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BY

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## WAGES AND EMPLOYMENT IN A LABOR-SURPLUS ECONOMY

By LLOYD G. REYNOLDS\*

A decade ago Arthur Lewis published the first of two pioneer articles on economic growth under conditions of labor surplus [5] [6]. While this problem has since been explored by other writers, particularly Gustav Ranis and John C. H. Fei [8] [9], it is appropriate to refer to a family of "Lewis-type models" of economic development. These models depict the absorption of an initial labor surplus by transference of labor from the traditional to the modern sector of the economy. Thus far, however, there has been little effort to compare the development experience of specific countries with the predictions derived from Lewis-type models. The present essay is intended as a step in this direction, using data for the Puerto Rican economy from 1945 to date.

The salient features of the Lewis model are illustrated in Figure 1. The economy is divided into subsistence and capitalist sectors. The capitalist sector is "that part of the economy which uses reproducible capital and pays capitalists for the use thereof" [5, p. 148]. The subsistence sector includes everything else. While the subsistence sector is often identified empirically with traditional agriculture, Lewis notes that surplus labor may be found equally well in petty trade, domestic service, and other service occupations.

The subsistence sector contains surplus labor in the sense of workers whose marginal productivity is negligible, zero, or even negative.<sup>1</sup> These workers nevertheless receive an income,  $OS$  in Figure 1, which

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<sup>1</sup>The existence of zero marginal productivity as a common phenomenon has been disputed by some writers, including Theodore W. Schultz [10]. If I understand Schultz aright, he is arguing that, through generations of experimentation, traditional agriculture gets organized in a way which makes optimum use of whatever labor supply is available, and which leaves each member of the labor force with a positive (though low) marginal product. If labor is withdrawn from agriculture *with no change in techniques*, output will fall. This may well be correct. But it does not contradict the possibility that, if techniques known and used in progressive agricultural economies can be transferred to a backward economy, labor can then be transferred out of agriculture with no loss of output. Withdrawal of labor may itself stimulate improvement of techniques. Moreover, nothing in the Schultz argument denies the possibility that the marginal productivity of labor, though positive, may be below the worker's income.

DOLLARS

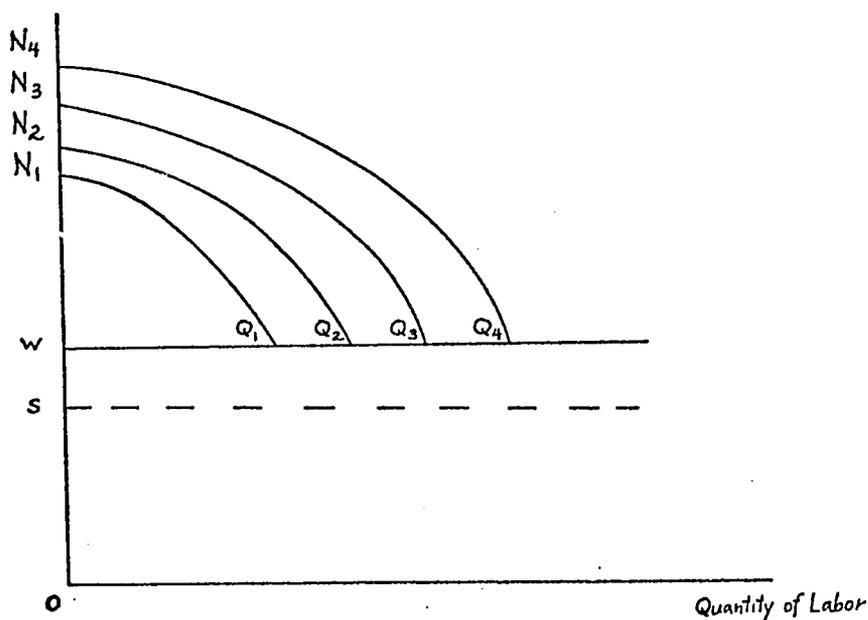


FIGURE 1

enables them to live after a fashion. This situation can arise *inter alia* because the income of a family group is shared among family members regardless of their individual contribution.

