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# LONG-TERM SUPPLY FUNCTION AND AGRICULTURAL ADJUSTMENTS IN A GROWING ECONOMY

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## I

The shape of the long-term supply function for agriculture has eluded precision so far. Efforts have been made by different authors to provide arguments for various conditions that would govern the shape of this curve. There seems to be a common agreement among authors on the major frame that the supply function is highly elastic during the period of rising prices and becomes almost inelastic during the period of low or falling prices. However, they have provided different bases for their arguments. For some years D. Gale Johnson's basis seems to have been accepted; he found the explanation for the supply function in the functioning of the factor markets. Lately, Glenn L. Johnson argues that the fixity of factors in agriculture is derived not mainly from the functioning of the factor markets but from the disparity between the requisition and disposal value of the assets.

In what follows, we follow the major framework of the analysis of the supply function. We, however, add few more considerations. To anticipate the conclusion at this stage, these considerations lead to less definite shape of the long-run supply function for agriculture. The low elasticity of supply during the low prices seems only to be the minimum condition which need not obtain most of the time. The problem of supply elasticity during the period of rising prices is more difficult to handle. It is shown that there are more evidences to show that the increasing returns to scale in agriculture become operative to a much greater extent during the period of rising prices, which may mean even a falling long-run supply curve. The considerations taken up here relate firstly to the relationship between product prices and supply shifters. It is maintained that no simple relationship is obtained. Secondly, the analysis of the factor markets, especially that of capital throws up the paradox of the capital rationing and excess capital existing side by side. This particular phenomenon has some important implications for agricultural adjustment problems. The withdrawal of labour gives rise to increasing returns to scale making labour further redundant. This is further complicated by the fact that the withdrawal of labour provides an opportunity for a section of farmers to adopt new and better technology.

We have only raised the problems and not answered them. We have drawn the material for the discussion mainly from one publication, "Agricultural Adjustment Problems in a Growing Economy."<sup>2</sup>

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1. Author is grateful to Prof. M. L. Dantwala and Prof. D. T. Lakdawala for helpful suggestions. However he owns all the errors that might have crept in.

2. Ed. by Earl O. Heady, Published by: North Central Farm Management Research Committee, Printed by: Iowa State College Press, Ames, Iowa, U.S.A., 1958.

This may in fact be treated as a review article. References given in this article when source is not indicated, refer to this publication. Page numbers in the bracket also refer to pages of this publication.

Students of the subject will find in this publication nearly all the aspects of the problem of agricultural adjustments adequately covered by experts in the respective fields. And it is this that makes this book a 'must' for all interested in the problems of agriculture especially in relation to a progressing economy. Researchers, teachers and administrators to whom the publication is especially addressed will find the reading amply rewarded not only by the issues raised and answered but also by the issues raised and not answered. In a way, the value of the book lies in the latter—the issues raised and unanswered which would provide a programme for research workers for a long time to come.

## II

## SUPPLY FUNCTION

We begin with Glenn L. Johnson's analysis of the long-term supply function.<sup>3</sup> Glenn Johnson's main contention is:

- (1) the supply function is highly elastic when farm production is to be increased,
- (2) it is much less elastic when farm production is to be reduced within a certain range,
- (3) it is again more elastic below that range.

One of the reasons, according to Glenn L. Johnson, for the particular nature of aggregate supply function is the fixity of certain resources. This fixity is due to the disparity between the MVP (marginal value product) and acquisition and salvage values of these resources. Land for instance will have less salvage value but greater acquisition value than MVP, whether product prices are rising or falling as indicated by Glenn Johnson (p. 82). Salvage value for land is the value of land for uses other than agriculture, which would be very low if large part of agricultural land is transferred out of agriculture. On the other hand, when new land is to be acquired to expand land under cultivation the cost of acquisition is much higher. The difference between the two values will be immensely big if we consider large additions or remove from the existing agricultural lands. For the most part the MVP of land will be between the two extreme values. MVP here is the present value of the expected future stream of annual MVP's. The acquisition and salvage values are for the industry as a whole. The fixity of land or disparity between the acquisition and salvage values and MVP, arises out of the fact that the alternative uses for land outside agriculture are limited, while it is a lot more expensive to reclaim new land for cultivation. What is true of land is true of other durable assets and family labour and hired labour (since industry as a whole is taken here and transfer of labour involves migration) to varying degrees.

