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A DISAGGREGATIVE APPROACH TO LDCs TERTIARY SECTOR

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A Disaggregative Approach to LDCs Tertiary Sector

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I. Introduction

This paper has two main objects. First, it is shown that the current explanations of growth in "tertiary" sector output and employment in the less developed economies have not been properly explored. Second, it is argued that Colin Clark's celebrated hypothesis about the relationship between per capita income and occupational distribution, viz. that the percentage share of tertiary output and employment rises with increases in per capita incomes, has often been misinterpreted in the context of the LDCs economies. In Section II an attempt is made to analyze the application of traditional production theory to services and its limitations. It is shown that 'localization' of technological change and the consumer quality as a factor input -- the two significant characteristics of most services -- are not allowed for in the conventional production function. Section III proposes an alternative approach of disaggregate employment functions for wage-labour, self-supporting labour, and family labour for different sub-sectors of services. In order to show the usefulness of this threefold labour disaggregation, in Section IV, some popular explanations of the growth of tertiary employment are briefly reviewed. In Section V, assumptions and conditions under which Clark's thesis is applicable to the labour surplus economies are examined. Finally, Section VI presents some tentative empirical illustrations in support of the proposed approach.

There is a justification in the disaggregation of macro-economic variables for a proper analysis of the problems of the LDCs. In the case of mature economies, the limitations of aggregative models and concepts such as income-

elasticities and production and employment functions may be less acute since the aggregation biases are minimized by market clearance, and the general homogeneity of economic systems and of components of aggregate variables. This is not true of the LDCs however. Variations in components themselves may be structurally different. For instance, changes in the magnitudes of variables crucial for services may not satisfactorily reflect interactions between their components; and constancy of these parameters actually conceal relative shifts in their importance.

The extremely heterogeneous composition of the tertiary sector does not easily lend itself to a meaningful aggregative analysis. Unlike agriculture and manufacturing, this sector is more difficult to fit within the framework of a macro-model in the classical or neo-classical tradition. Admittedly, there is as yet hardly any micro-economic theory of growth in general, let alone one suitable for explaining growth process in the tertiary sector. Nevertheless, a certain degree of disaggregation of key variables is advocated in the hope that a disaggregative approach, howsoever imperfect and difficult to manipulate, may lead to a better understanding in the application of general hypotheses to the LDCs services.

Attempts to analyze composition of output and productivity in the services sector and within its sub-sectors, are no doubt a step in the direction of sectoral analysis. While such efforts are very illuminating, they suffer from the inadequacies of the existing concepts of real output and productivity in their application to most services. As output of services cannot be easily measured independently of inputs, (e.g., the case of government with no non-wage

element) and as labour is, in many cases, the only or a major input in the productive process (if transport and communication and other public utilities are excluded), its remuneration, by and large, tends to determine the bulk of output. This being the case, it is perhaps as logical, if not more, to disaggregate labour input instead of its output.

II. Production Theory and its Limitations

In the application of production theory to manpower and educational planning, different types of labour input have been distinguished on the basis of occupational categories. An aggregate production function is specified in the following general form: $X = f(K_1, L_1, L_2, \ldots\ldots L_n)$ ————(1) Where X is output, K, capital, and L_j ($j = 1 \ldots\ldots n$), various occupational categories. This recognition of the heterogeneity of labour input assumes explicitly or implicitly that occupational categories reflect different levels of educational attainment. In other words, differential skill is used as a criterion of labour disaggregation. Our approach adopts a different criterion, namely, the characteristics of "status" of workers. Labour is divided into wage-earners, self-employed owner-operators, and family workers.[1] These three categories may or may not differ in skills defined in terms of educational attainment. Wage-labour and own-account labour are more likely to be distinguished by the 'entrepreneurial' skill or the capacity of risk-taking which is not necessarily a function of the level of education. A distinction may also be made on the basis of ownership of capital assets, or the size of relative earnings.

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[1] For an empirical analysis of employment in major service sub-sectors on the basis of this labour classification, see author's paper on "The Role of the Service Sector in Employment Expansion," International Labour Review, May, 1970.

In the case of services, three-factor inputs, viz. wage-labour, self-supporting labour and capital, and two stages in the process of production can be assumed à la Hicks. Wage-labour (L_w) can be considered analogous to Hicks' White Labour, and self-supporting labour (L_s) to his Black-Labour. In the first stage, wage-labour is combined with self-supporting labour to produce aggregate labour, L, (Hicks' Grey Labour). In the second stage, the latter intermediate product, L, is combined with capital to produce final output. If the three-factor production function is linear homogeneous, the intermediate product can be defined so that both of the partial production functions will be linear homogeneous also.[1]

However, it is uncertain whether any unique relationship exists between service output and labour input-mix. In a production function with perfect complementarity, the elasticity of substitution between factor inputs would be zero.[2] On the other hand, if substitution possibilities are assumed to occur with changes in the relative factor prices, then for a given level of "tertiary" output, elasticities of substitution between (a) capital and labour inputs, and (b) between one labour-input and another (in our case, between wage-labour and own-account labour would be positive. Within the services sector, both the above conflicting assumptions may be valid depending on the sub-sector one chooses. The Lenotief-type universe of fixed-coefficients and factor complementarity and the neo-classical universe of price-flexibility and factor substitution may in fact, occur in juxtaposition. For instance, services such as transportation and communication, and public utilities may well face production

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[1] J.R. Hicks, Marshall's Third Rule - A Further Comment, Oxford Economic Papers, October 1961.

[2] It may be noted that most of the recent work on manpower planning assumes fixed coefficients in production.

functions with fixed coefficients or very limited substitution. Price-rigidities resulting from union pressures and government controls may also tend to reduce possibilities of substitution between labour inputs in the case of professional services more than in others. In commerce and personal services, on the other hand, changes in labour-input mix will tend to occur either as a result of changes in technology, or in relative factor prices.[1] Thus, a movement along a given production function due to changes in prices of labour inputs, as well as a shift in the production function itself due to a technical change given relative prices, may occur more or less simultaneously in different sub-sectors of services sector. The latter long-run situation is more likely to obtain as a result of shifts in the composition of demand caused by changes in consumer tastes and levels of per capita incomes.

The substitution of supermarkets and department stores for small retail shops may be cited as one of the examples of changes in technology that bring about a shift from self-employment to wage-employment in the LDCs services. This change represents a structural shift that becomes economical only at very large scale of operations and size of the market. It is not a shift towards a new process on a given production function due to relative price changes that one might expect in the developed economies.

One must nevertheless recognize inherent limitations to technological advances and increases in productivity which are typical of several services.[2]

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[1] For relative price changes and substitution between wage-labour and self-supporting labour in commerce and personal services, see author's paper on "The Role of the Services Sector... op. cit.

[2] See William J. Baumol, Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crisis, American Economic Review, June 1967. Baumol's 'unbalanced' growth is developed by a two-sector model in which one sector represents services (e.g. municipal government, performing arts, education, and restaurants) with a constant productivity.

The relationship between labour productivity (O/L) and the ratios of factor inputs (L_w/L_s) and (K/L) can be depicted in Figure (1) below:

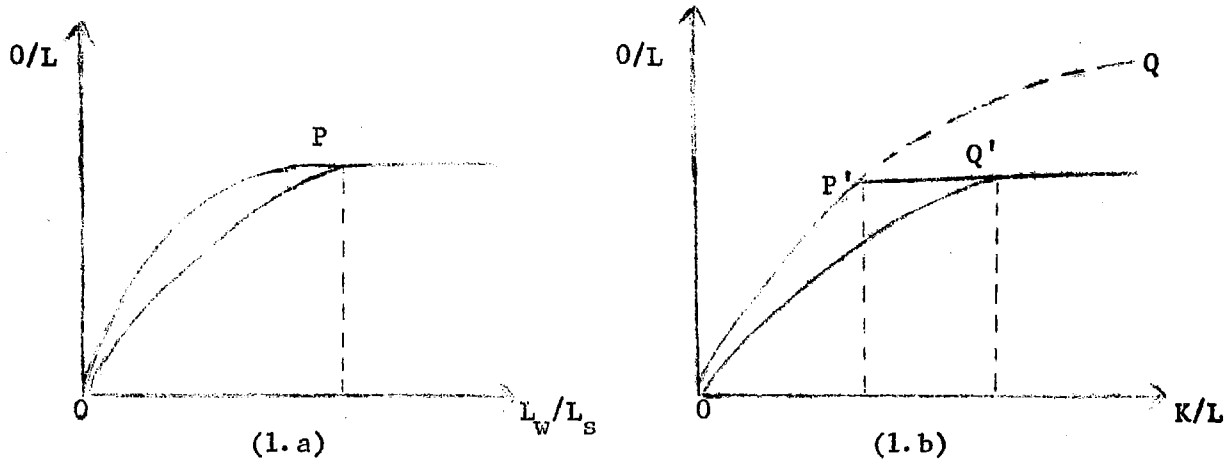

FIG. I

Figure (1.a) shows that upto point P, a rise in the ratio (L_w/L_s) will correspond to a higher labour productivity beyond which any increase in this ratio will have no effect and the level of productivity will remain constant over the relevant range. This is a case where the two production functions merge at point P, thus suggesting that technological change is zero at point P and beyond. Figure (1.b) shows a case in which an increase in K/L will not reflect any increase in O/L after points P' and Q'. This situation is somewhat different from the traditional Cobb-Douglas type of production function under which if one factor (in our case, K) increases indefinitely while the other (i.e. L) remains constant, output or labour productivity also grow

indefinitely, as is illustrated by the dotted curve P'Q in Figure (1.b).[1] However, the marginal product of the increasing factor K tends to disappear eventually.

In services, constant productivity or minor and sporadic increases in it may arise partly from "localisation" or "personalisation" of technical progress. Let us take the case of professionals such as physicians whose knowledge represents a labour-embodied technical change. 'Internal' human investment, experience (or "learning by doing") and knowledge, embodied in a few specialised surgeons, are also supplemented by natural aptitudes and innate abilities. If each physician and doctor is treated as a firm in the health industry, it is unlikely that the superior qualities of a few will be spread throughout the industry. Entrepreneurial and organisational skills of businessmen may be cited as another example of non-transferable and 'internalised' knowledge.