The wage rate in the capitalist sector,  $OW$ , must be somewhat above average income in the subsistence sector. Lewis suggests that the margin is usually 30 per cent or more, though its exact size does not matter for his argument. The reasons for this wage gap include higher living costs in the towns, the psychological cost to workers of transferring from the leisurely pace of traditional activities to the tighter discipline of industry, and perhaps also higher conventional standards of living in urban areas.

Employment in the capitalist sector is determined on ordinary maximizing principles. If at a certain time the marginal productivity schedule of labor in the capitalist sector is  $N_1Q_1$ , then  $WQ_1$  workers will be hired. Capitalist profit is  $N_1Q_1W$ , and Lewis assumes that this will be reinvested. This raises the marginal productivity schedule to  $N_2Q_2$ , so that  $WQ_2$  workers are now hired, and so on. Because of the reserve of surplus labor in the subsistence sector, labor supply to the capitalist sector is infinitely elastic at the constant real wage  $OW$ . The wage  $OW$ , incidentally, is measured in *industrial goods*, while  $OS$  is

measured in agricultural goods. This is explicit in the Ranis-Fei argument, but implicit also in Lewis.

When does the era of unlimited labor come to an end? It may never end because labor supply is being enlarged continuously through natural increase. Unless the labor demand curve moves to the right faster than the labor supply rises, surplus labor will increase over time. But suppose labor transference proceeds fast enough to cut into the labor surplus. Labor becomes scarce, and the supply curve of labor to industry turns upward, when disguised unemployment has been eliminated in the subsistence sector, i.e., when enough labor has been transferred to the modern sector so that the marginal productivity of those remaining in subsistence activity rises to the level of *OS*. Beyond this point, which Ranis and Fei term the *commercialization point*, the subsistence sector must pay workers the value of their (rising) marginal product and must compete with the industrial sector for scarce labor. The subsistence sector has vanished by becoming "modern," and both sectors now operate on commercial principles.

But the industrial wage rate may be forced up even before the commercialization point has been reached. Suppose, for example, that while labor productivity is rising in industry it remains unchanged in agriculture. When enough workers have been moved out of agriculture so that the marginal productivity of those remaining is no longer zero, further withdrawals of labor will reduce food output. Even without a drop in food output, expansion of incomes in the capitalist sector will raise the demand for food and, in a closed economy, turn the internal terms of trade in favor of agriculture. The industrial workers, whose wage is measured in industrial goods, will have to receive more of those goods to enable them to consume as much food as before.

The industrial wage level may also rise prematurely, that is, before the labor surplus is exhausted, for noneconomic reasons—a rise in conventional standards of life, voluntary increases granted by the capitalists on moral grounds, trade union pressure, or government regulation. This last possibility, which Lewis notes only in passing, has turned out to be quite important in Puerto Rico.

### I. *Aspects of the Puerto Rican Case*

Space does not permit an over-all review of the recent development of the Puerto Rican economy, but a few preliminary points must be made. Additional background material will be found in studies by Harvey Perloff [7], Werner Baer [1] [2], and others.

The growth rate of total and per capita output in Puerto Rico since 1940 has been one of the highest in the world. Real GNP per capita

rose at an average rate of 4.1 per cent a year during the 'forties and 5.2 per cent a year during the 'fifties. In 1954 dollars, per capita GNP rose from \$269 in 1940 to \$673 in 1961, placing Puerto Rico almost above the range of "underdeveloped" countries. GNP per employed worker, in 1954 dollars, rose from \$932 in 1940 to \$2,802 in 1961.

While the industrialization program has attracted widest public attention, economic progress has been general. Food production has risen at a rate which has permitted Puerto Rico to maintain about the same degree of self-sufficiency despite much higher income levels. This degree is quite low, however, only about 40 per cent of Puerto Rican food consumption coming from domestic sources. Different sectors of the economy have expanded at different rates, and the industrial composition of output has changed materially. Manufacturing rose from 12 per cent of total output in 1940 to 23 per cent in 1962, while agriculture dropped from 32 per cent to 13 per cent. There were substantial increases in the contribution of the construction industry and the Commonwealth government to national product.

