14 Interactions of Modern and Traditional Sectors

Almost from the beginning of economists' interest in economic fluctuations there was a strong suspicion that the key lay somewhere in the interactions among savings, investment, and consumption, but it took generations of thought before these relationships were sorted out in a form permitting useful recommendations for policy. So today there is an equally strong suspicion that the key to underdevelopment lies somewhere in the interactions between the modern or industrial sector of the economy and the traditional or agricultural sector. A number of two-sector models have been produced to analyze these interactions. It could hardly be said that these models are as successful in providing a foundation for development policy as the savings-consumption-investment models have become for suggesting stabilization policies for advanced countries; however, progress has been made and some insight has been gained. This chapter outlines some of the more important of such two-sector models.

Technological Dualism and the Population Explosion

In many underdeveloped countries the initial favorable impact of industrial investment (including investment in plantations as well as in mines, petroleum, etc.) was swamped by population growth, in a way that did not occur in the currently advanced countries. In most countries, an initial increase in population growth seems to have followed the first wave of rapid industrialization. In the advanced countries of the West, however, the rise in *per capita* income continued long enough to bring subsequent drops in fertility rates and to permit economic growth to be

sustained. The question is why the process in underdeveloped countries was different.

When the colonial powers first came into contact with countries of Asia and Africa, the populations of the latter were apparently not much higher, relative to natural resources, than those of European lands. In the case of Asia, moreover, there is little evidence that the level of technology was markedly below that of Europe in the sixteenth century. India, Indonesia, and China had firearms, navigation instruments, modes of land and water transport, techniques of manufacture and agriculture, and educational systems that compared favorably with Europe's best. We have small evidence that the standard of living of either rich or poor was significantly lower in Asian than in European countries at that time. Like the European countries, the Asian lands were actively engaged in international trade. The sixteenth-century picture would have given little basis for forecasting that in 400 years *per capita* incomes in Europe would be several times as high as in Asia.

During the seventeenth and eighteenth centuries, when the relationship of the colonial powers to Asian and African peoples was mainly a trading one, the countries of Europe seem to have made more progress toward establishing the preconditions for take-off than did those of Asia. In particular, during this period Europe benefited from improvements in agricultural methods and increased transport facilities. Even at the beginning of the nineteenth century, however, populations of many Asian countries were still small relative to resources, and prospects for economic growth would still have been good. By the end of that century, population growth in such countries as Indonesia, India, Japan, and the Philippines was already so high that launching a steady rise in *per capita* incomes had become a difficult problem.

Industrial Investment and Population Growth

The major impact of nineteenth-century industrial investment on rates of population growth probably came through the accompanying reduction in mortality rates. As the colonial powers shifted from trading to settlement, in order to exploit more effectively their new interest in plantations and mines (and later in petroleum), they followed policies that tended to reduce death rates. By maintaining internal law and order the colonial powers hampered the freedom of the native peoples to kill each other. Secondly, when Westerners settled in the country they became more interested in public health. In protecting themselves from malaria, typhoid, plague, and other diseases, they reduced the incidence of these diseases among the native peoples as well. Improved transport lessened the impact of famine. A fourth effect was an initial rise in *per capita* incomes even of native peoples. This improvement in living standards permitted—if it did not cause—a more rapid rise in the size of the population. Educational standards also rose, which may have had an indirect effect on mortality rates.

In some countries, industrial investment may have offered incentives for raising larger families. In Indonesia especially, after the shift from trading

to the "culture system," which involved compulsory deliveries of plantation products to the colonial authorities, the easiest way for the people to maintain their standards of living and leisure, while meeting the levy of the colonial government, was to have more children, occupy more land, and devote a larger proportion of the land to irrigated rice culture, as distinct from the slash-and-burn shifting agriculture. Something similar may be true of other countries. Harvey Leibenstein, who has devoted much study to demographic aspects of economic growth, is quite ready to generalize on this relationship and to argue that initial rises in *per capita* income will tend on balance to bring initial increases in the "demand for children."

We saw in Chapter 2 that a crucial factor in the course of *per capita* income is the length of the lag between the drop in mortality rates in the early stages of industrialization and the subsequent drop in fertility rates. The population explosions of Asian countries reflect a longer lag between the initial drop in mortality rates and subsequent drop in fertility rates than occurred in European countries or in the New World. No one knows for certain why this longer lag appeared. Some evidence suggests that the drop in fertility rates in Europe and the New World was a concomitant of urbanization. Development in Asia and Africa, centered as it was on plantations, mines, oil fields, and exports of raw materials, brought more *industrialization* than *urbanization;* hence the checks on family size enforced by the urban industrialization of Europe and the New World operated less effectively in the underdeveloped countries. Eventually fertility rates did drop in most Asian countries, but in some that drop came too late to prevent serious population pressure from arising before planned economic development began.

Colonial policy may, at least in part, account for the difference in the demographic patterns in the Asian-African countries and in Europe. Initial investment in Europe and the New World was also directed in large measure toward agricultural improvement, mining, and production of raw materials for export. In advanced countries, this investment gave rise to subsequent marked expansion of the secondary and tertiary sectors of the economy. Colonial policy in most of the Asian countries did not permit development of the secondary and tertiary sectors in the colonies themselves. Where domestic entrepreneurship appeared in the "Western" sector, it was usually discouraged. For example, when the development of the sugar plantations and refineries in the mid-nineteenth century in Java led to a shift from rice cultivation to sugar planting on the part of Javanese landowners, the Netherlands East Indies government sought to nip this local industrialization in the bud by imposing a regulation forbidding the sugar refineries to buy cane from native growers. Since the Javanese did not have the capital or the technical skills for large refineries, they had to be content with simple refining methods, producing brown sugar for the local market. Similarly, when smallholders' rubber became an active competitor of plantation rubber, the N.E.I. administration imposed a discriminatory tax on smallholders' rubber (in this case without much success). Thus the secondary and tertiary sectors associated with industrial

investment in the colonies developed in the metropolitan countries rather than in the Asian and African countries themselves. The financing, transporting, storing, insuring, and processing of industrial raw materials took place mainly *outside* the colonial country.