Besides, in such services as commerce , and personal services, increase in K/L may result not so much from an increase of capital with a given amount of labour as from the consumer substituting its non-marketed labour for the marketed labour services of the producer. In self-service stores and supermarkets the former replaces the services of shop stewardesses and sales attendants. Thus,

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[1] In the Cobb-Douglas production function,

$$O = A \cdot K^{a} \cdot L^{b} \quad \text{or} \quad O/L = A \left(\frac{K}{L}\right)^{a} \quad \text{where } a+b = 1.$$

Differentiating (O/L) with respect to (K/L), we obtain:

$$\frac{d\left(\frac{O}{L}\right)}{d\left(\frac{K}{L}\right)} = A \cdot a \left(\frac{K}{L}\right)^{a-1} \quad \text{where } 1 > a > 0 \text{ and } A > 0.$$

Thus, (O/L) is an increasing function of $\left(\frac{K}{L}\right)$.

it is possible that a given amount of fixed capital leads to a higher K/L ratio through a reduction in the denominator which is caused not so much by "capital-using" innovation as, paradoxically, a "labour-using" one. In Figure (1.b), after points P' and Q', the labour productivity of producers of services will cease to be a function of capital input. It will rise along the dotted path P'Q only under conditions in which the quality (education, knowledge, experience, etc.) of consumers' labour services is improving. It is a peculiar characteristic of the non-material production that consumer is a productive input which is not compensated for its services through the conventional market mechanism. The quality of the physician's services is partly determined by the 'external' human investment (or education) embodied in the consumer, and only partly by the 'internal' investment, ability and experience embodied in the physician. Similarly, teachers' productivity is also a function of the quality of his consumers (i.e. students). Unless due account is taken of the productivity of consumer's labour services one may find an anomalous situation in which a higher K/L would correspond to a given or even lower efficiency of producers' services rendered to the consumer. On the other hand, in the case of material goods production, absence of "personalisation" between the consumer and the producer would suggest that a consumer's quality does not matter although his tastes do.

The traditional production theory does not allow for "localisation" of technical change or for consumer quality as input in the productive process. Besides, it is conventional to assume that a production function for an industry is an aggregation of micro-functions at the level of the firm. However,

micro-functions for all firms in a given service industry are not homogeneous or identical. The assumption that the marginal rate of substitution between any two inputs is the same for each firm is unrealistic. Problem of aggregation biases is, of course, not peculiar to services alone. Possibly with the exception of cases in which Leontief-type conditions of zero substitution prevail, the problems of aggregation and estimation do not seem to have found a very satisfactory solution. But in the case of services, difficulties in the valuation of real output and productivity and lack of relevance of these existing concepts make production functions rather unrewarding from a quantitative and empirical point of view. On the other hand, employment functions with fewer empirical and conceptual difficulties, are likely to yield more significant results.

III. Disaggregate Empoloyment Functions

An aggregate employment function for the services sector of the LDCs is expected to be some sort of a "mongrel" relation indicating a mixture of demand and supply functions rather than a pure demand function. This is so because labour absorption in services (much more than in manufacturing) would tend to be induced by demand factors as much as the aggregate supply of labour. The form of an aggregate employment function may be written as follows:

$$E_s = f_1 (Y, K, N, W) \qquad \text{——————(2)}$$

where E_s - is employment in the services sector, Y - income, N - adult or economically active population, and W - wage-rate so that

$$\frac{\partial E_s}{\partial Y} > 0, \quad \frac{\partial E_s}{\partial K} < 0, \quad \frac{\partial E_s}{\partial N} > 0, \quad \text{and} \quad \frac{\partial E_s}{\partial W} < 0.$$

As service employment, E_s, is composed of paid employment (E_{ws}), own-account employment (E_{ss1}), and family labour including "traditional" self-employment (E_{ss2}), aggregate employment function (2) can be decomposed as follows:

$$E_{ws} = f_2 (Y, K, W) \text{ [Demand Function]} \quad \text{——————(2.a).}$$

$$E_{ss1} = F (Y, N) \text{ [Demand-supply Function]} \quad \text{——————(2.b).}$$

$$E_{ss2} = g (N) \text{ [Supply Function]} \quad \text{——————(2.c).}$$

So that,

$$E_s = E_{ws} + E_{ss1} + E_{ss2} = f_2 (Y, K, W) + F (Y, N) + g (N) \quad \text{———(3)}$$

where $E_{ss1} + E_{ss2} = E_{ss}$, i.e. total self-supporting labour.

It may at best be assumed that only the function (2.a) is purely demand-determined. Yet even in this case, the factor of labour supply is likely to act only indirectly, via a change in the price of labour (W). However, for self-employment function (2.b), labour supply N, may be strongly correlated with the demand for labour in self-employment under conditions of slack wage-labour market.[1] The third function (2.c) is a "residual" category the size of which is, by and large, determined by the excess labour supply (N-D). Given the level of income per capita and the wage-rate in the paid segment of the service sector, the excess of available labour supply over demand will roughly equal the

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[1] It is for instance, observed that in the U.K., "the high level of unemployment in the inter-war years drove people into low-wage jobs in services, and in particular, into self-employment, the consequence of this movement being a measurement of underemployment in the distributive trades and a fall in productivity" (See K.D. George, Productivity in the Distributive Trades, Bulletin of the Oxford University Institute of Economics and Statistics, May 1969).

employment of family labour plus what is often described as "disguised" unemployment or 'casual' and "precarious" employment (e.g. of hawkers, coolies, shoe-shiners, and peddlars). Thus, the concept of 'unemployment' has little relevance to this category. It represents a "potential" labour reserve for both the wage-segment and the "entrepreneurial" self-employment segment. Although a positive rate of unemployment in the paid services sector is, in principle, also a source of supply, it may tend to be only a short-run phenomenon. In the long run, this excess supply will be eliminated either by pushing down the prevailing wage assuming wage-flexibility, or alternatively, by disguising itself in the self-employed sector if the wages were institutionally fixed.

Disaggregation of aggregate elasticity of total service employment (E_s) with respect to different economic variables (e.g. income per capita as a measure of aggregate demand) is also desirable. The aggregate elasticity which is the average of the elasticities for wage-labour and self-supporting labour, is likely to conceal differences in the components. First, we consider below the relationships between the aggregate and the individual component which are derived from the preceding employment functions (2) and (3).

If η_1 is the partial elasticity of service employment (E_s) with respect to say, per capita income (Y), and η_2, the partial elasticity of a component of E_s, i.e. E_{ws}, with respect to per capita income (Y), then:

$$\eta_1 = (\eta_2 + \eta_2 \cdot \frac{\partial E_{ss}}{\partial Y} \cdot \frac{\partial Y}{\partial E_{ws}}) \left(\frac{E_{ws}}{E_s}\right) \qquad \text{(4.a)}$$

$$= \eta_2 \cdot \frac{E_{ws}}{E_s} \quad \text{if} \quad \frac{\partial E_{ss}}{\partial Y} \cdot \frac{\partial Y}{\partial E_{ws}} = 0 \qquad \text{(4.b)}$$

$$\text{or } \frac{\partial E_{ss}}{\partial Y} = 0 \text{ and } \frac{\partial Y}{\partial E_{ws}} > 0$$

and $\eta_1 = \eta_2$ only when $\frac{E_{ws}}{E_s} = 1$ ——————————(4.c)

i.e. when all service employment is wage-employment.

$\eta_1 < \eta_2$ when $\frac{E_{ws}}{E_s} < 1$ ——————————(4.d).

Thus, η_1 is likely to fall with a fall in the ratio of service wage-employment to total service employment, (i.e. E_{ws}/E_s).

Similarly, the partial elasticity (η_3) of E_s with respect to supply of labour, N, is likely to fall with a fall in the ratio of self-supporting employment to total employment, [(i.e. E_{ss}/E_s or $(1 - E_{ws}/E_s)$].

$$\eta_3 (E_s, N) = \eta_4 (E_{ss}, N) \cdot \frac{E_{ss}}{E_s} \quad \text{——————(4.e)}$$

$$\text{or } \eta_3 (E_s, N) = \eta_4 (E_{ss}, N) (1 - \frac{E_{ws}}{E_s}) \quad \text{——————(4.f).}$$

The elasticity of employment of self-supporting labour with respect to total labour supply, i.e. $\eta_4 (E_{ss}, N)$, is likely to be high as long as the "sponge" element (i.e. the "residual" or disguised unemployment) is not dried up. (The above relations are also relevant to Sections V and VI below).

An assessment of the absolute magnitudes of the component elasticities (i.e. of wage-labour, self-supporting and family labour) and differences between them can be roughly made by invoking Marshall's four rules on the elasticity of derived demand.[1] These rules are of course, formulated only in terms of

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[1] For a similar attempt at invoking Marshall's rules, see Koji Taira, The Relation Between Wages and Income from Self-Employment: Estimates and International Comparisons, Manchester School, May 1966.

price-elasticity. We have considered above the elasticity of derived demand with respect to per capita income since it is consistant with Colin Clark's thesis and is also more easily amenable to empirical manipulation. Besides, the quantity of services to be produced is a function of both income-elasticity and price-elasticity of demand. If income-elasticity is high and the price-elasticity is relatively low, the substitution of other services for the one in question may be limited and hence the quantity to be produced may not fall with rising costs of production, e.g. the cases of education and health services. Rising prices in these two types of services, at least, may not have any dampening effect on the final demand for services which is income-elastic.[1]

The demand for factor inputs will be more elastic, the larger the elasticity of substitution between them (a la Marshall's First Rule). In principle, the elasticity of substitution between self-supporting labour and wage-labour will be positive. However, in practice, it may be positive but low if there are qualitative barriers to entry of the self-employed into the wage-labour market; or if the supply of self-supporting labour were wage-inelastic. Psychic income of freer labour-leisure choices under self-employment may more than offset the pecuniary advantage of working for a wage. Under the wage system, paid labour does not have much option to regulate its working hours which are contractually fixed. On the other hand, the self-employed offer their labour services to different customers at different places dealing with each only for a short time. Being both producers and consumers at the same time, they enjoy different

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[1] It is quite likely that most LDCs spend increasing proportions of per capita incomes on health and education.

choices of labour, leisure and income. Thus, leisure-income curves for the wage-labour and self-employed labour will tend to have different elasticities. Also the supply of family labour to the paid sector tends to become less elastic with a rise in household incomes.