This is not a new approach. D. Gale Johnson in his earlier writing has taken this approach.<sup>4</sup> Glenn Johnson has tried to formalise the discussion. This formalization is helpful in understanding the problem but is not helpful for prediction purposes or for estimation purposes. The major difficulty lies in estimating the magnitude of disparity between the salvage and acquisition values and MVP's of various resources. That there is fixity of certain resources is not peculiar to agriculture. Industries too face the same problem. In fact some producing units in industries plan their plants in such a way that they can cope up with the varying demand. These units do not find it difficult to cut their production when demand is low despite the fixity of the plant. The explanation of the difference in supply responses of agriculture and industries to price variations (or demand fluctuations) lies firstly in the differences in the proportion of varying to fixed resources in the two economic activities. For agriculture as a whole the disparity between the acquisition and salvage values and MVP's in the

3. Supply Function—Some Facts and Notions (pp. 74-93).

4. *American Economic Review*, 1950, p. 539, D. Gale Johnson, "The Nature of Supply Function for Agricultural Products."

downward swing of prices arises in the case of land, durable assets, labour and management. The varying factor is only the recurring expenditure on seeds, manures and repairs. What is more important is that the varying factors are not completely complementary to the fixed factors in agriculture. This is especially true about fertilizers. Fertilizers are close substitutes of land. Supply of 'land' can be reduced to the extent of reduction of fertilizers once having reached that limit further reduction will face the problem of MVP of land being higher than salvage value. Only seeds are absolutely complementary to other resources. If no expenditure is incurred on seeds then there will be no production. But by spending less on seeds the cost reduced will be proportionately much smaller. Unless, therefore, the price in agriculture is reduced (for each farmer) below the cost of seeds, the production will continue even at loss.

But the basic problem of the fixity of large amount of resources arises due to three reasons: (i) specificity of form, (ii) specificity of location and (iii) limited duration of time.

Time unit considered by Glenn Johnson is less than the life duration of a tractor, or duration required for heavy drain of soil nutrients, or large scale movements of labour both in and out of agriculture. The unit of course is different for the three and shorter the duration greater the degree of fixity. If sufficiently long duration of time is taken then the form and location specificities automatically cease to be obstacles. But for shorter duration, form specificity for 'durable resources' presents a problem: the reduction of these durable resources will be limited only to the extent of repairs and replacements. Unless prices fall so low that loss due to destruction of form utilities (of say tractors) is less than the loss in the returns caused by low prices, the reduction in tractors will not be on large scale. To put it the other way, unless the price of the alternative use of the scrap of tractor is relatively so high as to cover the loss of form utility of tractor plus the cost of constructing a new form, the transfer of tractor for use in another form outside agriculture will not be carried out.

Locational advantages arise mostly to land and labour. Presuming that no new skill is required for labour to be used outside agriculture (to avoid form specification) the labour which performs the function of manager and sometimes the owner of the specified resources derives benefit in being where it is, in addition to the wages earned. This he loses when he leaves the farm.<sup>5</sup> Much of the force of Glenn Johnson's analysis is derived from another factor which he has not mentioned. It is uncertainty. If farmers knew the time, duration, frequency and magnitude of price changes they would certainly readjust their production activity so as to maximize profits. For instance they might prefer (for no rise in cost on the whole) a tractor with shorter life if the price variations are steep and more frequent, sequence and duration of variations given. In the same manner the form of other investments (including that of land and labour) be so adjusted that their mutation will be economically less expensive. The implication of this is clear. If, for instance, the Governments declare and follow the policy of stable or rising prices, a failure on their part to support them will give rise to large scale adjustment problems in the agricultural sector. Somewhat