Industrialization which is confined to the production of raw materials does not lead to urbanization. Indeed, it can proceed very far without seriously disrupting the pattern of village life led by most of the people. One may conjecture that the disastrously long lag between the initial drop in mortality rates and the subsequent drop in fertility rates is associated with the peculiar form of industrialization in underdeveloped countries, a form which did not bring with it rapid urbanization.

One may doubt whether the reverse process, urbanization without industrialization, such as has taken place in a number of developing countries since the war, can be expected to have the same effect on fertility rates as the combination of industrialization and urbanization in Europe during the eighteenth and nineteenth centuries. The growth of Calcutta, Bombay, Tokyo, Manila, and Djakarta since World War II reflects the "pull" of employment opportunities in industry less than the "push" of dwindling opportunities for advancement in rural society. There is, of course, no assurance that this kind of urbanization will affect fertility rates in the same way Western urbanization did.

Some sociologists and anthropologists might ask whether there would be any reason for expecting twentieth-century Asian society to behave like eighteenth-century European society even if economic conditions were similar. Two points might be made in reply. First, as a policy prescription no one would recommend urbanization as such; it is industrialization and urbanization together that hold the hope for rising per capita income. Secondly, we have some evidence that even in Asian cities fertility rates tend to fall below those of rural areas in the same country. For one thing, the extended family system tends to break down under urban conditions; indeed, the wish to escape the responsibilities of the extended family system is one of the motives for ambitious young people moving from country to city.

Technological Dualism

If the industrial investment which launched the "population explosions" in Asia, Africa, and Latin America had provided opportunities for productive employment for the whole of the population increase, per capita incomes could still have risen. But industrialization in the form common to underdeveloped countries did not provide a proportionate increase in job opportunities. Analysis of production functions and factor endowment in an economy with two sectors, two factors of production, and two goods, is enlightening in this regard. Although such a model is necessarily simplified, it approximates reality closely enough to provide significant results. The two sectors are the industrial sector (plantations, mines, oil fields, refineries, etc.) and a rural sector engaged in production of foodstuffs and in handicrafts or very small industries. The first of these sectors is capital-intensive. Moreover, it either is characterized in fact by relatively fixed

technical coefficients (fixed proportions in which factors of production must be combined), or is assumed by entrepreneurs to be so. The effect on employment patterns is much the same in either case. The other sector has variable technical coefficients; that is, the products could be produced with a wide range of factor proportions. The two factors of production are labor on the one hand and capital, including improved land, on the other. The two products are industrial raw materials for export and necessities for domestic consumption.

Figure 14–1 represents the production function in the industrial sector.

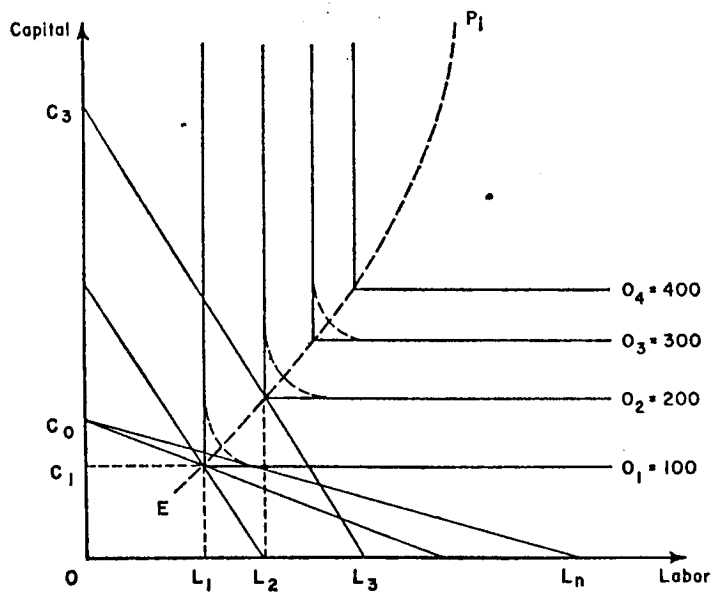

Figure 14–1. The Industrial Sector

Units of capital are measured on the vertical axis, labor on the horizontal axis. Each curve is an *isoquant* representing combinations of labor and capital producing the same output (sometimes called an "isopod"). As we move away from the origin from curve O_1 to curves O_2, O_3, etc., we move up the "hill" of production to higher and higher levels of output. The diagram is thus a kind of contour map.

The solid curves are drawn to conform to the case of "fixed technical coefficients." In this case labor and capital must be combined in fixed proportions to get any output at all. Output can be increased only by increasing the amounts used of *both* factors so as to maintain these proportions. (Some production processes, such as petroleum refining, actually

come very close to having fixed technical coefficients.) The production process in this sector is also capital-intensive; relatively large amounts of capital and relatively small amounts of labor are used. Thus to produce an output of O_1 the industrial sector will use OC_1 units of capital and OL_1 units of labor. If OL_2 units are available, the excess labor supply will have no effect on production techniques, and L_1L_2 units of labor will simply remain unemployed, or must seek employment in the other sector, no matter what the relation of wage rates to capital costs. As more capital becomes available through time, more labor will be employed and output will be expanded. The line EP_I is the expansion path of this industrial sector. However, employment increases relatively little as investment and output in the industrial sector expand along this path.

Perhaps technical coefficients are actually less fixed than entrepreneurs think. If managers and technicians, used to particular methods of production in Western countries which they accept without question as superior, do not look for alternative techniques more suited to the factor endowment, the effect is the same as if coefficients were technologically fixed. The dotted portions of the isopods in Figure 14–1 indicate a situation in which there is actually some flexibility in factor-proportions. It can readily be seen that *small* changes in factor endowments (and in relative prices of factors of production) would not bring marked changes in technique even if entrepreneurs learned that the production function was like the dotted lines rather than the solid ones. But for very large differences in factor endowment (and prices), such as that represented by the line C_0L_n, a more labor-intensive technique would be used if its existence were recognized by the decision makers.

Figure 14–2 represents the production function for the rural sector. Here coefficients are variable: a wide range of techniques and of combinations of labor and capital will give the same output. Accordingly the proportions actually used will be adjusted to the factor endowment (and to the consequent relative prices of labor and capital). In this context capital includes improved land.

