A TWO-SECTOR MODEL OF POPULATION GRWOTH AND ECONOMIC DEVELOPMENT(1)

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1. Introduction

For two centuries the growth of population has been regarded as both a blessing and a curse for the sustained growth of per capita income. This is what one writer has recently referred to as the 'paradox of labour'. /16/ As early as 1776 Adam Smith argued that an increase in the wage rate 'as it is the effect of increasing wealth, so it is the cause of increasing population: To complain of it,is to lament over the necessary effect and cause of the greatest public prosperity." Population growth reduces the standard of living for a given size and distribution of income, but tends to enhance it by increasing the national wealth.

The post-war interest in the problems of developing the poorer regions of the world has resulted in the revival of both tendencies concerning the relationship between population and its grwoth on one hand, and economic progress on the other. On the one hand, we have experienced the emergence of what has been described by one writer as a 'family of Lewis-type modles.' These modles generally

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1. I am grateful to my colleague Dr. A.P. Thirlwall for some useful comments on an earlier draft of this paper. The responsibility is entirely mine, of course..

take the existence of an 'unlimited supply of labour' (and its perpetuation through high population growth rates) almost as an 'engine of growth.' On the other hand we have seen the appearance of certain 'neo-Malthusian' modles according to which high population growth rates are responsible for 'low level equilibrium traps' that prevent the poor countries from achieving 'take-off into self-sustained grwoth.'

The policy implications of each of these two views are far-reaching. The notional 'trap' in which the poor countries are according to 'neo-Malthusians' caught would necessitate a 'critical minimum effort' or a 'big push' for a lasting achievement. Although the 'big push' strategy may be (and it has) been defended along Marxian and Rodanesque lines, it is also directly a consequence of the 'neo-Malthusian' model. This has its own implications for the relative valuation of productive factors, the choice of techniques and the choice of time horizon for development projects. It is hardly a coincidence that Libenstein-an exponent of the 'neo-Malthusian' model-is also a co-author of a public investment criterion which puts a law premium on present consumption. /4/ The Lewis type modles on the other hand, imply a development process in which, while accumulation and industrialisation can take place, aggregate consumption and employment do not necessarily lose out in the shorter run.

In section II we shall present a brief critique of each of these two modles in order to prepare the ground for the presentation of our two-sector model and its policy conclustions. These will appear, respectively, in Sections III and I.

II. A Critical Review of Leibenstein and Lewis

i) The Lewis Model

According to the simple and highly influential 'classical' model of development with unlimited supplies of labour-first proposed by Sir Arthur Lewis /7/ -a transfer of 'surplus labour' from the traditional sector into the modern sector of the economy would lead to accumulation through increased profits (and, later, also through an increase in the share of profits as a result of technical progress), until a terms-of-trade change in favour of villages and/or the physical exhaustion of the pool of 'surplus labour' brings it to an end. Later, the exact conditions for this result to obtain were investigated by G. Rais and J.C.H. Fei. /12/

Whether there in fact is a considerable pool of under employed labour in many developing countries is a question to which there could only be an empirical answer/see, for example, 2,4,9, 14. For what it is worth, however, we tend to believe that in the circumstances of some developing countries it is reasonable to think that-at least upon some institutional and technical improvements-a certain percentage of those engaged in the agricultural and service activities would be superfluous.

But the assumption that a potential 'pool' of surplus labour' would necessarily result in a perfectly-elastic supply curve of albour at a given subsistence wage rate has received less attention. Casual observation indicate that a relatively high wage rate in the modern sector usually persists side-by-side with high rates of urban unemployment. Indeed, in his recent lectures in Ghana, Sir Arthur Lewis himself has not failed to observe "the very high incomes of people in the towns (frequently 2:1 for unskilled labour , with a steep pyramid on top of that)" /8, P. 22./ This

situation has been well documerted for the Puerto Rican economy/13/. But all the available evidence indicates that, far from being a peculiar feature of Puerti Rica, it is likely to be a general phenomenon. Theoretically, there could be an unlimited supply of labour, while exogenously determined wage increases would shift the supply curve of labour upwards. This would reduce the producers surplus and diminish the absorption of labour. In addition, if technical progress is labour saving there will be a further reduction in employment possibilities. As a matter of fact the urban wage rates are rising much faster than the corresponding rural incomes, and this results in large-scale emigration from the village into the town. Once again, Lewis himself has observed that the fast rate of migration, and the ensuing unemployment, in African towns is a consequence of "the big gap which has now opened up between wages and farmers' income". /8,P. 29/. Furthermore, the investment-mix is usually such that ti involves a wholesale importation of highly-advanced foreign technology which tends to be characteristically labour-saving.

