vary his output of other products (e.g. by producing more of them)?
2. Should he change his method of producing commodity A (e.g by using more labour, less land, more fertiliser, etc.) and/or of the other products?
3. Should he work more or less and enjoy less or more leisure?
4. Should he consume more or less of his output of commodity A and of other commodities?

The first two types of decisions are in a slightly different form familiar from the general theory of the firm as applied to industrial enterprise. As against this, decisions of the types 3 and 4 are of the sort which rarely confront the typical non-farm firm (though they could well be relevant in the case of small tradesmen or family businesses). While at first sight these latter two considerations may appear to be trifling, they are nevertheless important. We shall begin by considering them first.

Work versus Leisure

According to the usual economic reasoning, if the price of a commodity or service declines (because demand has fallen off) less will be supplied. Arguing by analogy therefore if, as a result of a drop in the price of commodity A, a farmer's income and thereby the price paid for his own labour declines we should expect, other things being equal, that he will supply less labour. Such a conclusion, however, would be fallacious for our usual economic reasoning is based on the assumption that demand and supply schedules are determined independently.

We assume that the prices of factors do not vary because they have alternative employment opportunities to which they can turn. This assumption is subject to a good many reservations about the state of competition and the homogeneity of factors of production. These need not concern us here. By and large it is true to say that if the price of

buttons declines fewer buttons will be produced and some of the people previously employed in making buttons will find employment elsewhere. But on the whole, and that is the essential point, button manufacturers will find they still have to pay much the same prices for the things they require for production as they did before the price of buttons declined. In other words, although the demand schedule has shifted the supply schedule remains where it was.

As against that, when the price of commodity A declines it is rather less certain that the farmer can withdraw part of his labour from production of commodity A and apply it in some other line of production so as to prevent his income from declining. His alternative employment opportunities on the farm, and even more so outside the farm, are likely to be considerably more restricted than is the case with the industrial worker. In deciding what to do therefore—if we may continue to look upon the problem in an analytical manner—the farmer will be influenced by two conflicting considerations. For one thing his income has declined and if he is relatively poor this may be a serious matter. In order to keep up his income (and service his debts) he may be prepared to work a lot harder in these circumstances. But on the other hand the price paid for his labour has declined, work has become less remunerative and he may be inclined to devote more of his time to leisure which has become relatively more attractive.

Altogether his reaction will depend on the intensity of his desire to maintain his income as against the strength of his inclination to engage in non-productive activities (leisure) in a situation where productive activity has become less remunerative. In economic jargon his decision will depend on the elasticity of his demand for income in terms of effort.[3] It is probably true to say that over a fairly wide range this elasticity is very low, which means that the farmer will be prepared to put in roughly the same amount of effort irrespective of the price paid for his product.

The farmer's decision as to the amount of effort he should put in is very similar to the decision the taxpayer has to make when taxation rates go up. The matter has long been one of dispute among policy-makers, some contending that people will work harder if they are taxed more and others maintaining that taxation discourages effort. There is no way of determining this question a priori. We may be reasonably certain, however, that the elasticity of demand for income is related to the level of income and is probably low when incomes are low. If poor people are taxed more they have to work harder, as will people with large families and other permanent commitments. But the effect of any given change in tax rates will depend on the distribution of income and the degree of progression in the taxation structure.[4]

There is, of course, nothing perverse or irrational in working harder and possibly producing more when prices decline. No one would say

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[3] This concept was first introduced by Lionel Robbins, cf. his "On the Elasticity of Demand for Income in Terms of Effort," *Economica*, 1930.

[4] There is reason for thinking that the elasticity of demand for income in terms of effort is itself no simple concept. It may well (like the consumption function) be related not only to present income but to past income and have different values for upward and downward movements.

that housewives are irrational because when the price of sugar goes up they tend to spend a larger proportion of their household money on sugar in an attempt to maintain their total consumption of sugar. In exactly the same way it may be perfectly rational for farmers to work harder and to produce more when prices go down so that they may maintain their income and consumption.

Substitution in Consumption

In cases where agricultural producers consume a significant part of product A (the price of which has declined) another problem arises. Should they consume less of it? This is a minor problem in Australian agriculture but may be of great significance in lesser developed economies. Take a peasant who produces rice for the commercial market and who himself (with his family) consumes say 50% of the rice he produces. Now if the price drops the family's income will drop and being poorer they may eat less and sell more of the rice they produce. On the other hand, rice has become cheaper relative to other foods and that again may cause them to consume more rice and less of other foods; and if so they will have less rice to sell.