Manufacturing development has been stimulated by legislation granting manufacturers of products not produced in Puerto Rico in 1947 full exemption from both income and property taxes for periods ranging from 10 to 17 years, depending on the part of the island in which the plant is located; by a wage level which in the late 'forties was only about one quarter of that in mainland manufacturing plants; and by an energetic and capable Economic Development Administration which provides a variety of market research, plant-construction, labor-training, financing, and technical advisory services. Since 1947 about thirteen hundred E.D.A.-sponsored manufacturing plants have been established in the island, the great majority being branch plants of mainland companies. The failure rate among these new establishments has been about one-third, but 910 of them were still in operation at the end of 1963, with a total employment of about seventy thousand workers, or one-tenth of the island's labor force. Manufacturing development has been primarily in light industry. Clothing, textiles, and food products provide about half of manufacturing employment. But in recent years there has been a considerable development of oil refining, chemicals, paper, metal products, and other heavier types of industry.

The peculiarities of the Puerto Rican case are readily apparent. It is a small economy, with close ties to the United States, hence is a very open economy. Exports and imports run higher than 50 per cent of domestic output. Capital, labor, and commodities move freely between Puerto Rico and the mainland United States. Manufacturing investment has been financed mainly from the mainland rather than from

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domestic sources. Puerto Rico has autonomy in tax matters, but only limited autonomy in wage determination, and little control over product prices, which are dominated by price movements on the mainland.

In other respects, however, Puerto Rico appears as a labor-surplus economy in the early stages of industrialization, with the employment and wage problems common to such economies. From a research standpoint, the economic statistics available for Puerto Rico, which largely follow U.S. concepts and procedures, are of unusually high quality. See in particular the sources cited in [11] [12] [13] [14] from which most of the data in this and subsequent sections were derived. We proceed, then, to examine the behavior of wages, productivity, profits, employment, and unemployment in Puerto Rico since World War II, and to compare this behavior with the predictions from Lewis-type models.<sup>2</sup>

## II. *Employment and Unemployment*

Puerto Rico is one of the most densely populated areas on earth, with about 730 people per square mile in 1963. While birth rates have shown some tendency to fall since 1950, the rate of natural increase remains close to  $2\frac{1}{2}$  per cent a year. Total population is about  $2\frac{1}{2}$  million, the annual increment to population above 60,000. A major objective of the development program has been to provide jobs at a rate exceeding the rate of labor force growth, and thus to cut into the island's labor surplus.

Heavy emigration to the U.S. mainland, stimulated by good employment opportunities and cheap air travel, provided a respite from population pressure during the 'fifties. Net emigration from the island averaged 43,000 a year, or about three-quarters of the natural population increase, during the decade. Moreover, since migration was concentrated among young adults, the Puerto Rican labor force actually declined between 1950 and 1960. With a shrinking labor force and a booming island economy, one might have expected rapid strides toward elimination of unemployment.

<sup>2</sup>The substantive sections of this paper draw heavily on the findings of the Manpower Resources Project, which the writer directed at the Social Science Research Center of the University of Puerto Rico. Many of the points made here will be documented more completely in a forthcoming volume by the writer and Professor Peter Gregory, of the University of Minnesota, who served as assistant director of the project. I would like to acknowledge Professor Gregory's contribution to our joint effort, both in terms of data accumulation and techniques of analysis. In particular, he developed the measures of elasticity of demand for manufacturing labor in Puerto Rico described in a later section. He should not be held accountable, however, for any defects in this interpretation of our findings. Professor Luz Torruellas, director of the department of economics at the University of Puerto Rico, who also served as assistant director of the project, was most helpful throughout, and her contribution is gratefully acknowledged.

TABLE 1—EMPLOYMENT AND UNEMPLOYMENT IN PUERTO RICO, BY SEX,  
FISCAL YEARS 1951 AND 1963

Employment Status	Men				Women			
	1951		1963		1951		1963	
	No. (000)	Per cent						
Labor force	508	100.0	516	100.0	205	100.0	179	100.0
Employed	431	84.8	443	85.8	173	84.4	163	91.1
35 hours or more	255	50.2	300	58.1	71	34.6	91	50.8
less than 35 hours	162	31.9	117	22.7	93	45.4	55	30.7
employed but not working	14	2.8	26	5.0	9	4.4	17	9.5
Unemployed	78	15.3	73	14.1	32	15.6	16	8.9

Source: Puerto Rico Department of Labor, Bureau of Labor Statistics; 1963 figures are estimates based on extrapolation of data for the first three quarters; data include home needleworkers.