The derived demand for factor inputs is also a direct function of elasticity of demand for final product (à là Marshall's Second Rule). A change in self-employment in response to an increase in aggregate demand will in general, tend to be lower than a change in wage-employment if the demand for the services of the self-employed were relatively inelastic. However, in some cases it is conceivable and even likely that the reverse is true. If the services which by their very nature involve self-employment (e.g. physicians, lawyers, and other business and professional services) have relatively high income-elasticities (assuming that the demand is sufficiently price-inelastic) swamp the low income-elasticities for shoe-shining, peddling, hawking, vending and similar other traditional services, the aggregate demand for self-employment may turn out to be elastic.

The elasticity of demand for family labour by the owner-operator heads of families[1] is also expected to be low if its weight in the total cost of production were small as it would be when the direct cost of employing family

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[1]Strictly speaking, it may be legitimate to argue that the concept of elasticity of demand based on the marginal calculus, is irrelevant to the self-employed sector. The calculations of a head of the family in employing his family labour in business may rarely converge to what would be an optimum. Also the individual member of the family does not lose his maintenance in the family if his marginal product is zero.

labour is low or zero and the opportunity cost may also be equally low if not zero when the alternative job opportunities are limited (a la Marshall's Third Rule).[1]

Another factor accounting for the low elasticity of derived demand for self-employment (including family labour) may be the low elasticity of supply of such substitute or complementary inputs as capital and entrepreneurial skills. (a la Marshall's Fourth Rule).

In the final analysis, the size of the elasticities of derived demand ( ) for total service employment, wage-employment, self-employment, and family labour will depend on the relative importance of the elasticity of final demand, the elasticity of factor substitution and the supply elasticity of cooperant factors. The necessary conditions for high or low elasticities of derived demand are summarized in Table 1.

For elasticity of derived demand to be high or low, it is necessary but not sufficient that one of the conditions, 2-6, is fulfilled. For example, if elasticity of derived demand for labour in services is high, it implies that either the elasticity of final demand is high and/or the elasticity of factor substitution is high or at least positive. If condition 6, in Table 1, applies i.e. weight (k) of factor in total cost of production is large, then ( ) > 0 and (e) > 0 must hold if the elasticity of derived demand is to be high. Thus condition 6 is necessary but not sufficient.

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[1] For a reformulation of Marshall's Rules, and especially the conditions for technical validity of this Third Rule, See M. Bronfen-brenner, Notes on Elasticity of Derived Demand, Oxford Economic Papers, October 1961. Also, see J.R. Hicks, Marshall's Third Rule, A Further Comment, Oxford Economic Papers, October 1961, op.cit.

Table 1

Elasticities of Derived Demand for Wage- and Self-Supporting Labour in Services.

Elasticities and Necessary conditions ↓ / Derived Demand for Labour →	Total Service employment (E_s) =	Wage-employment (E_{ws}) +	Self-employment (E_{ss1}) +	Family Labour (E_{ss2})
1. Elasticity of Derived Demand (η)	High/Low	High	Low	Low
2. Elasticity of Final Demand (Λ)	High/Low	High	Low	Low
3. Elasticity of Factor-Substitution (σ)	High/Low	Positive	Positive	Low
4. Difference (2-3) or ($\Lambda - \sigma$)	> 0	> 0	$\leqq 0$	$\leqq 0$
5. Supply elasticity of factor (ϵ)	Positive/Lg.	Positive/Lg.	Small	Small
6. Share of factor in costs of production (k)	Large	Large	Small	Small

If we consider only wage-employment and self-employment in services as two factor inputs, the elasticities of final demand and of factor substitution are likely to be the predominant determinants of the elasticities of derived demand. Unionization and minimum wage-legislation tend to raise the price of paid labour relative to that of self-employed labour since the latter (with the exception perhaps of some professions) is least affected by these institutional pressures. Assuming that the wage of the paid labour rises under union pressures while that of the self-employed remains unchanged, the cost of the production will rise and the quantity to be produced will fall if the demand for the product were price elastic. If the elasticity of substitution between E_{ws} and E_{ss}, i.e. $\tau > 0$, the 'substitution effect' will raise the demand for labour in self-employment whereas the decline in the demand for the product will lower the demand for self-employment. The net effect of the two opposing forces will depend on whether $\lambda - \tau \gtrless 0$. This implies that $\lambda \gtrless \tau$, - a condition which also influences the movement of the demand curve for labour in self-employment and hence determines whether the earnings in self-employment will rise or fall, rather than remaining constant.

IV. Growth of Service Employment

Several explanations of the increase of labour absorption in the services are at present in vogue. First, structure of demand is used as an explanatory variable. It is argued that the income-elasticity of demand for services is greater than that for goods and hence also for labour in services. This approach is often associated with the name of Colin Clark. Second, many writers have approached the problem via productivity and explained growth of employment in services by a relatively slower rate of its increase in services. Third, a more

recent approach which may be loosely called the "employment approach" correlates rate of growth of tertiary employment with that of employment in manufacturing assuming that the latter determines employment in services.[1]

Apart from these popular causes of service employment growth, two more are worth mentioning. Firstly, the nature of technological advance in the modern non-tertiary sectors (that is, whether the innovations have a capital-using or a labour-using bias) also tends to determine the size of the labour force in the services sector. Growth of modern industry with high capital-intensity generates a low additional demand for labour in the manufacturing sector with the consequence that the excess supply spills over to the services. Secondly, the reasons for the inflow of manpower into services may be sought in the relative increases in the prices of services instead of production volumes. This implies that relatively higher prices in services (e.g. trade and commerce and professions) attract an inflow of new-comers. However, if the relatively higher prices are due to monopolistic markets, one cannot easily assume an easy entry into those services. Whether the entry to various services is open or restricted is an empirical question which deserves investigation. Yet, it would appear at least intuitively, that the monopolistic advantage to wholesalers and retailers, even if it exists in the LDCs, is at best only a short-run phenomenon which disappears

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[1] Walter Galenson, Economic Development and the Sectoral Expansion of Employment, International Labour Review, June 1963; and A.H. Tulpule, Towards an Integrated Model of Distribution of Service Employment in the Non-Central Areas of Greater London, Bulletin of the Oxford University Institute of Economics and Statistics, August 1968.

with the large influx of new competitors particularly in retail trade.[1] The restriction of entry into the professions, e.g. medicine, is however a universal phenomenon which is accounted for by the minimum legal and educational requirements.

The above explanations refer only to the aggregate amount of labour absorbed in the services sector without any concern with the implications for its components. Labour disaggregation into our three categories, viz. wage-labour, self-supporting labour and family labour, is more useful however, since different explanations may correspond to these different categories or their combination. For example, the income-elasticity of demand is likely to explain best the growth of wage-employment in services in general. On the other hand, the reasons for growth or "swelling" of self-employment in commerce (especially petty retailing) and personal services are to be sought largely on the supply side, viz. constant or declining productivity. High rate of mortality of retail establishments and extremely low earnings from retailing are indicative of low productivity in this service industry.

Thus, the differences in income-elasticities or in productivity can in principle, serve as alternative criteria for labour disaggregation in services. The differences between the different categories of labour lie not so much in the 'status' of workers as in the causal factor of demand or supply accounting for their growth. The 'status' or characteristics of labour is used only as a convenient operational classification. As shown in the following table, the

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[1] Some indication in support of this hypothesis is given in the author's paper on the "Role of the Services Sector..." op.cit.

criterion of differential income-elasticities (we prefer this to that of productivity differentials in view of its empirical advantage in the case of services) also facilitates separation of "modern" and "traditional" types of employment.

Table 2

"Modern" vs. "Traditional" Employment

Labour categories	Income-elasticity	Productivity	Nature of Employment
Wage-labour	High	High	Modern
Self-Supporting Labour	High	High	Modern
	Low	Low/Nil	Traditional
Family Labour	Low	Low/Nil	Traditional

A high income-elasticity qualifies economic activity and employment to be considered as 'modern' whereas a low income-elasticity implies its 'traditional' character.[1] The above three labour categories may only roughly correspond to differences in these elasticities. For instance, within the category of self-

[1]The terms "modern" and "traditional" have gained wide currency in the literature on macro-economic dualism although very little rigorous attempt has been made to define these concepts at a disaggregated level. Most commonly the term "modern" has been used to denote sector of an economy which utilises capital-intensive techniques of production in contrast with the "traditional" sector which is characterized by labour-intensive technology. Although the boundaries between the "modern" and "traditional" are likely to be fuzzy whatever criterion of distinction one uses, the type of techniques or the degree of mechanization seems to be an inappropriate criterion for the services sector. If the commodity-oriented sub-sectors, e.g. transport and communications and public utilities, are excluded, the remainder of the services in the labour surplus LDCs will, by and large, all be relatively labour-using.

supporting labour, the income-elasticity of demand for the services of such professions as health will also tend to be high. Also the earnings in this sub-sector may be well above the average in the wage-sector. Hence, this employment would be included in the "modern" instead of the "traditional" category.

Even at an aggregative level, the conventional explanations of employment growth in services are often considered in isolation rather than in conjunction. For instance, the proponents of the "income-elasticity-of-demand" concept seem to explain growth of tertiary employment by assuming implicitly that the growth of demand does not induce increases in productivity. A jump from the income-elasticity of demand to employment-elasticity is based on the implicit assumption of equality between the two and hence an equality of the rates of increase in consumption and employment. It implies that the level of productivity remains unchanged. In reality however, growth in consumption has two effects, viz. the employment-effect[1] and the productivity effect. When both these effects are positive, growth in employment is greater or smaller depending on whether the relative strength of the employment effect is greater or smaller than that of the productivity effect. The difference between the magnitudes of income-elasticity (η_y) and employment elasticity (η_e) will roughly measure the productivity effect, i.e. $\eta_y - \eta_e \gtreqless 0$ depending on whether the productivity effect

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[1] Positive employment effect need not show itself in a net addition to the employed workers. Instead, a substitution of man-hours for additional workers may occur under conditions of excess labour capacity or low ratio of overtime wages to normal wages. Growth in demand may also lead to an increase in the intensity or effectiveness of work, i.e. an increase in the number of effective hours given the total of nominal hours.

is positive, nil, or negative.