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5. The managerial skill of farmers is oriented in large measure to the conditions of local soils and climate.

rigorous treatment of supply function given by Glenn Johnson so far relates in a way to comparative statics. If we take the words like depression, recession, recovery and prosperity out and substitute for them rise or fall in prices with given unit for duration of time, the theory given so far can be upheld and the shape of the supply curve envisaged by Glenn Johnson can be derived. But when dynamic considerations are injected the shape of the supply curve becomes hazy and unpredictable. That is to say when we allow the free and full play of supply shifters, especially the technology (and change in the quality of inputs) the price-quantity relationship loses definiteness. This is opposite of what Glenn Johnson maintains.

Glenn Johnson's position is as under. The greater elasticity in the upper segment of the supply curve during the period of rising prices increases further if we relax the restraint of constant technology. He extends the main content of his previous analysis — *i.e.*, the 'fixed asset theory' — to apply to this situation. He argues that with the rising prices of farm products the prices of fixed assets move up. This eases somewhat the situation of capital rationing which is used by the farmer to buy additional resources. This opportunity to buy additional resources enables the farmer to exercise his choice between the existing technique and the new technique made available by research and awaiting adoption. It is contended that adoption of new techniques in whatever form requires additional resources and investment in additional resources becomes possible only during the period of high or rising prices.

This linking of the supply shifters<sup>6</sup> with the price movements is unreal. Suppose prices of farm products rise by a certain margin above the level where MVP = acquisition price on all 'fixed' resources. The shifters will now become active. With shifters active, the curve joining price-quantity equilibrium points may have price elasticity positive and very high or infinity or may be even negative. Now the relevant question is: will the shifters cease to operate as soon as the prices begin to decline? The irreversibility of supply relationship (during the down swing) envisages a cut-back in production though small. But if shifters continue to operate to the extent non-complementary variable factors can be reduced and fixed factors depreciated whatever the direction of the price movement, we get an absolutely new relationship.

Shifters are not necessarily related to price movements. Firstly, the expected rise and the expected duration of high prices influence the initiation and the rate of adoption of new techniques. Secondly, the accumulated back-log of researches will influence the amount of technological change. Thirdly, technological change will be influenced by the available system of extension, the managerial skill of the farm operator and the intra-industry communications and resource mobility. Fourthly, just as rising prices offer an opportunity to alter factor-proportions, even falling prices offer an opportunity to alter factor-proportions. This needs to be explained. By rising or falling prices we do not mean here general prosperity or depression but rise or fall of agricultural prices relative to other prices. Taking the period of declining prices of agriculture,

6. There are more than one shifter (i) technology, (ii) inter-industry reallocation of resources, (iii) risk changes. Glenn Johnson has considered them all. We discuss their relationship later. We should add to this list the improvement in quality of inputs particularly labour mainly due to the external economy provided through the Government expenditure on education.

as we know the fall in prices will result in revenue reduction, supply is assumed inelastic. Costs will be mostly unaltered or will fall relatively to a smaller extent. The managerial returns and hence the family labour income will decline. If employment opportunities outside agriculture are rising, the widening of gap between labour returns in two sectors will encourage migration. Withdrawal of labour may not result into reduction in farm output but may provide an opportunity for some who would substitute capital for labour to adopt new cost-reducing techniques.<sup>7</sup>

Besides, certain improvements are adopted even when prices are low if such improvements reduce costs. The hybrid corn came to be adopted mostly during the depression years at least in the corn belt states.<sup>8</sup> Then, the supply curve was all the while shifting to the right.<sup>9</sup>

What matters therefore is not the recorded money price of the product but the margin between the price and the cost. This can be made positive and large by the technological changes. If the life duration of the new resource to be employed is short during which the fall in prices envisaged is limited and is less than the reduction in the cost caused by the use of the new improved resource then this new resource will be put to use and new investment may be found for it either from borrowed or self-provided finance. In case of durable assets, the lower limit will be the one given by the rate of replacement of old and worn out assets. This is quite sizeable in a growing economy. And even during the period of low and declining prices this rate can be exceeded in some cases if the cost reduction consequent on adoption of new technique is sizeable, thus rendering existing asset obsolete earlier than the completion of its life span.

