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**A General Model of Derived Demand
Linkages in a Dual Economy:
Some Structural Implications**

by
Dilip D. Dutta

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Abstract

A general model of derived demand linkages in terms of technological interdependence of both the segments - *modern and traditional* - of a dual economy is developed. After defining two types of (complementary) demand linkages - *induced and diffused*, the economic states of those segments are characterized either from production and price structures point of view or from consumption and cost structures point of view. The combinations of the economy-wide investment levels with either terms-of-trade or wage-inequality that give rise to the above states of the economy are identified under both *lower* and *higher* stages of development.

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A GENERAL MODEL OF DERIVED DEMAND LINKAGES
IN A DUAL ECONOMY: SOME STRUCTURAL IMPLICATIONS

I. Introduction

It is often argued that Lewis's (1954) classical model of development process in labour surplus *dualistic* economy¹ is basically supply oriented i.e., expansion of the modern segment is restricted only by its capital shortage, and, therefore, demand for its product has no direct role to play in its growth process as such. The importance of demand linkages between *modern* (capitalist) and *traditional*² (pre-capitalist) segments of a dualistic society or between industrial and agricultural sectors³ of an economy has been recognized by economists including Lewis (1972) himself. In the past decade, a few attempts have been made in constructing integrated models of growth and development in labour surplus dual economies especially in the classical and Keynesian/neo-Keynesian traditions. Models of Rakshit (Ch. 2 in 1982), Taylor (1982, Ch. 3 in 1983), de Janvry and Sadoulet (1983), Dutta (1985), Thirlwall (1986), Rattso (1988), etc. are some examples of such attempts.

Usually, two types of demand are considered-- technologically determined *derived* demand for intermediate/capital goods, and socially determined *final* demand for consumer goods. Although we do not rule out consumption demands within and across the segments/sectors, the 'demand linkage' in our model below will primarily reflect the production structure, and hence refers to the first type of derived demand. Such 'demand linkage' could be of either two-way or one-way depending on if technological interdependence for each other's products used as inputs exists both

¹ The main characteristic of a dual economy is that two different socio-economic-technological environments-- namely, *modern* and *traditional*, co-exist within the geographical boundary of a single nation. The details of other characteristics of such an economy are discussed by the author in Dutta (1985, pp. 53-57).

² The terms-- 'formal', 'organized', and 'regular' are often interchangeably used for the term *modern*, while the opposites-- 'informal', 'unorganized', and 'irregular' are similarly used for the term *traditional*.

³ The term 'segment' refers to the compartmentalization of a society on the basis of specific mode of production (e.g., capitalist and pre-capitalist). The term 'sector' refers, on the other hand, to the compartmentalization of any segment on the basis of either specific goods under production (e.g., capital and consumer goods) or economic activities (e.g., agriculture and industry).

way or not. In the models of Taylor (1982, 1983) and Thirlwall (1986), production in agricultural sector depends on industrial sector for intermediate/capital goods. Similar one-way demand linkage exists in the model of de Janvry and Sadoulet (1983). However, Rakshit's (1982) model assumes that non-agricultural sector's production depends on agricultural sector's surplus wage-good. Thus, these models are the examples of one-way demand linkages⁴. In **section-II** below we will develop a general (static) model of two-way demand linkages in the context of a closed dual economy. It is partly neo-Keynesian in nature because prices are determined according to some mark-ups formula, and partly neo-classical because investment level is endogenously determined by saving supply. The **section-III** first transforms the model to a fully neo-Keynesian one in that investment level is exogenously determined, and then it focuses on the general solution as well as the stability of the model. In **section-IV** attempts will be made to characterize two types of complementary linkages (*induced* and *diffused*) under different (*lower* and *higher*) stages of development. Finally, a concluding note will be provided in **section-V**.

II. An Analytical Model of a Dual Economy

In our following analysis, we will call the two segments--'modern' and 'traditional' as *advanced*(A) and *backward*(B) respectively⁵. The government or any ruling authority is assumed to have administrative control over the price and wage policies in the A-segment, and over the fixation of the mark-up rates in both the segments. The A-segment is capitalistic and predominantly industrial; it produces one type of composite good that could be used as a consumption/capital good in both the segments, or as an intermediate one in the B-segment; the prevailing wage-rate (W_A) of

⁴ It is to be noted that in these models mentioned above the modern sector uses surplus labour of the traditional sector. Since we define demand linkages in terms of sectoral interdependence on each other's products (not labour) as intermediate/capital inputs, these models are said to have no two-way demand linkages.

⁵ The terms-- *advanced* and *backward*-- are here used just for the sake of categorization of the two segments of a dual economy in terms of their material progress. This does not mean that the traditional segment is necessarily backward and the modern one is necessarily advanced from the social point of view. As sociologist Gusfield (1967) warns, tradition and modernity must not be used as polar opposites as it is widely used in a so-called *linear* theory of social change. On examining seven assumptions of this theory, he shows how this theory greatly distorts the history and variety of civilizations.

the (unskilled) workers is institutionally fixed in nominal terms. The B-segment is, on the other hand, predominantly agricultural, and producing a primary product say, corn used as wage good/cash crop; the (nominal) wage rate (W_B) is here variable, and $W_A > W_B$.

The structural phenomenon of *disguised* unemployment or the *reserve army* of surplus labour⁶ (measured in terms of full-time equivalent jobs) is assumed to exist in the B-segment as is the case in many of the developing countries. If L_A and L_B are the labour forces engaged in the production of A- and B-segments respectively, and \bar{L} is the total labour force of the economy as a whole, then $(\bar{L} - L_A - L_B)$ is the reserve army of unemployed labour force. We also assume that the production relation in the B-segment is *semi-feudal*⁷; only the landlords and the rich peasants manage to trade their marketable surplus with the A-segment. The production processes in both the segments are assumed to follow fixed co-efficient technologies, which can be justified from the short-run point of view. The B-segment is *capital constrained* and capital is here fully utilized. On the other hand, capital in the A-segment is presumed to be under-utilized. Similar to the political phenomenon of *over-staffing* that exists especially in the public sector of many of the developing countries, such a structural phenomenon of chronic excess capacity of capital services in the A-segment of our model is justifiable. This is partly because of the technical indivisibilities of many of the plant-structures, capital-equipments and machines, and partly because of the lack of effective demand that causes less thrust for induced investment. Under these circumstances, Kaleckian or neo-Keynesian mark-up pricing rather than neo-classical marginal cost pricing seems to be a more realistic description of price policies of the capitalists in the

⁶ Surplus labour is defined by Sen (1966) as 'that part of the labour-force in the peasant economy that can be removed without reducing the total amount of output produced, even when the amount of other factors is not changed.' In our present model, the reserve army of surplus labour in the B-segment is said to include the disguised and unemployed labour force of the urban informal part as well.