The entire increase in income (or consumption) is itself attributed to increases in employment and productivity. This may be shown, symbolically as follows:

$$\left(\frac{\partial Y}{Y}\right) = \left(\frac{\partial E}{E}\right) + \frac{\partial (Y/E)}{(Y/E)} \qquad \text{---------- (5)}$$

$$\text{or} \quad \left(\frac{\partial E}{E}\right) = \left(\frac{\partial Y}{Y}\right) - \frac{\partial (Y/E)}{(Y/E)}, \qquad \text{---------- (5.a)}$$

where the first variable on the right-hand side of theequation measures the growth of employment or income, and the second measures the growth of average labour productivity. If employment elasticity of output, $\eta_e = 1$, the entire increase in output will result from an increase in employment. If $(1-\eta_e) > 0$, part of the increased output will be due to an increase in average labour productivity.[1]

It is quite likely that the tertiary producers are induced to raise productivity in response to income-elastic demand for their products. For instance, in retail trade, it is conceivable that rapid increases in sales in consequence of growth in demand, facilitate introduction of productivity-raising methods of selling. Increases in productivity in turn may raise demand via cost reduction. This inducement to reduce costs will tend to be greater in industries that are subject to international competition and less in those

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[1] For empirical estimates of employment elasticities of output by sector as planned in various economic development plans, see C. Hsieh, Planned Rates of Employment Increase in Development Plans, International Labour Review, January 1968. Of the twenty-two development plans considered, only three, namely, the Philippines (1963-1967), Ghana (1963-1970), and Turkey (1963-1967) showed that the employment elasticity of output in the services sector was greater than unity.

that are not. Since a large bulk of the service industries belong to the "national" sector, it is likely that the rate of demand-induced or endogenous increases in productivity would be relatively low. The differences in the size of external economies of scale between manufacturing and services are also likely to account for a part of the differential in these induced productivity changes. For the income-elasticity of demand to explain increase of labour absorption in services, it is necessary to assume that either the productivity effect is zero or its labour-displacing effect is more than offset by the net employment resulting from the income-effect.

The 'productivity school' seems to lay much of the burdean on slower rate of increase in productivity, presumably assuming a given income-elasticity of demand for services. It has also tried to demonstrate empirically that the income-elasticity of demand for services is not much greater than unity.[1] However, not much reliance can be placed on any productivity estimates for the services

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[1] Victor Fuchs has shown that the income-elasticity of demand for services is only slightly higher than that for goods in the United States. According tohis estimates, the elasticity for total retail sales of goods is 0.97, for personal services 1.12, and for total state and local government expenditures, 1.07. (See Victor Fuchs, The Service Economy, 1968, p. 42). In an OECD study covering member countries, income-elasticity of demand for services, estimated on the basis of inter-country comparison of consumer expenditures, also turned out to be relatively low. The low elasticity refers to the group "other goods and services" which excludes commerce, banks, insurance and real estate, business services and part of this consumption of services by households supplied by collective bodies. Thus, the coverage is limited mainly to those activities which produce services directly for final consumers. (See Maurice Lengellé, The Growing Importance of the Service Sector in Member Countries, OECD, Paris, 1966).

sector in view of measurement difficulties and conceptual and definitional differences and disagreements among economists. Gary Becker[1] has argued that the conventional low productivity estimates for such services as barbers and beauty shops, and for retailing are seriously biased downwards since no account is taken of the productivity of non-marketed time consumed by households. While the conventional estimates pertain to service industries, Becker's argument clearly covers all service activities.

The "employment approach" which assumes that growth of service employment is a function of the growth of manufacturing employment can only be a variant of the "income approach." It assumes that the growth of employment in manufacturing reflects (a) increased final demand for consumer services, and (b) increased intermediate demand for services resulting from the growth of industrial output. In other words, growth of industrial employment works only as a proxy for the growth of industrial output, assuming a fixed output-employment relationship. Professor Galenson has described (a) above as the "employment multiplier effect," and (b) as "fixed technological relationships between jobs in manufacturing and supporting services elsewhere."[2] A disaggregated analysis of labour absorption in the individual service industries of the LDCs may tend to reveal however that the most rapid increases occur in the public welfare-type services such as health and education that can be largely independent of

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[1] G. S. Becker, A Theory of the Allocation of Time, The Economic Journal, September 1965.

[2] Walter Galenson, op. cit.

commodity or manufacturing production. This is an empirical question that merits investigation. The effect of "technological relationships" on tertiary employment may also be uncertain. Empirical evidence indicates that even in the most advanced economies like the United States, growth of intermediate demand for services by goods-producing industries accounts for only a small part of the total shift of labour force to the services sector.[1]

V. Colin Clark and the Critics

It is clear by now that the income-elasticity of demand for tertiary products has some explanatory role in the growth of services employment. In principle, if expenditure on agricultural products declines with increases in incomes, as Engel's law demonstrated, the services-sector as a 'residual' will necessarily have an expenditure-elasticity greater than one unless manufacturing had an elasticity much greater than unity. Colin Clark[2] was one of the early economists who appears to have extended Engel's law to the tertiary sector. To quote him:

> (a) "Studying economic progress in relation to the economic structure of different countries, we find a very firmly established generalization that a high average level of real income per head is always associated with a high proportion of the working population engaged in tertiary production. The reason for this growth of the relative number of tertiary producers must largely be sought on the demand side." (Emphasis added). (1st Edition, 1940, pp. 6-7).

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[1] Victor Fuchs, The Service Economy, op.cit. p. 39.

[2] Colin Clark, The Conditions of Economic Progress, 1940, and 1957.

(b) "As real income per head increases, it is quite clear that the relative demand for agricultural products falls all the time, and that the relative demand for manufacture first rises, and then falls in favour of services. This generalization remains; though it should be pointed out that if we confined our analysis to consumers' services alone, we would not, in the the United States and other wealthy modern communities, get quite the same result. At the prices which now have to be paid for them, these services direct to consumers are not showing a high marginal demand, relative to that for other goods. If, on the other hand, we include that large and increasing range of services which are now supplied to business, we again conclude that the relative demand for services as a whole is increasing." (Third Edition, 1957, pp. 493-494).

It is somewhat surprising that a largely rewritten Third Edition of Colin Clark's book which qualifies his former "firmly established generalisation," has gone unnoticed by the critics and commentators. The concept of income-elasticity of demand cannot explain the influence of other factors such as changes in relative prices. This is also recognised in the revised version of Clark's thesis.

In the light of our attempt at disaggregation, we consider below the two interrelated aspects of the oft-quoted proposition of Colin Clark, viz. (a) inter-sectoral reallocation of labour with economic development, and (b) relationships of these changes in occupational distribution to those in levels of income per capita.

Let us assume that the marginal propensity to consume services varies with different income-groups so that it is higher for groups higher in the income scale,[1]

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[1] If $\frac{\partial C_{js}}{\partial Y_j} = \frac{\partial C_{ks}}{\partial Y_k} = \frac{\partial C_{ns}}{\partial Y_n}$, i.e. marginal propensity to consume services of households were equal irrespective of their incomes, redistribution of a given increment in national income would leave the aggregate level of service consumption unchanged.

i.e.

$\frac{\partial C_{js}}{\partial Y_j} > \frac{\partial C_{ks}}{\partial Y_k} > \frac{\partial C_{ns}}{\partial Y_n}$, where subscripts 'j', 'k', 'n' refer to the upper, middle, and low income groups respectively and subscript 's' stands for services. Let us also assume that the bulk of an increment in national income accrues to the low-income group. This increase in national income may not raise the national average propensity to consume services if the marginal propensity to consume services for this group (i.e. $\frac{\partial C_{ns}}{\partial Y_n}$) is lower than the national average propensity to consume services (i.e. $\frac{C_s}{Y}$). However, given the premise that the bulk of the increment in national income instead accrues to the upper income group whose marginal propensity to consume services (i.e. $\frac{\partial C_{js}}{\partial Y_j}$) is likely to be greater than the national average (i.e. $\frac{C_s}{Y}$), the propensity to consume tertiary products will rise.[1]

Thus, the conditions necessary for the growth in demand for services would be as follows:

(a). $\frac{\partial C_s}{\partial Y} > \frac{C_s}{Y}$, i.e. the aggregate marginal propensity to consume services is greater than the national average;

(b). $\frac{\partial C_{js}}{\partial Y_j} > \frac{C_s}{Y}$, i.e. marginal propensity to consume services for the upper income group is greater than the national average;

The differences in the marginal propensities to consume services are attributed not only to the <u>level</u> of income of the consumers and to the <u>pattern</u> of income-distribution but also to the <u>stability</u> or <u>instability</u> of these incomes.

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[1] For a discussion of the relationship between marginal and average propensities to consume in defense of Colin Clark, See L. Triantis, Economic Progress, Occupational Redistribution and International Terms of Trade, <u>Economic Journal</u>, Sept. 1953; and for a vehement critique of Clark's thesis, See Peter Bauer and B.S. Yamey, Economic Progress and Occupational Distribution, <u>Economic Journal</u>, December 1951.