When one looks at the data, however, one gets an unpleasant surprise. Total employment *fell* between 1950 and 1960. The extent of the decline in labor force and employment depends on whether one includes home needleworkers in the totals. If one excludes home needleworkers as being very part-time employees,<sup>3</sup> the labor force dropped by 35,000 and employment declined by 12,000 between 1950 and 1960. It follows that there was only modest progress in reducing unemployment.<sup>4</sup>

This impression is confirmed by Table 1. The percentage of full-time unemployed male workers was almost as high in 1963 as it had been in 1951. The unemployment percentage for women, however, fell from 15.6 to 8.9 over this period. This reflects the fact that about 60 per cent of the jobs in the new E.D.A.-sponsored factories have been filled by women workers. Note also that the proportion of employed people working less than 35 hours a week dropped considerably for both sexes. In the case of men, this probably represents mainly a transference of underemployed workers out of agriculture. In the case of women, the

<sup>3</sup>The number of women doing needlework in their homes was 51,000 in 1950, only 10,000 in 1960, which is why their inclusion or exclusion makes a substantial difference in the behavior of employment. Net annual output per worker, however, is estimated at only \$143 for 1955 and \$159 in 1960, which is suggestive of very part-time supplementary employment. On this ground it seems reasonable to set these workers aside as a separate category.

<sup>4</sup>Since 1960, labor force and employment in Puerto Rico have begun to rise; and this has been accompanied by a sharp decline in net emigration to the mainland. So while part of the recent increase in employment is no doubt genuine, part may represent a "backing up" of surplus labor and an increase in underemployment.

figures reflect a decline of 40,000 in the number of home needleworkers, most of whom seem to have dropped out of the labor force instead of seeking other employment.

Why was there not more striking progress on the employment front? There are two lines of explanation that may be widely applicable to newly industrializing countries. First, economic development brings a shrinkage of employment in some sectors, so that total employment can rise only if this shrinkage is more than offset by expansion in other sectors. Second, manufacturing industries embodying modern production methods create relatively little employment; and part even of this employment involves drawing new people into the labor force rather than absorbing previously unemployed workers.

The most dramatic employment shrinkage in Puerto Rico has been in agriculture. In the single decade 1950-60, agricultural employment fell from 214,000 to 124,000. There was a drop of about 40,000 in sugar growing, 10,000 in tobacco cultivation, and 40,000 in food production for local consumption. This last decline is especially interesting, since the farm value of domestic food production on the island rose from about \$70 million in 1949-50 to \$130 million in 1960-61, indicating a substantial gain in real output. The implication is that the 1950 farm labor force was seriously underemployed.

This impression is confirmed by special studies of the Puerto Rico Department of Labor. Between 1955 and 1960, for example, the agricultural labor force dropped by 45,000. But the number of *fully employed agricultural workers* declined by only 12,000. The rest of the shrinkage came from a drop of 12,000 in the full-time unemployed, 8,000 in wage workers averaging less than 35 hours a week, and 12,000 in subsistence farmers.<sup>6</sup>

The decline of 41,000 in the number of home needleworkers between 1950 and 1960 has already been mentioned and in part discounted as representing a much smaller decline in equivalent full-time employment. It nevertheless represents a substantial decline in economic activity, due mainly to the fact that rising legal minimum wages have made it increasingly difficult for Puerto Rican producers to compete with products from the Philippines, Hong Kong, Japan, and other areas. Finally, economic development brought the usual rapid decline in the number of domestic servants, which fell from 31,000 in 1950 to 17,000 in 1960.

The declines in these sectors during the 'fifties were about balanced by expansion in others. Between 1950 and 1962 manufacturing added

<sup>6</sup> Puerto Rico Department of Labor, Bureau of Labor Statistics, *Full Employment and Underemployment in Puerto Rico*, Special Reports Nos. 22, 27, 31, and 34.