Thus, rater than the traditional and modern secters, the 'dualistic' approach should concentrate on the existing gulf between the village and the town, although one cannot deny that the latter accomodates a section of the 'traditional' sector (for example a substantial part of the service sector) which probably includes some 'disguisedly-unemployed' labour. The research being, of course, that high wage rates are not only peculiar to the strictly modern industrial sector but the whole of the urban sector. Lewis is historically right in claiming that if one hears the middle-class wives complain of the scarcity andd dearness of domestic servants it would mean "that economic development is going rather well" /8,P. 23/. But in the present circumstances it appears that even this is not necessarily true. Men go without jobs, while the 'artificially' high urban earnings ensure that the middle-classes of poor countries will buy domestic labour-saving devices by means of relatively easy terms of consumer credit. In one word, the original 'Lewis' model would by relevant, rather ironically, both to a perfectly-competitive framework and strong 'command economy'. Neither is characteristic of the socio-economic environment of the poor countries, and

the actual or potential 'bargaining process' (which is sometimes curiously invisible, but always very real in its effects) leads to the present dichotomy.

ii) The 'neo-Malthusian' Model

In the works of Leibenstein /6/ and Nelson /11/ population appears as an endogenous variable, the rate of increase of which is a function of the level of per capita income. In Figure I, if income per head rises beyand the level of OS- the subsistance income level at which population and income are constant-then the rate of population increase will be greater than the rate of growth of income until an arbitrary level of per capita income (corresponding to the point T) has been reached. It follows that no level of per capita income between S and T can be sustained in the long run, and policies that result in small increases in the level of income per head would be doomed to failure.

The theoreticla basis for the $\frac{p}{p}$ curve is fairly clear and has been discussed at some length by Leibenstein in particular. However, the relationship between the y and $\dot{y}$ is less explicit. In fact, the $\dot{y}$ curve traces income growth-rates which are compatible with rates of accumulation that may be allowed at given levels of income per head through domestic saving. The explicit recognition of this point is fundamental to our alternative two-sector presentation. The validity of these assumptions as they stand will be carefully examined in the following section. Menwhile, it is important to observe that in most developing countries the income growth rates are higher than the rates of increase in population, this observation does not refute the model as a device for abstract speculation, but it makes policy implications rather irrelevant for the problems of the developing countries in the contemporary world.

However, in view of the frustrtions that 'overpopulation' is causing for the development efforts of a growing number of poor countries, it would be too nasty to