Now let us imagine that we begin with production at O_1 in each sector. Then capital begins to flow into the industrial sector, mostly from abroad. The industrial sector expands along EP_I. But we have already seen that this industrialization generates a population explosion. In some countries and some periods, the percentage rate of population increase considerably exceeded the rate at which capital was accumulated in the industrial sector. Because of the actual or accepted fixed technical coefficients in that sector, employment opportunities did not occur at the same rate as that at which the population grew. Far from bringing a shift of population from the rural to the industrial sector, industrialization, after its first impact, may even have brought a relative *decline* in the proportion of total employment in that sector.

Thus the increased population had to seek a livelihood in the other, variable-coefficient sector. At the beginning of the expansion process, no factor of production was relatively abundant or scarce in this sector. For

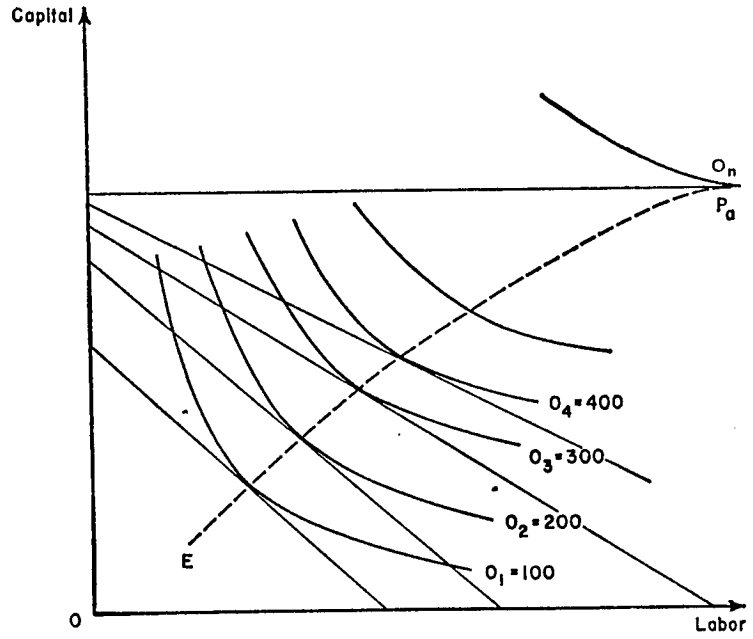

Figure 14–2. The Agricultural Sector

a while, the response to population growth was to bring additional land under cultivation, so as to keep the ratio of labor to land relatively constant; since other forms of capital were not available in any quantity to this sector, the amount of land that could be effectively worked by one family was in any case limited. Thus for a while the "optimal" combination of labor and capital (mostly improved land) could be maintained, as output rose from O_1 to O_3. Eventually, good land tended to become scarce. The ratio of labor to capital available in that sector rose steadily, and since technical coefficients were variable, techniques in that sector became increasingly labor-intensive. For example, irrigated rice culture was substituted for shifting dry rice culture. Finally the point was reached at output O_n where all available land was already cultivated by highly labor-intensive techniques and the marginal productivity of labor fell below zero even with the most labor-intensive techniques available; with continuing population growth, disguised unemployment began to appear.

Under these conditions there was *no incentive* for groups of individual farmers or small enterprises to make marginal and unrelated investments of capital in the labor-intensive sector, even if they had capital to invest. Nor had they any reason to introduce labor-saving innovations, even if they knew about them and could finance them. And as yet there is no technology designed to raise output per man-hour without also raising the

ratio of capital to labor. Labor *as a group* had no incentive to increase its efforts, since the labor supply was already redundant. Thus methods remained labor-intensive and levels of technique, man-hour productivity, and economic and social welfare remained low.

This tendency toward "disguised unemployment" in the rural sector is enhanced if technological progress takes a form favoring the capital-intensive sector. There can be little doubt that this process is what in fact occurred. Indeed, during the last two centuries little or no technological progress has occurred in peasant agriculture and handicrafts, while technological progress in the plantations, mining, and petroleum sector has been rapid. The tendency toward disguised unemployment in the rural sector will also be aggravated if wage rates are kept artificially high by trade-union activities or by government policy. Industrial wage rates that are high relative to productivity provide an incentive for the introduction of labor-saving devices and consequently diminish still further the capacity of the industrialized sector to absorb the population growth.

Esther Boserup suggests that diminishing average returns to labor may set in before land is used really intensively. Shifting agriculture, she suggests, may be quite efficient in terms of manpower productivity; given the possibility of varying periods of fallow, the distinction between cultivated and uncultivated land virtually disappears. We should think in terms of a continuum of types of land use, ranging from still virgin land which is never cropped, through land cropped at shorter and shorter intervals, to land where a new crop is planted as soon as the last one is harvested. The shift to more intensive agriculture as population pressure mounts may bring a decline in man-year productivity even while some land is still under shifting cultivation. Conversely the return from intensive to shifting agriculture in parts of Latin America where population has declined is not retrogression, but a rational adaptation to the factor endowment.[1]

Conclusions

Putting together the theory of the population explosion with the theory of technological dualism we obtain a deeper understanding of some of the "characteristics" of underdeveloped countries. We saw in Chapter 1 there that the proportion of the total labor force in agriculture is virtually a measure of the degree of underdevelopment; the more people in agriculture, the more underdeveloped the country. Yet we also saw that it is precisely in agriculture that the spread in man-year productivity is greatest as between advanced and underdeveloped countries. In the industrial sector, techniques are often advanced and productivity is high; in agriculture, techniques are labor-intensive and simple and productivity is abysmally low. Why does labor not shift from the rural to the industrial sector, from low-yield to high-yield occupations, in accordance with orthodox theory?

[1] Esther Boserup, *The Conditions of Agricultural Growth* (London and Chicago, 1965).

The same sort of question arises with respect to capital. According to orthodox theory, the marginal productivity of capital ought to be higher in the rural sector, where the ratio of labor to capital is high, than in the industrial sector, where it is low. There is evidence that returns to capital actually are higher in the rural sector than in the industrial sector. George Rosen, on the basis of his extensive knowledge of the Indian economy, concludes that an important factor delaying the development of indigenous industry has been the high returns on investment in agricultural credit.[2] Interest rates on loans in the rural sector range from 16 to 100 per cent; in addition, the rural capitalist, who usually makes loans on a sharecropping basis, is frequently in a position to earn a handsome profit on speculative investment in stocks of food crops. It is easy to see why the rural capitalist is not attracted to industrial investment. But why does not industrial capital flow into agriculture, if returns there are really so much higher than on the plantations and in the mines and oil fields?