⁷ As Bhaduri (1973, pp. 120-21) uses in the context of Indian agrarian economy, the *semi-feudal* production relation has 'more in common with classical feudalism of the master-serf type than with industrial capitalism.' He points out four prominent features of such an economy: (a) sharecropping, (b) perpetual indebtedness of the small tenants, (c) concentration of two modes of exploitation, namely, usury and landownership, in the hands of the same economic class, and (d) lack of accessibility for the small tenant to the market.

oligopolistic A-segment and of the landlords or the rich peasants in the semi-feudal B-segment of a dual economy. Mark-ups over variable cost are found to be quite stable in the developing countries⁸ -- more so in their A-segment at least in the short-run. To note that these mark-ups are some kind of *exogenous* profit rates as distinguished from the *endogenous* profit rates in the neo-classical sense of marginal productivities.

Let X_A be the level of output-flow in the A-segment. Disregarding any possibility of inventory demand for its product, the supply (or producer) price, P_A , can be determined by some mark-up pricing formula such as:

$$P_A = (1+\tau_A)(W_A b_A + P_B a_A) \quad (1)$$

where τ_A is the mark-up over variable cost, b_A is the labour-output co-efficient and a_A is the input-output co-efficient. Let X_{BA} be the amount of the B-segment's output used as intermediate input in the A-segment and since L_A has been assumed to be the number of labourers employed in this segment, then one can write:

$$X_A = \frac{X_{BA}}{a_A} \quad (2)$$

and

$$X_A = \frac{L_A}{b_A} \quad (3)$$

Since the amount of fixed capital goods (including *infra-structure*), K_A , is assumed to be under-utilized, u_A may be *some measure of* capacity utilization in the A-segment. In fact, one can write:

$$X_A = u_A K_A \quad (4)$$

Mark-up rate for the firms in this segment remains stable at least until the capacity is fully utilized.

⁸ Taylor (1983, p. 14) cites a number of recent studies in support of the existing stable mark-ups in some of the developing countries.

Income-flows generated in the A-segment can be decomposed into three parts: wage income ($W_A L_A$), rental income ($r_A K_A$), and income to the suppliers of intermediate goods from the B-segment ($P_B X_{BA}$) so that one can get:

$$P_A X_A = W_A L_A + r_A K_A + P_B X_{BA}$$

or

$$P_A X_A = W_A b_A X_A + r_A K_A + P_B a_A X_A \quad (5)$$

where r_A is *quasi-rent*⁹ or gross return to capital services. Although return to capital seems to be some kind of residual measure in the present context, it is certainly endogenous and depends on P_B and u_A in the following way:

$$\begin{aligned} r_A &= \frac{(P_A - W_A b_A - P_B a_A) X_A}{K_A} \\ &= \tau_A (W_A b_A + P_B a_A) u_A \end{aligned} \quad (5.a)$$

The rental income of the A-segment is assumed to be spent on products of both the segments either for final consumption and/or for investment expenditure in the A-segment itself.

Because the A-segment, the B-segment is capital constrained, the existing fixed capital (including land and *infra-structure*¹⁰, K_B , in the B-segment is assumed to be fully utilized. Due to this capital constraint, employment opportunities are limited in the B-segment. Output supply is, therefore, not responsive to price or other (market) incentives at least in the short-run. In fact, a considerable portion of goods and services generated in the B-segment is basically not even meant for market at all; these are

⁹ In fact, as Kaldor (1955-56, p. 90) points out, the *quasi-rent* earned on the use of capital goods of various kinds is nothing but the *profit* in the Marshallian sense of a short-period theory of distribution. "The doctrine of the 'quasi-rent' assimilates capital as a factor of production to Ricardian land: the separate kinds of capital goods being treated as so many different kinds of 'land'. Here the problem of the measurement of capital as a factor of production does not arise ..."

¹⁰ Usually, the government provides the services of the major *infra-structural* facilities like that of irrigation, highways, railways, cold-storage, electricity, etc. to both the segments. In the present model, we assume that these services are supplied privately. The government or any ruling authority acts only as an arbitrator in fixing the wage-rate in the A-segment and mark-up rates in both the segments.

rather produced and consumed directly within the households themselves. Sustained output increase, especially in agriculture, is possible only through capital investment in land-clearing activities, irrigation, power-generation, etc. If X_B is the level of *marketable* output-flows in the B-segment, then one can write:

$$X_B = u_B K_B \quad (6)$$

where u_B is the output-capital ratio in the B-segment. The level of employment in this segment with surplus labour supply directly follows from the level of existing capital. So,

$$L_B = b_B X_B = u_B b_B K_B \quad (7)$$

where b_B is the labor-output ratio in the B-segment.

If X_{AB} is the amount of the A-segment's output (say, fertilizer, pesticides, small tools and machineries, high-yielding varieties of seeds, etc.) used as intermediate inputs in the B-segment, then

$$X_B = \frac{X_{AB}}{a_B} \quad (8)$$

where a_B is the (intermediate) input-output co-efficient in the B-segment.