What can be saved of Glenn Johnson's analysis of supply function is that the supply is more easily increased than decreased from any given position. In a dynamic situation no simple price-quantity relation can be derived.

### III

#### PROBLEMS RELATING TO FACTOR MARKETS

In reality, supply function is a derived function, derived from supply functions of individual factors and the production function. And some of the difficulties originate in the factor supplies which ultimately explain the problems re-

7. Besides, as will be discussed later, due to excess capital there might be increasing returns to scale *i.e.*, reduction in per-unit cost when labour is withdrawn.

8. Grilliches, ZVI, "Hybrid Corn: An Exploration in Economics of Technological Change," p. 6. Ph. D. dissertation (unpublished), University of Chicago, 1957.

9. Harald R. Jensen gives a model in which the technological outcome depends on such factors as basic enquiry, invention, innovation and imitation. In his model, imitation depends on knowledge of credit and capital sources among other factors such as managerial ability and training, marginal utility for gains (or disutility for losses), communication, differences in goals and ends. Thus capital rationing and indirectly product prices are determinants of adoption of new technology. It omits probably one of the important determinants—the soil variety which would affect the technological possibility of adoption of a technique of production.

What is important to note is that the adoption of new technology depends on several factors beside product-prices. If, therefore, other factors are not kept constant no simple relationship can be obtained regarding product-prices and adoption of new technology.

The central point of Earnest J. Nesius' paper is that the task of extension education when production is to be restrained is much more difficult to achieve.

lating to product supply. The supply shifters, especially the technological change, discussed so far relate to production function. We may now examine factor supplies which also shift the product supplies in their turn.

The conditions of factor supplies occupy a very big chapter in the price theory. We do not intend to discuss all the conditions here. Only some problematic conditions may be noted.

- (1) There seems to be too many labourers in U. S. agriculture.
- (2) There seems to be an excess of fixed capital too.

What are the conditions that bring about these two phenomena in U. S. agriculture and what are their consequences?

### *Labour*

We have to find out whether there is an excess labour in U. S. agriculture. The excess of labour has an implication for the supply functions. If excess labour is removed the production efficiency will improve. It means that per unit cost will be reduced which in effect means shifting of the supply curve. As we shall see later the implication is still deeper, since the withdrawal of labour may result in increasing returns to scale due to excess of fixed capital. And to repeat there is also the possibility of availing the opportunity of the withdrawal of labour for introduction of better techniques of production already referred. Let us examine, therefore, conditions of excess labour and what causes them.

Regarding excess labour, D. Gale Johnson observes as under (pp. 163-172) :

- (1) The relative income of the farmworker compared with that of the factory worker was 39% in 1940 and 43% in 1955.
- (2) The comparative income of the two should be 68 : 100 if allowance is made for differences in sex ratio, age composition, labour capacity, dependency, purchasing power of income and tax payments.

This means that the present level of labour income in agriculture is much less compared to income obtainable in the alternative occupation.

It is observed that production capacity of farm labour in non-farm occupation is about 90 per cent of the earning capacity of urban residents.<sup>10</sup> During the period 1940-1956 number of agricultural workers declined from 10,890 thousands to 7,876 thousands.

D. Gale Johnson's calculations include managerial returns to self-employed operators.

Elsewhere D. Gale Johnson has examined that the conditions of monopoly (in the form of strong trade unions) do not explain the earning differential between agriculture and industry.