Here is the most vicious of all the vicious circles encountered in a theory of underdevelopment. Labor does not flow into the industrial sector because the supply of capital to that sector is limited—each investment project in an underdeveloped country competes against projects the world over in the international capital market—and technical coefficients are fixed, or thought to be so. The supply of domestic capital to the rural sector is also limited. It is not directed toward improving techniques, because although the elasticity of substitution of labor for capital may be high, the elasticity of substitution of capital for *land* is low. Relatively small amounts of investment in tools, simple irrigation, seed selection, and fertilizer could bring the *marginal* productivity of capital down to zero, given the present ratio of labor to land. It may well be that in some underdeveloped countries the marginal productivity of both labor and capital is close to zero in the rural sector.

The only way to overcome the redundancy of labor in the rural sector is to increase the supply of the scarce factor. But the *immediately* scarce factor is land. The only way to raise the marginal productivity of capital is to increase the ratio of land to labor a great deal. The production function is highly discontinuous in this respect. Increasing the size of the typical family farm from 2 acres to 3 will not raise the marginal productivity of capital very much. The size must be raised to 20 or 200 acres so that mechanization becomes profitable. With high population densities such increases in size of holding can be attained only by luring people out of peasant agriculture into the industrial sector. For *this* kind of program, however, capital becomes the scarce factor once again. It requires heavy investment in *both* the industrial and agricultural sectors. Neither agricultural improvements on the present holdings nor industrialization will, by itself, break through this particular vicious circle. Industrialization without an agricultural revolution brought the underdeveloped countries where they are.

The failure of foreign capital to flow into peasant agriculture must be explained in somewhat different terms. The industrial and rural sectors are not part of the same "economy" in the ordinary sense. Geographically, the plantations, mines, and oil fields are in the same country, but economically they may be more closely tied to the metropolitan country providing the capital, technical knowledge, and managerial skill than to the underdeveloped country in which the operation is located. The men who launch, organize, finance, and manage these enterprises—even when they are urbanites of the country itself—know little of peasant agriculture and village life. The rural capitalist relies for his success on his personal and firsthand knowledge of the villagers with whom he deals; he lends to them, sells to them, and buys from them. This is knowledge of a sort the foreign or urban capitalist does not have and does not wish to acquire. As for a wholesale shift to mechanized commercial agriculture, it is not an operation to be carried out on a piecemeal private enterprise basis.

Indeed here is one of the major reasons for government intervention in the development process. Once countries are in the situation analyzed in this chapter, only a unified and large-scale program involving more rapid industrialization and bold schemes for agricultural improvement can launch cumulative growth. In short, a "big push" is necessary.

[2] George Rosen, "Capital Markets and Underdeveloped Economies: A Theoretical Frame-Hypothesis for Empirical Research," M.I.T., CENIS, May, 1958.

Unlimited Supplies of Labor?

W. Arthur Lewis begins his well-known article on "Economic Development with Unlimited Supplies of Labour" by asserting that many underdeveloped countries conform to the Classical model, in which the supply of labor is perfectly elastic at current wage rates.[3] The "widow's cruse" of workers consists of existing farmers, casual workers, petty traders, domestic retainers, and additions to the labor force through population growth. As his conclusions rest on this basic observation, let us begin by examining the premise itself.

Some observers, including the present writer, have pointed out that the optimism concerning development by absorption of disguised unemployment from agriculture was unfounded. It is not possible to transfer large numbers of workers permanently and full time from peasant agriculture to industry without a drop in agricultural output, for during planting and harvesting seasons, which together amount to several weeks per year, the entire labor force is occupied. It may even be necessary to bring back members of the village who have gone off to take casual jobs in the industrial sector. Reorganization of agriculture and a shift to relatively extensive and mechanized techniques could release large numbers of workers from agriculture, to be sure, but that requires a certain amount of investment in the agricultural sector itself. Some observers have suggested that disguised unemployment has moved from country to city, and cite as evidence the host of petty retailers. But even the urban peddler, with three empty bottles in one basket and two right shoes in the other, may be performing a real service, and so may be truly employed, if there

[3] W. Arthur Lewis, "Economic Development with Unlimited Supplies of Labour," *The Manchester School of Economic and Social Studies*, May, 1954.

are customers with left shoes and customers who want empty bottles. Thus, in the static sense, it may be questioned whether supply curves of labor to the industrial sector are perfectly elastic.

If one puts the whole growth process in time, however, as one must to get meaningful results, the Lewis model accords with reality in many underdeveloped countries, as far as *unskilled* labor is concerned. The Lewis argument does not require disguised unemployment. It requires three conditions: that the wage rate in the industrial sector be above the marginal productivity of labor in the rural sector by a small but fixed amount; that investment in the industrial sector be not absolutely large relative to population growth; and that costs of training the necessary numbers of skilled workers be constant through time. The first condition seems to be met in many countries. If the "population multiplier" operates, population growth being accelerated by the very process of industrialization, the second condition is automatically guaranteed. But even if industrial investment does not actually accelerate population growth, the second condition can be met if employment in the industrial sector is a small proportion of the total and population growth is fairly high. Suppose, for example, that the labor force is twenty million, that four million are employed in the industrial sector, that the capital-job ratio in that sector is $2,000 per man, and that the total labor force grows at the rate of 2 per cent per year. To employ the total increase in the labor force in the industrial sector would require net investment of $800 million next year, or 10 per cent of the total stock of capital. Net investment on this scale would double the stock of capital in about seven years, a rate of growth beyond the wildest dreams of most underdeveloped countries. Thus for all practical purposes the supply of unskilled labor to the industrial sector can be treated as perfectly elastic, whereas in the rural sector it is already redundant, in the sense that marginal productivity there is below the subsistence standard of living.

Of course, the industrial employers are interested in skilled labor too. Lewis argues that labor skills are only a "quasi-bottleneck"; if you have unskilled workers, you can convert them into skilled ones.

