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A Model of Optimal Resource-Transfer from Agriculture  
for the Benefit of Nonagricultural Activities

by

Mohammad Irshad Khan

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Pakistan Institute of Development Economics  
Old Sind Assembly Building  
Bunder Road  
Karachi-1  
Pakistan

about the author

Dr. Irshad Khan is a Research Economist at the Pakistan Institute of Development Economics, Karachi. He is indebted to Professor Emile Despress of Stanford University and Professor M. E. Rozen, a former Senior Research Adviser at the Pakistan Institute of Development Economics, and Dr. Azizur Rehman Khan, Research Director at the Pakistan Institute of Development Economics, for their comments on a previous draft. The author is, however, solely responsible for any errors still remaining in the paper.

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FROM AGRICULTURE FOR THE BENEFIT  
OF NONAGRICULTURAL ACTIVITIES

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INTRODUCTION

In the literature on economic development, growth of nonagricultural activities is usually taken as synonymous with economic development [4]. In this sense, economic development is, from its start, a greedy absorber of revenue. The most pressing needs for revenue arise during the early stages of economic development when the country is greatly handicapped in raising revenue either through private saving or through taxation since low per capita income results in low saving and taxable capacity [9]. The underdeveloped countries are generally characterised by a large agricultural sector which is based mainly on subsistence farming. The predominance of agricultural sector both in labour force and national income of an undeveloped country has attracted the attention of many development economists towards agriculture as the potential source of finance for the growth of nonagricultural activities [4;8;18]. Accordingly, various fiscal and nonfiscal measures are proposed to transfer resources from agriculture to the government and private nonagricultural sector to serve the purpose of economic development by financing the growth of nonagricultural activities.

The contributions made by agriculture to economic development are tied with improvements in agricultural productivity [7]. In

fact, the efforts to achieve economic growth are likely to be frustrated if increase in agricultural productivity does not keep pace with the growth of nonagricultural activities. In a developing country there is usually a great reserve of productivity in agriculture which can be tapped with modest investment of capital inputs which in turn can provide a significant finance both through providing direct finance as well as providing a market for industrial goods [4;7;8]. Improvements in agricultural productivity generate increased farm incomes and the increased farm incomes, if successfully transferred to those who invest in modern sector, contribute to economic development. The mechanism through which income transfer can be effected to benefit nonagricultural sector can take the form of increased agricultural taxes, depressed terms of trade for farmers, saving higher than investment in agriculture, taxation of agricultural goods exported abroad, and transfer of labour from agricultural to nonagricultural activities.

Many of the presently developing countries seem to have a combination of the mechanisms through which resources are transferred from agriculture to industry. The necessary transfer is not usually optimal in the sense of being efficient with respect to the growth of the economy; for, if, in the process of transfer, the agricultural marketable surplus becomes a bottleneck, the growth of nonagricultural activities will be hampered rather than promoted [17]. The purpose of this paper is, therefore, to provide a model for optimal

resource-transfer from agriculture to nonagricultural sector in the sense that agricultural marketable surplus does not become a bottleneck for the growth of nonagricultural activities. We shall try to formulate the model under the assumptions which are plausible in the context of many of the developing countries. The immediate application of this model will, however, be to the case of Pakistan.

For the purpose of definition, by optimal resource transfer we mean the maximum sacrifice which can be imposed on agriculture without retarding the growth of marketable surplus for agricultural products. In other words, whatever the mechanism of transfer adopted to generate conditions which benefit nonagricultural activities by draining resources from agriculture, it must enhance the marketable agricultural surplus.

## II. THE MODEL

We assume that a division of the economy along the line of two sectors, one engaged in agricultural activities and the other engaged in nonagricultural activities, is possible. Accordingly, we represent agricultural activities by sector A, and nonagricultural activities by sector N. In sector A, we have mostly farmers producing food and raw materials, some of which are sold to sector N for its own consumption or for export to foreign countries. In sector N, we have: (i) private producers who produce for the market within sector N, in sector A and for export to foreign countries; and ii) the

(4)

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government which collects revenue from both sectors and distributes its services between the two sectors without any regard to the proportion of its revenue obtained from the two sectors. Sector A is also the major producer of labour which it produces in excess of its own needs; Sector N's requirements of labour is in excess of labour produced in that sector. In both sectors we have consumers who consume final products of both sectors. Thus sector A needs some of the products of sector N as an intermediate and as a final good and in return provides some of its own goods for intermediate and final consumption in sector N. Sector A's relation with the foreign countries is through sector N, i.e., no direct trade between sector A and a foreign country is allowed although sector A might consume some of the goods imported from abroad.

A. Sources of Transfer

Given the above assumptions, sector A can be subjected to resource drain for the benefit of nonagricultural activities performed by sector N in five broad ways. The agents of transfer are: i) the government, ii) the domestic market, iii) the foreign market, iv) the capital market, and v) the labour market.

i) Transfer Through the Government: Since the government collects revenue from both sectors and provides its services to both sectors, a transfer of resource from sector A to N is involved if the proportion of government services received by sector A is less than the proportion in which revenue<sup>s</sup> has been collected from that

sector. It does not, however, assume a balanced budget. But, if the budget is not balanced we have to know the distribution of private saving between the two sectors. This is taken care of in the section dealing with transfer through capital market. The government collects revenue from sector A by levying taxes on land and/or income and provides services such as police and military protection, justice, road facilities, flood controls, agricultural extension, health, education and similar other services free of cost. It also provides some other services such as irrigation facilities, reclamation and drainage of land; but we assume that farmers pay for such services, i.e., they buy water from government canals, and reclaimed and drained and other improved lands from the government. Such purchases of farmers from the government are, therefore, included in the products of sector N sold to sector A and are not to be offset against taxes collected from sector A.

Let  $T_G$  be the net transfer of resources from sector A to N through the government. Then,

$$T_G = t_1Y + t_2A - G$$

where, Y is gross agricultural income in sector A; A stands for area cultivated in sector A; G represents the total government services provided to sector A free of cost;  $t_1$  and  $t_2$  are the rates of taxes on income and land, respectively. For simplification, we express all direct taxes, land revenue and agricultural income taxes, collected from sector A as a proportion of income in sector A.



Therefore, the above equation can be re-written as:

$$T_G = t^Y - G \dots \dots \dots (1)$$

where  $t = t_1 + t_2(A/Y)$ .

ii) Transfer Through the Domestic Market for Goods and Services:

The terms of trade between sector A and N are important determinants of the distribution of income between the two sectors. But they also affect the incentive to produce and sell [3;12;13]. The case for turning the terms of trade against agriculture and in favour of industry is largely based on the assumption that industry is the high saving sector and it is easier to tax industry in comparison to agriculture [16]. Hence it is not uncommon in underdeveloped countries to find a) marketing boards and export monopolies for agricultural products; b) compulsory procurement, price controls and crop licensing; c) inflationary financing of government expenditures; d) overvaluation of exchange rates; e) import controls; f) export duties on agricultural products and excise taxes on industrial goods; g) imports of United States PL-480 agricultural commodities. All these policies seem to give a lower price for agricultural goods in terms of industrial goods than what would be obtained in their absence [5;6;11;14].

Since sector A sells some of its products to sector N and buys some of the products of sector N, a resource transfer from A to N is involved if deliberate interference with the market gives less and less of N's products to sector A for a given amount of A's



market can, therefore, be identified for the purposes of measuring the magnitude of resource transfer from agricultural to nonagricultural sector through the terms of trade for the farmers.

For the purpose of estimating resource transfer, we shall take the net barter terms of trade for farmers as defined by the ratio of wholesale prices of goods that farmers sell to sector N to the wholesale prices of goods that farmers buy from sector N. By dividing the index of wholesale prices of agricultural goods sold to sector N with the index of wholesale prices of nonagricultural goods sold to sector A, we can obtain the measure of net barter terms of trade. Such a measurement has all the usual problems associated with index number. For our immediate purpose, however, we have two serious problems: 1) selection of the base year, and 2) changes in the relative productivities of the two sectors.