As to the price of the B-segment's produce, one could consider two types of price - *producer* price and *supply* price separately. Because of the timing constraint on buying and selling activities of a large number of small indebted peasants, or to borrow Bhaduri's (1983, p. 22) terminology, because of the latter's 'temporal inaccessibility to the market', the producer price becomes a *distress-sale* price. It is typically lower than the supply price, and sometimes it even reduces to mere cost price. It is the landlords and the rich peasants¹¹ who, usually being also the wholesale traders, enjoy the fruit of higher supply price. This

¹¹For simplicity, we will consider the households of landlords and rich peasants together as a single class. Similarly, the households of small peasants and landless labours together are assumed to form another class.

supply price does also include the capital rent to their investments on storage capacity, transportation, and other facilities for the marketability of the product to the A-segment. If τ_B is such a parameter (similar to that of mark-up in the A-segment) that covers both (commercial) risk premium and capital rent over the producer price, then the supply price, P_B , can be written as:

$$P_B = (1 + \tau_B) (W_B b_B + P_A a_B) \quad (9)$$

We however assume that the government fixes P_B as *support price* for the marketable surplus of the B-segment.

Just like in the A-segment, income-flows generated in the B-segment can be decomposed into three parts: wage income ($W_B L_B$)¹², rental income including risk premium that we call *general rental* income ($r_B K_B$)¹³, and income to the suppliers of intermediate inputs from the A-segment ($P_A X_{AB}$). In other words,

$$P_B X_B = W_B L_B + r_B K_B + P_A X_{AB}$$

or,

$$P_B X_B = W_B L_B + r_B K_B + P_A a_B X_B \quad (10)$$

¹²This is, in fact, labour income of various households such as self-employed producers, share-croppers, traders, bonded and hired labours, etc. when translated in terms of some kind of full time equivalent jobs.

¹³According to Hicks (1969, pp. 142-43), use of fixed capital (rather than the use of hired labour) in the production process is the essential criterion of the capitalist mode of production. From this point of view, the landlords and the rich peasants who are also the wholesale traders of the B-segment's produce can be called capitalists. Consequently, their income from trade using fixed capital (including land) is categorized as *general rental* income.

The rate of above *general rental income*¹⁴ in the B-segment therefore becomes:

$$r_B = \frac{(P_B - W_B b_B - P_A a_B) X_B}{K_B} = \tau_B (W_B b_B + P_A a_B) u_B \quad (10.a)$$

Similar to the expenditure pattern from the capitalists' rental income in the A-segment, the B-segment's rental income is assumed to be spent either as final consumption (e.g., on food of the B-segment and the products of the A-segment used as consumer goods) and/or as investment expenditure (on products of the A-segment as capital goods). Workers in both the segments are assumed to spend all of their wage income ($W_A L_A + W_B L_B$) as final consumption on either or both segments' products. Even if they manage to save some portion of their earnings, sooner or later it is spent on unproductive luxurious housing construction, gold and jewellery purchase, marriage or other social ceremonies, etc.

Let s_A and s_B be the saving propensities of the recipients of rental incomes in the A- and the B-segment respectively. The total amount of saving (S) in the economy as a whole is:

$$S = s_A r_A K_A + s_B r_B K_B \quad (11)$$

The part of the rental incomes used for final consumption is of the amount $(1-s_A)r_A K_A + (1-s_B)r_B K_B$. If D is the value of the economy-wide total consumption demand coming from the workers and the non-workers in both the segments together, then

$$D = (W_A L_A + W_B L_B) + (1-s_A)r_A K_A + (1-s_B)r_B K_B = (1-s_A) \tau_A (W_A b_A + P_B a_A) X_A + W_A b_A X_A + (1-s_B) \tau_B (W_B b_B + P_A a_B) X_B + W_B b_B X_B \quad (12)$$

¹⁴If we do not distinguish between different households in the B-segment and consider them together a single (peasant) class as in Taylor (1983, p. 166), then the labour and non-labour incomes are not separated and, therefore, the overall rental rate (r_B) will be determined simply on the basis of the total value of (net) output, $P_B X_B$. Consequently, $r_B = P_B X_B / P_A K_B$.

Using (1) and (9), we can write (12) as:

$$D = \begin{bmatrix} \tau_A & 1 & P_B \\ (1-s_A) & & - a_A \\ 1+\tau_A & 1+\tau_A & P_A \end{bmatrix} \begin{bmatrix} P_A X_A \\ P_B X_B \end{bmatrix} +$$

$$\begin{bmatrix} \tau_B & 1 & P_A \\ (1-s_B) & & - a_B \\ 1+\tau_B & 1+\tau_B & P_B \end{bmatrix} \begin{bmatrix} P_B X_B \\ P_A X_A \end{bmatrix}$$

or

$$D = [u_A \cdot \frac{P_B}{P_A} a_A] P_A X_A + [u_B \cdot \frac{P_A}{P_B} a_B] P_B X_B \quad (12.a)$$

or

$$D = [u'_A P_A X_A + u'_B P_B X_B] \quad (12.b)$$

where u_A and u_B are the propensities to consume from the income flows of the two segments before the intermediate input payments are made, while u'_A and u'_B are the consumption propensities after these payments are made.

It is to be noted that u'_A and u'_B are, unlike in Taylor (1983, sec.3.1), functions (linear) of the inter-segmental terms-of-trade (P_B/P_A). Depending on the economic and political strengths of the capitalists and the landlords, the terms-of-trade could be manipulated via the fixation of τ_A and τ_B vis-a-vis that of W_A . If this is favourable to the B-segment, then obviously it will increase the propensity to consume from the B-segment's income. This is simply because the intermediate inputs now become relatively cheaper. This will, on the other hand, decrease the propensity to consume from the A-segment's income because the intermediate inputs (food/cash crop) used here become relatively expensive.

Total consumption spending (D) is split between the two segments. If C_A and C_B are the real consumption spendings on products of the A- and the B-segment respectively, then

$$D = P_A C_A + P_B C_B$$

Let's assume that a constant level of the B-segment's product (e.g. food) of say, θ , is consumed as the *subsistence* requirement for the economy as a whole, and this is independent of prices and income. To capture this stylized fact of Engel's law that food consumption is relatively income inelastic, we use Taylor's treatment¹⁵ of this fact in the following way:

$$P_B C_B = \lambda D + P_B \theta \quad (13)$$

and

$$P_A C_A = (1-\lambda)D - P_B \theta \quad (14)$$

where λ is the fraction of the economy-wide total consumption expenditure spent on the non-constant (or non-subsistence) part of the B-segment's product, and $(1-\lambda)$ is its other fraction spent on the A-segment's product and on the subsistence part of the B-segment's product. This formulation is, in fact, the simplified version of econometrician's linear expenditure system according to which non-subsistence consumption expenditures are linear functions of prices and income.