Exactly what will happen in the short run (leaving out of account possible adjustment in the level of production) will depend on the quantitative relation between a number of variables. Given a drop in the price, the decline in the amount of rice sold (or the increase in the amount consumed by the peasant and his family) will be the greater the more responsive peasant's consumption is to price changes; the less is the variation in peasant's income arising out of a unit change in price; and the less responsive their consumption is to income changes.

In the longer period where production can be adjusted to a new price situation further considerations will apply which we shall discuss under the succeeding headings. But we may anticipate, and draw attention here to one case of interest: take a peasant producing two products, one a cash crop (say rubber), the other, say, rice, part of which he consumes himself. If the price of rubber goes up, the family income will rise and with it consumption including presumably the consumption of rice. At the same time the producer may give more attention to this rubber enterprise and less to his rice plot with a consequent decline in rice production. In this way the supply of rice to the commercial market may be drastically reduced, more being consumed on the farm and less being produced. Minor changes in relative prices can in this way lead to serious food shortages in the short run.

Substitution of Products

The questions raised under this heading are: to what extent should the farmer cut back production of commodity A if its price falls and to what extent should he substitute other products for it? Any decline in the price of a product is likely to be reflected to some degree in the price of the factors employed in its production. We have already discussed how the price of one factor (farmer's own labour) will be affected and possible repercussions of this effect. But for discussion under the present heading we shall assume that factor prices are fixed

and leave the complications due to their changes for consideration in the next section.

There are at least three processes of substitution which are open to the farmer in this situation. He can reduce the sum total of his productive effort—work less—and in this way substitute leisure for work. Or he can live off his capital and thereby substitute future output for present output. Finally he can produce another commodity, i.e. substitute production of one output for another. And naturally he can combine these three courses of action in varying degrees. We shall consider them in turn.

(a) *Less Work*

In the usual economic model which assumes production under conditions of rising marginal costs, if price declines, output is reduced to a point where marginal costs have fallen sufficiently to be again equal to the new reduced price. This model is, however, of limited practical significance to the farm firm. For one thing, farming is carried on in an economic and physical environment which is full of uncertainty and makes it difficult to achieve a perfect adjustment of marginal cost to price even if it were intended to obtain such an adjustment. But farmers faced with uncertainty frequently will not aim at achieving such an adjustment but rather to make sure that they err on the side of caution by keeping their marginal costs well below the average price. For these reasons even if the price declines it may not decline below the prevailing level of marginal cost. Moreover, to the extent that a price decline reduces the expectation of further declines (because farmers argue that prices have gone down and therefore are more likely to go up in the future) farmers may be prepared to allow the differential between their marginal cost and their price to narrow. In other words they will not necessarily try to reduce their marginal costs by lowering production even where this would be practical. In many cases, however, it will not be practical because marginal costs often tend to be constant over a fairly wide range of output. Moreover, fixed costs form a large proportion of total costs in many lines of farm production. This will mean that with marginal costs constant over a wide range of output unit cost may actually rise if production is cut back.

In a situation therefore where no alternative productive enterprise is possible there would thus appear to be no strong reason for reducing output when prices decline.

We have neglected one point so far: a farmer may genuinely prefer leisure to work and thus wish to work less when the price declines even though because of the consideration referred to he would wish to maintain the quantity of other inputs constant. But he may find that a substantial cut in production may result if the input of his own labour is reduced (because the marginal rate of substitution of other factors for labour may be very low). He may even find that substitution is not possible and that other factors will be unemployed and production decline in about the same proportion as labour input has been reduced. If in this situation the proportion of fixed cost is high and unit cost therefore tends to rise with contracting output the farmer may find the cost of additional leisure very high in terms of income foregone. This line of reasoning (as well as our previous one concerning the price of

income in terms of effort) leads to the conclusion that the amount of farmers' own labour employed in production will often not vary a great deal—or in other words that leisure will not be substituted for effort to any large extent—when prices fall.

(b) *Less Investment*

This problem arises partly from the imperfection of the rural credit mechanism. The supply of credit to farmers is often rationed (somewhat in the same way that our imports are restricted) not through the price mechanism but by an absolute limitation placed on the supply available to the individual farmer. In this way it may frequently not be possible for a farmer to carry on his operations in the most advantageous and profitable manner given the current rate of interest.[5] When income declines a farmer may thus be led to live off his capital, being unable to increase his resources by recourse to borrowed funds. Sheds and fences are allowed to fall into disrepair, machinery is run down, rotations may be shortened with a consequent decline of yields in future years. In this way present output is maintained (or increased) at the expense of future income.