Regarding the causes of low earnings in agriculture sociologists take a different view. They believe those who have strong preference for farming stay be-

10. "Comparability of Labour Capacities of Farm and Non-Farm Labour," D. Gale Johnson, *American Economic Review*, Vol. 43, June 1953, pp. 296-314.



hind and accept low income. Their efficiency too is low.<sup>11</sup> Among economists at least those who have contributed to this discussion, there seems to be near unanimity about the cause, *viz.*, inadequate emigration due to lack of proper information. Except this, labour market functions smoothly. The rate of migration, for instance, is higher from low income areas 33.8 per cent against 28.0 per cent for medium and high income areas (p. 168).

D. Gale Johnson rules out two alternative remedies as not feasible: (i) to prevent flow of capital to agriculture, (ii) to prevent flow of new technology to agriculture. The latter cannot be prevented because apart from the researches sponsored by the Government sector, non-government industrial researches (*e.g.*, electricity, motor, road building machinery, drugs, chemicals) do have an impact on agricultural techniques. Capital flow is difficult to prevent because to a very large part capital requirements in agriculture are self-financed. If expectation model involving relation of migration of labour with income expected for a long time to come is set aside, then the only explanation left for explaining low labour income in agriculture is lack of proper information, and hence providing better information is the only remedy to remove excess labour. J. H. Sitterley discloses many weak links in the existing organization of employment (p. 184). C. E. Bishop points out that in North Carolina only 2% of adult members of farm operator family obtained information regarding non-farm employment during 1950 when non-farm employment was high. The data relate to low income families of South Piedmont area of the State (p. 180). According to Mervin G. Smith (p. 180) in Indianapolis 13 per cent of Negroes had accurate information, of those who migrated 76 per cent found they obtained employment more easily than they had expected. But against this, 44 per cent of those migrated were actively planning at the time of the survey to return to farm.

The human factor is unpredictable, it is sometimes more responsive to experiments and adventure, sometimes swings back with equal reaction. On account of this, in spite of these migration data we do not know what is the irreducible minimum differential income acceptable to farm families for their preference for farm life. This differential is of course to be calculated on the long term basis. As Earl O. Heady implies these calculations should include differences in the managerial abilities too. To quote, "A poor manager cannot equate real income with alternative employment opportunities even by operating 320 acres" (p. 153). It is very likely that those with low managerial ability stay behind. Between these two theses, the preference for farming thesis, and the lack of information thesis, regarding the explanation of low farm incomes relative to incomes of corresponding labour outside agriculture (implying thereby the excess labour in agriculture) the latter thesis seems more acceptable if the statistical evidence on migration and efficiency performance is to be counted. This excess labour then provides one of the potential but powerful supply shifter. Once again this shifter will depend on market organization for supply of information besides non-farm job opportunities. During the depression period, when non-farm job opportunities are few and dwindling, the excess labour in agriculture will increase, which will reduce production efficiency and raise production cost. This does not preclude the introduction of better technique because cost-reducing measures will be more welcome during depression. But these techniques will, of necessity, be

11. "Aspirations of Low-Income Farmers and their Performance and Potential for Change," Fredrick C. Fliegal, *Rural Sociology*, September, 1959.

more labour involving if they are to be widely adopted. We can quote in support the experience regarding the hybrid corn once again. This means non-reduction supply is the minimum condition which will not obtain for most time.

### Capital<sup>12</sup>

There are two conflicting phenomena that we face in regard to capital: (1) capital rationing and (2) excess of capital. On the whole one will be led to conclude that the second is more predominant than the first. But this depends on how one views the problem. Nevertheless the situation seems to contain some surprises for many economists.

Cecil B. Haver observes regarding capital rationing as under: "Productivity studies on commercial farms indicate that the marginal productivity of current expenditures and working capital investments is considerably above costs" (p. 132). Commenting on Haver's paper, Earl R. Swanson observes, "Clearly we need to develop criteria of adequacy in the credit market that would enable us to distinguish more clearly between the cases which have come to be known as internal capital rationing, on the one hand, and external capital rationing on the other." These criteria are not difficult to provide.<sup>13</sup> His comments thus endorse the general belief of capital rationing experienced by farmers.