The material balances of the two segments can now be written as:

$$X_A = C_A + X_{AB} + I \quad (15)$$

and

$$X_B = C_B + X_{BA} \quad (16)$$

¹⁵In Taylor's (1982) two-sector model, though the workers in both the sectors of the modern economy are assumed to have real demand for agricultural goods, the recipients of capital incomes do not consume agricultural products. In his other two-sector model, Taylor (1983, sec. 3.1) assumes that the agricultural sector is classless in the sense that it has only one class - peasants. No distinction is drawn between the food-sectors capitalists and labours as two separate economic classes. In our dual economy model, on the other hand, we assume that both the segments have their class structures - capitalists and labours in the A-segment, and landlords and labours in the B-segment. Besides, we also assume that all the classes consume both types of products produced in the two segments.

Since investment (in terms of products of the A-segment), I , is here saving determined¹⁶, we can easily show that:

$$P_A I = S \quad (16.a)$$

In the above model, there are 14 *endogenous* variables ($X_A, L_A, W_B, P_A, r_A, r_B, u_A, X_{AB}, X_{BA}, C_A, C_B, D, S$ and I); 8 *exogenous* variables ($X_B, L_B, K_A, K_B, W_A, P_B, \tau_A$ and τ_B); and 9 *parameters* ($a_A, a_B, b_A, b_B, s_A, s_B, \lambda, u_B$ & θ). Because the number of *structural* equations [(1)-(5), (8), (10)-(16)] in the model is 13 which is less than the number of *endogenous* variables by one, the model is *indeterminate*.

III. The General Solution, Adjustment Process and Stability in a Short-Run Framework

Here we will concentrate our analysis in a framework of short-run model with the assumption that the economy-wide investment (I) is exogenously determined, but could also be parametrically changed, say, by the State or any planning authority. The model which fully becomes neo-Keynesian in nature is now a *determinate* one because the number of both structural equations and endogenous variables is 13. Since the output level (X_B) of the B-segment is determined basically by its available capital, it is *supply-constrained* and not responsive to the terms-of-trade (P_B/P_A) at least in the short-run. The output level (X_A) of the A-segment is, on the other hand, *demand-constrained*, and more importantly, it is directly responsive to the terms-of-trade. If the economy is in macro-economic *constrained equilibrium*¹⁷, then the excess demands for the commodities in the two segments will be zero. Excess demands for

¹⁶In the neo-classical view, investment is endogenously determined by saving, whereas the vice-versa is the case in the neo-Keynesian tradition. In the latter tradition, exogenously given investment behaviour is, as Sen (1963, p. 54) elaborates, further determined by the 'animal spirits' of the entrepreneurs or by their expected rate of growth.

¹⁷The term 'equilibrium' is not really the concept of 'equilibrium' as we understand in the context of the *General Equilibrium* model of purely market economies. Such a model of a developed market economy is generally based on the assumption that there are no structural constraints in either the demand-side or the supply-side of the market. The equilibrium notion used in our model of a dual economy is a static state of *quantity-constrained equilibrium* that can be called *structural disequilibrium*. Here actual quantity of products marketed is the minimum of the quantities demanded and supplied, and the demand and supply are very likely with some kind of social, economic, political or technological constraints.

labour and financial assets are not considered. This is because we assume that the economy is labour-surplus, and we emphasize the real aspect of the economy by disregarding money and other financial assets. Contrary to the Say's Law, here demand creates its own supply at least in the A-segment where there exists under-utilization of capital due to the lack of effective demand. In fact, the deficiency of effective demand arises in our model as a result of the wage-good/cash-crop bottleneck of the A-segment that exists in the forefront and the capital-good bottleneck of the B-segment that exists in the background.

The material balances (15) and (16) of the two segments can be written as excess demand functions:

$$ED_A = - \left[(1 - (1-\lambda)v_A + (1-\lambda) \frac{P_B}{P_A} a_A] X_A + [(1-\lambda)v_B X_B - \theta] \frac{P_B}{P_A} + \lambda a_B X_B + I \quad (20)$$

[using (14) & (12.a)]

and

$$ED_B = [(1-\lambda)a_A + \lambda v_A \frac{P_A}{P_B}] X_A - (1-\lambda v_B) X_B - \lambda a_B \frac{P_A}{P_B} X_B + \theta \quad (21)$$

[using (13) & (12.a)]

The condition for the macro-economic *constrained equilibrium* is:

$$ED_A = ED_B = 0 \quad (22)$$

where ED_A and ED_B are functions of the two endogenous variables X_A and P_B/P_A (or, r_B/r_A).

As regards to the adjustment processes in terms of the level variables, the terms-of-trade will go in favour of the B-segment (i.e. P_B/P_A rises) when there is an excess demand in the market of its product (especially cash-crops/wage-goods). And then the A-segment adjusts its output level (X_A) in such a way that the economy may get back to its demand-supply balance within the various

structural constraints under consideration. In fact, the demand-supply balance in the markets for commodities is nothing but the saving-investment balance of the economy. In other words, exogenously given investment is financed, in (constrained) equilibrium, either by saving out of total income flows of the two segments together, so that:

$$P_A I - [(1-v_A) P_A X_A + (1-v_B) P_B X_B] = 0$$

[using (13), (14), & (12.a)]

or by saving out of rental income in particular to get:

$$P_A I - s_A r_A (W_A b_A + P_B a_A) X_A - s_B r_B (W_B b_B + P_A a_B) X_B = 0$$

[using (5.a), (10.a) & (11)]

If 't' be the unit of time during which adjustment takes place, then the adjustment processes will be described by the following differential equations:

$$\begin{aligned} \bullet \quad X_A &= \frac{dX_A}{dt} = f[ED_A(X_A, \frac{P_B}{P_A})], \\ \bullet \quad (P_B/P_A) &= \frac{d(P_B/P_A)}{dt} = g[ED_B(X_A, \frac{P_B}{P_A})] \end{aligned} \quad (23)$$

and

Under macro-economic (constrained) equilibrium when (22) is satisfied, functions 'f' and 'g' satisfy

$$f(0) = g(0) = 0,$$

that is, the system is at rest. Under macro-economic disequilibrium, functions 'f' and 'g' have positive first order derivatives. That is:

$$\frac{dg}{dED_B} = \frac{d(P_B/P_A)}{dED_B} > 0, \text{ and}$$

$$\frac{df}{dED_A} = \frac{dX_A}{dED_A} > 0$$

It is to be noted that the stability of our model of a dual economic system with the adjustment processes described by (23) is not guaranteed. This is shown in **Appendix**.