The above argument, however, over-simplifies the picture. The rationing of credit is to some extent due not to factors on the side of supply but to the attitude of the farmer himself towards the incurring of debts. Past experience often predisposes farmers to put a very high premium in terms of income foregone on the security of tenure which goes with owning a large equity in one's farm. When the equity rises during times of booms or good seasons their reluctance to borrow may be reduced but at that time their need for borrowing is also reduced because of the saving available from their increased income. Similarly as the value of the equity declines during bad years their reluctance to borrow may become greater even where attractive opportunities for investment exist or where recourse to borrowed funds would avoid the need for costly disinvestment. Moreover, the supply of credit, too, tends to shrink during times of adversity partly because of reduced confidence by potential lenders and partly as a result of the general loss of liquidity which (in Australia at least) tends to accompany periods of low rural income.

Substitution of present for future income has been an important feature in Australian agriculture during the years of the depression of the 1930's. In a similar way, during years of agricultural prosperity considerable substitution of expected future income for present income tends to occur.

(c) *Other Products*

When relative prices change it will as a rule be profitable to produce a little less of the commodity for which the price has declined and a little more of all other commodities. The extent to which various

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[5] Another way of putting this is to say that the price (interest rate) at which bankers will give loans to farmers is above the current market rate of interest. When the latter rate is fixed (by law or convention) credit to farmers tends to be rationed. The important question which arises is, of course, why do bankers often regard loans to farmers as such a costly or risky business that they refuse to meet the demand at the prevailing interest rate?

possible substitute products will be expanded depends partly on the type of factors of production for which the demand has fallen off as a result of a contraction in output of the commodity for which the price has declined. By and large it seems to be true to say that in regions where mixed enterprises are customarily carried on a good deal of flexibility seems to exist. Factors in many cases can be turned from the production of one commodity to another without a great deal of difficulty. It is comparatively easy in many areas in Australia, for example, to turn from the production of wheat to the production of oats, of barley, of linseed and so on.

Nevertheless the possibilities of substitution are not unlimited. In some cases there may be no practical alternative enterprise. In others where an alternative enterprise exists the relationship between the two may be fixed in fairly rigid manner. This is the familiar case of joint supply. All that can be said in a general way is that where the proportions are rigidly fixed, when the price of one commodity falls and total supply is restricted as a consequence, the price of the other will rise somewhat. Where substitution is possible the prices of the two goods will tend to move in the same direction.

There is a way, and an important way, in which agricultural production over a wide range are both substitutes and complementary to one another. Where wheat, for example, is grown in rotation with pastures it is possible to substitute wheat for pasture by shortening the rotation. But wheat yields are related to the length and appropriateness of the rotation and the reduction in fallowing or in pasture growth will in the longer run depress wheat yields and production. In practice it has sometimes been found that the pattern of land use practised customarily has not been optimal and that, say, a reduction in wheat acreage due to a drop in wheat prices, results in wider rotation and leads to higher yields with little or no reduction in the output of wheat.

Substitution of Factors

We now come to the final of the four questions with which a farmer is confronted when the price for one of his products declines. What adjustment should he make in the combinations of factors which he employs?

The repercussions that a change in agricultural prices has on the price of the factors employed in producing it depends largely on the supply schedule of the factor. If the supply of the factor is completely inelastic, that is to say, if it is fixed, its price will be governed by the demand for it. If the price for a commodity declines there would be a tendency for the demand schedule for the factors of production used in the production of this commodity to shift downwards. The question then is: how important is this demand relatively to the total demand for the factor in question? If this demand bulks large in the total demand, the price of the factor may be sharply reduced.

Where this happens there will be scope for substitution of this factor for other factors in the production of other commodities for which it can be used. Thus if the price of wool drops and the value of grazing land goes down, it might become profitable to substitute land for other

factors in, say, dairy production by substituting grazing land for improved pastures.

The change in the relative price of factors brought about by the drop in the price of a commodity may not merely result in adjustments being made in the methods of producing the existing output of other commodities; it may lead to variations in the volume of output of other commodities. A drop in the value of grazing land may thus result in an expansion of other enterprises which are potential users of this type of land and which were not able to compete for its use with grazing enterprises at the previously existing price relationship.