Now it is interesting to note that Haver made following observations regarding other forms of capital: "(i) Machinery, equipment and motor vehicle investments have increased many fold in the past 15 years and no let up is indicated in the near future (p. 132), (ii) real estate returns appear to be equivalent to the cost of funds for acquiring real estate." He further observes, "the overall capital and credit market for agriculture seems to be functioning properly, closer examination indicates that institutional adjustments are needed." His major complaint is that institutional lending drives rationing from interest rate levels to non-price criteria with the result that it does not ensure the most efficient use of loans. For instance the handling of small loans would cost between 10 to 36 per cent (p. 136) and this cost should be fully reflected in the loan transactions. Institutional lendings do not reflect this cost in the interest rate. What we can sift from Haver's observations is that both the varieties of capital rationing though widely prevalent are not predominant. Rationing becomes operative more particularly for current expenditure.<sup>14</sup>

Let us examine the case of excess of capital investment. Earl O. Heady gives following data (p. 9).

Year	Productive assets per worker (Dollars)	
	Farm	Non-farm
1910 .. ..	3,370	2,060
1935 .. ..	18,470	7,140

12. I am indebted to Mrs. Tara Shukla for her suggestions and criticism regarding this section.

13. MVP > effective interest rate in case of internal capital rationing; effective interest rate > market rate of interest in case of external rationing. Effective interest rate in case of private money-lender will be that charged to individual borrower being different from that prevailing in the market for non-risk loan. In case of an institutional lender the effective rate of interest will be interest rate charged plus cost of waiting, collaterals, etc.

14. This would be surprising, because ordinarily larger the amount lent, greater the risk and greater the rationing. But higher interest rate for smaller loans for current expenditure can be explained by the fact that most of the big loans are secured loans; thus the amount of risk is greatly reduced. And this is beside the cost criterion considered by Haver.

While commenting on the table Heady mentions non-farm activity refers to industries.<sup>15</sup>

Not only the data show that the per-worker productive assets are larger but also that they have increased to a greater extent in case of agriculture compared to that in non-farm activities.<sup>16</sup>

Heady supplies another set of data which indicate the existence of excess capital in agriculture (p. 150). According to Iowa State study of Shelby-Grundy-Haig soils, fixed-asset-costs are \$2,125 and \$2,372 for 160-acre farm and 270-acre farm respectively.

James S. Plaxico in his comments on Sherman Johnson's paper (p. 55) quotes results of researches at Oklahoma A. and M. University, "that the labour and machinery supply on modal 320-acre and 640-acre north central Oklahoma wheat farms are the same."

The consequences of the excess of capital are easy to infer. In the existing situation it depresses the income on the sub-optimum farms. In a changing situation especially when labour is withdrawn from agriculture and the farms left behind are consolidated with those in operation, it leads to increasing returns to scale. Hence the withdrawal of labour instead of resulting into a shift in the supply curve to the left causes a rightward shift. The excess of labour necessitates withdrawal of labour out of agriculture but this is followed by increase and not decrease in output. The U. S. agriculture thus faces in this a grave situation difficult for immediate solution.

Imperfections in the labour markets, *i.e.*, lack of information, etc., cause excess of labour in the agricultural sector (ignoring the preferences regarding income and leisure). But what is it that causes excess of capital and how can we reconcile this condition with the phenomenon of external and internal capital rationing? This becomes a crucial question on account of the consequences observed above.

It seems the problem of excess capital has not received fuller attention probably because as Haver has pointed out investment in capital takes place only if it is profitable (p. 132). But then this is incompatible with the increasing returns to scale for the agricultural industry as a whole caused on account of excess of fixed capital.

An hypothesis can be hazarded.<sup>17</sup> The hypothesis is as under:—

$$\text{VMP}^{18} (\text{owned assets}) = \text{Cost price of (owned assets)}$$

$$\text{VMP (rented services of assets)} = \text{Cost (rental of assets).}$$

15. May be it includes small industries.

16. The trend has varied for different periods, between 1952-55 productive assets per worker decreased in agriculture but increased in non-farm activities.