The quantum of resource transfer over a period of time will be overestimated or underestimated depending upon the year which is selected as the base year. If the base year happens to be the year in which agricultural prices relative to nonagricultural prices were the highest, then the resource transfer will be overestimated; it will be underestimated in the reverse case. Since we shall not be making any direct estimate of indirect taxes on goods bought by farmers, we implicitly assume that these taxes shall be reflected in the terms of trade. Therefore, our problem is to select that year as base year in which the prices of agricultural and nonagricultural

goods are truly market determined, that is, no forces other than demand and supply acted to determine the relative prices as seen by the consumers and producers in the two sectors. Such a year is hard to find in countries like India and Pakistan where markets are subject to various governmental controls and regulations of a permanent nature. Some adjustments can, however, be made to make the base year free of controls, regulations and indirect taxes.

One should make adjustments for the changes in the relative productivity of the two sectors. If productivity in sector N is rising faster than that in A and farmers are still subjected to greater and greater depressed terms of trade facing them, then the resource transfer will be much more greater than would be in the case in which farmers' productivity is rising faster than that in the nonagricultural sector. To take account of this, we multiply the net barter terms of trade for farmers with the ratio of the index of productivity in sector A to that in sector N. Thus, the constant relative productivity terms of trade ( q in Equation (2) ) for farmers is defined as<sup>1/</sup>,

$$q = ( P_A/P_N ) \cdot ( \bar{Q}_A/\bar{Q}_N )$$

where P refers to the index of wholesale prices of goods and services bought by one from the other sector and  $\bar{Q}$  to the index of productivity in the two sectors. Thus (  $P_A/P_N$  ) is the net barter

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<sup>1</sup>This is called "double-factorial terms of trade".

terms of trade for farmers in any year assuming that it was unity in the base year; and  $(\bar{Q}_A/\bar{Q}_N)$  is the relative productivity of the two sectors in any year assuming that it was unity in the base year.

Thus if the productivity in sector A relative to that in sector N has gone up and consequently the net barter terms of trade for farmers has fallen at the same rate at which the relative productivity in sector A has gone up, then there is no change in the constant relative productivity terms of trade and, therefore, no resource transfer is implied, that is, no additional sacrifice on the parts of farmers is involved. However, if the relative productivity is constant, and the net barter terms of trade for farmers is falling, then a resource transfer and sacrifice by the farmers is involved.

If relative productivity is falling and the terms of trade is also falling then a still greater transfer and sacrifice on farmers is entailed.

iii) Transfer Through Foreign Market: Some of the products of sector A are exported abroad. Such exports are usually subject to export duty. Besides, the payment for such exports are received by sector N; sector A gets paid in domestic currency. The compulsory surrender of foreign exchange earned by exports to the central bank of the country works towards a gain for sector N and a loss for sector A since sector A is usually export sector while sector N is the consumer of major portion of the imports and the scarcity price of foreign exchange is often higher than the official fixed exchange

rate. Since export duty is collected by the government and the benefit of the price of foreign exchange lower than its scarcity value accrues to importers in sector N, the export duty and the difference between the market value of foreign exchange and official fixed exchange rate involve a resource transfer from sector A to sector N. Such transfer are measured by the equation:

$$T_F = (e + r).E \quad . . . . . (3)$$

where  $T_F$  is the net resource transfer through foreign market;  $E$  is value of total exports of agricultural products;  $r$  is the exchange-rate differential; and  $e$  is the effective export duty on the export of agricultural products. The exchange-rate differential and the effective export duty are defined as follows.

Let  $r'$  be the scarcity value of a unit of foreign exchange and  $r_0$  the fixed official exchange rate. The exchange-rate differential can, then, be defined as:

$$r = (r' - r_0)/r_0 \quad \text{or} \quad r = (r'/r_0) - 1$$

The problem now is to find the scarcity value of foreign exchange ( $r'$ ). Suppose the exporters of nonagricultural goods get  $x$  per cent of the foreign exchange thus earned to import goods from abroad. Now, instead of importing goods from abroad, they sell this foreign-exchange voucher to other importers in the country at a price of  $v$  domestic currency per unit of the foreign-exchange voucher. Then, the total domestic currency received for a unit of foreign exchange will be  $r' = (x).(v) + r_0$ . Taking this to be the value for  $r'$ , the exchange-

rate differential can be written as:

$$r = x \left( \frac{V}{R_0} \right)$$

In Pakistan, such a scheme of bonus vouchers is in operation [1] and the estimation of  $r$  will, therefore, be easier there than in other countries where no such scheme is in operation. It should be noted that treating  $r'$  as the scarcity price of foreign exchange is certainly an overestimate of the value of foreign exchange. If the demand for bonus vouchers is infinitely elastic, we may safely take  $r'$  as the scarcity price of foreign exchange. But the demand for bonus vouchers is not likely to be infinitely elastic. If the demand for bonus vouchers is less than infinity, the increase in bonus-vouchers supply due to increasing the list of commodities entitled for bonus, will certainly bring down the prices of bonus vouchers and thus reduce the scarcity value of foreign exchange.  $r'$  is, therefore, a very rough approximation of the scarcity value of foreign exchange.

To define effective export duty, let  $z$  be the price of one unit of agricultural exportables after export duty paid by foreigners and  $d$  be the duty per unit of agricultural goods. Then the effective rate of duty on agricultural exports is defined to be,

$$e = (d - z + z_0) / z$$

where  $z_0$  is the price of agricultural exportables before the export duty. If the change in price after the duty is equal to the duty imposed then farmers are not paying anything to sector N. If there

is no change in foreign prices after duty, then the whole tax is collected from the farmers. If the foreign demand is completely inelastic then farmers would neither pay the duty nor would suffer any reduction in their total income ( $d = z - z_0$ ). If the foreign demand is perfectly elastic, then farmers would have to bear the full duty and their income would be reduced more than the amount of duty. In intermediate cases they bear some duty and suffer some reduction in their income ( $e$  is positive).

iv) Transfer Through Capital Market: To the extent investment in sector A falls short of savings in that sector, a transfer of resources from A to N is involved. Such transfers may occur through people in A buying bonds and securities in N or through people in A moving to N with their accumulated savings. The extent to which bonds and securities held by people in A are retired, the capital transfer to sector N from A is reduced. However, it is more plausible that holders of bonds and securities eventually move to N. Farmer's deposits in banks, post-office savings bank and other financial institutions, offset by any loans received by farmers from such financial organisations, are also transfer of capital from sector A to N. All types of capital transfer will, however, be reflected in the difference between savings and investments in sector A. Thus, denoting transfer through capital market by  $T_K$ , we have:

$$T_K = s.Y - I \quad . . . . . (4)$$



where  $s$  is the proportion of gross farm income saved and  $I$  is the gross investment in sector A on private account.

v) Transfer Through the Labour Market: The hypothesis of disguised unemployment implies the existence of surplus labour in the agricultural sector of underdeveloped countries and this surplus labour is thought to be a potential source of capital formation and labour supply to nonagricultural sector [4;8;16;18]. Since sector A is producing surplus labour and sector N is in short supply of labour, under a system of free labour as opposed to slavery, the transfer of labour from sector A to sector N involves a resource transfer embodied in the labour transferred. Sector A spends its resources in rearing and educating a child upto the age the child is grown up into potential or actual labour, moves to N. This must however, be offset by the amount which the child has contributed to sector A during the stay in sector A. The potential gain of labour transferred from sector A to sector N is also reduced to the extent the transferred labour makes remittances and gifts to sector A. It is also quite likely for persons in sector A to send gifts and remittances to sector N; the financing of education of a farmer's child in a city is also a transfer of resource from sector A, if the child does not return to the village. Let then  $T_L$  be the net resource transfer from A to N through the movement of labour from A to N such that,

$$T_L = (c - y).L - R \quad c \geq y \quad . \quad . \quad . \quad . \quad . \quad (5)$$

where  $L$  is the number of actual or potential labour moved to  $N$  from  $A$  during a year;  $R$  is the net remittances and gifts from  $N$  to  $A$ ;  $c$  is expenditure on an average labour moved to  $N$ ;  $y$  is income of an average labour earned during the presence in sector  $A$ .