Again, when income declines as a result of lower prices, and capital funds and working balances become scarce as a result of the imperfections in the supply of capital to farmers, the need may arise for rationing these funds on the farm by cutting down on cash expenditure. The input of factors of production requiring cash expenditure (e.g. hired labour, fertiliser, new machinery) will be reduced. With the relative supply of factors thus changed, different combinations of factors may have to be used to produce the existing output and, moreover, it may become more profitable to produce a somewhat different combination of outputs so as to make more efficient use of the available factors of production.

Agricultural Output during a Slump in Relative Farm Prices[6]

We have now covered in broad outline the major considerations governing farmers' decisions when faced with a change in the relative price of a commodity. It remains to say something on how farm output is affected when farm price levels as a whole change relatively to the level of non-agricultural prices. We can approach this question by examining briefly how the various considerations listed in the foregoing discussion will affect the level of rural output as a whole.

First there is the elasticity of the demand for income at low levels of farm income, such as are likely to be associated with an agricultural depression. This elasticity may be low and farmers may therefore be prepared to work harder and possibly to produce more.

Farmers' demand for their own output is not likely to be a significant feature in the Australian context. Its effect if any would appear to be indeterminate and need not detain us.

The substitution of future for present income, however, will be an important influence on the level of agricultural output as rural incomes vary. The familiar proposition that farmers' consumption expenditures tend to be fairly sticky carries the corollary that farmers' savings and

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[6] It is here intended for reasons of space to deal only with the reactions to a decline in rural prices. For the case of a boom a somewhat different analysis would be needed, because as pointed out in the text not all reactions to price changes are symmetrical. Technical innovations introduced during a boom are not necessarily abandoned during a slump; and capital consumption may sometimes occur in response to boom prices as well as during a depression. It therefore will not be true to say that the conclusion reached for the case of a slump need merely be reversed to fit the case of a boom.

Nor will the analysis in the text necessarily apply to the case where the relative price of farm output declines not because of an agricultural slump but because of a boom in the non-agricultural sector, which leaves farm incomes relatively stable.

investments expenditure tends to fluctuate heavily between booms and depressions. Combined with the effect of capital rationing and farmers' attitude to borrowing, this is likely to lead to disinvestment during a slump and after an appropriate time lag to a contraction of output.

At this point in the argument some allowance has to be made for the effect of technological change. Farm investment adds to the amount of capital available for combination with other factors thus helping to make them more productive. But it is also the vehicle by which new technologies are introduced on the farm. It makes possible the acquisition not only of more machines but also for newer and better types of machines—the adoption of improved strains of pasture, of more productive rotations and so on. Disinvestment (i.e. a reduction in capital) tends to reduce the productivity of other factors of production and at the same time slow down the pace of technological innovation. This, however, applies to the longer run. In the short run disinvestment may well take the form of greater output of crops through shorter rotations (combined with increased labour input) and of increased livestock production through overstocking and through the selling of breeding stock.

Factor substitution will, too, on the whole make for lower output. Those factors for which the supply is fixed and which have little or no alternative employment outside agriculture will find their prices reduced in line with a drop in the price of agricultural output.[7] The price of other factors comprising largely those purchased by the agricultural sector from the rest of the economy (fertiliser, fuel, new machines) will tend to decline less and there will be a tendency to economise in their use by substitution. This will apply especially in the case of factors such as fuel of which agriculture is only a minor consumer; it will apply rather less in the case of fertilisers and other factors which have few uses outside agriculture.

Because of capital rationing and the depletion of working funds this substitution is likely to be carried beyond the optimal level indicated by relative price change. Productivity, therefore, is likely to suffer and output to decline even in the relatively short run. Changing factor prices and capital rationing (as was observed in the previous section) may also prompt adjustments in the pattern of output in such a way as to use less of the factors which have become relatively dearer or whose supply to the farmer tends to be restricted by capital rationing. This, too, is likely to lead to reduced productivity and output.

Summarising we find that in an agricultural depression a few factors are likely to operate so as to maintain or possibly to raise output in the relatively short run. Other factors tend to lower output even in the short run. After some lag of time factors making for lower output are likely to become increasingly important and to outweigh those making for stable or increased production.

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[7] The opportunity cost of some factors (especially labour) will largely be determined by what happens outside the agricultural sector. If full employment prevails during an agricultural slump the supply of labour in the rural sector will be reduced and wages will decline less. This applies, too, to the price of the farmer's own labour, i.e. the price of income in terms of effort. This will be maintained to the extent that some farmers migrate to non-farm occupations.