They will tend to vary also according to the nature of the occupational composition of households. Those who earn fluctuating incomes (e.g. farmers and businessmen) are noted to have lower marginal propensities to consume than those of wage-and salary earners.[1] It is therefore likely that the marginal propensity to consume services of the former group would also be relatively lower. Since the fluctuating incomes are the remunerations to self-employment, the proportions of the self-employed and wage-labour in the total labour force, and their relative changes would also affect the demand for services. Further, the self-employed form a heterogeneous category covering entrepreneurial businessmen, family workers, and the under-employed or the "near-employed." It is conceivable that the low marginal propensity to consume of the entrepreneurial self-employed is due to the increase in the ratio of their retained to disposable incomes or due to an increase in their marginal propensity to save. Yet, the Engel's law would suggest that an increase in their disposable incomes is spent largely on the less necessary goods and services than on food. The situation of the "near-unemployed" and the own-labour with "subsistence" earnings may on the other hand, be quite different. The small increases in these low and fluctuating incomes are more likely to raise the consumption of "essential" goods (mainly foodstuffs) than of services. As the LDCs observe a large-scale 'disguised unemployment' (primarily in self-supporting service occupations) at

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[1] Some statistical estimates of the marginal propensity to consume for Netherlands, 1935-36, made by A.L.G.M. Rombouts, show that figures for the agricultural workers, and farmers were 0.79 and 0.44 respectively as compared to 0.83 and 0.82 for manual and brain workers respectively (Statistical Measure of Keynes' Concepts, "propensity to consume, etc." for the Netherlands, Netherlands Business-cycle Studies, XI (1940), p. 21 (in Dutch), quoted in J. Tinbergen Econometrics, 1951, p. 96.

low levels of development, the elasticity of demand for services would tend to be relatively low (even if it is greater than one), partly because of the low magnitude of decline in the expenditure elasticity for food.[1]

Colin Clark's proposition on intertemporal reallocation of labour, particularly the shifts from secondary to tertiary industries has been the subject of much greater controversy among scholars of the LDCs economies. Its applicability to the experiences and situations in the LDCs has been frequently challenged. For instance, it is shown that at low levels of income per capita, the proportion of total labour force engaged in services can be much higher than that in industry.[2] It is further claimed that an increase in the total labour force is also associated with relative increases in labour absorption in the tertiary sector and declines in agriculture and not in manufacturing, as Colin Clark's thesis would suggest. We argue that these criticisms at least in the context of the LDCs, are fallacious

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[1] A similar situation may also obtain at very high levels of total expenditure. Houthakker's estimates of expenditure elasticities show that the elasticities for food are relatively high for USA and Canada, whereas those for "miscellaneous" items (largely services) are relatively low compared to those for other countries. Since $\Sigma Y_i \beta_i = X$, where, Y_i - expenditure on i^{th} item and β_i - expenditure elasticity of the i^{th} item, and X - total expenditure, and the sum of the elasticities on food, clothing, housing and miscellaneous group is equal to unity, a relatively high elasticity for food must mean a decline in some or all of the other components. See H.S. Houthakker, An International Comparison of Household Expenditure Patterns, Commemorating the Centenary of Engel's Law, Econometrica, October 1957.

[2] See Alain Cotta, Analyse Quantitative de la Croissance des Pays Sous développés, Presse Universitaires de France, 1967. Mr. Cotta gives a table showing percentage distribution of labour force among sectors in seven low-income African countries and demonstrates that with the exception of Senegal, the share of tertiary sector in the labour force ranges between 20 to 30 percent, whereas that of secondary sector, only between 10-18 percent (p.77). In the case of Senegal, the share of tertiary and secondary sectors were respectively, 40 percent and 24 percent.

and do not necessarily invalidate Clark's thesis. The empirical evidence presented by the critics is also inconclusive and perhaps, even misleading.

There is no a priori reason to believe in the existence of any definite, consistent and universal pattern of labour transfers between agriculture, manufacturing and services sectors of the LDCs. The differential rates of industrial and economic growth among countries will account for differences in the magnitudes and directions of inter-sectoral as well as intra-sectoral labour flows. At rates of growth close to the "critical minimum", the surplus agricultural labour may tend to shift towards 'traditional' manufacturing. Such a shift may well represent a move from low marginal-productivity occupations to relatively higher marginal productivity ones, which is "equilibrating" and hence economically desirable. This would be consistent with Colin Clark's proposition of a shift of labour from agriculture to manufacturing. However, in most LDCs, faster growth is usually achieved through the development of modern industry which is more amenable to the use of capital-intensive techniques due to greater economies of scale, better linkages and higher capacity for capital accumulation. Rapid industrial growth of this nature tends to push labour absorbed in traditional manufacturing to non-modern services, thus raising productivity in the former and employment in the latter. This effect on labour-absorption is not totally unmixed. At the rates of growth much above the "critical minimum", the "potential" labour surplus in services may begin to be absorbed in industry. Second, the rapid growth of industry will generate "modern" employment in complementary services. This technical complementarity does not exist between the "unorganised" services on the one hand, and "modern" or "unorganised" traditional industry on the other. The net effect of these opposite movements, viz. industry absorbing the 'labour

reserve' of the services (i.e. E_{ss2}) and generating "modern" employment (i.e. E_{ws}, and E_{ss}) in the latter would tend to raise the relative share of "tertiary producers" whose growth is accounted for by forces "on the demand side" à la Colin Clark. The rate of transformation of the "sponge" into the modern types of tertiary and manufacturing labour will depend on the rate at which the two contrary processes occur as a result of increases in per capita incomes. It is the "modern" demand-induced service employment to which Clark's thesis is really relevant in the case of the LDCs. Probably, his thesis will be more valid if increases in income per capita were large and rapid than if they were very small and slow. For in the former case, an increase in the rate of growth is more likely to generate larger 'complementary effect' and thus accelerate the rate of transformation of the potential labour reserve into productive and modern employment in services.

Thus, it becomes clear that single-factor explanation, viz. income-elasticity of demand for tertiary products cannot account for the entire growth of the labour force engaged in the services sector of the LDCs. A very large observed employment in services is also partly due to a relatively greater amount of labour input per unit of real tertiary output; it is particularly due to the supply factors such as population pressure, which are unimportant in the developed countries in the explanation of growth of tertiary employment. Obviously, a large bulk of employment in such unorganised services as shoe-shining, petty retail trades and similar activities of peddlers, hawkers and vendors has insignificant income-elasticity of demand. It may well be totally independent of the demand variable in question, namely, income per capita. The point becomes

clear by tracing the effect of changes in explanatory variables on total service-employment in our employment function (2), when $E_s = f(Y, K, N, W)$,

$$dE_s = \left(\frac{\partial E_s}{\partial Y}\right) dY + \left(\frac{\partial E_s}{\partial N}\right) dN - \left(\frac{\partial E_s}{\partial K}\right) dK - \left(\frac{\partial E_s}{\partial W}\right) dW \qquad (6)$$

In order to test Colin Clark's hypothesis, it would be necessary to overcome the identification problem and determine the portion of observed tertiary employment that is demand-determined and in the case of which the supply effects are insignificant.[1] In other words, in the equation (6) above, the effect of Y on labour absorbed in the tertiary sector, $\left(\frac{\partial E_s}{\partial Y}\right) dY$, will have to be singled out, holding all other explanatory variables constant. Thus, the partial derivative would be of the form $\frac{\partial E_s}{\partial Y} = fy$, with $\frac{\partial E_s}{\partial K} = 0$, and $\frac{\partial E_s}{\partial N} = 0$, and $\frac{\partial E_s}{\partial W} = 0$. In the case of most labour surplus LDCs, however, it is quite unrealistic to assume that $\frac{\partial E}{\partial N} = 0$, i.e. the elasticity of employment with respect to labour supply is nil. In fact, the well-known phenomenon of "work-sharing", taken to extremes would instead suggest that at least a portion of E_s, say $E_{si} = f(N)$ with $\frac{\partial E_{si}}{\partial N} > 0$ and $\frac{\partial E_{si}}{\partial Y} = 0$.

Our approach to disaggregate employment functions, as in (2.a-2.c), provides a partial solution to the problem of identification of the demand and supply determinants of labour requirements in services. It is only when condition (4.c), i.e. $E_{ws}/E_s = 1$, or when all service employment is wage-employment, holds that the Colin Clark-type arguments become truly relevant to the situations in the

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[1] Mr. Cotta (op.cit.) has shown that in Senegal, the share of labour in tertiary sector is as high as 49 percent. Mr. Pfeffermann, who has on the other hand, conducted extensive on-the-spot enquiries and collected detailed data on Senegal states: "A large pool of 'near-unemployed' petty traders, shoe-cleaners, occasional beggars, etc. can be added to unemployment figures." (See Guy Pfeffermann, Industrial Labour in the Republic of Senegal, 1968, p. 43). If account is taken of this "near-unemployed" element, it is quite certain that the high figure of 49 percent would be considerably reduced.

LDCs. So long as $E_{ws}/E_s < 1$, and E_{ws} is small, $(1-E_{ws})$ which is equal to the self-employed, will be large. The latter also includes "traditional" supply-induced element. It is therefore illogical to assume that all self-employment in the LDCs is demand-determined, or that the income-elasticity of demand for self-employment is high. The "residual" category of self-employment in the services represents a 'structural' phenomenon (unlike the 'cyclical' one in the developed countries)[1] which occurs primarily due to the limited availability of capital and slow growth of wage-earning jobs. Its disappearance is essentially a long-run problem which cannot be easily explained by short-run concepts such as static income-elasticities of demand.

Colin Clark's thesis is said to fit well to the cases of the developed economies however. Although it is rarely made clear why this is so, it would appear that this is largely because either (i) self-employment in total service employment forms a relatively small proportion, or (ii) it represents a "modern" element, (which is a function of high income-elasticity of demand) and not the "sponge" which has dried up over the past century or so.[2] Thus, even though in

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[1] In the developed economies, a drift towards services is only a temporary phenomenon caused by cyclical fluctuations of demand. Kaldor, has, for instance, suggested that in the case of a "stop-go" cycle in Britain, there might have been a drift of labour into services due to a fall in employment in manufacturing in the "stop" phase, which was not reversed in the subsequent "go" phase. See N. Kaldor, Causes of the Slow Rate of Economic Growth of the United Kingdom - An Inaugural Lecture, Cambridge University Press, 1966, p. 30.

[2] To quote Kaldor, "However, disguised unemployment in "services" had been just as prevalent in Victorian England (as in present-day India or Latin America) there were vast numbers of people who eked out a living in urban areas as hawkers, petty tradesmen, servants, etc. on very low earnings." He goes on to state that this "relates to both self-employed and employees alike. In the population Census of 1891, 15.8 per cent of the occupied population of Britain were classified as domestic servants. In the Census of 1961, the figure was 1.4 per cent." (See Nicholas Kaldor-Productivity and Growth in Manufacturing Industry: A Reply, Economica, November, 1968.

reality, $E_{ws}/E_s \neq 1$, the self-employed can be treated at par with the wage-employed so that it is "as if" $E_{ws}/E_s = 1$.