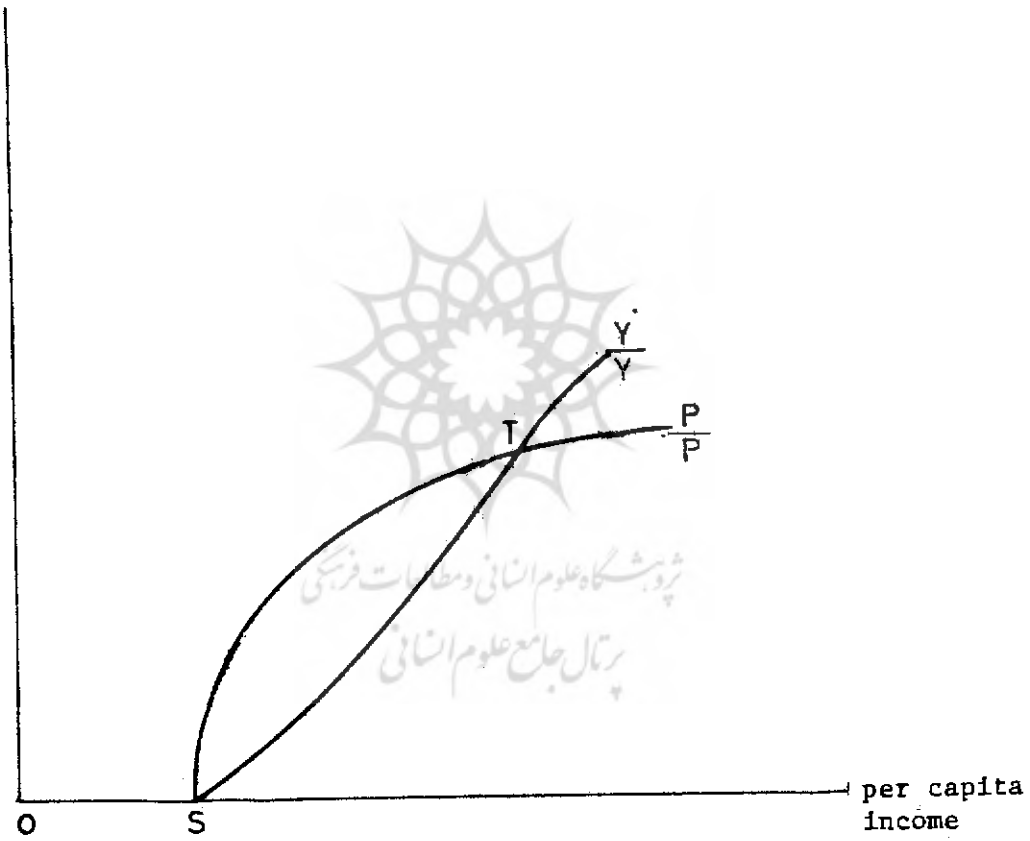
Rate of income growth,
rate of population growth
Ẏ/Y
P/P
T
O
S
per capita
income

Figure 1

reject this simple analytical model completely. The following two-sector model of economic grwoth with population as an endogenous variable, combined with the lessons drwon from the 'Lewis' model, leads to certain policy conclusions which may be very relevant to some of the problems at present encountered by the developing nations.

III. A Two-Sector Model

i) Population growth and per capita income

Speaking generally, the growth of population is the result of a decline in death rate, a rise in birth rate, or both. There is a fair amount of consensus that mortality rates decrease with increases in per capita income. In her useful econometric study, Irma Adelman /1/ found a negative correlation between per capita income and death rate; but she also acknowledged the significant role that 'public health' campaigns-usually determined by exogenous factors such as foreign technical assistance-might have played.

Strictly speaking, however, it is not per capita income but consumption which ought to have been taken as the 'independent' variable. Now it may be argued that, in the circumstances, these two variables are virtually indentical. This is surely why the classics related population growth to the wage rate. But, however nearly true this may be the case of the rural sectors of the poor countries, it is hard to apply to their growing urban sectors where relatively high wage rates are affored. Therefore in this respect, it is useful to distinguish between income per capita and consumption per head.

It may seem a little odd to argue that birth rates vary positively with per capita consumption. The argument that higher income groups tend on the whole to propagate less than the poore people seems to be an almost indisputable generalisation. But this, as it were, is a cross-section view.

It is intuitively persuasive to suppose that, ceteris paribus, increased consumption beyond subsistence would tend to give rise to higher fertility, and this would tend to taper-off with still further increases in consumption: firstly, the 'learning effect' of reduced infant mortality would make people realise that more of their children now survive that they used to. Secondly, all the other factors which are concomitant of growth and increased welfare (e.g. education) will make their own 'independent' impact on birth rates. Irma Adleman's study found a direct relationship between birth rate and per capita income in the long run although the "calculated income" elasticity never exceeded 0.55. /1/

The 'benefits' of offsprings to their perents-seen from a strictly 'rational' point of view-are threeford; the pleasure of parenthood, a possible source of supplementing family-income, a security for the future. There is no a priori reason why the first of these factors should vary as between richer and poorer individuals, or nations, in its intensity. But the latter two should lose importance with rising consumption and welfare possibilities in addition to an increase in the complexities of socio-economic relations. At any point of time this should make a difference as between rural and urban-sectors of a developing country.