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36,000 workers, construction 24,000, government 12,000, and other service industries about 20,000. Together with smaller expansions in utilities, trade, and finance, about 115,000 jobs were added to the economy over these twelve years. Note that manufacturing provided less than one-third of the new jobs. It is significant also that, while manufacturing output tripled in real terms between 1950 and 1962, factory employment rose only 65 per cent. The source of these productivity gains will be explored in a later section.

Today, about one-eighth of the Puerto Rican labor force is wholly unemployed. Another one-quarter work less than 35 hours a week.<sup>a</sup> There are doubtless others who could be withdrawn from agriculture, trade, and service with little loss of output. The unlimited supply of labor to industry remains a reality.

### III. *Wage Determination and Wage Behavior*

Despite this abundance of labor, Puerto Rican wages have risen at a startling rate. Between 1950 and 1963, the average hourly earnings of production workers in E.D.A.-sponsored manufacturing plants almost tripled (Table 2). The gap between Puerto Rican and mainland wages narrowed considerably. Because of substantial differences in the composition of manufacturing in the two areas, the gap should really be measured on an industry by industry basis. Table 3 indicates that, for selected industries which are important both in Puerto Rico and on the mainland, Puerto Rican wages rose from between 25 and 35 per cent of mainland levels in 1952 to between 50 and 70 per cent in 1962.

Even this comparison is not conclusive for appraising locational advantage. The Puerto Rican wage level in each industry should properly be compared with low-wage areas on the mainland which might be considered as alternative locations. One might also compare wages in Puerto Rican plants with those of mainland plants operated by the same company. One such study, which covered 50 companies in the spring of 1958, found that wages in the Puerto Rican plant ranged from 35 per cent to 94 per cent of those in the mainland plant, with a median of 59 per cent [3]. Considering the continued improvement of Puerto Rico's relative position since 1958 shown by Table 3, a comparable survey today would probably show a median in the neighborhood of 70 per cent.

<sup>a</sup>Only part of this group, of course, can be considered underemployed. Women workers in particular often prefer a part-time schedule. Special analyses by the Puerto Rico Department of Labor suggest that about 70 per cent of the women working a short week, and 35 per cent of the men, consider themselves fully employed and do not want longer hours of work.

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**TABLE 2—AVERAGE HOURLY EARNINGS OF PRODUCTION WORKERS IN E.D.A.-SPONSORED MANUFACTURING PLANTS AND IN U. S. MANUFACTURING, 1950-63**

Year	E.D.A. Plants Puerto Rico	All Manufacturing United States	Ratio of E.D.A. Plants to U. S. Manufacturing
1950	\$0.412	\$1.501	.274
1951	.448	1.615	.277
1952	.453	1.705	.266
1953	.475	1.79	.265
1954	.505	1.81	.279
1955	.607	1.91	.318
1956	.720	2.02	.356
1957	.830	2.09	.397
1958	.884	2.14	.413
1959	.935	2.21	.423
1960	.983	2.30	.427
1961	1.031	2.34	.427
1962	1.091	2.39	.457
1963	1.159	2.47	.470

Sources: The Puerto Rican data for E.D.A.-sponsored plants are reported in E.D.A., *Annual Statistical Report*, 1960-62, pp. 27-31. The U.S. data derive from the U. S. Bureau of Labor Statistics. Data are for October of each year.

**TABLE 3—AVERAGE HOURLY EARNINGS IN SELECTED INDUSTRIES: PUERTO RICO AS PER CENT OF U.S., 1952 AND 1962**

Industry	1952	1962
Cigars	.30	.67
Broad woven fabrics	.38	.56
Knitting	.41	.70
Floor coverings	.26	.53
Men's and boys' furnishings	.32	.61
Women's and misses' outerwear	.26	.52
Women's and children's undergarments	.32	.70
Girls' and children's outerwear	.28	.59
Paperboard containers and boxes*	.36	.63
Drugs	.22**	.49
Leather footwear	.30	.52
Fabricated metal products	.31	.51
Machinery—nonelectrical	.39	.54
Household appliances	—	.56
Toys and sporting goods	.26	.51
Costume jewelry, buttons, and notions	.33	.50

\* The data for Puerto Rico are for the broader industrial group, paper and allied products; however, the bulk of the activity is to be found within the paperboard and box division.