Let's consider three following special cases of the above general model (with $a_A > 0$ and $a_B > 0$) of a closed dual economy:

Case (i): $a_A = 0, a_B = 0,$

Case (ii): $a_A = 0, a_B > 0,$ and

Case (iii): $a_A > 0, a_B = 0.$

While Case (i) corresponds to Lewis's (1954) basic model, Case (ii) is in the spirit of the models of Taylor (1982, ch. 3 in 1983) and Thirlwall (1986). It can easily be shown (following **Appendix**) that the unique stable solution could be guaranteed in these first two cases¹⁸, with certain restriction only on the level of the economy-wide investment. Case (iii) is, on the other hand, not only analytically similar to the general case, it also does not necessarily guarantee the stability of the system. Although Rakshit's (1982, Ch. 2) model falls under Case (iii), it has two major restrictions. Firstly, neither of the two sectors in Rakshit's model uses (fixed) capital, and secondly, the terms-of-trade between the two sectors is fixed as in Rattso's (1988) paper. In the following section, we will characterize the structural situations when the states of *induced* and *diffused* complementary linkages between the two segments of a dual economy prevail.

¹⁸ In both of these two cases, X_A and P_A are the two endogenous variables to solve the two excess demand functions of the two segments. In these cases, a_A being zero, P_B is exogenously given. It should also be noted that the comparative static analyses are similar in both the cases as is shown in Dutta (1985, Ch.-3).

IV. The Characterization of the Induced and Diffused Complementary Linkages

As we have already mentioned, there exist wage-good/cash-crop bottleneck in the A-segment and capital-good bottleneck in the B-segment. The *demand-determined* A-segment of the dual economy, which is dominant in relation with the *supply-determined* B-segment, is also assumed to be with under-utilized capital goods. This is so essentially because of deficiency of the *effective demand* in the **economy as a whole**. Under this less-than-full-employment state of **the economy**, we will characterise the forces of linkages (**backward/forward**) that could exist within and across the two **segments** in the context of the social *division of labour* aspect of **the economy**.

In our model with the neo-Keynesian mark-up pricing mechanism, variable costs of labour and intermediate inputs are the basic determinants of the price structure in both the segments. Again, the incomes from the variable inputs (especially of labour) and the rental incomes are the basic determinants of the segment-specific consumption structure of the economy as a whole. This is so mainly because of the (intermediate) inputs requirement in accordance with the fixed technical co-efficients, and the residual nature of the rental incomes. Consequently, the causality between production and price structures is simply the mirror image of that between consumption and cost structures. Keeping the above characteristics of our model in mind, a dual economy is said to have *induced* complementary linkage when either of the two situations prevail:

(i) Under the existing consumption (social preference) and income (class) structures of the economy, the wage-inequality favourable to the A-segment's workers [with (W_B/W_A) declining] encourages the consumption demand for its own product [i.e. C_A or (C_A/C_B) increases]. In other words, under *induced* complementary linkage, one can get:

$$\frac{d(C_A/C_B)}{d(W_B/W_A)} < 0 \text{ or, } \frac{d(C_B/C_A)}{d(W_B/W_A)} > 0 \quad (24)$$

(ii) Alternatively speaking, under the existing production (technological) and price (market) structures of the economy, the terms-of-trade favourable to the A-segment [with (P_B/P_A) declining] encourages its own growth [i.e. X_A or (X_A/X_B) increases]. In other words, under induced complementary linkage, one can also get:

$$\frac{d(X_A/X_B)}{d(P_B/P_A)} < 0 \quad \text{or,} \quad \frac{d(X_B/X_A)}{d(P_B/P_A)} > 0 \quad (25)$$

Under *diffused* complementary linkage, the inequality signs in (24) and (25) will be reverse (along with the equality sign to hold as well).

We will now show how different levels of terms-of-trade (P_B/P_A) or wage-inequality (W_B/W_A) correspond to the induced or diffused states of the economy as reflected in the resulting different levels of the economy-wide total investment, I . Before we do so, let's first distinguish two stages of development of a dual economy - *lower* and *higher* - in terms of the values of some of its structural parameters. A developing dual economy is said to be in *lower* stage of its development from the point of view of its material growth when the proportion of (wage-good) saving in the B-segment (and hence the *marketable surplus* of its produce available to the A-segment) out of the (general) saving level from its own income flows is *less* than the proportion of expenditure level [as the economy-wide *subsistence* (wage-good) consumption] out of the economy-wide total investment demand i.e.,

$$\frac{1 - \lambda v_B}{1 - v_B} \frac{P_B \theta}{P_A I} < \frac{P_A \theta}{P_A I} \quad (P_A \text{ assumed to be a numeraire}).$$

Otherwise, the developing dual economy will be in *higher* stage of development. In fact, this above condition with an equality sign could be called a 'turning point' in the process of development of the dual economy under consideration.

Setting ED_A and ED_B equal to zero in (20) and (21) and then solving them one can get:

$$X_A = \frac{[1 - \lambda v_B + \lambda (P_A/P_B) a_B] I - (1 - v_B) (P_B/P_A) \theta}{\Delta} \quad (26)$$

and

$$X_B = \frac{[(1 - \lambda) a_A + \lambda v_A (P_A/P_B)] I + (1 - v_A) \theta}{\Delta} \quad (27)$$

where $\Delta = [1 - \lambda v_B - (1 - \lambda) v_A] + \lambda (1 - v_A) (P_A/P_B) a_B + (1 - \lambda) (1 - v_B) (P_B/P_A) a_A$.