To take the growth of urbanisation as a factor negatively influencing birthrates is no new discovery. Indeed, Adelman has observed that "the socio-economic phenomena associated with the urbanisation process tend to reduce birth rates in the long run"./1/ In urban communities, traditional family ties characteristically tend to loosen up, comparatively to the stnadards expected and maintained in rural areas. Increased opportunities in towns tend to increase both types of mobility, and the role of external (i.g.non-family) factors in shaping attitudes gain significance. Thus an urban family of comparative economic means must expect a smaller benefit in terms of future income-supplementation and security from its young members; or indeed a high risk of not enjoying any benefits at all. In addition, where market-providing securities and insurances are totally absent in the village, they are rapidly becoming

a familier feature of working conditions in the town. Notwithstanding all-this, there is such a things as unemployment. Therefore, on the benefit side, one would expect a lower birth rate for the same per capita consumption in the urban areas.

Costs of child-reading would als tend tc increase with economic growth and urbanisation. These are a function of attitudes and aspiration as well as sheer physical needs. Economic growth by increasing competitiveness as well as social mobility puts a high premium on education. It also increases the opportunity cost of time. Therefore, by analogy to the above arguments, the cost of raising children in towns should be greater than in the village for equal levels of per capita consumption. Hence there is a strong a priori case, on both 'sociological' and economic grounds, for believing that in the urban centers of the poorer countries birth rates would tend to be lower for corresponding levels of consumption per head.

It is more difficult to imagine a significant difference in mortality rates between town and village. Adelman obtained negative correlation between urbanisation and death rate, but this overlooks the fact the incomes in the urban areas are usually higher. There is no firm a priori reason for thinking that, for the same per capita consumption, the rate of mortality in the towns is lower than in the village. Medical facilities and know-how are more available in the areas of urban concentration, but death due to accident, heart ceasure and pollution also more frequent. And when famine breaks out it is anybody's guess as to who suffers most.

Figure II summarises the above discussion. The curves bu and br, in Figure II(i), refer to urban and rural birth rates as a function of per capita consumption,while curve d shows the general rate of mortality. Figure II(ii)shows the resulting population growth curves nu and nr. On the basis of the above discussions the urban population growth rate would be less than the rural rate by the distance ab for cr consumption. But this is subject to a further qualification.