$c$  and  $y$  are measured by the following formulas

$$c = \left( \sum_{i=1}^L \sum_{j=1}^n c_{ij} \right) / L \quad \text{and} \quad y = \left( \sum_{i=1}^L \sum_{j=1}^n y_{ij} \right) / L$$

where  $c_{ij}$  is the expenditure on the  $i$ -th labour in the  $j$ -th year of age lived in sector  $A$ ; and  $y_{ij}$  is the income of the  $i$ -th labour in the  $j$ -th year of age spent in sector  $A$ ;  $n$  is the number of years lived in sector  $A$ .

B. Behavioural Relations of the Model

We postulate certain behavioural functions depicting the relationships between sectors  $A$  and  $N$  as well as certain behaviour pattern within sector  $A$  which are relevant for the purposes of resource transfer from sector  $A$  to sector  $N$ . We assume that the demand for the goods of sector  $A$  consists of demand from sector  $N$  for its own use as well as for export to foreign markets. We further assume that the conditions should be such that the supply of agricultural products must fulfill this demand. This relationship is expressed in the equation:

$$S = E + X = S(q.L) \quad . . . . . (6)$$

where  $S$  is the demand for agricultural products and  $S(q.L)$  is the supply of agricultural products. Thus the supply of agricultural products is a function of the constant relative productivity terms of

trade for farmers<sup>(q)</sup> and the number of people moving to sector N from sector A<sup>(L)</sup> is positively related with both q and L; the higher the terms of trade for farmer's the higher the incentive to market their products and, assuming constant terms of trade, the more the people move out of sector A, the higher the marketable surplus would be.

The demand for agricultural products comes from the use of agricultural products in sector N as well as from the export demand. We assume that the export demand is given and, therefore, it is exogenous in our model. The demand which originates from the use of agricultural products in sector N is, however, dependent on the terms of trade (q) as well as the output in sector N(y).

Thus:

$$X = X(q, Y) \dots \dots \dots (7)$$

This demand is a decreasing function of the terms of trade for farmer's and an increasing function of the income in sector N.

We assume that the labour moving out of sector A is motivated by the wage differential between the two sectors. Sector N is the high-wage sector because of high marginal productivity of labour in that sector; sector A is the low-wage sector because the marginal productivity of labour in that sector is low. Movements for non-pecuniary reasons such as charm of the city life may occur; but we shall ignore such factors in calculating wage differential between the two sectors largely because of the difficulty of quantifying them.

Thus, our labour movement function is:

$$L = L( w ) \dots \dots \dots (8)$$

where  $w$  is the wage differential between the two sectors; it is measured as follows: Suppose  $w_A$  is the wage rate for labour in sector A and  $w_N$  is the wage rate in sector N, both measured in terms of nonagricultural goods, then  $w = (w_N - w_A)/w_A$  or  $w = (w_N/w_A) - 1$ .

We assume that the wage rate in sector N is equal to the marginal productivity of labour in that sector but that the wage rate in sector A is institutionally determined and fixed because of existence of surplus labour [4].

We measure the income in sector A in terms of the products of N. Then the income in A is simply the output of that sector multiplied by the terms of trade. Thus:

$$Y = q.Q \dots \dots \dots (9)$$

where  $Q$  is the physical output in sector A.

The productivity in sector A as measured by output per labour is assumed to depend on the current/capital/labour ratio or more generally on current/capital-input/labour ratio in agriculture. Current/capital-input includes fertilizer, improved seeds imported from abroad or grown at special farms at home, water purchased from government canals, pesticides, etc. The productivity in sector A is also affected by the level of fixed capital in agriculture. Fixed capital-inputs include farm tools and machinery, irrigation facilities

built by farmers (wells and tubewells), land (both existing and new) improvements through drainage and clearance. Thus, most of the fixed and current capital inputs are to be provided by sector N to sector A. A shift in the productivity function occurs when the level of gross fixed capital inputs rises such that net investment by farmers becomes positive or when the government provides growth type services to the farmers free of cost. Growth type services provided by the government are flood control, extension services and education which are reflected in government expenditure in sector A. Fixed capital inputs depend on the level of investment by the farmers. We assume that gross fixed capital inputs in sector A are at the level where net investment is zero and government development type services are infinitesimally small in relation to the size of the agricultural sector so that any small change in it does not have any appreciable effect on the productivity in sector A. Then, the productivity function in sector A may be defined by the equation:

$$(Q/L_A) = Q(k) \quad \text{Q, the physical output in A.}$$

where  $k$  is the current capital-input/labour ratio in agriculture and  $L_A$  is the labour force available to sector A. This productivity factor may be multiplied by a shift factor  $\lambda$  to show the effect of fixed inputs and governmental expenditures on the level of productivity. We assume that  $\lambda$  is unity at the moment and cannot be increased significantly unless there is a big jump in net investment in agriculture and governmental development expenditures in the rural

areas. Then, the functional form for total output in A is:

$$Q = L_A \cdot Q(K) \dots \dots \dots (10)$$

Now we have to make an estimate of  $L_A$ . We assume that whatever labour is left in sector A after the movement of some labour to sector N each year, is employed in sector A irrespective of its marginal productivity because of the family farm enterprise. Hence  $L_A$  is the residual of total labour available in sector A minus the labour transferred to sector N. Thus:

$$L_A = p(N_A - L) \dots \dots \dots (11)$$

where  $N_A$  is the total number of population in A; p is the proportion of the population in A which is member of the labour force.

Finally, we add one more equation or identity which sums up the total resource transfer from sector A to sector N through various agents of transfer. Denoting total net resource transfer from sector A to sector N by T, we have,

$$T = T_G + T_D + T_F + T_K + T_L \dots \dots \dots (12)$$

Now our model is complete with twelve unknowns and twelve equations. The unknowns or the endogenous variables of the model are:

- T,  $T_G$ ,  $T_D$ ,  $T_F$ ,  $T_K$ ,  $T_L$
- Y, X, L, S, Q,  $L_A$

In this model we have eight more variables which are exogenous or given from outside the system. These exogenous variables include

four policy variables and four variables which are not manipulatable by policy. These variables are:

G, q, w, k : policy variables

E, I,  $N_A$ , Y : not controllable by policy.

In addition to four policy variables we have four policy parameters.<sup>2</sup>

These parameters are;

t, e, r,

There is no need to explain why G, t, e, and r are policy controlled. But policy control on q, w and k needs some explanation. We say that the terms of trade for farmers can be and are usually affected by government policies. The government is usually in a position to fix prices for agricultural commodities and to procure their supplies at a fixed price. In many underdeveloped countries, the government operates extensively in the market for agricultural commodities; it buys agricultural commodities when prices are down and decumulates stocks when prices are up to depress them. Similarly, minimum-wage legislation and other practices keep a significant gap in wage rate between rural and urban sectors. The provision of current capital-input is also dependent on policy since it is the government which decides about fertilizer import and production at home, seed multiplication, digging of canals and

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<sup>2</sup>There will be more parameters when we specify the form of the behavioural relations. These parameters, however, are not policy parameters.

selling of water to farmers at policy determined water rate, and so forth.