\*\* The ratio is for 1950.

Sources: The Puerto Rican data were derived from the annual *Census of Manufacturing Industries of Puerto Rico*, published by the Puerto Rico Department of Labor, Bureau of Labor Statistics. The wage data apply to the week ending nearest the first week of October for each year. The wage data for the United States were taken from the *Monthly Labor Review* and apply to the month of October for each year.

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The large wage increases since 1950 have not been confined to manufacturing, but have been general throughout the economy. Manual workers in construction, public utilities, and the service industries have received increases of roughly the same percentage size as in manufacturing. There has been a serious lag, however, in agricultural earnings. In 1952 the average wage earner in agriculture earned about half as much as the average factory worker. By 1962 he earned less than one-third as much. The urban wage level has pulled away increasingly from the agricultural base.

It is hard to find an economic rationale for the rapid rise of the urban wage level. Some pressure on food supplies is suggested by the fact that consumer prices of domestically produced foodstuffs rose more than 50 per cent between 1947 and 1961. But 60 per cent of the food consumed on the island is still imported, and import prices have risen only slightly. Prices of nonfood items, and the over-all consumer price index, have risen at about the same rate as on the mainland. Thus there has been a rapid rise in real wage levels, and it is this which has to be explained.

Trade union organization in Puerto Rico is relatively weak. Pressure for higher wages has come mainly from the U.S. and Commonwealth governments, operating through legal minimum wages. Industries involved in external commerce are covered by special provisions of the Fair Labor Standards Act. There is also a Puerto Rico minimum wage law, passed originally in 1941 and revised and strengthened in 1956. This act can be applied to external commerce, but in practice the Commonwealth government has ceded jurisdiction in this area to industry committees appointed under the FLSA. The main impact of the Puerto Rican law is on intra-insular activities, where minima have been established for most of the major industries, including agriculture.

We are accustomed to regard minimum wage regulation in the mainland United States as rather unimportant. The reason is that the legal minimum is a flat rate, infrequently revised, and set well below the prevailing wage level of most industries. The control structure in Puerto Rico is quite different. Under both the federal and island legislation, minimum wages are set separately for each industry on the recommendation of tripartite industry committees. The minima are geared to the estimated wage-paying ability of each industry, and there is at any time a wide range between the highest and lowest industry rates. Most workers in each industry earn very close to the minimum rate; and as the minimum is raised, which happens every year or two, the industry wage level is forced up by a proportionate amount. There is convincing evidence that minimum wage regulation, rather than labor-supply conditions, is mainly responsible for the advance of real wages over the past 15 years.

The rate at which the legal minima have been raised, as well as the dispersion of industry minima at a particular time, is illustrated by Table 4. In 1949 the median minimum wage was about 30 cents an hour, and there were still many rates below 25 cents. By 1963 the median minimum wage was \$1.00 an hour, and there were scarcely any rates below 70 cents. The impact of successive revisions stands out clearly from Puerto Rican wage statistics. When an industry's minimum is raised, average hourly earnings rise by about the same amount, though usually with some lag because the rates of upper occupational

TABLE 4—FREQUENCY DISTRIBUTION OF INDUSTRY WAGE MINIMA  
UNDER THE FLSA, 1949 AND 1963

Minimum Rates	1949	1963*
Under .25	37	0
.25-.299	20	1
.30-.349	17	1
.35-.399	16	0
.40-.449	35	0
.45-.499		2
.50-.599		2
.60-.699		2
.70-.799		27
.80-.899		20
.90-.999		19
1.00-1.149		38
1.15-1.249		36

\* Data as of June 1963; a further automatic increase of 10 per cent in all rates was scheduled for November 1963.

Source: U. S. Department of Labor, Wage and Hour and Public Contracts Division.

groups may not be revised immediately. After the increase, as before, the bulk of the labor force is found earning very close to the legal minimum.