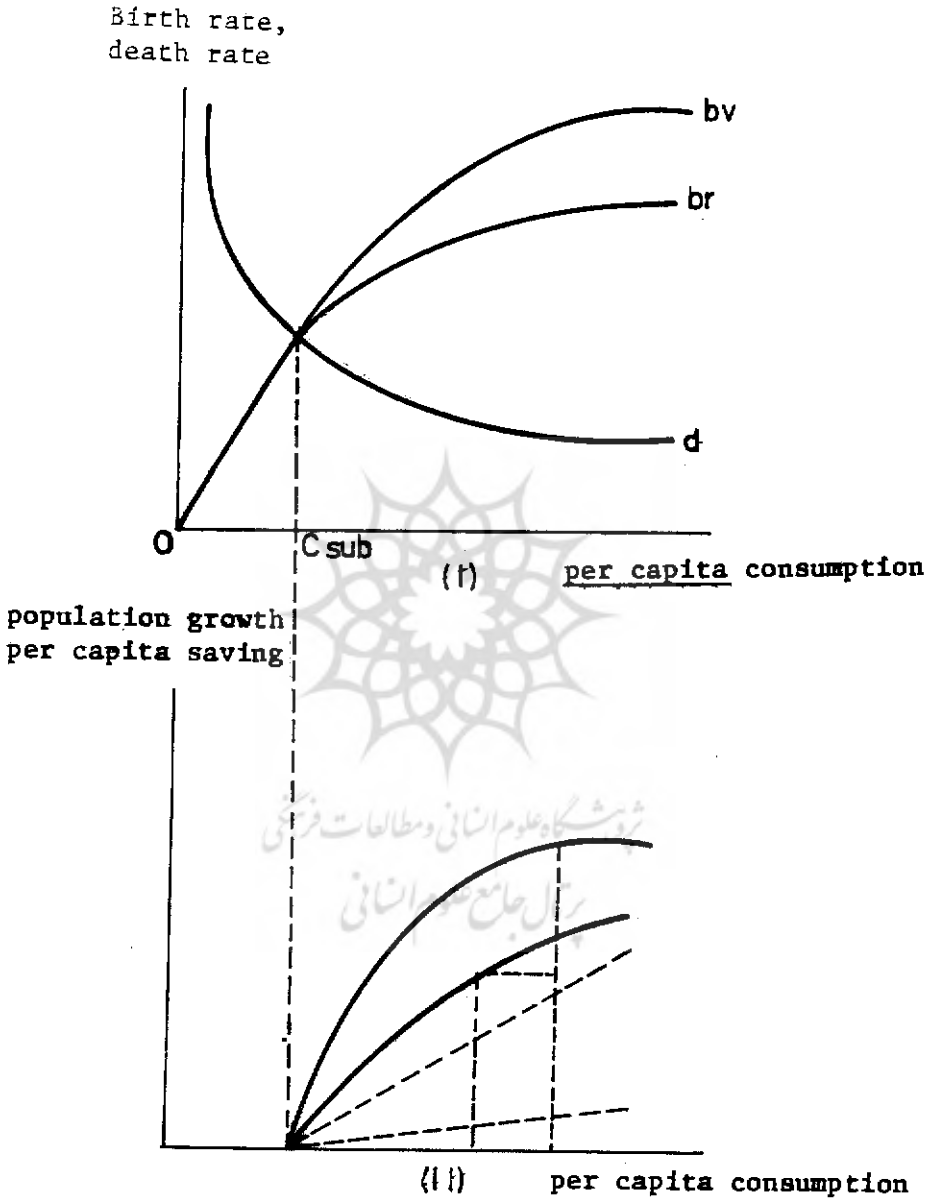
Birth rate,
death rate
bv
br
d
O
C sub
(I)
per capita consumption
population growth
per capita saving
(II)
per capita consumption

Figure 2

It was suggested above that it is important to distinguish between per capita consumption and per capita income in this context. Equal consumption per head for the rural and urban areas would imply equal income per head if saving rates were the same in both regions. Now in the absence of any reliable evidence it might seem a bold claim to say that the urban sector saves more than the rural sector out of the same income. Intuitively, however, this appears to be plausible. In the case of many developing countries a substantial portion of rural incomes is accrued to the village rentiers of all kinds-land lords, moneylenders and traders-and both historically and theoretically there is some justification in believing that the rentier saves little. In contrast, a sizeable portion of urban-incomes is received in the form of profit, usually with a high proportion of it going to saving. In other words, one may imagine the aggregate rural and urban saving rates themselves consisting of two classes, the saving rates of urban and rural workers, and the saving rate of rentiers and profit-makers. Therefore, assuming that saving rates of the urban and rural workers are equal then greater savings out of profits would ensure that the aggregate saving rate of the urban sector would be greater than that of the rural sector(1).

In Figure II(ii) the lines ar and su imply saving functions with different saving rates for the two sectors(2). At

(1) It is true that studies of aggregate consumption behaviour in the West have suggested a lower mpc for farmers. But sociologically, peasant farmers of poor countries cannot be put in the same category as independent (capitalist) farmers of advanced economies. In addition, since urban workers are likely to spend more of their income on durable goods(including housing), their 'consumption' expenditure would contain a greater ratio of 'disguised' investment. But, ultimately, this is an empirical question which has not yet been adequately answered. The effect of the relaxation of this assumption would be considered later.