VI. Some Empirical Illustrations

Unfortunately, satisfactory and required data for the LDCs are not available for a proper empirical support of our hypotheses. For example, in the employment function (2), no reliable information on exogenous demand variables, viz. capital stock and wage rates could be obtained. Under the circumstances, per capita income is chosen as a single measure of aggregate demand. The choice of this variable is also consistent with Colin Clark's thesis. A second exogenous factor is a supply variable, viz. the ratio of labour force (employed plus unemployed) to adult population. It is assumed that all types of employment in services (i.e. wage-employment, self-employment and family labour), and in particular self-employment, is determined by available labour supply as well as aggregate demand. The substitution possibilities between labour and capital and/or between one type of labour for another will take place indirectly via flexibility or rigidity of the wage rate. If the wages were institutionally fixed in the wage-sector, the excess labour supply will put strong pressures for absorption into the self-employed sector. Use is made of the multiple regression technique to isolate the effects of the above two exogenous variables. The following regression equations were tested with the aid of cross-country data for sixteen LDCs and time-series for the Philippines and Japan. In the latter case, an attempt was also made to compare the results of pre-war series (1930-42) with those of the post-war series (1950-64). In the absence of employment data by 'status'

of workers for the pre-war period, only the aggregate employment function of equation (7) below could be tested.

$$\log \frac{E_{is}}{E} = a_o + b_o \log \left(\frac{Y}{N} \right) + c_o \log \left(\frac{L}{N_o} \right) \text{ ——————(7)}$$

$$\log \frac{E_{wis}}{E} = a_1 + b_1 \log \left(\frac{Y}{N} \right) + c_1 \log \left(\frac{L}{N_o} \right) \text{ ——————(8)}$$

$$\log \frac{E_{sis}}{E} = a_2 + b_2 \log \left(\frac{Y}{N} \right) + c_2 \log \left(\frac{L}{N_o} \right) \text{ ——————(9)}$$

$$\log \frac{E_{ssis}}{E} = a_3 + b_3 \log \left(\frac{Y}{N} \right) + c_3 \log \left(\frac{L}{N_o} \right) \text{ ——————(10)}$$

Where $\frac{E_{is}}{E}$ = the proportion of total employment in the i^{th} sub-sector of the services (S) sector;

$\frac{E_{sis}}{E}$ = the share of self-employment of the i^{th} sub-sector of the S-sector in total employment;

$\frac{E_{ssis}}{E}$ = the share of family labour of the i^{th} sub-sector of the S-sector in total employment;

$\frac{Y}{N}$ = per capita income;

$\frac{L}{N_o}$ = ratio of labour force to adult population

Three service sub-sectors, viz. commerce, (ISIC 4) transport (ISIC 5), and services (ISIC 6), were considered. For lack of data, further disaggregation of services could not be undertaken.

The regression results of the cross-country data and the Philippine time-series (only nine observations were available) turned out to be quite unsatisfactory. Since R^2 were very low and most of the regression coeficients were insignificant, these results had to be rejected.[1] On the other hand, the results obtained with

[1] It is not very surprising that the cross-sectional results were bad. The large differences in the definitions and concepts regarding self-employment and family labour are bound to distort results. Besides, the proportions of labour engaged

(continued on next page)

the Japanese data for both the periods considered, were much better. The explanatory power of the exogenous variables, as indicated by R^2, was quite large for all the three sectors considered. Most parameters were also significant at the 95 per cent level of confidence. The values of the estimated equations are presented below:

JAPAN I (1930-42)

Number of Observations		R^2
	A. Commerce	
13	$\log \frac{E_{is}}{E} = 4.338 + 1.009 \underset{(0.015)}{(\log \frac{Y}{N})} + 0.256 \underset{(0.018)}{(\log \frac{L}{N_o})}$	0.999
	B. Services (including government)	
13	$\log \frac{E_{is}}{E} = 4.561 + 0.945 \underset{(0.008)}{(\log \frac{Y}{N})} + 0.041 \underset{(0.010)}{(\log \frac{L}{N_o})}$	0.999
	C. Transport (including communication, gas, water, electricity)	
13	$\log \frac{E_{is}}{E} = 4.678 + 1.091 \underset{(0.018)}{(\log \frac{Y}{N})} - 0.088 \underset{(0.021)}{(\log \frac{L}{N_o})}$	0.999

JAPAN II (1950-64)

	A. Commerce	
15	(1) $\log \frac{E_{is}}{E} = -4.792 + 0.358 \underset{(0.043)}{(\log \frac{Y}{N})} + 1.998 \underset{(0.515)}{(\log \frac{L}{N_o})}$	0.885

Footnote continued from page 35: engaged in wage-sector and the self-employed sector at any particular point of time, are affected by the tightness or slackness of the wage-labour market. The observations for different countries related to very different periods of time. In the case of the Philippines, apart from the fact that the sample was very small, the employment data (taken from the Statistical Survey of Households) referred only to the survey week rather than an average for the whole year.

Number of Observations		R^2
	A. Commerce	
15	(2) $\log \frac{E_{wis}}{E} = -4.371 + \underset{(0.047)}{0.781} \left(\log \frac{Y}{N}\right) + \underset{(0.566)}{1.944} \left(\log \frac{L}{N_o}\right)$	0.961
	(3) $\log \frac{E_{sis}}{E} = -3.248 - \underset{(0.041)}{0.102} \left(\log \frac{Y}{N}\right) + \underset{(0.499)}{1.094} \left(\log \frac{L}{N_o}\right)$	0.449
	(4) $\log \frac{E_{ssis}}{E} = -16.125 + \underset{(0.076)}{0.666}^{1} \left(\log \frac{Y}{N}\right) + \underset{(0.916)}{4.177} \left(\log \frac{L}{N_o}\right)$	0.653
	B. Services (excluding government):	
15	(1) $\log \frac{E_{is}}{E} = -2.312 + \underset{(0.031)}{0.355} \left(\log \frac{Y}{N}\right) + \underset{(0.374)}{1.304} \left(\log \frac{L}{N_o}\right)$	0.926
	(2) $\log \frac{E_{wis}}{E} = -0.422 + \underset{(0.056)}{0.553} \left(\log \frac{Y}{N}\right) + \underset{(0.673)}{0.858} \left(\log \frac{L}{N_o}\right)$	0.895
	(3) $\log \frac{E_{sis}}{E} = -7.436 - \underset{(0.027)}{0.029}^{1} \left(\log \frac{Y}{N}\right) + \underset{(0.329)}{1.997}^{1} \left(\log \frac{L}{N_o}\right)$	0.755
	(4) $\log \frac{E_{ssis}}{E} = -12.796 + \underset{(0.038)}{0.050}^{1} \left(\log \frac{Y}{N}\right) + \underset{(0.456)}{3.050} \left(\log \frac{L}{N_o}\right)$	0.802
	C. Services (including government):	
15	(1) $\log \frac{E_{is}}{E} = 1.430 + \underset{(0.031)}{0.257} \left(\log \frac{Y}{N}\right) + \underset{(0.374)}{0.424}^{1} \left(\log \frac{L}{N_o}\right)$	0.857
	(2) $\log \frac{E_{wis}}{E} = 4.189 + \underset{(0.050)}{0.359} \left(\log \frac{Y}{N}\right) - \underset{(0.610)}{0.251}^{1} \left(\log \frac{L}{N_o}\right)$	0.805
	D. Transport (including communication, gas, water, electricity):	
15	(1) $\log \frac{E_{is}}{E} = 7.405 + \underset{(0.011)}{0.236} \left(\log \frac{Y}{N}\right) - \underset{(0.138)}{1.232} \left(\log \frac{L}{N_o}\right)$	0.974
	(2) $\log \frac{E_{wis}}{E} = 7.900 + \underset{(0.014)}{0.262} \left(\log \frac{Y}{N}\right) - \underset{(0.169)}{1.346} \left(\log \frac{L}{N_o}\right)$	0.969

$$(3)\quad \log \frac{E_{sis}}{E} = 10.854 - \underset{(0.124)}{0.305}\ (\log \frac{Y}{N}) - \underset{(1.495)}{3.179^{2}}\ (\log \frac{L}{N_o}) \qquad 0.494$$

$$(4)\quad \log \frac{E_{ssis}}{E} = -11.550 - \underset{(0.161)}{0.295^{2}}\ (\log \frac{Y}{N}) + \underset{(1.933)}{1.894}\ (\log \frac{L}{N_o}) \qquad 0.248$$

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1 = not significant at 5% level of probability.
2 = significant at 10% level of probability. N.B. Other coefficients are all significant at 5%.

N.B. (a) For Japan I, employment data refers to gain-fully occupied population. Data are taken from Ohkawa - The Growth Rate of the Japanese Economy Since 1878. For basic data used, see Appendix I;

(b) Durbin-Watson Statistic at 5% significance shows that in most cases, there is no autocorrelation in the time series.

It is worth noting that in the case of services, for Japan II, the explanation through the chosen exogenous variables is improved if employment in government is excluded. For equation (1), R^2 increases from 0.85 to 0.92 and for equation (2), it rises from 0.80 to 0.89.

Since the regression equations were run in double-log form the regression coefficients can be taken as employment elasticities with respect to per capita income (η_Y) and the size of labour force (η_L). These elasticities are given in the following table:

Table 3

Employment Elasticities

Sector and Labour Category	Japan I (1930-42)		Japan II (1950-64)	
	(η_Y)	(η_L)	(η_Y)	(η_L)
A. Commerce				
E_{is}/E	1.00	0.25	0.35	1.99
E_{wis}/E	-	-	0.78	1.94
E_{sis}/E	-	-	-0.10	1.09
E_{ssis}/E	-	-	0.06	4.17

Sector and Labour Category	Japan I (1930-42)		Japan II (1950-64)	
	(η_Y)	(η_L)	(η_Y)	(η_L)
B. Transport				
E_{is}/E	1.09	-0.08	0.23	-1.23
E_{wis}/E	-	-	0.26	-1.34
E_{sis}/E	-	-	-0.30	-3.17
E_{ssis}/E	-	-	-0.29	1.89
C. Services				
E_{is}/E	0.94	0.04	0.35[a] 0.25[b]	1.30[a] 0.42[b]
E_{wis}/E	-	-	0.55[a] 0.35[b]	0.85[a] -0.25[b]
E_{sis}/E	-	-	-0.02	1.99
E_{ssis}/E	-	-	0.05	3.05

[a] excluding government,
[b] including government,
- data are not available.