In the short run, the need to train or import skilled workers may not alter the argument very much; if the cost of training or importing is constant, the elasticity of supply of skilled labor can still be infinite. As we have seen, it is possible that the cost of training or importing technicians may be high enough to induce entrepreneurs to use capital-intensive techniques in those parts of their operation where skill is necessary, but this fact does not change the argument either, unless these costs are rising. The Lewis thesis is of dubious validity even for unskilled workers, if we think in purely static terms, however; and if we think in terms of long-run supply through time, the relevant question about the supply of skills is whether the cost of training or importing is rising through time. The answer will depend on the nature of technological progress; if it is of a sort that reduces both the capital-labor ratio and the capital-output ratio simultaneously, the Lewis thesis may hold for skilled labor as well as

for unskilled.

Now if we accept the thesis, the process of growth will look like Figure 14–3. Here $\bar{w}$ is the productivity per man-hour in peasant agriculture, and w is the conventional wage in the industrial sector. The marginal productivity of labor in industry is M_1M_1, which permits the capitalist to earn a surplus, AM_1s. When he invests this surplus—perhaps improving techniques at the same time—the curve of marginal productivity shifts to M_2M_2 and so on. Industrial employment grows from N_1 to N_2, N_3, etc. The per capita income of workers and peasants remains unchanged, and the entire benefits of development accrue to capitalists. Lewis suggests three ways in which the process might be halted: if the expansion of the industrial sector is rapid enough to reduce the absolute population in the

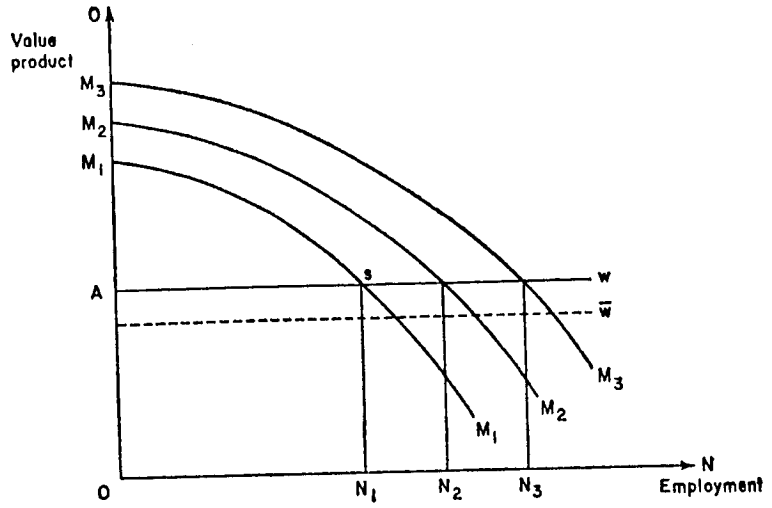

Figure 14–3

rural sector, raising the man-hour productivity in that sector, and so raising $\bar{w}$ and w (this will not happen if the population multiplier is operating); if technological progress in the rural sector raises productivity there, and so raises $\bar{w}$ and w; or if the terms of trade turn against the industrial sector with rising prices of food and raw materials, and so bring a rise in $\bar{w}$ and w (this is the Classical model). The achievement of balanced growth and generally higher living standards requires that the process *must* be halted by either method 1 or method 2, while, at the same time, measures are taken to continue investment in the industrial sector.

Lewis applies his analysis to the impact of international trade. First, he shows that technological progress in the export sector of underdeveloped countries helps only the workers of advanced countries. Suppose one

man-day of labor in the advanced country, A, produces three food or three steel, whereas in the underdeveloped country, B, it produces one food or one rubber. The rates of exchange will then be one food equals one steel equals one rubber. Now assume that productivity in rubber growing trebles. Then one steel will buy three rubber. But the wage in B is still equal to one food (plus the conventional surplus in the industrial sector) because the supply of labor to the rubber industry is unlimited. Thus foreign investment in the industrial sector of B can provide only additional employment and perhaps some tax revenues; in itself it cannot raise per capita incomes.

Now assume a man-day in A produces three food or three cotton manufactures, whereas a man-day in B produces two food or one cotton manufactures. The *marginal* man-day in A produces three food or three cotton, and the *marginal* man-day in B produces zero food and one cotton. On the principle of comparative advantage, B should export cotton manufactures and import food. But w in cotton manufactures is two food in country B; and w is three to six food in country A. In money terms, it is cheaper for B to export food and import cotton.

Lewis seems to be correct in his conclusion that countries with inadequate agricultural resources relative to their population (India, Japan, Egypt, the United Kingdom) should export manufactures and import agricultural products. It is impossible to imagine India as a truly efficient agricultural country, but it is easy to see India as an efficient producer of steel and textiles. This kind of misallocation of resources occurs in many underdeveloped countries. The implication is that planning must be based on "shadow prices" as they would prevail after a drastic structural change has been achieved.

Finally, Lewis indicates a way out of the vicious circle. Suppose a man-day in A produces five food or five cotton textiles, and a man-day in B produces one food or three cotton. Wages in B are one food, and B will export textiles. Wages in A are five food; A gets all the benefit from trade. Now suppose productivity is raised in B's cotton-manufacturing industry. The wage in B is unchanged, and the entire benefit goes to A, as before. But if productivity is raised in B's food production, B's wage will rise. Then cotton prices will also rise, to the benefit of B and the disadvantage of A. Thus economic development requires raising productivity per man-day—not per acre—in the peasant agriculture sector. Given the rates of population growth in that sector, raising productivity per man-day almost certainly requires—sooner or later—a shift to more extensive and more mechanized agriculture.

One final point may be noted. The current nationalist policies, with their emphasis on training and upgrading domestic labor and their limitations on immigration of skilled workers, managers, and technicians, may mean that skilled workers will be a more serious bottleneck to future expansion than they have been in the past. It is a question whether techniques of training, as well as of production, can be improved sufficiently to keep training costs per unit of *output*, at least, from rising as industry expands.