Since our basic purpose is to find out the net resource transfer from sector A to sector N, we shall try to solve the system such that net resource transfer (T) is given in terms of the known parameters or variables of the system. We now proceed for such a solution. By substitutions we obtain the following equations:

$$T_G = t \cdot q \cdot \sqrt{N_A - L(w)} \cdot p \cdot Q(k) - G \dots \dots \dots (13)$$

by substituting Equations (8), (9), (10), (11),  
(12) and (1)

$$T_D = (1 - q) \cdot X(q, Y) \dots \dots \dots (14)$$

by substituting Equations (2) and (7)

$$T_F = (e + r) \cdot S \sqrt{q, L(w)} - X(q) \dots \dots \dots (15)$$

by substituting Equations (3), (6), (7)  
and (9)

$$T_K = s \cdot q \cdot \sqrt{N_A - L(w)} \cdot p \cdot Q(k) - I \dots \dots \dots (16)$$

by substituting Equations (4), (9), (11),  
(10) and (8)

$$T_L = (c - y) \cdot L(w) - R \dots \dots \dots (17)$$

by substituting Equations (5) and (8)

$$T = q \cdot (t + s) \sqrt{N_A - L(w)} \cdot p \cdot Q(k) + (1 + q - e - r) \cdot X(q, Y) \\ + (e + r) \cdot S \sqrt{q, L(w)} + (c - y) \cdot L(w) - (G + I + R) \dots \dots (18)$$

by substituting Equations (13), (14),  
(15), (16) and (17)

Thus, from Equation (18) we can estimate the net resource transfer from sector A to sector N in any given year. Since t, s, e, r, c, and y are constant known parameters,  $N_A$ , R, I and Y are given variables, we estimate T by specifying the value of the



policy variables,  $w$ ,  $k$ ,  $q$  and  $G$ , assuming that functions are known. We can also estimate  $T$  under the changing assumptions of the policy parameters,  $t$ ,  $e$ , and  $r$ . In addition, we can show the efficiency of the mechanism of resource transfer by calculating  $T$  under various combination of the policy variables and parameters and seeing its effect on the generation of agricultural marketable surplus in relation to the demand for agricultural products both for  $N$ 's use and for export.

As we see, Equation (18) has five parts, which can be labelled as production part, industrial demand part, agricultural marketable surplus part, human capital (labour) producing part, and a constant offsetting part. The production part ( $P$ ) is denoted by:

$$P = q.(t+s)(N_A - L(w)).p.Q(k) \dots \dots \dots (19)$$

the industrial demand part ( $D$ ) is given by

$$D = (1+q-e-r).X(q,Y) \dots \dots \dots (20)$$

the agricultural marketable surplus part ( $M$ ) is expressed by

$$M = (e+r).S(q,L(w)) \dots \dots \dots (21)$$

the human capital producing part ( $H$ ) is represented by

$$H = (c-y).L(w) \dots \dots \dots (22)$$

and the constant offsetting part ( $C$ ) is denoted by

$$C = (G+I+R) \dots \dots \dots (23)$$

Assuming that  $C$  is constant over time, the interesting variables are:  $P$ ,  $D$ ,  $M$ , and  $H$ . Since  $N_A$  is always more than  $L(w)$ , for it is not possible to transfer labour from sector  $A$  which exceeds

the available number of people in that sector,  $P$  is positively related to  $q$ ,  $t$ , and  $k$  and negatively related to  $w$ . Likewise,  $D$  is negatively related to  $q$ ,  $e$ , and  $r$ ;  $M$  is positively related to  $e$ ,  $x$ ,  $q$ , and  $w$ ;  $H$  is positively related to  $w$  since  $c$  is more than  $y$  and becomes zero when  $c = y$ . Thus, it seems that  $t$  is the only parameter or variable with which resource transfer is positively related. We can, therefore, say unequivocally that  $t$  is, in terms of the direction but not the magnitude of resource transfer, the most efficient method of transferring resources from sector A to sector N, aside from any political and administrative difficulties. There is no such clear-cut conclusion with respect to  $q$ ,  $e$  or  $r$ . If  $t$  is restricted to certain minimum value due to political reasons, then the most efficient way of transferring resources from sector A to sector N is by increasing  $k$ , the current capital-input ratio in agriculture. Incidentally, if  $t$  is not constrained, then  $k$  is the only variable which, if increased, enhances the effectiveness of  $t$  in transferring resources from A to N. The important conclusion derived from this brief discussion is that taxation is the most efficient method of transferring resources ( in terms of direction of transfer ) from A to N and capital-input per unit of labour in agriculture helps to enhance the efficiency of taxation.

C. Efficiency of the Transfer Mechanism with respect to the Generation of Agricultural Marketable Surplus

There are several possible combinations of the policy variables under which same amount of resource transfer can be affected with

varying amounts of agricultural marketable surplus. From the efficiency point of view, our problem is to pick that resource transfer which leaves the optimum agricultural marketable surplus unaffected. By optimum marketable surplus we mean that amount of agricultural supply which will be equal to the export demand plus the demand from domestic industrial sector for the products of sector A. Although there are many interesting cases which can be analysed, we limit ourselves to four cases which are relevant to practical and policy purposes.

i) Terms of Trade and Taxation: Any constant sum of resources of sector A can be transferred to sector N by increasing tax rate with increasing terms of trade for the farmers or by decreasing tax rate with decreasing terms of trade for farmers. In other words, the higher the  $t$  the higher the  $q$  should be to leave  $T$  unchanged. In Figure 1, the straight lines marked with  $T$ 's show such constant resource transfer under various possible combinations of  $t$  and  $q$  in Quadrant I. In Quadrant II, we measure the supply of agricultural goods at various levels of terms of trade for farmers. Against this supply we place the total demand for agricultural products at various levels of terms of trade for farmers. Quadrant III measures the level of labour moving out of agriculture and the release of marketable surplus associated with that movement. The curve relating  $S$  to  $L$  shows that  $S$  is an increasing function of  $L$ .  $L$  is here given as determined by the wage differential. Looking from the origin,

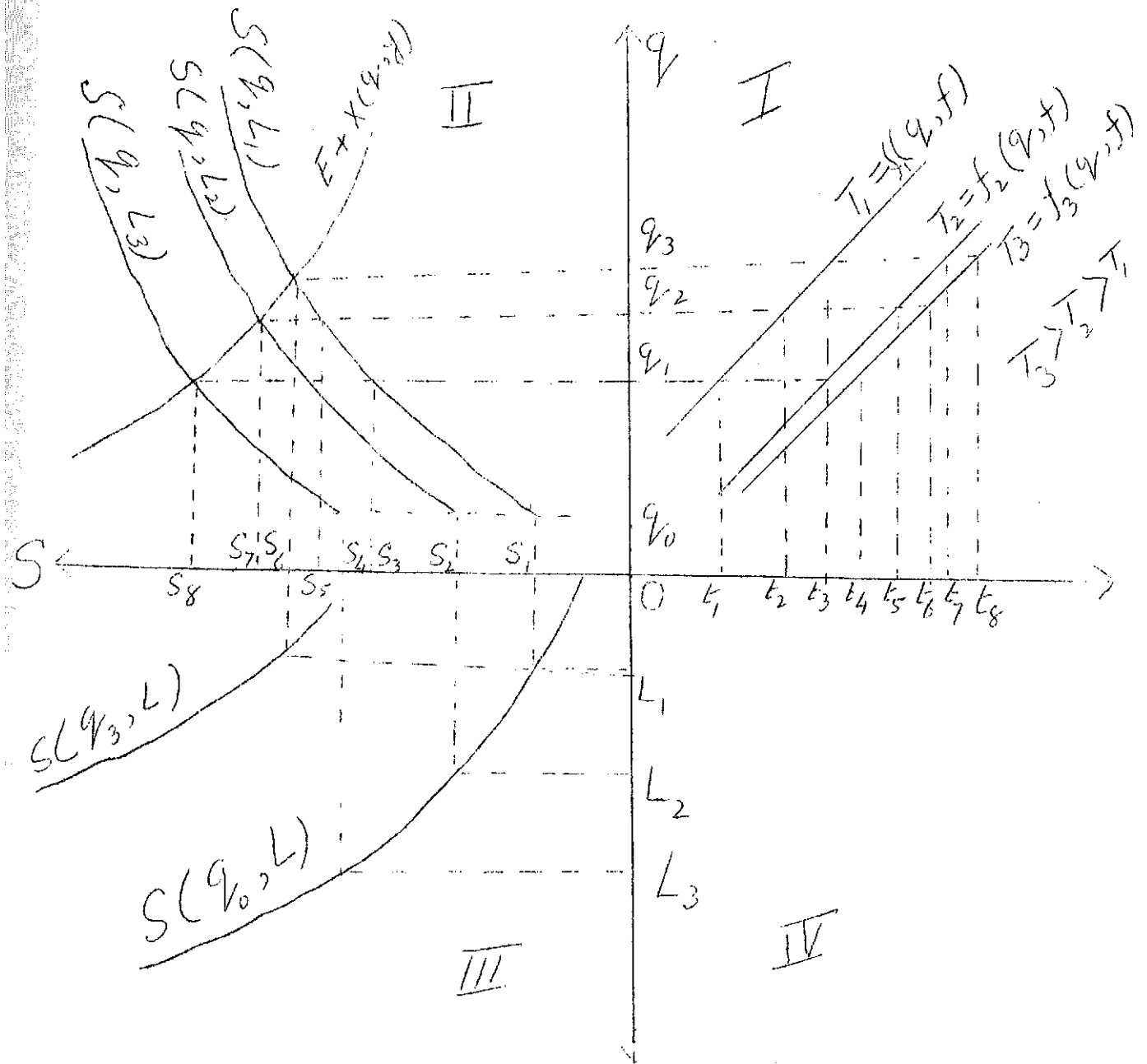


Figure 1. Terms of Trade for Farmers and Direct Taxation.