Now, using (26) and (27), we can write:

$$\frac{X_A}{X_B} = \frac{[1 - \lambda v_B + \lambda (P_A/P_B) a_B] I - (1 - v_B) (P_B/P_A) \theta}{[(1 - \lambda) a_A + \lambda v_A (P_A/P_B)] I + (1 - v_A) \theta} \quad (28)$$

Taking the derivative of (X_A/X_B) in (28) with respect to (P_B/P_A) , our general model with positive a_A and a_B gives the following:

When the dual economy is with *induced* complementary linkage, its quantitative characterisation of (25) holds. Therefore,

$$\frac{d(X_A/X_B)}{d(P_B/P_A)} < 0$$

$$\Rightarrow \Phi \equiv [-\lambda(1-\lambda)a_A a_B + \lambda(1-\lambda v_B)v_A] \frac{P_A^2}{P_B} - \lambda(1-v_A)a_B \theta \frac{P_A^2}{P_B} - I - 2\lambda v_A(1-v_B)\theta \frac{P_A}{P_B} - I - (1-\lambda)(1-v_B)a_B \theta I - (1-v_A)(1-v_B)\theta^2 < 0.$$

If $a_B = 0$ as in Case-(iii), the characterisation (25) can alternatively be written in terms of I , from the above inequality, as:

$$\Phi \equiv \lambda(1-\lambda v_B)v_A I^2 - 2\lambda v_A(1-v_B)\theta \frac{P_B}{P_A} I - (1-v_A)(1-v_B)\theta^2 \left[\frac{P_B}{P_A} \right] < 0 \quad (29)$$

Let's take the derivative of (29) with respect to (P_B/P_A) and set it equal to zero to get:

$$\frac{dI}{d(P_B/P_A)} = \frac{(1-v_B)\theta(\lambda v_A I + (1-v_A)\theta(P_B/P_A))}{\lambda v_A[(1-\lambda v_B)I - (1-v_B)\theta(P_B/P_A)]} \quad (30)$$

which, on further differentiation, will give:

$$\frac{d^2 I}{d(P_B/P_A)^2} = \frac{\lambda v_A(1-v_B)\theta^2 I [\lambda v_A(1-v_B) + (1-v_A)(1-\lambda v_B)] \left[1 - \frac{(P_B/P_A)}{I} \frac{dI}{d(P_B/P_A)} \right]}{[\lambda(1-\lambda v_B)v_A I - \lambda v_A(1-v_B)\theta(P_B/P_A)]^2} > 0 \quad (31)$$

for inelastic investment demand. The numerator on the RHS of (30) is positive, but the denominator could be positive or negative depending on the stages of development. In other words:

$$\frac{dI}{d(P_B/P_A)} < 0 \quad (32)$$

holds for the lower stage of development in a dual economy with

$$\frac{1-\lambda v_B}{1-v_B} < \frac{P_B \theta}{P_A I} \quad \text{and}$$

$$\frac{dI}{d(P_B/P_A)} > 0 \quad (33)$$

holds for the higher stage of development in a dual economy with

$$\frac{1-\lambda v_B}{1-v_B} > \frac{P_B \theta}{P_A I} \left[1 - \frac{(1-\lambda)v_A}{2\lambda v_A} \left(\frac{P_B}{P_A} \right) \right]$$

In the case of the lower stage of development, (31) will invariably be positive. In the case of the higher stage of development, (31) will very likely be positive only if the elasticity of adjustment between the planned investment and the announced terms of trade is less than unity.

Now, (31) and (32) together will depict diagrammatically areas of induced/diffused linkages in the case of lower stage of development of a dual economy as is shown on the plane of $(I, P_B/P_A)$ in Figure-1 below. Similarly, (31) and (33) together will do the same in the case of its higher stage of development as is shown in the following Figure-2. In the shaded areas the induced linkage holds (with $\Phi < 0$) and is reflected through different combinations of an economy's terms-of-trade and investment levels. If $(P_B/P_A) = 0$, then from (26) we get:

$$\Phi = \lambda(1-\lambda v_B)v_A I^2 = I^*, \text{ say.} \quad (34)$$

This I^* will be intercept of the curve represented by $\Phi=0$, and its level depends on the level of I and the values of the parameters λ , v_A and v_B , which are different under different stages of development. Thus, I_1^* and I_h^* are the intercepts of $\Phi=0$ curve for the developing dual economies in their lower and higher stages of development respectively.

FIGURE 1

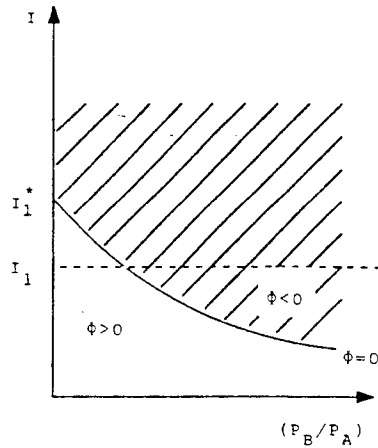
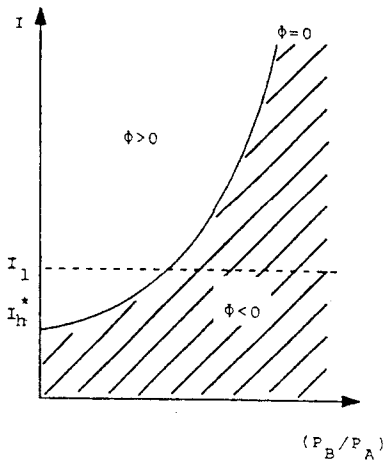


FIGURE 2



For given values of the structural and institutional parameters and a given level of investment (say, I_1), the induced linkage state in either type of development stage will correspond to the terms-of-trade (P_B/P_A) relatively favourable to the B-segment compared to those in the case of their diffused linkage state. However, if $I_1 > I_1^*$ (in the case of lower stage of development) and $I_1 < I_h^*$ (in the case of higher stage of development), the state of induced linkage will prevail irrespective of the level of the terms-of-trade.