17. It is based on researches in India but may hold good probably for U. S. A. too. C. H. Shah: "Problems of Small Farmers," Indian Society of Agricultural Economics, Bombay, 1958, pp. 90 and 109. "Obstacles to Grow More Food," M. B. Desai and C. H. Shah, *The Indian Journal of Agricultural Economics*, August 1950, pp. 69 and 70.

18. VMP—Value of marginal product. We take here VMP and not MVP because we analyse here the behaviour of the individual producer in a competitive industry.

In simple language this means, that the stock market and rental market for assets and asset services respectively function properly so that conditions of maximum profit can be fulfilled, that is assets are owned or hired till the value of their marginal product becomes equal to their price. But there is disparity between the value of marginal product obtained with owned assets and that obtained with hiring the services of assets.

This happens because of the time specificity of farm operations and hence would be valid even if it is assumed that rental market for fixed asset services functions perfectly. But now add imperfections to this market. Customs work is undertaken in most cases by the owners of these assets who also operate their fields. But they always would give priority to their own operations. But due to simultaneity of farmers' needs for assets, those hiring farm assets would be somewhat delayed in their operations and consequently suffer loss in production.

Further, farmers with less or no fixed assets have to make cash payments for hire charges for which they will have to borrow. This means their credit needs will be larger to that extent. The larger credit needs for current expenditure will make the credit rationing severer for them which would raise the servicing charges of credit for all operations depending on credit. This cost might be greater than the difference between cost of hired assets and owned assets (not fully utilized), if the credit is supplied through the private lenders. In case credit is institutionally supplied, the amount of credit might be severely restricted and hence the operational charges may have to be reduced with harmful consequences on production.

It is true that if the purchase of the asset is financed by borrowed capital, the credit problem will be merely shifted from short term to long term borrowings. But as is known and also pointed out in the publication (p. 132) an incredibly large part of the total equity capital on farms is self-financed.<sup>19</sup> When the earnings rise temporarily, consequent increase in savings can be utilized for investment in fixed assets because the earnings of these savings from alternative investments (open and known to rural families and convenient for them) will in most cases be less than the cost of credit required for financing the hiring of services of fixed assets for annual farm operations.

There are mutual aid arrangements too. Mostly these arrangements do not function smoothly. There is always a fear of a mid-season break-up and in case of alliance of unequals there is a lurking suspicion of exploitation of weak by the strong. Many of them would opt for individual rather than joint operations.<sup>20</sup>

The phenomenon of disparity between VMP of owned assets and VMP of hired assets can be general (*i.e.*, applicable to a large number of assets) but will have some limits. These limits are set by acuteness of time specificity of the farm operation served by the particular asset. Well for irrigation is a case in point.

19. The volume of farm mortgage loans in 1955 was at an all-time high of 802 billion dollars. This sounds high, but the total value of land and buildings was 91.3 billion dollars; thus, 91 per cent of equity was in the hands of farm owners. Also 9.8 billion dollars in non-real estate debt was outstanding while non-real estate assets were valued at 71.8 billion dollars.

20. P. S. Patel: "Problems Relating to Farm Implements and Bullocks with special reference to their Distribution, Use and Annual Cost and Investment in them." He gives this information: Out of 230 farmers interviewed, 67 farmers had mutual aid arrangements, of them 29 declared themselves being against the arrangement. The results refer to three villages of Gujarat.

In India in quite a few places a new pattern of use of a well serving several farms with the help of waterdrawing pumps and irrigation pipes—is coming into vogue. This device makes possible to meet the time specificity of irrigating crops. Besides timeliness of irrigation needs is not so rigid as farm operations for monsoon-fed cultivation. Consequently the excess capacity of wells is being rapidly reduced in India.