this curve will shift down and to the right through time due to increasing productivity and commercialization of agriculture. Suppose  $L_1$  number of labour is forthcoming. The supply curve for agricultural products will then be given by a curve like  $S(q, L_1)$ . If the demand for the agricultural products is given by  $X(q, Y) + E$ , then the demand and supply will be in equilibrium with terms of trade for farmers given by  $q_3$ . A transfer of  $T_1$  resource can be affected with a tax rate of  $t_3$ . However, if  $T_2$  level of resource transfer is needed, it is efficient to increase tax rate from  $t_3$  to  $t_7$  and leave the terms of trade unchanged. The same level of resource transfer could be made by depressing the terms of trade for farmers to the level of  $q_1$ ; but, then the marketable surplus will fall short of the demand for agricultural products by  $(S_8 - S_4)$ . Similar analysis with  $L_2$  and  $L_3$  number of labour moving out of agriculture will show that tax rate is the efficient parameter to raise the level of  $T$  without affecting the supply of agricultural goods which is crucial for industrialization both as raw materials and food for urban sector as well as the source of foreign exchange.

ii) Terms of Trade and Capital-Input/Labour Ratio: To obtain any constant sum of resource transfer, increasing terms of trade for farmers must be accompanied by increasing capital input per unit of labour in agriculture or lower  $q$  must be accompanied by lower  $k$ . Such a relationship is shown by straight lines marked with  $T$ 's in Quadrant I in Figure 2. Now, increasing  $K$  will release labour from

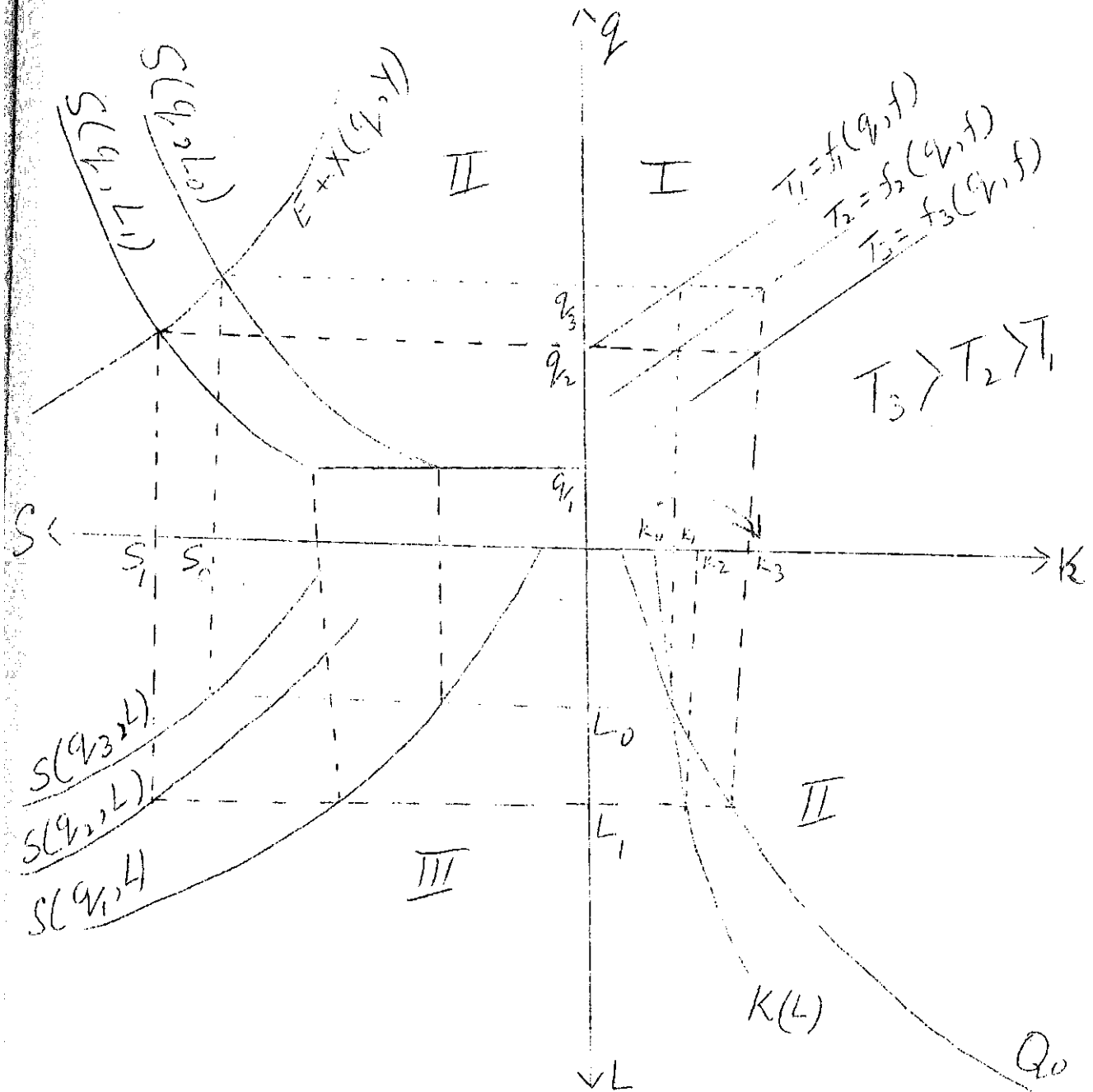


Figure 2. Terms of Trade for Farmers and the Capital input/Labour Ratio.

agriculture; the curve  $Q_0$  in Quadrant IV shows how much  $L$  can be released with increase in capital inputs per remaining labour in agriculture leaving the output in sector A constant at the level  $Q_0$ . The curve  $k(L)$  in the same Quadrant shows the variation in  $k$ , without any addition of further capital input in agriculture, upon the movement of labour out of agriculture, i.e., application of current level of capital input remains unchanged with movement of labour out of agriculture. As long as labour is redundant in agriculture, this curve will always be to the right of the curve  $Q_0$  showing the fact that increase in  $k$  with a given movement of labour out of agriculture will be more than what is needed to keep output constant. When all redundant labour is moved away from sector A, the two curves will meet each other and for a further movement of labour away from agriculture, more capital inputs are required to keep the output constant in that sector. Quadrants II and III show the same relationships as in Figure 1.

It is obvious that  $L_0$  number of labour can be removed from agriculture without any further application of capital input. With  $L_0$  forthcoming, the supply curve of agricultural goods will be  $S(q, L_0)$  and  $q_3$  terms of trade for farmers will equate the supply with the demand for agricultural products; a transfer of resource equivalent to  $T_1$  will occur from sector A to sector N, with capital-input labour ratio being  $k_1$ . If further resource transfer, say to the level of  $T_2$ , is desired, then the efficient way is not

to depress  $q$  to the level of  $q_2$  but to raise  $k$  to the level of  $k_3$ . It is not, however, necessary to increase capital inputs to achieve the full increase in  $k$ ; only increase from  $k_2$  to  $k_3$  will need additional capital inputs. In the process, terms of trade will be lowered to  $q_2$  due to increase in agricultural productivity and  $S_1$  level of agricultural goods will be demanded and supplied.

The crucial point in this analysis is how to increase  $k$ .