An important consideration is the relative stability which is shown by farmers' customary consumption expenditure. This tends to set at any time a critical level which farm income must reach before there is any investible surplus. Above this level investment takes place, below it farmers' demand for income is likely to become very inelastic.

As farmers' incomes decline therefore towards this critical level investment is likely to cease and the prospects for output in the longer run will become adverse. As farmers' incomes fall below this level, effort and capital consumption may increase and so lead to a rise in output in the short term.

In the opposite case when farm incomes rise, investment will go up, innovations will be adopted more readily and more quickly and production will, after a lag, respond. It is in this way that the supply of agricultural products in the longer term tends to be responsive to price changes. But the chain of causations which tends to make the supply of agricultural products elastic in the longer run is somewhat different from that operating in other industries. When the demand for a manufactured product is expected to rise capital tends to be attracted into its production and the output of the industry expands. As against that in agriculture because of the prevalence of family farming and the (related) shortcomings of the credit mechanism any additional investment must largely come from savings out of farmers' income and it is only after higher prices have raised income thus leaving a larger investible surplus that expansion can, as a rule, proceed.

In conclusion it may be worth pointing to another type of question which lends itself to analysis along the same lines: How will the pattern of agricultural production be affected when the relative prices of factors of production change as a result of longer term trends in the non-agricultural sectors of the economy?

One outstanding development in Australia in recent years has been a very rapid rise in productivity in manufacturing industries. This development tends to raise real wages. At the same time it has been our policy to restrict by tariffs and import licensing the supply of many manufactured products and in this way to improve the incomes of domestic producers of these products relatively to other domestic income. This development, too, tends to make labour dearer relatively to other factors of production.

Wage costs thus tend to rise, thereby serving notice on actual or potential users of labour that this factor of production has now become more valuable and that its use should be restricted accordingly. Industries in which the productivity of labour cannot easily be increased may thus find themselves in a difficult position unless the demand for their product is sufficiently inelastic to enable them to pass increases in costs on to their consumers. Export industries frequently are not in a position to do this and unless they can raise the productivity of labour they may have to contract their output. This problem is likely to be most troublesome to those industries like the dairy industry where labour costs account for a large proportion of total costs.

DISCUSSION

Mr. J. H. Duloy (University of Sydney): Although Mr. Gutman's paper is a very competent presentation of the factors influencing supply, I found it a little disappointing. Mr. Gutman chose to consolidate the

existing theoretical apparatus for considering supply with all that that implies with regard to restrictive assumptions, rather than to examine some of the more dynamic elements which make up the actual supply response of farmers.

Conceding the limited objectives of the paper for a moment, there is little that I can raise in criticism of Gutman's analytical approach, except that I would have preferred a rather more explicit division of the analysis into the consideration of the income effect and the substitution effect. However, there are a couple of more down-to-earth points which I should like to make.

I feel that it is unfortunate that Mr. Gutman chose, in the main, to abstract from the effects of uncertainty of production and price. This is surely a far more relevant consideration in Australian agriculture than the effects of product consumption by the farm family which was given fairly detailed treatment. It is worth remembering that the farmer's scope for rational economic decision-making may be severely circumscribed by climatic changes beyond his control, and that, consequently, he may be more concerned with minimising losses than with maximising gains.

Price variability, however, leads to some problems more amenable to conventional economic analysis. Mr. Gutman mentioned the effects of uncertainty in leading to "informal insurance," or the leaving of a gap between the marginal productivities and the prices of factors. Uncertainty also has effects on the concept of price itself, which are worthy of mention. For instance, in so far as they behave in the rational manner prescribed by economists, farmers are concerned with expected prices for the production decisions, rather than with realised prices (of course, the prices realised in the current year are important in the formulation of expectations of next year's prices). Thus we must look at "expected price" rather than "price" when we are attempting to determine the supply response. However, farmers are accustomed to considerable year-to-year fluctuations in the prices of products and inputs, and consequently take some time before they recognise as permanent a genuine shift in demand leading to a new price level around which year-to-year changes occur. That this "recognition lag," as it may be called, exists in Australian agriculture, may be illustrated by the length of time required before the land market recognised the post-war boom in wool prices. The situation of fluctuating prices, and so on, suggests that concepts akin to those used in consumption theory by Friedman may be useful. However, for supply analysis, what we need to know is when a change in price which the farmer regards as "transitory" becomes recognised as "permanent," and consequently demanding of a production decision. It is only when this has occurred that the considerations enumerated in Mr. Gutman's paper come into operation, although in the meantime, if the price change was for instance an increase, there may well have been an increase in investment, due primarily to the additional funds made available by the price increase and the tendency of farmers to plough surplus income immediately back into the business. What comes out of all this is the rather topsy-turvy conclusion that there well may be a change in investment due to changes in liquidity induced by product price shifts, well in advance of conscious production decisions. For instance, the increased

liquidity due to the wool boom led to a big increase in the purchases of wheat machinery in spite of the fact that the increased prices for wool meant a sharp decline in the relative price of wheat!