(2) $X=C$ ——— $\frac{S}{C} = \frac{Y}{C} - 1 = \frac{Y}{CY} - 1 = \frac{1}{C} - 1$

Therefore, the higher the mpc(the lower the mps) the lower $\frac{B}{C}$

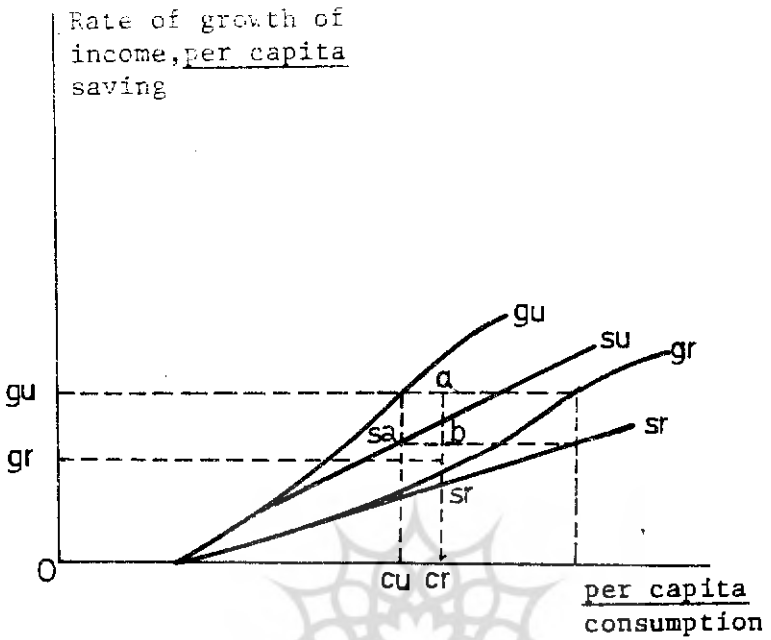

Figure 3

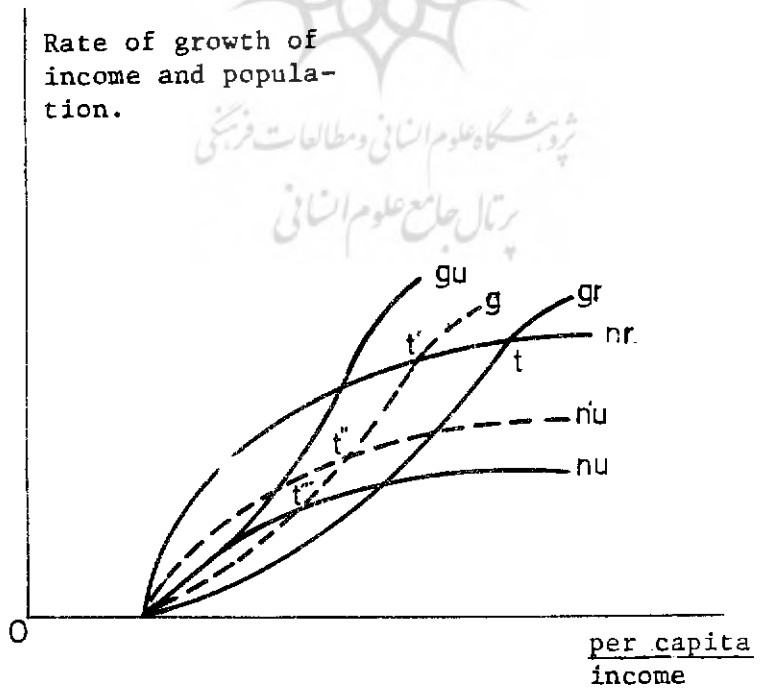

Figure 4

the given per capita income (Ocr and crd), the rural consumption per head equals cr but-because of its higher saving rate-the urban per capita consumption would be equal to cu which induces a population growth rate of a'per cent Thus the population growth rate of the urban sector(net of migration) would be less than the rural rate on two accounts, by ab because of a difference in birth rates, and by aa" because of a difference in saving rates. In other words, if, rather than consumption the x-axis was showing income per head, then the urban population growth curve would have passed through the point a".

ii) Income Growth Rates and Per Capita Income

In section II above we saw that the $\frac{y}{y}$ curve (Figure I) was best considered as showing the path of income growth rates capable of being sustained at the corresponding per capita income levels. But, once again, to be accurate it is the saving component of a given per capita income that is strictly relevant to this relationship. Income growth depends on saving per head just as population growth is affected by consumption per head. If, as we have assumed, the sectoral saving rates are different, then the rate of growth of income associated with a given per capita income would be higher in the urban sector.