Development of the Labor Surplus Economy

One of the most ambitious efforts at a theory of underdevelopment to appear in recent years is that of John Fei and Gustav Ranis.[4] It does not pretend to complete generality: "It is the purpose of this book," the authors state in their preface, "to present a theory of development relevant to the typical labor surplus type of underdeveloped economy and to extract some policy conclusions from it." It is time, they say, to "venture beyond the customary eclectic survey of growth problems and ideas and towards the evolution of a particular theory aimed at a particular type of economy." In their view, efforts at a completely general theory are less likely to be fruitful, in our present state of knowledge, than "attempts to generalize from specific country experience." The theory presented in their book, accordingly, is limited to "a particular type of underdeveloped economy, the labor surplus type." It is clear, however, that the authors consider this type of economy common enough; and the theoretical construction they build to analyze this kind of economy is one of the most elaborate yet to be presented in the whole field of economic development.

The Basic Model

The fundamental features of the labor surplus economy, on which the entire analysis rests, are as follows: (1) The supply of land is sharply limited. (2) There is a "constant institutional wage" in the industrial sector. The supply of labor is perfectly elastic to the industrial sector at this wage, which is taken to be slightly above the real wage in the agricultural sector, as in W. Arthur Lewis's "unlimited supply of labor" model. Workers do not have to be "bid away" from the agricultural sector through raising wage rates above current levels, at least in the initial stages of industrialization. (3) Labor is redundant in the agricultural sector. There exists some number of workers in the agricultural sector with zero marginal productivity, who can be transferred—completely, permanently, and full time—without investment in the agricultural sector and without a fall in agricultural output. (4) There are "well-behaved" isoquants in the industrial sector. This assumption is fundamental to the analysis. Any number of workers whatsoever can be absorbed into the industrial sector, with no additions to the stock of capital in that sector, and without innovations, by resorting to known techniques which are increasingly labor-intensive. (5) For this reason, innovation in the industrial sector as such leads to a transfer of workers to the industrial sector. Innovations of any kind raise the marginal physical productivity of labor, and employment will accordingly increase until the marginal physical productivity of labor is once again reduced to the critical minimum wage. The increase in employment depends on the "intensity" of the innovation (the magnitude of the increase in labor productivity) and on its capital-using or labor-using bias. As in the Classical model, innovation seems to be

[4] John C. H. Fei and Gustav Ranis, *Development of the Labor Surplus Economy: Theory and Policy* (Homewood, Ill., 1964).

largely limited to the industrial sector. (6) The transfer of labor to the industrial sector is limited by the size of the agricultural surplus. If the attempt to shift workers from agriculture to industry results in a shift of the terms of trade against the industrial sector, industrial money wage rates must be raised, thus limiting the increase in employment. (7) Capital accumulation as such also increases employment in the industrial sector. The transfer of the agricultural surplus to the industrial sector is easiest if there are "dualistic landlords," who operate in both sectors and invest agricultural profits in industry. (Indeed, it is so much easier if dualistic landlords exist that it is not quite clear from the book how it is to be accomplished otherwise.)

The basic diagram of the Fei-Ranis model is reproduced in Figure 14–4. Both the upper and the lower parts of the diagram apply to the industrial sector of the economy. Each part shows one cross section of the production function: the upper part presents the usual isoquants (or isopods), the curves showing combinations of labor and capital that will produce the same output, with output rising as we move from Q_0 to Q_1 to Q_2; and the lower part is the usual curve of marginal productivity of labor, showing additions to total output as more units of labor are combined with a fixed stock of capital (and land). As the stock of capital is increased from K_0 to K_1 to K_2 in the upper figure, the marginal productivity curve in the lower figure shifts from M_0 to M_1 to M_2, etc. To maximize profits (the shaded area bounded by the marginal productivity curve and the supply curve of labor), employment will be extended to the point where the marginal productivity is equal to the real wage rate. With a capital stock of K_0, this point is reached with employment of L_0. As the stock of capital is increased to K_1, K_2, etc., employment will rise to L_1, L_2, etc., taking us along the expansion path in the upper diagram.

Up to the point L_2 additional labor can be attracted into the industrial sector as a constant real wage. But beyond that point the real wage rate must be raised in order to lure more labor away from the rural sector, either because labor becomes scarce in agriculture or costs of food rise or both. Beyond this "turning point" capital accumulation in the industrial sector must proceed at an ever-faster rate if employment in that sector is to continue expanding at the same rate—or something else must happen to shift the marginal productivity curves upward and to the right.

The various factors influencing the rate of labor absorption into the industrial sector are pulled together in the fundamental equation,

$$\pi L = \pi K + \frac{B_L + J}{\epsilon_{LL}}$$

The dependent variable "πL," is the rate of labor absorption, most easily thought of as the percentage rate of growth of industrial employment through time. The term "πK" is the rate of capital accumulation through time. "B_L" is the degree of labor-using bias, or deviation from "neutrality," of innovations. Completely neutral innovations would leave the ratio of capital to labor unchanged; the more innovations deviate from neutrality in this sense, in the direction of raising the labor-capital ratio, the higher