The leaders of the Commonwealth government would doubtless have acted to raise the manufacturing wage level in any event. However one may view the classical model of capital accumulation in principle, the spectacle of very large profits and stagnating wages can scarcely be viewed with equanimity by a democratically elected government. Whether Commonwealth leaders, given completely free choice, would have moved so rapidly to reduce the island's locational advantage is uncertain, for they have been under strong pressure from the mainland. Each time Congress has revised the Fair Labor Standards Act, many mainland manufacturers and union leaders have urged that Puerto Rico be blanketed under the federal minimum to eliminate "unfair" competition. Political and business leaders on the island have avoided this only by accepting substantial wage increases under the

industry committee system.<sup>7</sup> Each industry committee contains union, industry, and public representatives from the mainland as well as from Puerto Rico. The Puerto Rico industry representatives, who alone have a strong incentive to resist wage increases, find themselves outnumbered; and the wage decision which emerges may well differ from that which would have been reached by a committee of island residents only.

We shall argue in a moment that rapid wage increases have operated to retard the expansion of factory employment in Puerto Rico. They have doubtless had advantages in other directions, and opinions will differ on where the balance of advantage lies. But even if one concludes that a more moderate rise of wages would have better served the interest of Puerto Rico, this is not necessarily a criticism of the economic judgment of Commonwealth officials. Domestic and external political pressures have operated to restrict their freedom of maneuver.

#### IV. *Wages, Productivity, and Employment*

The rapid rise of wages may have retarded the expansion of employment in two ways. It may have deterred some mainland companies from establishing branch plants in Puerto Rico, and it may have induced plants that were established to use more labor-saving methods of production. What evidence is there on the strength of these effects?

Puerto Rico has certain cost disadvantages which must be offset to make location there attractive. Transportation costs are often higher, especially where components are shipped from the mainland to Puerto Rico for processing or assembly and the finished product is re-exported to the mainland. Uncertainty of shipping is an additional cost, for the docks are well organized and dock strikes are not infrequent. Executives brought from the mainland to manage plants in Puerto Rico are usually paid a substantial premium over their mainland salaries to cover the cost of living in their accustomed fashion by buying imported U.S. goods, the cost of sending children to mainland schools and colleges, and vacation and other travel for themselves and their families. Companies seem also to expect a substantially higher profit margin on their Puerto Rico operations to offset additional risks and uncertainties.<sup>8</sup>

<sup>7</sup> And even so, they have not always averted specific Congressional action. In the most recent FLSA revision, Congress provided that the mainland minimum of \$1.00 was to be raised in two steps, to \$1.15 in 1961 and to \$1.25 in November 1963. In the case of Puerto Rico, all minimum rates were to be increased in two steps, simultaneously with the mainland increases and by the same relative amounts. Thus a 15 per cent increase was provided for the first step and a further 10 per cent increase for the second. Still higher minima, of course, could be set by industry committee action.

<sup>8</sup> For evidence on this point see the study by Mrs. Griffith [3], based on interviews with 50 companies which have located in Puerto Rico and 50 companies which considered locating there but decided against it. It is possible, of course, that companies which require a high profit rate to locate in Puerto Rico initially may be willing to stay there

Labor efficiency appears to be an unfavorable consideration *ex ante*, although it is on the average a neutral factor *ex post*. Prominent in the thinking of companies which have decided against locating in Puerto Rico is an expectation that labor productivity will be sufficiently lower that, even with lower wage rates, there will be no saving in unit labor costs relative to the mainland. These expectations are in fact unduly pessimistic. The evidence suggests that well-managed plants designed to mainland standards can reach mainland productivity levels after a reasonable breaking-in period. For locational decisions, however, it is expectations which matter rather than facts; and productivity expectations have usually been unfavorable.

The main favorable factors are tax exemption, which is temporary in nature, and a lower wage level. Many companies reason that the wage level should yield savings in labor cost sufficient to offset the cost disadvantages noted above, leaving them with the tax advantage as a net gain. Thus as the wage level in Puerto Rico approaches that of competing areas on the mainland, one may expect a rise in the proportion of companies deciding against a Puerto Rican location. Eventually one should reach an equilibrium leaving no net inducement for plant migration to Puerto Rico. But at this equilibrium, will Puerto Rican wages be 5 per cent below competitive areas on the mainland, or 10 per cent below, or 20 per cent below? This is hard to estimate, and the answer will differ from one industry to another.