It is evident from (34) that I^* is an increasing function of I and v_A (or λv_A), and a decreasing function of v_B (or λv_B). If the propensity to consume from the income flows of the A-segment (i.e. v_A) increases or that of the B-segment (i.e. v_B) decreases, or even if the propensity to consume (B-segment's product particularly as non-subsistence demand) from the income flows of the A-segment (i.e. λv_A) increases or that of the B-segment itself (i.e., λv_B) decreases and if their joint effects (via saving supplies of the two segments) do not sufficiently reduce the level of the economy-wide investment demand (I),

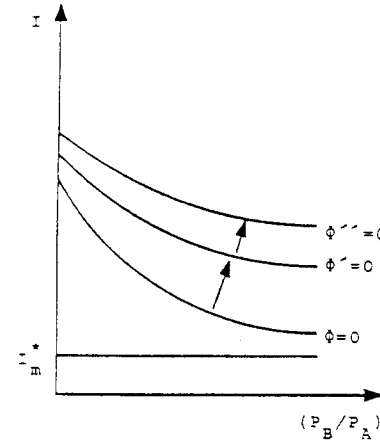


FIGURE 3

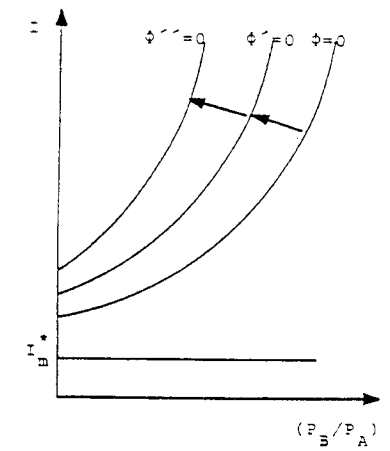


FIGURE 4

then there will be an upward shift of the $\Phi = 0$ curve. As a result, the region of induced linkage will shrink (as shown in Figure 3) in the cases of lower stage of development (with relatively high θ , while that under the higher stage of development (with relatively low θ) will expand (as shown in Figure 4).

$$\text{For } v_A = 0, \frac{dI}{d(P_B/P_A)} = \infty \text{ [from (30)], so that the } \Phi = 0 \text{ curve}$$

becomes vertical. This means that the economy-wide investment demand, I , is independent of levels of the terms-of-trade or perfectly elastic with respect to the terms-of-trade.

$$\text{Similarly, for } v_B = 1, \frac{dI}{d(P_B/P_A)} = 0 \text{ [from (30)], so that the}$$

$\Phi = 0$ curve becomes horizontal. This means that the economy-wide investment demand, I , is fixed at its minimum possible level of, say, $I_m^* [= \lambda(1-\lambda)v_A I^2]$ as could be seen from (34), and is perfectly inelastic with respect to the terms-of-trade. Thus, for some given values of λ and θ , as $(v_A, v_B) \rightarrow 0$, if $\Phi = 0$ curve shifts upward with higher (or at least non-decreasing) level of the economy-wide investment demand, I , then the dual economy is said to expand or

have economic growth, although the growth takes place under the lower stages of development with shrinking region of induced linkage.

The analytical implication that automatically follows the above result is given below. As we have noted, under induced linkage, the terms-of-trade (P_B/P_A) favourable to the A-segment encourages its own growth. We also know that, for given values of the parameters, as the terms-of-trade become favourable to the B-segment, the minimum level of the economy-wide investment declines in the case of induced linkage under lower stage of development and the maximum level of the same investment rises under higher stage of development. Now, when the consumption propensities (v_A and v_B) tend to fall, reduction in consumption demand takes place in terms of the A-segment's product when the dual economy is under lower stage of development (i.e. with relatively high subsistence consumption, θ), while the same thing happens but in terms of the B-segment's product when the economy is under higher stage of development (i.e. with relatively low subsistence consumption, θ). Thus, under the circumstances of reduced consumption propensities, to maintain the same level of economy-wide investment demand, a dual economy under lower stage of development will go through some higher level of terms-of-trade (P_B/P_A) in response to the relatively high demand for the B-segment's product. But, if the B-segment fails to have sufficiently higher level of its production and, instead, if (X_A/X_B) rises, then the dual economy under lower stage of development will experience the state of induced linkage. Similarly, under the same circumstances of reduced consumption propensities, to maintain certain levels of economy-wide investment demand, a dual economy under higher stage of development will go through some lower levels of terms-of-trade (P_B/P_A) in response to the relatively high demand for the A-segment's product. But, if the A-segment fails to have sufficiently higher level of its production and, instead, if (X_A/X_B) falls, then the dual economy under higher stage of development will experience the state of diffused linkage.

The concept of induced/diffused linkage can alternatively be characterized by expressing the ratio of the consumption spendings (C_A/C_B) in terms of the prevailing wages (W_A and W_B). The areas of induced/diffused linkages then can be shown on a plane of

($I_A, W_B/W_A$) where I_A being the investment level in the A-segment¹⁹. We are not going to present the alternative characterisation in order to restrict the length of the paper.

V. Conclusion

In our above general model of a developing economy with specific structural features we have focused first on its analytical aspect, and then on the policy aspect. Attempts have been made to give a broader picture of the process of economic growth and development of a structurally differentiated economy—namely, a *dualistic* economy, the simplest one of this kind. Various segmental imbalances along with skewed distribution of income and asset-holdings give rise to a multitude of heterogeneous socio-economic and political forces in this type of economy. Not only the transactional modes of both market and non-market parts of such economies exist in limited degree, but also there exists a pronounced asymmetry in market exchanges. The major socio-economic and political constraints that influence different economic agents differently on the market arena have been brought into attention in the earlier sections of our analysis.

As to the policy aspect of our model, a note of precaution seems to be relevant. The policy implication lies in the choice of terms-of-trade or wage inequality between the two segments vis-a-vis the level of economy-wide investment. Because this choice is the final market outcome filtered through the various structural aspects of the economy, the decision-making authority, such as the Government, must have a thorough awareness of the background structural forces and their intensities. Such an awareness will better serve the authority concerned in fulfilling its long-term objective of sustained growth and development.

¹⁹ Similar analysis, although in different context, can be found in Dutta (1985).