A number of observations are noteworthy in the above table, viz:

(a) η_Y - elasticity of employment with respect to per capita income is high when η_L - elasticity of employment with respect to supply of labour is low and vice versa. This is true in the case of all sectors and labour categories, in the two periods considered;

(b) η_Y - is invariably high for wage-employment and low or negative for both self-employment and family labour in all the three sectors considered. This appears to bear out our hypothesis that differential income-elasticities can be used to disaggregate labour into "modern" and "traditional" categories. Per capita income hardly explains the employment of family labour or self-employed

labour. On the other hand, large values of η_L for these categories, particularly for family labour, suggests that the 'supply effects' are particularly strong and that the self-supporting labour, engaged mostly in the small-scale enterprises represents a subsistence sector in services. In both commerce and services, although income-elasticity for family labour is positive, it is as low as 0.05. This very low but positive income-elasticity for family labour may reflect a slow process of modernisation of employment structure in services. The percentage of family labour, between 1956 and 1968, has remained fairly steady in services in general. In business services however, dependence on family labour has slightly increased, which may suggest a gradual expansion of the scale of own-account business.[1]

(c) The negative income-elasticities for the self-employed (or owner-operators) in all the three sectors suggests that there is a positive substitution of the wage-labour for self-supporting labour.

(d) In the case of transport sector alone, all types of employment (except family labour) show a negative correlation with respect to the supply of labour. With the assumption of positive supply effects, one would however expect a positive sign. There can perhaps be two economic interpretations of this negative correlation. First, the transport sector (which in our case, also includes communication, gas, water and electricity) is more likely to be capital-intensive so that there is a technical limit to the possibilities of labour-capital substitution. Second, it may also be argued that negative η_L reflects a

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[1] See Koichi Emi, Employment Structure in the Service Industries, Developing Economies, June 1969.

downward wage-rigidity. However, this latter argument is less plausible in view of its irrelevance to non-wage-based self-employment. Besides, if the wages were rigid or rising, there would be a tendency for the excess supply of labour to show up in an increase in self-employment. Yet, η_L for owner-operators in transport is also negative although it is positive for family labour. This may only suggest that the supply effects on the amounts of labour demand need not always operate through wage-flexibility.

(e) While in commerce, η_Y - income-elasticity for wage-employment (E_{ws}) is more than twice as high as that for total commerce employment, (E_{is}), it is only slightly higher in the case of transport (e.g. 0.26 against 0.23) and services (e.g. 0.55 against 0.35). This observation fits in with our hypothesis that η_Y for total employment in a sub-sector is low when the share of wage-labour in total, i.e. E_{ws}/E_s, is small or when the share of the self-employed, i.e. $(1 - E_{ws}/E_s)$ is large (see relations 4.a-4.d). η_Y for E_{is} approaches η_Y for E_{ws} as E_{ws}/E_s approaches unity. This explains why we notice only a slight difference between these two elasticities in transport. In this sector, the bulk of the labour force works for a wage and the share of self-supporting labour is very small. On the other hand, in commerce, the share of wage-labour (E_{ws}/E_s) is relatively quite small or that of the self-employed ($1-E_{ws}/E_s$) is quite large. (See Appendix II).

(f) Finally, the contrast between the prewar and the post-war period elasticities is perhaps the most striking. The statistical discrepancies in the coefficients may in part be due to the non-homogeneity of the time-series (except the series for per-capita income) for the two periods. In Japan I, data on

"gainfully occupied population" had to be used as a proxy for employment the information for which is not available for the prewar period. Secondly, while the labour supply exogenous variable in this case represents ratio of 'total gainfully occupied to working-age population' (taken from Ohkawa), in Japan II, it refers to the ratio of total labour force to adult population. However, with the use of working-age data (taken from the UN Demographic Yearbook) attempt was made to see if the results were sensitive to a change in this exogenous variable. No significant change or improvement of the regression results was obtained. The original results which were more significant are retained.

One may only conjecture that the supply effects in the services sectors were perhaps relatively insignificant before the war, and fairly significant in the post-war period. This is no doubt contrary to the popular hypotheses about the existence of unlimited supplies of labour in the prewar period and labour shortage in the post-war period. One plausible explanation for this inconsistency may be severe labour market imperfections and monopolistic restrictions to entry into commerce and services in the prewar period which disappeared in the fifties and the early sixties.

The following alternative regression equation was also estimated:

$$\log \frac{E_{is}}{E} = a + b \left(\log \frac{Y}{N}\right) + c \left(\log \frac{\Delta L}{L}\right) \qquad \text{(11)}$$

where $\left(\frac{\Delta L}{L}\right)$ is the annual rate of growth of labour force substituting $\left(\frac{L}{N_o}\right)$ in equations 7 to 10. In case of both Japan I and Japan II, the explanatory power of the exogenous variables declined since the values of R^2 were generally lower than those of the earlier estimates. The coefficients for $\left(\frac{\Delta L}{L}\right)$ were statistically insignificant. The standard errors of this coefficient were also

large and the D-W statistic suggests the existence of auto-correlation in the time-series. (See Appendix III).

The choice of Japan was conditioned largely by the availability of time-series data classified into our three labour categories. It may be quite legitimate to argue that Japan is not an LDC and therefore its experience, particularly of the post-war period, is markedly different from that of a developing country. While this is in general true it appears that Japan's employment structure in service industries is relevant to, at least, a few if not several developing countries. Existence of a sizeable proportion of the self-employed and family labour engaged in commerce, personal services, business and repair services, indicates that Japan's service industries have been slow to modernise their employment structure.

VII. Concluding Remarks

We have made a plea that a disaggregated analysis of the LDCs services sector is more rewarding than a purely aggregative one. The conventional disaggregation of total service output into that of sub-sectors alone is not adequate. It has been demonstrated that a disaggregation of labour input, i.e. a three-fold classification into wage-labour self-supporting labour, and family labour is more appropriate. In most LDCs which suffer from dualistic economic structures, labour disaggregation, and the disaggregate employment functions as proposed in this paper serve both analytical and policy objectives. On an analytical plane, they help (a) to identify the size and magnitude of "residual" employment and (b) to provide a conceptual basis for distinguishing between "traditional" and "modern" types of employment. On a policy level, they provide

a sound basis for fixing sectoral employment objectives and targets.

It is interesting to note that apart from setting total employment target (to be determined by particular planned rates of income growth), the Japanese planners envisaged reallocating labour out of the categories of self-employed and family workers into that of wage-labour. One of the employment objectives of the Japanese Five-year Plan (1958-62) was to absorb the new-school-leavers into wage-earning jobs. In the Ten-Year Plan of Japan (1961-70), the employment target set for 1970 was defined in terms of a transfer of the self-employed and family workers (e.g. mostly supply-induced employment) to wage-earning or salaried "modern" employment.[1] This policy goal of "modernising" employment structure should be equally relevant to the less developed countries in their long-term perspectives.

Implicit in the above planning objectives or targets is the implication that all self-employment (including family labour) is the result of "push" rather than "pull" factors, and hence it is of a low-productivity nature. In other words, it simply means that the conditions of labour supply largely determine the amount of labour demanded in services. We have attempted to show that the simple demand rationale which ignores "supply effects" is inadequate for the analysis of the LDCs tertiary sector. It is for this reason also that Colin Clark's thesis can be valid only under very special assumptions.

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[1] New-Long-Range Economic Plan of Japan (1961-1970) - Economic Planning Agency, Japanese Government, Tokyo, pp. 16-17.

APPENDIX I

Values of Endogenous and Exogenous Variables of the Sample

Table I Japan I (1930-42)

Year	Endogenous: Commerce (E_{is}/E) (%)	Endogenous: Transport (E_{is}/E) (%)	Endogenous: Services (E_{is}/E) (%)	$(\frac{Y}{N})$ (000 Yen)	Exogenous: $(\frac{L}{N_o})$ (%)	$(\frac{\Delta L}{L})$ (%)
1930	16.6	3.9	9.0	68.4	82.1	2.39
1931	15.9	3.9	9.2	67.4	79.3	1.33
1932	15.5	3.9	9.2	69.2	78.8	1.28
1933	15.5	4.0	9.4	71.8	79.3	1.41
1934	16.0	4.0	9.3	75.0	81.0	1.24
1935	16.5	4.0	9.3	78.2	81.4	1.46
1936	15.9	3.7	9.7	82.4	78.7	1.63
1937	15.7	3.9	9.7	91.5	78.3	1.51
1938	15.5	4.0	9.7	88.6	77.9	1.51
1939	15.4	4.1	9.7	89.2	77.8	1.10
1940	15.0	4.3	9.6	86.8	79.2	0.38
1941	13.9	4.4	9.7	88.7	78.4	1.32
1942	12.3	4.6	9.9	86.2	77.4	1.35

Sources and Explanations:

Commerce E_{is} = employment in commerce. Source : Ohkawa, The Growth Rate of the Japanese Economy Since 1878, p. 246.

Transport E_{is} = employment in transport and communication. Source: Ibid.

Services E_{is} = employment in services (= Government and professional services + Miscellaneous). Source: Ibid.

E = Gainfully occupied population. Source: Ohkawa, p. 145.

N= total population. Source: Hundred years statistics of the Japanese Economy, p. 12.

Y= N.D.P. at 1960 factor cost. Source: ibid, pp. 45 and 51.

L/N_o = ratio of gainfully occupied to working-age population. Source : Ohkawa.

$\frac{\Delta L}{L}$ = Annual percentage rate of increase of labour force. Working age population (derived from Ohkawa) is taken as a proxy for labour force.