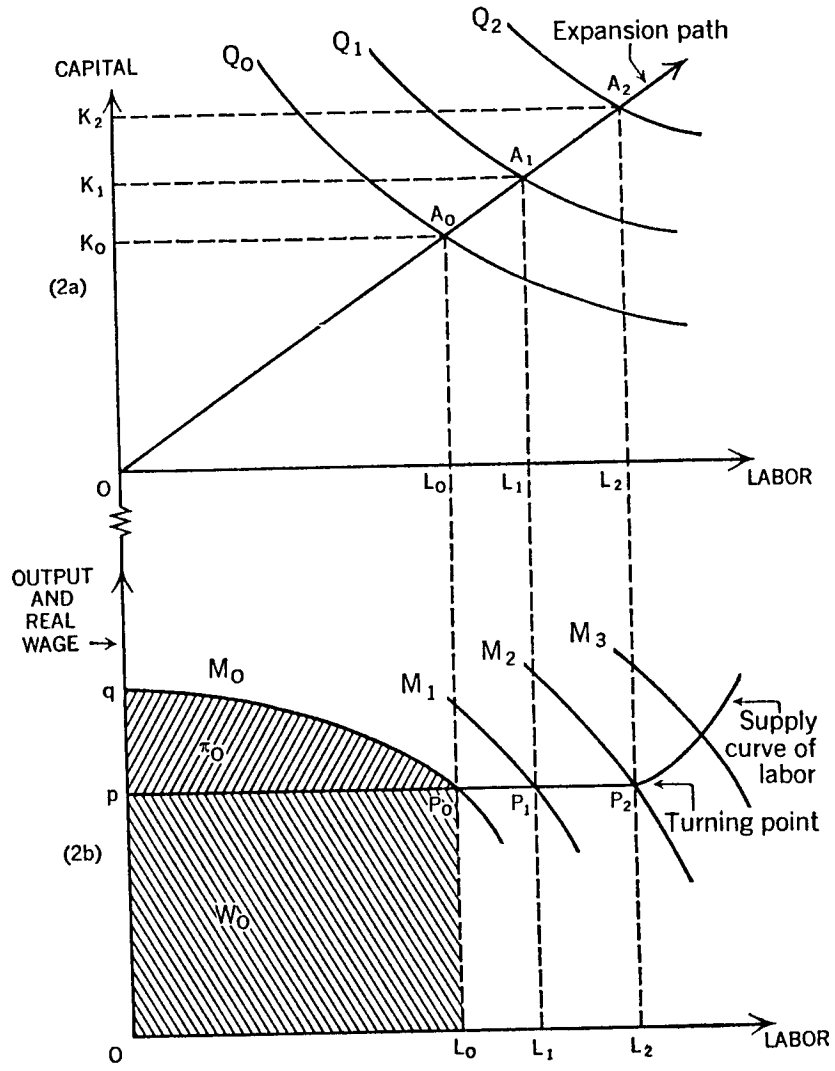

Figure 14–4

is B_L. "J" is the "intensity of innovation," or "the fractional increase in output due entirely to the passage of one unit of time, holding both capital and labor constant." In simpler language, it is the rate at which productivity is raised through time by technological progress, and may be thought of as the rate at which the marginal productivity curve of labor is shifted upward and to the right through innovations. ϵ_{LL} is the rate at which the marginal productivity of labor falls as the ratio of labor to capital is raised. Thus the equation states the truism that the rate of growth of industrial employment depends on the rate at which marginal pro-

ductivity of labor falls with increased employment (other things being equal), on the rate of capital accumulation in the industrial sector, on the extent to which innovations release or absorb labor, and on the rate at which productivity is raised by technological progress.

The concepts and their interactions are illustrated further in Figure 14–5, which is an elaboration of Figure 14–4. We have added a curve showing the shift in the curve of marginal productivity of labor that would constitute a "neutral" innovation, with which actual shifts may be compared. We begin with a stock of capital K_1 and employment L_1. Then

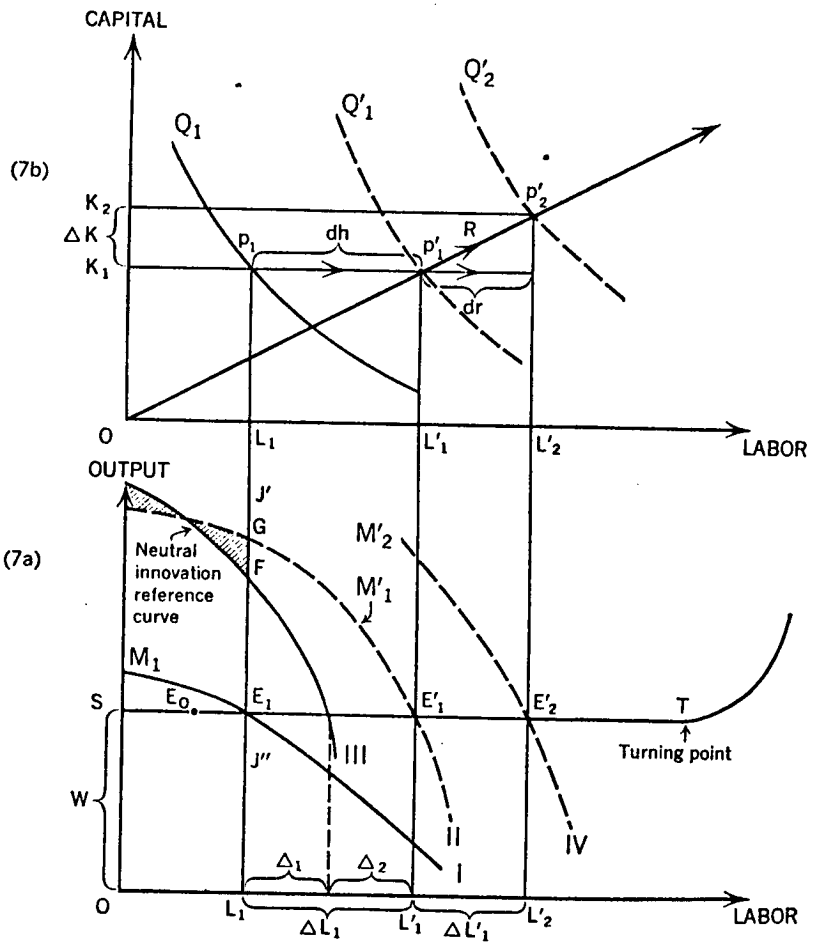

Figure 14–5. Production Contour Map Industrial Sector

technological progress raises the marginal productivity of labor to the dotted curve M'_1. Because the innovation is labor-absorbing in character, employment rises to L'_1 even without any capital accumulation. In the upper diagram this shift is shown by redrawing Q_1 and Q'_1. If in addition the stock of capital is increased to K_2, the equilibrium position shifts to E'_2 and employment increases to L'_2.

Reiterating the fundamental equation in terms of this diagram, the authors state that the rate of labor absorption depends partly on the rate of capital accumulation, whereas the absorption due to innovations alone, with fixed capital stock, depends in turn on three factors:

1. The "height" of point F relative to point E_1, representing the intensity of the innovation, that is, how much the original production contour has been blown up.

2. The "height" of point G relative to point F, representing the degree of labor-using bias of the innovation.

3. The "steepness" or "flatness" of the M'_1 curve representing the relative strength or weakness of the law of diminishing returns to labor. (The "flatter" M'_1 the further to the right equilibrium point E'_1.)