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Appendix

To check the stability of our model, i.e., to check the existence of solution of the system of differential equations (23) that converges to an equilibrium value of X_A and P_B/P_A , we need to depend on the properties of the following Jacobian matrix of the excess demand functions:

$$J = \begin{bmatrix} \frac{\partial ED_A}{\partial X_A} & \frac{\partial ED_A}{\partial (P_B/P_A)} \\ \frac{\partial ED_B}{\partial X_A} & \frac{\partial ED_B}{\partial (P_B/P_A)} \end{bmatrix} = \begin{bmatrix} e_{11} & e_{12} \\ e_{21} & e_{22} \end{bmatrix}, \text{ say.}$$

Following Takayama's (1974, p.314) reference to Hicksian method for stability analysis of comparative statics, the condition for (perfect) stability for the equilibrium of the system is:

$$e_{11} < 0, e_{22} < 0, \text{ and the determinant } |J| > 0.$$

Now taking the derivatives of (20) with respect to X_A and (P_B/P_A) , we get:

$$\frac{\partial ED_A}{\partial X_A} = - \left[1 - (1-\lambda) \left(v_A - \frac{P_B}{P_A} a_A \right) \right], \text{ and}$$

$$\frac{\partial ED_A}{\partial (P_B/P_A)} = (1-\lambda)(v_B X_B - a_A X_A) - \theta.$$

Similarly, taking derivatives of (21) with respect to X_A and (P_B/P_A) , we get:

$$\frac{\partial ED_B}{\partial X_A} = (1-\lambda)a_A + \lambda v_A \frac{P_A}{P_B}, \text{ and}$$

$$\frac{\partial ED_B}{\partial (P_B/P_A)} = -\lambda(v_A X_A - a_B X_B)(P_A/P_B)^2.$$

After substituting these derivatives in the Jacobian matrix, we can write:

$$J = \begin{bmatrix} -[1 - \lambda(1-\lambda)(v_A - \frac{P_B}{P_A} a_A)] & (1-\lambda)(v_B X_B - a_A X_A) - \theta \\ (1-\lambda)a_A + \lambda v_A \frac{P_A}{P_B} & -\lambda(v_A X_A - a_B X_B)(P_A/P_B)^2 \end{bmatrix}$$

$$= \begin{bmatrix} -\left[1 - (1-\lambda) \left(\frac{v_A P_A X_A - P_B X_{BA}}{P_A X_A} \right) \right] & -(-\lambda)(X_{BA} - v_B X_B) - \theta \\ \frac{(1-\lambda)P_B X_{BA} + \lambda v_A P_A X_A}{(P_B/P_A)P_A X_A} & -\lambda \left(\frac{v_A P_A X_A - P_A X_{AB}}{P_B} \right) \frac{P_A}{P_B} \end{bmatrix}$$

The bracketed term in the north-west element of the J-matrix is one minus the propensity to consume A-segment's product from its own income flows. This propensity being a fraction, the north-west element of the matrix is negative. If the amount of consumption expenditure out of A-segment's income flows (before its payment for the intermediate inputs to the B-segment is made) is higher than its receipt as payment for the intermediate inputs by the B-segment, then the south-east element of the J-matrix will also be negative. Let's now deduce the condition for the determinant of the J-matrix to be positive. The determinant of the Jacobian matrix is:

$$|J| = \lambda \left[1 - \lambda(1-\lambda)(v_A - \frac{P_B}{P_A} a_A) \right] (v_A X_A - a_B X_B) (P_A / P_B)^2 - \\ \left[(1-\lambda)a_A + \lambda v_A \frac{P_A}{P_B} \right] [(1-\lambda)(v_B X_B - a_A X_A) - \theta].$$

The condition for $|J|$ being positive is:

$$X_A > \frac{[(1-\lambda)(a_A + \lambda v_A (P_A / P_B)) \{ (1-\lambda)v_B X_B - \theta \} (P_B / P_A) + \lambda a_B X_B] + \lambda(1-v_A)(P_A / P_B) a_B X_A}{[(1-\lambda)a_A + \lambda v_A (P_A / P_B)] [1 - (1-\lambda)v_A + (1-\lambda)(P_B / P_A) a_A] - (1-\lambda)a_A} \quad (A.1)$$

When the A-segment is in equilibrium (i.e., the excess demand for its product is zero), then from (24) X_A is given by:

$$X_A = \frac{[(1-\lambda)v_B X_B - \theta](P_B / P_A) + \lambda a_B X_B + \bar{I}}{1 - (1-\lambda)v_A + (1-\lambda)(P_B / P_A) a_A} \quad (A.2)$$

So long as the investment demand (\bar{I}) is positive,

$$X_A > \frac{[(1-\lambda)v_B X_B - \theta](P_B / P_A) + \lambda a_B X_B}{1 - (1-\lambda)v_A + (1-\lambda)(P_B / P_A) a_A} \\ = \frac{[(1-\lambda)a_A + \lambda v_A (P_A / P_B)] [(1-\lambda)v_B X_B - \theta] (P_B / P_A) + \lambda a_B X_B}{[(1-\lambda)a_A + \lambda v_A (P_A / P_B)] [1 - (1-\lambda)v_A + (1-\lambda)(P_B / P_A) a_A]}$$

But,

$$\frac{[(1-\lambda)a_A + \lambda v_A (P_A / P_B)] [(1-\lambda)v_B X_B - \theta] (P_B / P_A) + \lambda a_B X_B}{[(1-\lambda)a_A + \lambda v_A (P_A / P_B)] [1 - (1-\lambda)v_A + (1-\lambda)(P_B / P_A) a_A]} \\ \frac{[(1-\lambda)a_A + \lambda v_A (P_A / P_B)] [(1-\lambda)v_B X_B - \theta] (P_B / P_A) + \lambda a_B X_B + (1-v_A)(P_A / P_B) a_B X_A}{[(1-\lambda)a_A + \lambda v_A (P_A / P_B)] [1 - (1-\lambda)v_A + (1-\lambda)(P_B / P_A) a_A] - (1-v_A)(1-\lambda)a_A}$$

So, there is no guarantee that $|J| > 0$. Hence, unlike in Taylor (1983, sec.-3.1), the condition for stability is not necessarily satisfied in our above model.

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