Another way of expressing this is that farmers probably make definite *decisions* to alter production patterns only on the basis of the permanent portion of price. However, before the changed level of prices is recognised as permanent and requiring a production decision, the changed level of prices will have led to changes in farmers' incomes and hence in farm investment, with which, incidentally, the adoption of new technology is strongly associated.

Thus it may well be that some of the actions of farmers most important for future supply are taken quite outside the framework developed in Mr. Gutman's paper, and in such a way that the decisions would not be true decisions in the sense defined by Katonia in "Psychological Analysis of Economic Behaviour." This type of problem, I feel, deserved of more attention than was given it.

I was interested in the brief mention of the probable effects on primary industry of increasing labour productivity in manufacturing. Whether or not the affected primary industries, such as dairying, will be able to contract their output as Mr. Gutman suggests, will depend a lot on the mobility of the family labour which predominates in agriculture. This mobility, of course, will be strongly dependent on whether or not the rest of the economy is enjoying full employment conditions, and the type of skills required in a manufacturing industry becoming more efficient due largely to the development of a more advanced and more complex technology. Or perhaps Mr. Gutman and I are both on the wrong track here, and the problem will be more or less resolved (or postponed) not in accordance with economic considerations, but by wider and more lavish subsidies!

A final point may be to note that Schultz, in the paper referred to by Gutman, was rather pessimistic about the possibility of being able to say much of practical relevance about supply within our present analytical framework of the theory of the firm because he was able to account for only a comparatively small portion of the observed increase in supply in the United States by reference to conventional input items. Improvements in technology and in the quality of labour accounted for the rest. These items do not fit within the scope of the conventional type of analysis followed by Gutman.

Dr. F. G. Jarrett: Mr. Gutman has provided an exhaustive framework within which to consider the supply response in agriculture. This is a useful contribution in view of the importance of understanding the nature of supply changes in formulating trade policies, in particular. Mr. Gutman has helped to overcome the notion held by general economists that the response to changes in price in agriculture in the short run is zero.

The analysis could have been broadened by a consideration of alternative expectation models in situations of uncertainty, and by considering the effects upon factor prices in the case where supply increased, or was held constant.

Mr. E. A. Saxon: What constitutes "rational behaviour" in the

allocation of time between leisure and work? In view of the post-war expansion of pasture improvement and in the use of superphosphate, there may not be rising marginal costs in agriculture. In any event, the farmer was more concerned with average than with marginal costs.

Mr. C. H. Defries: There are two practical considerations which should be paid some attention.

Firstly, the behaviour of farmers is not homogeneous. In Queensland, for instance, small and large producers react differently to a fall in price. Small producers tend to produce less and finally to leave the industry whilst large producers tend to increase production. Further, many decisions are not made by farmers themselves, but by their creditors.

Mr. K. L. Kinsman: There should be further development of the models for supply response and such a model should be quantified with accurate numerical data. Estimates of the relevant elasticities should be attempted. In the final analysis, success in forecasting is the fundamental test of the validity of a model.

Mr. C. I. A. Beale: A possible decision open to the farmer not dealt with in the paper was to withhold the product from the market. I know of a group of farmers in Victoria who, during the depression, withheld wool from the market for three years.

Mr. Gutman (in reply): There are many points relevant to a study of supply response which I have excluded from my paper, because, in an analytic treatment, it is not possible to give consideration to all possible factors, and, at the same time, to produce a conclusion.

I agree with Mr. Duloy that more attention could have been given to the effects of uncertainty, and with the point he raised about investment, but not with his suggestion that the analysis would have been improved by a separate treatment of income and substitution effects.

In response to Mr. Saxon I would define rational behaviour as behaviour which pursues material interests. On the other point raised by Mr. Saxon, the average costs are of more interest to the farmer, but in analytic treatment a consideration of marginal costs is necessary.