Successful economic development requires "structural change" in the sense of growth of industrial employment more rapid than the growth of total employment. This condition can be expressed as a "critical minimum effort criterion" derived from the basic equation above, letting "π_P" stand for the rate of growth of total employment through time:

$$\pi_P < \pi_L = \pi_K + \frac{B_L + J}{\epsilon_{LL}}$$

Thus for "success" we need capital accumulation, technological progress in the modern sector, preferably of a labor-absorbing type, and improvement in agricultural productivity, to prevent excessive increases in the industrial real wage which would slow down the relative transfer of labor from the traditional agricultural to the modern industrial sector.

From this model the authors derive a simple and not very original formula for launching economic development. First, the total agricultural surplus should be raised; and then there should be as much investment and capital-saving (labor-absorbing) innovation in the industrial sector as possible. "Our analysis indicates," the authors conclude, "that besides accumulating as much capital as possible [either domestically or via foreign aid] the economy should seek innovations of as high intensity as possible and, given intensity, subject to as high a labor-using bias as possible." No one could quarrel with this formula; the problem is to arrange its application in particular cases.

Major Questions of Fact

The validity and applicability of the model, of course, depends on the extent to which the basic assumptions conform to reality. The authors

cultural surplus. Thus the effort to expand the industrial sector entails a continuous worsening of the terms of trade of the industrial sector and a rise in the industrial real wage. This rise in the industrial real wage in turn leads to the introduction of labor-saving innovations in the industrial sector, thus choking off the increase in industrial employment.

Once again, this case of "failure" seems oversimplified and does not fit the cases of "failure" most familiar to this writer. It overlooks, for example, the fact that the product of the industrial sector is frequently sold in the world market, whereas the product of the agricultural sector is sold in the domestic market. Indonesia is as clear-cut a case of failure as one could find, but there is no evidence of improving terms of trade between the agricultural and industrial sectors of Indonesia itself; indeed, the evidence suggests just the reverse. What has happened in Indonesia is that because of the very low elasticity of substitution of labor for capital in the industrial sector, the capital-intensive nature of the most efficient technology in that sector (efficient in terms of capital-output ratios), the limitation of technological progress of the industrial sector, and the nature of the technological progress, the absorption of labor into the industrial sector—despite rapid expansion of that sector—never kept pace with population growth in the country as a whole. When World War II began, only 7 per cent of the labor force had been absorbed into the modern sector. The other 93 per cent of a large and rapidly growing population had to find a livelihood in the traditional sector, where their productivity was inevitably low.

Population growth is a factor that seems not to enter into the Fei-Ranis model. Despite the complexity of the diagrams, and the emphasis on innovation, the whole analysis remains essentially neoclassical and static.

The analysis includes two case studies, Japan as a "success story" and India as a failure. Japan's success is attributed mainly to a rapid rate of innovation, initially of a capital-saving and labor-absorbing nature. About 80 per cent of the total growth of the industrial labor force is attributed to such innovation, capital accumulation accounting for the other 20 per cent. According to the figures presented, the capital-labor ratio actually fell in Japan between 1888 and World War I, and this fact is given high marks in explaining the success of Japan. Japan also succeeded in reducing the absolute size of its agricultural labor force after 1898.

On the other hand, in India there was a "premature deepening" of capital, with an increase in the capital-labor ratio throughout the whole period, 1949–60. The industrial labor force grew very slowly, and the agricultural labor force continued to increase. Thus India has yet to reach a critical minimum effort.

The authors summarize the comparison as follows:

> The contrast between these two historical cases is unmistakably clear. Continuous capital shallowing in Japanese industry between 1888 and the end of World War I is evidence that Japan made maximum use of her abundant factor, surplus agricultural labor, while adopting labor using (or, at least, not very labor-saving) innovations. The continuously positive labor absorption due to innovations corroborates this finding. India, on the other hand, seems to have resorted to very labor saving innovations from the very beginning of her development effort, thus yielding to the temptation of an increasingly capital-intensive industrial structure and neglecting the potentialities of a maximum utilization of her abundant, and rapidly growing, surplus agricultural labor force.

This statement of the contrast between Japan and India is a distortion of the facts. Has India stubbornly and misguidedly refused to use capital-cheap, labor-intensive techniques? On the contrary, the second Indian Five-Year Plan states clearly that if it is a choice between employment and income, employment should be given preference; and a good deal of experimentation and research has been conducted in India with small-scale, labor-intensive activities. The point is that these proved to be too expensive in terms of capital—as stated above; the products and technologies with the low capital-labor ratios turned out to have high capital-output ratios. Moreover, the statement ignores both the difference between the choice of technology and the choice of product-mix, and the difference between launching industrialization in 1888 and launching it in 1949. It seems likely that the change in the product-mix had more to do with the drop in capital-labor ratios in Japan than any ingenious and insistent use of labor-using, capital-saving innovations. Industrialization on the basis of toys and silk scarves is not a process that other countries can follow, launching their industrialization today.[5] For some countries, comparative advantage forces them into industries where the most efficient technology —efficient even in terms of capital-output ratios—is one that is highly capital-intensive.

In any case, the figures themselves are suspect. The authors have elected to use a depreciation rate of 20 per cent in calculating the rate of capital accumulation in Japan. For the kind of industrialization that was taking place, and for the rate at which new plants and equipment were being built up, this rate of depreciation is surely too high. Obviously, selection of a lower depreciation rate would assign a greater role to capital accumulation in the explanation of Japan's growth, and a smaller one to innovations. Moreover, the estimate of the stock of capital excluded land. Even with a realistic "shadow price" for improved rice land (which could be rather high) the capital-labor ratio for the economy as a whole no doubt rose in Japan during the first phase of industrialization. The impression left by Fei and Ranis that growth can be achieved with relatively little capital accumulation, provided only that decision-makers are diligent in introducing innovations of a labor-saving nature, is quite misleading. Of course, there is no reason to suppose that the "residual factor" was not high in Japan as elsewhere; but the "residual factor" does not operate by itself; it needs capital accumulation and resource discovery to make it operate. There are still no primrose paths to prosperity.

In any case, the model does not lend to fundamentally new prescriptions for policy. Government action to create the preconditions of growth, to

[5] The Japanese "success story" is outlined in Part VI, Case Studies.