Since farmer is the decision maker and it is he who is going to decide how much more capital inputs he will employ on his farm,  $k$  will not increase unless the farmer is persuaded, cajoled, given incentive to or forced to do so. Better terms of trade and availability of capital inputs at the improved terms of trade would certainly have an incentive for the farmer to apply more capital-inputs. The movement of labour out of agriculture would be another factor demanding the farmer to apply more capital; but here again he would do so if he faces improving terms of trade and capital inputs are easily available. If labour is moving out of agriculture, it is therefore all the more desirable why the farmer should have better terms of trade. Hence, aside from the collectivization of farms, the only way to persuade the farmers to apply more capital inputs is to give them better terms of trade. The rise in population and income in sector  $N$  will shift the demand curves for agricultural products and the terms of trade for farmers will rise unless depressing policies are persued by the government.



iii) Terms of Trade and Effective Tax on Agricultural Exports:

By effective tax on agricultural exports we mean export duty plus currency overvaluation. Let  $f$  be the effective tax on agricultural exports. Then,

$$f = e + r$$

where  $e$  is effective export duty and  $r$  is the exchange-rate differential, as defined previously.

Any constant sum of resource transfer from sector A to sector N can be affected by low  $q$  and low  $f$  or high  $q$  and high  $f$ . Such constant resource-transfer lines are shown by T's in Figure 3 in the first Quadrant. It is likely that the terms of trade will decline with rise in effective tax rate and will improve with reduction in the effective tax rate. This relationship is shown by curves marked E's in the same Quadrant. Thus, at a lower level of exports, say  $E_1$ , both the terms of trade and effective export tax will be lower than at a higher level of exports, say  $E_2$ , because the higher the export demand for agricultural goods, the higher the terms of trade for farmers will be and, therefore, the government will have more incentives to tax agricultural exports.

Suppose the level of exports is given by  $E_1$ . Then, if the number of labour moving out of agriculture is  $L_0$ , the optimum rate of tax on export will be  $f_0$  with terms of trade for farmers at the level of  $q_2$ . However, if the exports of agricultural products shift upward, say to the level of  $E_2$ , then the optimum tax which could be

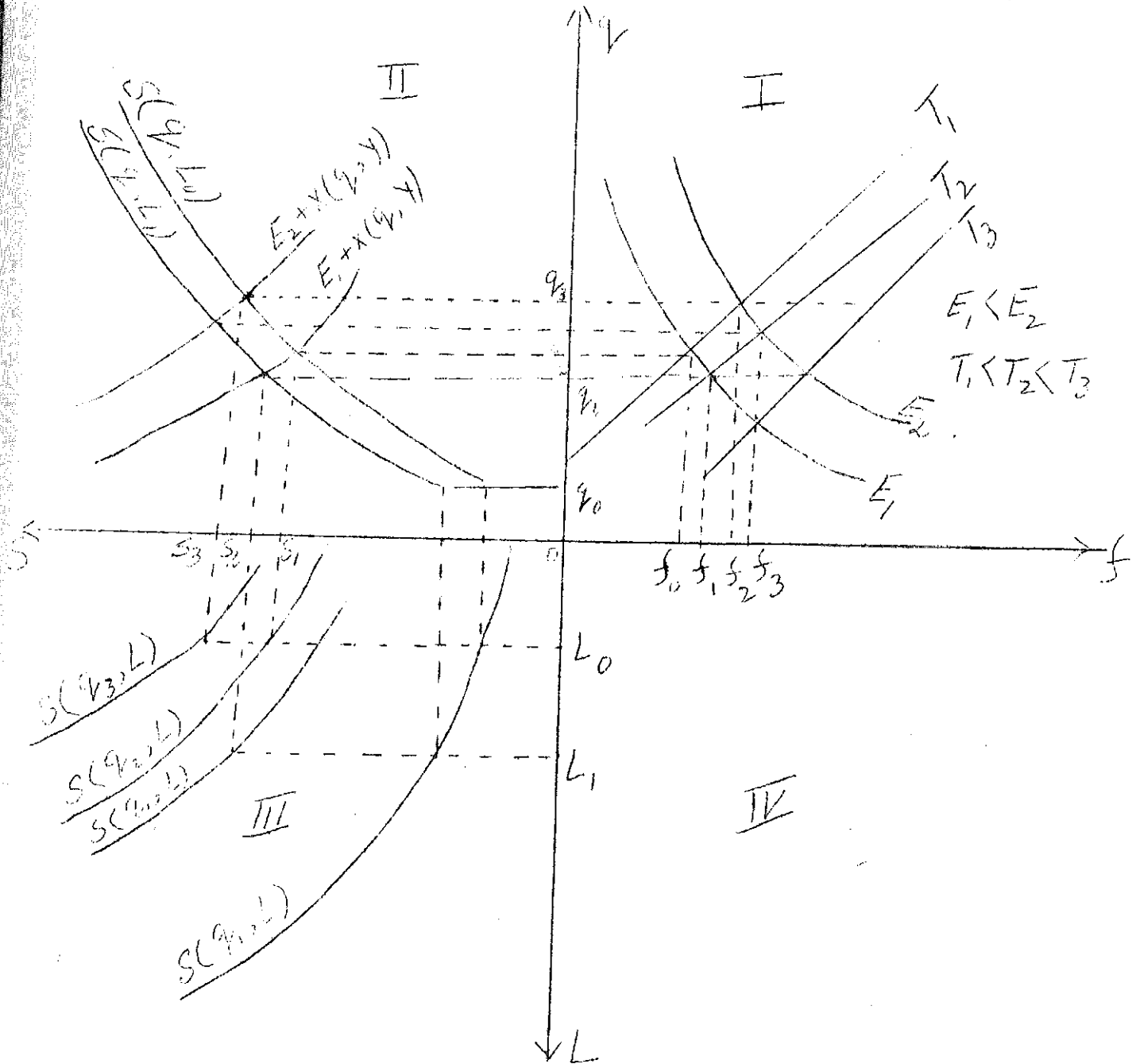


Figure 3. Trade and Taxation of Agricultural Exports.

placed on agricultural exports is  $f_2$  with terms of trade for farmers being at the level  $q_3$ . If labour moves out of agriculture at the rate  $L_1$ , then the optimum tax rate on agricultural exports could be  $f_1$  giving terms of trade for farmers at the level  $q_1$  to transfer  $T_2$  resources from sector A to sector N. Thus, we see that there is an optimum level of tax on agricultural exports and terms of trade for farmers which will generate the necessary marketable surplus and will give a constant resource to sector N from sector A. An attempt to transfer higher than that constant resource through tax on exports and depressed terms of trade for farmers will reduce the agricultural surplus coming out to the market.

iv) Terms of Trade and the Wage Differential Between the two Sectors: The higher the wage differential, the greater the tendency of labour to move to sector N, aside from any social or cultural barriers to movement. Quadrant IV in Figure 4 shows such a behaviour. The curve  $L(w)_1$  is drawn for the case where labour is less responsive to wage differential because of attachment with land or some other nonpecuniary reasons.  $L(w)_2$  curve depicts the case where labour is highly responsive to wage differential. In Quadrant I, we have the lines of constant resource-transfer at various levels of terms of trade and wage differential.