This is illustrated in Figure III where, for the given per capita income (cr+sr=cu+su), the rate of grwoth of urban income-gu) is greater than the rural rate(gr) by the distance ab(1). In other words, had the x-axis been showing income per head, the curve of the urban growth rate (gu) would have passed through the point a.

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(1) The saving rate differential has been purposefully assumed to be different from that in Figure II(ii) in other to make the illustration manageable.

iii) The Complete Model

Figure IV summarises the model. It represents a combination of Figures II(ii) and III with the difference that, this time, the x-axis refers to per capita income rather than consumption. The overall picture shows that while there may be something to be said for the assumption of a 'low level equilibrium trap' in the rural sector of some developing countries (see point T), this would not be necessarily true for the whole of the economy; and least of all for the urban sector(1).

(1) An examination of some United Nations data for a sample of 44 developing countries revealed, that rates of growth of the gross national product-expect in three cases-and those of the industrial output-expect in one case- were generally higher than the corresponding rates of increase in population. Industrial growth rates were generally higher (sometimes much higher) than the respective gdp growth rates. However, rates of growth of agricultural output in the case of 30 per cent of the sample were (sometimes appreciably) less than the relevant population growth rates, and in the case of a further 20 per cent equal or a little higher that the growth rates of population. The data for population growth referred to the country-wide rates of increase of population. If, as we have argued, the rates of increase of population in towns are in fact less than those in the village, then these observation will further strengthen our case. See United Nations, Department of Social and Economic Affairs, Demographic Yearbook, 1966, Table 2; and World Economic Survey, 1967, Table 6 and 15.
In a recent empirical study, Dr. A.R. Thirlwall has concluded that attempts to reduce population growth rates do not make much of an impact on living standards/16/. A similar empirical study of the rural sector may, perhaps, yield different results. But, generally, what is needed for avoiding 'traps' and 'viscious circles' is to try and reduce the income differential of the two sectors while increasing employment opportunities in the twon. Both of these are, of course, related to the investment strategy and the choice of techniques.

At this point it is useful to see what will happen if the assumption of differential savings rates is dropped. In Figure IV, suppose that the path of the rate of growth of income for both sectors is depicted by the (broken) curve g. The assumption of a uniform saving rate would also shift the nu curve to the position of n'u. The respective 'equilibrium trap' points for the two sectors would then be represented by T' and T". This shows that, given a lower urban birth rate, the urban sector's 'trap' point will be reached at a lower level of per capita income. If we further assume that the urban death rate is lower than the rural death rate such that (for simplicity's sake) nu is, once again, the relevant population growth curve for the urban sector, then the urban 'trap' point will be reached at T". In other words, the per capita income level at which the urban sector's 'trap point' is reached will be lower still.

So far we have been assumign that the per capita incomes of the two sectors are equal. But simple observation shows that the average income of the town is (sometimes substantially) higher than the income per head of the village(1). Thus if, in Figure IV, the urban income per capita corresponed to (say) the point T' and the rural income per head to the point T" the rural sector alone would be cuaght in the 'trap'. It seems therefore that, even if we drop the saving assumption, our general conclusion that an 'equilibrium trap' exists in the rural sector alone will be difficulty to dismiss.

Before concluding the paper a few remarks for the clarification of some obscure points would be in order. Firstly, of all the major growth factors the model (as also the original 'neo-Malthusian' model, by implication), takes account for the influence of accumulation. Assuming

(1) Comparative data for agricultural and non-agricultural earnings-for a sample of ten developing countries show that, expect in one case where the difference is insignificant, the ratio of the latter to the former ranges between 1.35 and 2.71.
See United Nations, International Labour Office, Yearbook of National Accounts Statistics, 1969, Table 18 and 23.

that labour is equally available for both sectors, there remains the role of technical progress. However, it might be argued, with some justification, that the incremental capital-output ratio for industry is higher than it if for agriculture and, therefore, the higher rate on the part of industry should not necessarily imply a higher growth rate for that sector. Two points come to mind in reply to this query. In the first place our model is really intended to refer to a regional disaggregation comprising of the rural and urban sectors. The latter usually includes both the industrial and the service sectors, and there is no reason to assume a high capital-output ratio for the service sector. Besides, industry itself consists of all kinds of activities including the traditional crafts and light industries with relatively smaller capital-output ratios. In the second place, in so far as technical progress tends to be either endogenous or exogenous but embodied in machinary it should benefit industry more than agriculture. This is to say nothing of entrepreneurial ability which is more generously allocated to the industrial and service sectors.