Table 2

JAPAN II

Endogenous Variables of the Sample

Year	A. Commerce (%)				B. Transport (%)			
	(E_{is}/E)	(E_{wis}/E)	(E_{sis}/E)	(E_{ssis}/E)	(E_{is}/E)	(E_{wis}/E)	(E_{sis}/E)	(E_{ssis}/E)
1950	11.8	4.7	4.5	2.6	5.0	4.7	0.2	0.1
1951	14.2	5.5	5.3	3.4	5.1	4.8	0.2	0.1
1952	14.5	5.6	5.2	3.7	5.1	4.8	0.2	0.1
1953	14.7	5.9	5.0	3.8	4.9	4.6	0.2	0.1
1954	16.1	6.3	5.4	4.4	4.8	4.5	0.2	0.1
1955	16.5	6.9	5.3	4.3	4.7	4.4	0.2	0.1
1956	17.8	8.0	5.2	4.6	4.9	4.7	0.1	0.0
1957	18.0	8.2	5.2	4.6	5.0	4.8	0.1	0.1
1958	18.5	9.0	5.0	4.4	5.1	4.9	0.1	0.0
1959	18.9	9.1	5.3	4.4	5.4	5.2	0.1	0.1
1960	19.0	9.6	5.1	4.3	5.5	5.3	0.1	0.0
1961	18.6	9.9	4.8	3.9	5.6	5.4	0.1	0.0
1962	18.5	10.4	4.5	3.6	5.8	5.6	0.1	0.0
1963	19.4	11.1	4.6	3.7	6.0	5.8	0.2	0.0
1964	19.8	11.4	4.6	3.8	6.3	6.0	0.2	0.1

Sources and Explanations:

E_{wis} = Wage and salary workers

E_{sis} = Self employed workers

E_{ssis} = Unpaid family workers

Commerce = wholesale and retail, finance, insurance and real estate

Transport = transport, communication, electricity, gas and water

Services = excluding government services

Y = Net domestic product at 1960 factor cost

Source: Hundred year statistics of the Japanese Economy, p. 45.

NDP has been deflated by a GNP implicit price deflator taken from the same source p. 51; deflator converted to 1960 base.

Table 2 (continued)

Endogenous and Exogenous Variables

Year	Endogenous Variables				Exogenous Variables		
		C. Services (%)					
	(E_{is}/E)	(E_{wis}/E)	(E_{sis}/E)	$E_{ssis}/E)$	$(\frac{Y}{N})$ (000 Yen)	$(\frac{L}{No})$ (%)	$(\frac{\Delta L}{L})$ (%)
1950	9.0	5.7	2.5	0.8	62.8	65.3	-
1951	8.9	5.2	2.8	0.9	67.7	65.1	0.88
1952	9.0	5.4	2.8	0.8	74.3	65.7	3.14
1953	9.5	5.5	3.0	1.0	76.5	69.5	4.82
1954	9.6	5.6	3.0	1.0	78.0	69.4	1.59
1955	10.5	6.2	3.2	1.1	86.5	70.4	3.38
1956	11.1	6.8	3.2	1.1	91.8	70.1	1.90
1957	11.4	7.1	3.2	1.1	96.8	70.7	3.02
1958	11.7	7.7	3.0	1.0	100.0	69.7	0.55
1959	12.2	8.3	2.9	1.0	112.5	69.0	1.04
1960	12.4	8.4	3.0	1.0	129.0	69.2	1.75
1961	12.4	8.4	2.9	1.0	143.1	69.1	1.13
1962	12.3	8.6	2.8	1.0	152.5	68.3	1.13
1963	12.4	8.7	2.8	0.9	168.1	67.1	0.82
1964	12.6	9.0	2.7	0.9	181.3	66.1	1.24

Sources and Explanations (continued)

N = total population

L = total labor forces

N_o = adult population: 15 years and over

Sources: Japan Sorifu, Tokeikyoku:
Monthly Statistics of Japan

- Japan Statistical Yearbook

APPENDIX II

Table I

Shares of Wage and Self-Supporting Labour
(Commerce, Transport, Services)
(Percentages)

Year	A. Commerce			B. Services			C. Transport		
	(E_{ws})	(E_{sis})	(E_{ssis})	(E_{ws})	(E_{sis})	(E_{ssis})	(E_{ws})	(E_{sis})	(E_{ssis})
1950*	40.2	38.0	21.8	63.8	27.8	8.4	94.9	4.0	1.1
1951*	38.8	37.1	24.1	57.9	31.9	10.2	95.1	3.8	1.1
1952*	38.8	35.9	25.3	59.6	30.9	9.5	95.3	3.7	1.0
1953*	39.9	34.0	26.1	57.7	32.1	10.2	94.8	3.7	1.6
1954*	39.2	33.6	27.2	58.6	31.1	10.3	94.7	3.7	1.6
1955*	42.3	31.9	25.8	59.3	30.2	10.5	94.3	4.2	1.6
1956	44.8	29.1	26.1	61.6	28.6	9.8	96.1	2.9	1.0
1957	45.5	29.0	25.5	62.1	28.1	9.8	95.8	2.8	1.4
1958	48.9	27.2	23.9	65.9	25.5	8.5	96.8	2.3	0.9
1959	48.4	28.2	23.4	67.8	23.9	8.3	96.6	2.1	1.3
1960	50.4	27.1	22.5	67.6	24.1	8.3	97.1	2.0	0.8
1961	53.3	25.8	20.9	67.9	23.7	8.4	96.8	2.4	0.8
1962	56.4	24.2	19.4	69.7	22.5	7.5	97.0	2.3	0.7
1963	57.3	23.6	19.1	70.1	22.4	7.5	96.7	2.5	0.7
1964	57.4	23.3	19.3	71.0	21.7	7.3	96.3	2.7	1.0

E_{ws} = Wage and salary workers

E_{sis} = Self employed workers

E_{ssis} = Unpaid family workers

Services are without government services

Sources: Monthly statistics of Japan

*Japan Statistical Yearbook

APPENDIX III.

Alternative Regression Estimates

Japan I (1930-42)

Number of Observations		R^2
	A. Commerce	
13	$\log \frac{E_{is}}{E} = 4.374 + \underset{(0.122)}{0.608} (\log \frac{Y}{N}) + \underset{(0.947)}{0.092^*} (\log \frac{\Delta L}{L})$	0.728
13	B. Services (including government)	
	$\log \frac{E_{is}}{E} = 3.379 + \underset{(0.131)}{0.392} (\log \frac{Y}{N}) + \underset{(1.013)}{0.133^*} (\log \frac{\Delta L}{L})$	0.489
13	C. Transport	
	$\log \frac{E_{is}}{E} = 2.789 + \underset{(0.133)}{0.441} (\log \frac{Y}{N}) + \underset{(1.034)}{0.063^*} (\log \frac{\Delta L}{L})$	0.542

Japan II (1951-64)

	A. Commerce	
14	(1) $\log \frac{E_{is}}{E} = 1.506 + \underset{(0.055)}{0.290} (\log \frac{Y}{N}) - \underset{(0.028)}{0.019^*} (\log \frac{\Delta L}{L})$	0.778
	(2) $\log \frac{E_{wis}}{E} = -1.207 + \underset{(0.070)}{0.712} (\log \frac{Y}{N}) - \underset{(0.036)}{0.047^*} (\log \frac{\Delta L}{L})$	0.930
	(3) $\log \frac{E_{sis}}{E} = 2.334 - \underset{(0.037)}{0.153} (\log \frac{Y}{N}) - \underset{(0.019)}{0.002^*} (\log \frac{\Delta L}{L})$	0.657
	(4) $\log \frac{E_{ssis}}{E} = 1.497 - \underset{(0.102)}{0.022^*} (\log \frac{Y}{N}) + \underset{(0.052)}{0.019^*} (\log \frac{\Delta L}{L})$	0.029
14	B. Services (excluding government)	
	(1) $\log \frac{E_{is}}{E} = 0.768 + \underset{(0.055)}{0.351} (\log \frac{Y}{N}) - \underset{(0.028)}{0.012^*} (\log \frac{\Delta L}{L})$	0.829
	(2) $\log \frac{E_{ws}}{E} = -0.636 + \underset{(0.067)}{0.559} (\log \frac{Y}{N}) - \underset{(0.035)}{0.037^*} (\log \frac{\Delta L}{L})$	0.897

APPENDIX III

(continued)

(3) $\log \frac{E_{sis}}{E} = 1.278 - \underset{(0.044)}{0.045^{*}} \left(\log \frac{Y}{N}\right) + \underset{(0.023)}{0.030^{*}} \left(\log \frac{\Delta L}{L}\right)$ 0.307

(4) $\log \frac{E_{ssis}}{E} = -0.159 + \underset{(0.076)}{0.028^{*}} \left(\log \frac{Y}{N}\right) + \underset{(0.039)}{0.035^{*}} \left(\log \frac{\Delta L}{L}\right)$ 0.068

14 C. Services (including government)

(1) $\log \frac{E_{is}}{E} = 1.379 + \underset{(0.034)}{0.272} \left(\log \frac{Y}{N}\right) - \underset{(0.017)}{0.016^{*}} \left(\log \frac{\Delta L}{L}\right)$ 0.889

(2) $\log \frac{E_{ws}}{E} = 0.534 + \underset{(0.034)}{0.384} \left(\log \frac{Y}{N}\right) - \underset{(0.017)}{0.037^{*}} \left(\log \frac{\Delta L}{L}\right)$ 0.945

14 D. Transport (including communication, gas, water, electricity)

(1) $\log \frac{E_{is}}{E} = 0.581 + \underset{(0.035)}{0.233} \left(\log \frac{Y}{N}\right) - \underset{(0.018)}{0.012^{*}} \left(\log \frac{\Delta L}{L}\right)$ 0.843

(2) $\log \frac{E_{ws}}{E} = 0.460 + \underset{(0.037)}{0.251} \left(\log \frac{Y}{N}\right) - \underset{(0.019)}{0.025^{*}} \left(\log \frac{\Delta L}{L}\right)$ 0.860

(3) $\log \frac{E_{sis}}{E} = -0.939 - \underset{(0.173)}{0.214^{*}} \left(\log \frac{Y}{N}\right) + \underset{(0.090)}{0.098^{*}} \left(\log \frac{\Delta L}{L}\right)$ 0.309

(4) $\log \frac{E_{ssis}}{E} = -2.053 - \underset{(0.185)}{0.191} \left(\log \frac{Y}{N}\right) + \underset{(0.096)}{0.160} \left(\log \frac{\Delta L}{L}\right)$ 0.380

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* - coefficients are not significant (at 5% or 10% level of probability).