Suppose the wage differential is given by  $w_1$ . Then, if the labour is less responsive to wage differential,  $L_1$  number of labour will move to sector N and the terms of trade will be  $q_4$ ;  $T_1$

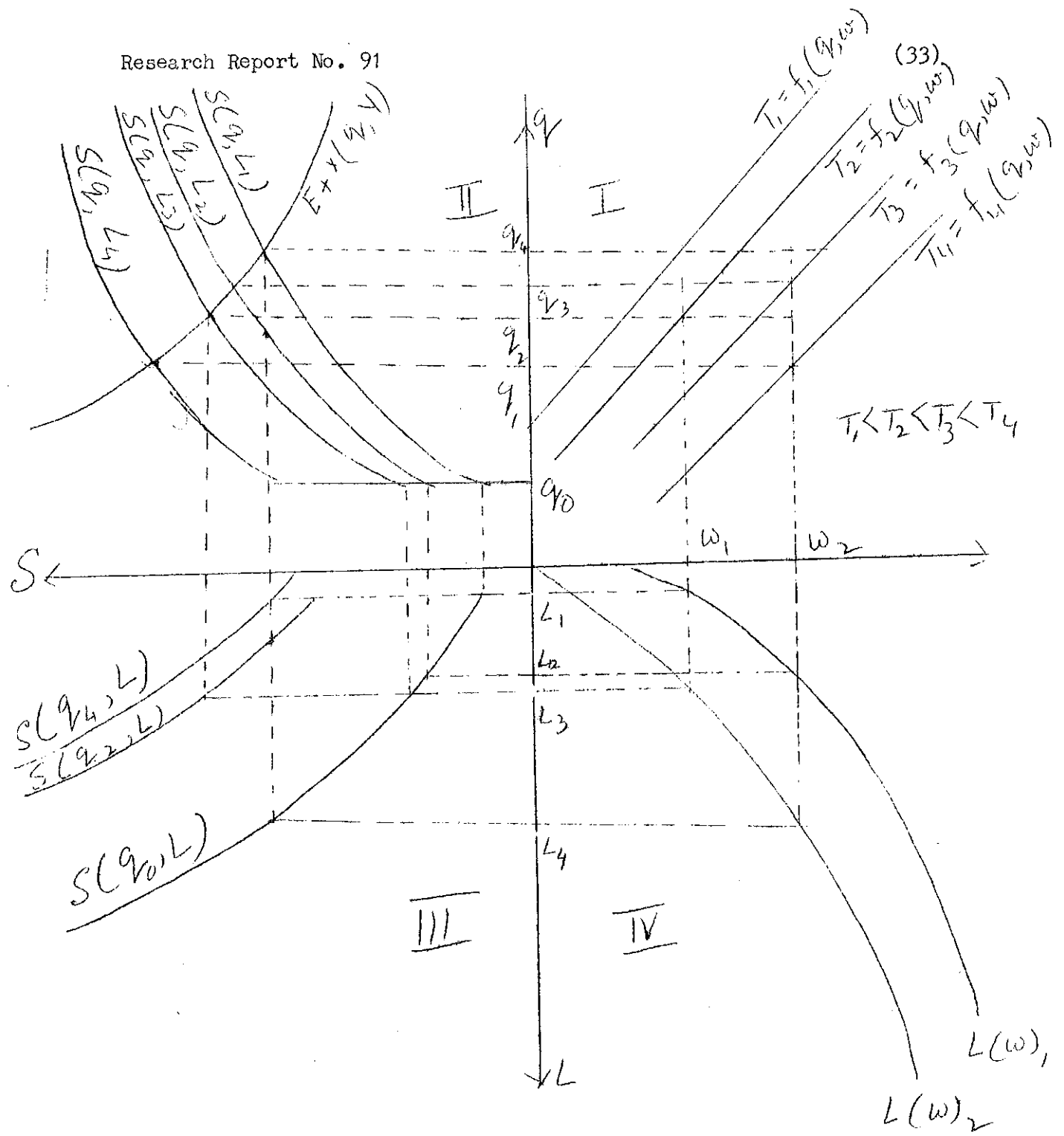


Figure 4. Terms of Trade and Wage Differential between the Two Sectors.

resource will be transferred. However, if the labour in sector A is more responsive to wage differential, then  $L_3$  number of labour will move to sector N and the terms of trade for farmers will be  $q_2$  with  $T_2$  level of resource being transferred from sector A to sector N. Similar analysis can be done with  $w_2$  level of wage differential.

Unless labour is responsive to wage differential, the terms of trade will be high for farmers if the supply of agricultural marketable surplus is not to be diminished. The terms of trade for farmers can be lowered by an improvement in the marginal productivity of labour in sector N and thereby enhancing the wage differential to attract more labour to sector N even if the labour in sector A is not highly responsive to wage differential. In case labour is highly responsive to wage differential, the terms of trade for farmers can be significantly lowered and the transfer of resources can be accelerated with improvements in the productivity of labour in sector N. Thus, we can conclude that sector N can command greater and greater resources of sector A by improving its own labour productivity.

### III - EMPIRICAL FINDINGS

We are not able to estimate all the parameters and the relations of our model because of lack of the relevant data. Therefore, it is not possible to estimate the net resource transfer from agriculture to nonagricultural sector in Pakistan. However, we shall try to

estimate the gross resource transfer through taxation, terms of trade, export duties and exchange-rate overvaluation.

In Table I, we present the total tax paid by the agricultural sector in Pakistan (land revenue plus agricultural income tax) during the period from 1949/50 to 1966/67. It can be seen that the agricultural sector of Pakistan paid about 5,863 million rupees as land revenue and taxes on agricultural income during that period, the annual average tax payment being 326 million rupees. This comes to about 2.02 per cent

TABLE I

AGRICULTURAL TAXES IN PAKISTAN  
(1947/48 to 1966/67)

Year	Land revenue	Taxes on income	Total	As a percentage of agricultural income
..... in million rupees .....				
1949/50	63.3	15.4	78.7	.671
1950/51	69.4	18.0	87.4	.726
1951/52	95.6	17.4	113.0	.892
1952/53	109.5	26.8	136.3	1.137
1953/54	121.8	45.1	166.9	1.43
1954/55	107.9	48.9	156.8	1.45
1955/56	109.1	51.5	160.6	1.38
1956/57	114.8	53.4	168.2	1.19
1957/58	204.3	63.7	268.0	1.79
1958/59	323.4	95.5	418.9	2.68
1959/60	250.2	71.1	321.3	1.90
1960/61	421.9	73.7	495.6	2.68
1961/62	261.8	86.2	348.0	1.84
1962/63	222.1	234.5	456.6	2.31
1963/64	241.7	299.4	541.1	2.64
1964/65	194.5	325.5	520.0	2.37
1965/66	248.2	459.2	707.2	3.30
1966/67	225.4	493.1	718.5	2.60
<b>Total</b>	<b>3384.9</b>	<b>2478.4</b>	<b>5863.1</b>	
<b>Average</b>	<b>188.05</b>	<b>137.69</b>	<b>325.93</b>	<b>2.02</b>

Source: [ 20 ] ✓

of the agricultural income during the same period. Hence,  $t = 0.0202$ .

S. R. Lweis Jr. and S. M. Hussain estimated the domestic terms of trade for farmers for the period from 1951/52 to 1963/64 taking 1958/59 as the base year [15]. We, however, take 1960/61 as the base year because most of the controls on the market and price of agricultural commodities were lifted by 1960/61 [10]. The Lewis - Hussain estimates, as converted to 1960/61 base, are presented in Table II. It shows that the domestic terms of trade for farmers were, on the average, 0.8321 and 0.9065 in East and West Pakistan respectively, during the period from 1951/52 to 1963/64. We therefore,

TABLE II

TERMS OF TRADE FOR FARMERS IN EAST AND  
WEST PAKISTAN DURING 1951/52 to 1962/63

(1960/61 = 100)

Y e a r	East Pakistan	West Pakistan
1951/52	84.01	94.47
1952/53	76.54	92.85
1953/54	56.55	77.90
1954/55	50.85	77.46
1955/56	69.53	82.53
1956/57	100.00	88.95
1957/58	84.00	90.03
1958/59	89.47	89.96
1959/60	93.87	90.78
1960/61	100.00	100.00
1961/62	93.65	98.84
1962/63	96.34	95.93
1963/64	92.92	98.91
A v e r a g e	83.21	90.65

Source: [15].

take  $q_E = 0.832$  and  $q_W = 0.906$  where E stands for East Pakistan and W for West Pakistan.

Table III shows export duties realized from the export of agricultural commodities during the period from 1951/52 to 1966/67. The table shows that the rate of export duty on agricultural exports averaged 0.292 per cent of agricultural exports during that period.

Hence,  $e = \frac{282}{100} = 0.00282$ .