Secondly, by emphasising the role of the saving component of per capita income we have tacitly assumed that the existence of unemployment is rather a consequence of the shortage of factor supplies (or their incorrect valuation) than a Keynesian-type deficiency in aggregate demand. This in general is by no means a foregone conclusion but in the framework of the present model it seems to be a reasonable assumption.

Thirdly, all saving has been assumed to result from domestic sources. Generally, the present model is best considered in the framework of a closed economy, but even if we allow for additional investment funds from abroad there is every reason to believe that this would favour the urban sector more than the rural sector.

Fourthly, of course, the complete separation of the two sectors in relation to income growth, consumption and saving may theoretically sound a little artificial. After all these are not two distinct economies effectively insulated by the usual political and economic barriers. However, there could be no doubt that the general dualistic

approach to the problems of poor economics is more realistic than their treatment as one single (nearly homogeneous) economic entity. Casual observation, at any rate, seems to show that if there is any movement between the two sectors it is more in the direction of towns.

Finally, our model refers to the real rather than money values of the variable involved. But if the money values are considered this should, on the whole, rather strengthen our conclusions, since, if anything, the terms of trade between the town and the village tend to move secularly in favour of the former.

IV. Concluding Remarks

The original 'neo-Malthusian' and 'Lewis'models-despite the fact that they are based on fairly common premises-are mutually incompatible both in their theoretical assumptions and, particularly, in their policy implications. Our two sector model of economic growth, with population as an endogenous variable, is not (at least)wholly incompatible with the original 'Lewis' approach, particularly once the latter is seen in terms of rural and urban (rather than modern and traditional) sectors. Given higher rural growth rates of population a continuous transfer into towns would in fact postpone the physical exhaustion of 'surplus labour'; while it would prevent the possibility of a 'low level equilibrium trap' from causing stagnation in the country-side. But, as we have seen, the climate is quite different from the one in which the "Lewis' model is supposed to bear fruit.

The policy conclusions of this paper should by now be quite clear. In the present circumstances the theoretical implication of the neo-Malthusian' model in not relevant to most of the developing countries where incomes in general seem to grow faster than the population. Nor is its policy conclusion of a 'big push' strategy,which-among other things would involve an undervaluating of capital, either possible or desirable.

High population growth rates in the rural areas combined with low or nil (or sometimes negative) rates of increase in productivity, usually resulting in a high rates of migration into towns-and hence increasing the rate of 'open' unemployment seem to point to one inescapable conclusion: namely, that sooner rather than later a genuine effort is required in order to increase agricultural incomes rapidly. If anywhere, this is the direction towards which the 'big push' should apply.

Superficially, this may seem to be an odd conclusion in view of the fact that we have assumed high population growth rates, and low saving rates, for the rural sector. But, on the contrary, once the rural sector has embarked upon faster growth, through institutional and technical incentives, these differences should begin to disappear. There need be nothing 'inherent' in the behaviour of the peasant that would make him breed more and save less. Indeed he must be bewildered at the official campaigns of population control and the like, while he observes nearly all else remaining the same, if like, while he observes nearly all else remaining the same, if not deteriorating.

It is true that the international terms-of-trade have recently been turning against some producers of primary products. Fortunately not all developing countries produce coffee and cocoa. In any case, this would be a poor argument for the neglect of agriculture, and sometimes, its further exploitation by city-dwellers, especially as no truely spectacular achievements can be cited elsewhere in these economies. At any rate a solution to the secular deterioration of terms-of-trade, where it applies, should be found in other quarters.

The agricultural sector of developing countries usually supports over a half of their population. If high-and increasing-urban unemployment rates are also present, then, even if all else fails, our conclusion should be self-evident on the basis of some simple considerations from the realm of political economy.

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