For U. S. there are two factors to be accounted for, *viz.*, continuous research and continuously expanding size of holding. The expansion of size provides an opportunity to employ more specialized machinery made available through continuous research. This is adopted first by comparatively larger units. This reduces cost per unit and the smaller units have to fall in line with bigger units to prevent either falling profits or increasing losses. But in the process they create an excess capacity in the assets on their farms. Yes, it is profitable to invest in these assets and hence farmers invest in them but in doing so they give rise to a new problem. The excess capacity in capital leads to increasing returns to scale and this makes withdrawal of labour ineffective and adjustment problem in agriculture more acute. The magnitude of the problem at each of these steps is not known.

How do we reconcile the two opposite market forces of capital and credit rationing and over-investment in certain assets? Without going into the detailed discussion of the equilibrium conditions, we will only indicate its nature. In case the asset, either in the form of stock or flow of services, can be obtained in perfectly divisible units it is the capital rationing that will be operative more predominantly, in case the assets are available in large indivisible units of stock the excess capacity may tend to predominate.<sup>21</sup>

Our discussion of supply function and factor market problems leads to this conclusion. If agricultural prices rise relative to other prices the supply becomes elastic due to inflow of capital and new technology, if agricultural prices fall relative to other prices the supply curve shifts to the right due to increasing returns coming into the play as a result of withdrawal of labour. Adoption of new technique is rather a continuous process only its tempo may vary. The adjustment problem is rendered acute therefore both ways. And it is probably this phenomenon which if further examined may provide an explanation for continued gap between farm and non-farm incomes in U. S. agriculture.

We have not offered a solution. Neither does the publication offer a solution. The publication has a contribution in raising several pertinent questions which will provide an agenda for research workers for quite some time.

#### IV

Thus the long-term supply function for agricultural products seems elusive. That is because most of the supply shifters are linked in no direct manner to the product prices. The technological change, an important supply-shifter, is operative during both rising and falling prices and operates in one direction—right-

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21. We should add a caution here; this analysis applies to known techniques of cultivation irrespective whether the form of asset is new or known. The remark made earlier regarding the small loans being unsecured also applies here.

ward. At the most the rate of shifting of supply due to technological change may be related to product prices, being high during high prices and low during low prices. What is true of technology is true of other shifters especially like inter-industry resource-allocation and communications and risk changes because of mutuality between technological changes and these shifters.

Functioning of the factor markets further complicates the long-term supply function for agricultural products. Functioning of the labour market in agriculture depends in a large measure on the job opportunities outside agriculture. Due to lag in the creation of non-farm job opportunities and spread of information about them among agricultural community the full speed labour-mobility is not achieved. During high prices even labour moves out of agriculture, the net effect is not the reduction of production but otherwise, due to reduction in the cost per unit of output caused by operation of increasing returns to scale. During the depression years, it is true that direction of labour mobility will be reversed, this does not prevent technological change. The increasing returns to scale on the withdrawal of labour is made operative due to excess of capital which obtains due to peculiarity of functioning of the stock and service market for capital in agriculture, there being a disparity between VMP (owned assets) and VMP (hired assets). It is difficult to prevent the flow of new technology and capital into agriculture. The remedy of excess labour and low labour incomes in agriculture lies in migration of labour. But this remedy in turn leads to cost reduction—a further shift in supply function. We start out with the problem created by the shift in the supply function and when we apply the remedy we end up with a similar situation with probably worse effect. This is one of the difficult problems of agricultural adjustment in a growing economy.

Out of this what we save of the supply function is a picture in which supply curve is continuously shifting, only its rate is high or low, and the limiting situation of no shift (and inelasticity) may obtain only during exceptional circumstances. On the other hand the high rate of outward shift is a more frequent phenomenon. In a community in which the demand does not keep pace with the supply, this phenomenon creates a grave problem of sectoral adjustment.

We have only raised the issues. Answers are much more difficult to provide.<sup>22</sup>

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22. Prof. Cochrane makes an admirable attempt to search for a workable solution for an excess supply. He nearly succeeds. Though the solution has a merit of being workable it is not a happy one since it provides only a symptomatic treatment. "Some Further Reflections on Supply Control," Willard W. Cochrane, *Journal of Farm Economics*, November, 1959, pp. 697-718.