TABLE III

EXPORT DUTIES ON AGRICULTURAL  
EXPORT FROM PAKISTAN

(1951/52 to 1966/67)

Y e a r (	Exports ( 000 )	Export duties ( 000 )	Percentage ( per cent )
1951/52	1,889,356	8,872	.47
1952/53	1,398,002	2,522	.18
1953/54	1,186,974	2,759	.23
1954/55	1,075,333	1,866	.17
1955/56	1,525,161	5,401	.35
1956/57	1,278,716	4,252	.33
1957/58	1,208,710	13,935	1.20
1958/59	1,037,422	3,756	.36
1959/60	1,226,608	3,632	.296
1960/61	1,219,612	2,248	.18
1961/62	1,376,200	2,954	.246
1962/63	1,557,800	3,447	.22
1963/64	1,540,100	3,254	.21
1964/65	1,578,800	1,154	.073
1965/66	1,604,900	1,547	.072
1966/67	1,598,300	1,299	.081
T o t a l	22,301,994	62,898	.282
Average	1,393,874	3,931	.282

Source: [19;20]



In Table IV, we present the average rate of bonus on exports and the average price of bonus vouchers during the period from 1959/60 to 1966/67. It can be seen that the average rate of bonus on exports has been about 26.12 per cent per annum during the period from 1962/63 to 1966/67. We, therefore, take  $x = 0.2612$ . On the other hand, the annual average price of bonus vouchers was 149 rupees during the period from 1959/60 to 1966/67. Thus  $v = 1.49$ . Since  $r_0 = 4.76$  (\$ 1.00 = 4.76 rupees), we estimate the exchange-rate differential ( $r$ ) to be 0.0818. ✓

TABLE IV

PRICE OF BONUS VOUCHERS AND  
BONUS RATES ON EXPORTS FROM  
PAKISTAN

(1959/60 to 1966/67)

Y e a r	₹ Bonus price (per '00' rupees)	₹ Bonus rates (percent)
1959/60	160	n.a.
1960/61	125	n.a.
1961/62	142	n.a.
1962/63	157	22.80 ✓
1963/64	153	26.19
1964/65	152	25.46
1965/66	149	27.37
1966/67	154	28.80
Average	149	26.12

n.a. means not available.

Source: [19; 20] ✓

With the help of the parameters estimated above, we can now estimate the gross resource transfer from agriculture to nonagricultural sector in Pakistan during the period from 1951/52 to 1963/64.

In Table V, we present the gross value of resources transferred from agriculture to nonagricultural sector in Pakistan through taxation, terms of trade, export duties and overvaluation of exchange rate. It can be seen that about 4.5 per cent of the agricultural income during the period from 1951/52 to 1963/64 was transferred to the nonagricultural sector. The highest transfer occurred in 1954/55 (about 7.9 per cent) while the lowest transfer occurred in 1956/57 (about 2.4 per cent). In terms of the percentage, the transfer seems to be low. But looking at the magnitude of the transfer, we can see

TABLE V

GROSS RESOURCE TRANSFER FROM AGRICULTURE TO NONAGRICULTURAL SECTOR  
(1951/52 to 1963/64)

Y e a r	Transfer from agriculture to nonagricultural sector (000 rupees)	Transfer as a per cent of agricultural income (per cent)
1951/52	557,844	4.36
1952/53	624,554	5.21
1953/54	807,448	6.92
1954/55	852,599	7.86
1955/56	729,906	6.27
1956/57	334,576	2.35
1957/58	684,464	4.59
1958/59	756,806	5.21
1959/60	623,686	3.72
1960/61	597,569	3.24
1961/62	636,681	3.37
1962/63	691,958	3.50
1963/64	865,510	4.31
Total	876,361	4.46
Average	674,125	4.46

Taxes, terms of trade, export duties and exchange rate overvaluation.

Source: Tables I-IV.

quite a substantial amount being transferred every year from agriculture to nonagricultural sector, on the average about 674 million rupees worth of resources have been transferred every year during the period of thirteen years.

The major transfer has occurred through taxes closely followed by terms of trade. The transfer through exchange rate overvaluation is also quite significant. Export duties on agricultural goods, however, contributed very little in the gross resource transfer from agriculture to nonagricultural sector. We can see from Table VI that agricultural taxes contributed 42.9 per cent of the gross resource transfer during the period from 1951/52 to 1963/64 while terms of trade for farmers contributed 40.2 per cent to the gross source transfer during the same period. About 16.3 per cent came from exchange-rate overvaluation and only 0.03 per cent came from export duties. Thus, agricultural taxes and terms of trade have been two major sources of transfer of agricultural income to nonagricultural sector.

TABLE VI

AVERAGE ANNUAL GROSS RESOURCE TRANSFER THROUGH  
VARIOUS SOURCES DURING 1951/52 to 1963/64

Source of transfer	Gross resource transfer (000 rupees)	Percent of the total (per cent)	Percent of agricultural income (per cent)
Taxes	289,100	42.9	1.91
Terms of trade	270,763	40.2	1.79
Export duties	4,530	0.7	0.03
Exchange rate	109,732	16.2	0.73
<b>T o t a l</b>	<b>674,125</b>	<b>100.0</b>	<b>4.46</b>

## IV. CONCLUSION

We have seen that terms of trade is not an efficient way of transferring resources from agriculture to industry as far as the direction of transfer is concerned. Taxation is better than terms of trade because of the absence of its direct influence on the incentive to produce. By taxation we mean only direct taxes, for, we have seen that there is an optimum tax on export beyond which taxing agricultural exports will diminish supply of agricultural goods. Taxation on land or on income or both may be increased significantly without jeopardising the agricultural marketable surplus. And, if sector N has to depend on resources from sector A for its growth, then sector N must increase its own productivity and provide capital requirements of the farmers for it is through these changes that sector N can command greater and greater resources of sector A. The effort of sector N to get terms of trade for farmers depressed without increasing its own productivity and without providing capital inputs to the farmers will ultimately hamper rather than promote the growth of nonagricultural activities. It is, therefore, highly important that the resources obtained from the farmers must be devoted to increase productive capacity of both sectors rather than to increase the standard of living in urban sector. It is not uncommon that farmers are subjected to heavy income drain through various measures and their incomes, instead of improving the productive capacity of the economy, are

utilized to provide cheap food and cheap imported goods to the urban people. This may be one of the reasons why the standard of living in urban and rural sector of a single economy is so different.

The more important question is whether taxation is a feasible alternative. The strategy of transfer of resources through indirect means, i.e., depressing terms of trade for farmers, export duties on agricultural commodities, overvaluation of exchange rates, etc., has usually been adopted where the size of sector N is small so that even if it is a high saver it cannot generate sufficient total savings. ~~Subsistence agriculture is hard to tax. That is why the~~ mechanism of resource transfer has been found to be very expedient although it creates lots of distortions and leads to a loss of efficiency in the static Pareto terms [19].

We have not been able to estimate the net resource transfer from agriculture to nonagricultural sector in Pakistan because of the lack of data. But the magnitude of the gross resource transfer ( 5,863 million rupees per annum ) shows that the farmers in Pakistan have been financing a significant proportion of investment in non-agricultural sector. The major sources of transfers have been taxes and terms of trade followed by exchange-rate overvaluation.

Can we say that farmers are worse off because of the resource transfer? we are not in a position to answer such an ethical question. We may look this transfer as a saving for the offsprings of the farmers.

By such savings the farmers help build offices, factories, highways, railroads, etc., for the use of their children who move to urban areas. And if they are willing to save for their children and are interested in urban jobs for their children then they are not worse off. However, there may be several farmers who may be worse off because they do not want to save for their children or they do not have any who will move to urban jobs. There is one clear case where the farmers will be surely worse off. This is the case where farmers' disguised saving is just a disguised consumption of the urban people. Unless farmer's savings are put to investment and to create more jobs in the urban sector, the savings are wasted from the point of view of the farmers although the urban people may be happy and well fed. Since urban people are more vocal than rural, there is a chance of subsidizing consumption bill of urban people through expropriation of rural income. But as long as nonagricultural activities are increasing in proportion or more than in proportion to the transferred resources and as long as labour is attracted to urban jobs and not simply pushed to urban areas, the chances of wastage are slight.

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