There has been no absolute retardation in the movement of industry into Puerto Rico. On the contrary, the number of new E.D.A.-sponsored plants established in the island has risen from 283 during the four-year period 1952-55 to 388 during 1956-59 and 511 during 1960-63. It seems likely that the inflow of plants would have been even larger had wage increases been less rapid; but it is hard to test this hypothesis.

We can speak with more confidence about the reactions of plants already established in Puerto Rico. They responded with productivity-raising improvements which were sufficient to offset most of the higher wage costs. But the offset was not complete. Average annual profits for all E.D.A.-sponsored manufacturing plants, calculated as a percentage of owners' equity, varied in the range of 35 to 40 per cent up to 1956. As the pace of wage increases accelerated in the mid-'fifties, the annual profit rate declined until by the early 'sixties it was in the range of 25-30 per cent.<sup>9</sup> In some labor-intensive industries, such as the important

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for a lower rate. Despite large wage increases and eventual expiration of tax exemption, relatively few plants have been shut down. Of 95 E.D.A.-sponsored plants whose tax exemption had expired by the end of 1962, only 21 had been closed.

<sup>9</sup> Calculations based on data from Economic Development Administration, *Annual Statistical Report of EDA Manufacturing Plants*, successive editions through 1962.

foundation-garment industry, pretax profits in Puerto Rico have fallen to about the mainland level, leaving only the tax advantage to the Puerto Rican producers.

How were productivity increases accomplished? The aggregate statistics for the manufacturing sector are revealing. The period of accelerated wage increase seems to have brought little change in capital-output ratios.<sup>10</sup> But over the years 1954-61 both capital per worker and output per worker approximately doubled. There was a sharp reduction in the use of labor relative to *both* capital and output. Management found ways of dispensing with labor and of getting greater output from those who remained.

Introduction of labor-saving machinery in response to wage increases does not seem to have been of major importance. It is true that in some of the older native firms, wage pressure has forced modernization of the entire plant, with a consequent increase in the amount of capital employed. But in mainland branch plants, the capital equipment was usually already of recent vintage. With a few notable exceptions, mainland firms establishing branch plants in Puerto Rico did not adopt production techniques different from those employed in mainland plants. Where exceptions were made, they were generally in the direction of more labor-intensive methods of materials handling. Thus the possibility of factor substitution was limited, and seems inadequate to explain more than a small part of the increase in capital-labor ratios.

What mainly happened was that personnel and production management were much improved over the years. Field investigation of 85 recently established manufacturing plants in Puerto Rico, carried out in the mid-'fifties as part of the Manpower Resources Project, revealed remarkable instances of inefficiency. Among the managers of mainland branch plants whom we interviewed, almost half had never before occupied a management position, and some had no industrial experience of any sort. First-line production supervisors had been chosen largely from the Puerto Rican population, often on the ground of fluency in English, which is scarcely a sufficient qualification. Workers were often carelessly selected, training methods were inadequate, standards of expected output were low, waste of materials and spoiled work were excessive, labor turnover and absenteeism were high. Even at this time one encountered some well-managed establishments which were approaching mainland productivity levels. But in others the feeling seemed to be that, with wage rates so low, one could scarcely avoid showing a profit.

Efficiency would doubtless have risen over the years through normal

<sup>10</sup> For E.D.A.-sponsored manufacturing plants of assets of less than \$1 million, capital employed per dollar of sales receipts was \$0.90 in 1954 and \$0.87 in 1960. For plants with assets above \$1 million, the corresponding figures are \$1.27 in 1954 and \$1.23 in 1960.

learning. But the rising wage level was a powerful stimulus to learning. Each time a minimum wage increase was impending, most managements reviewed their personnel policies and production standards to see what might be done to offset the higher wage; and usually something could be done. Managers and supervisors were replaced, job layout was improved, work crews were trimmed down to minimum size, waste of materials and products was reduced through better training and supervision, standards of expected output were raised, costs of turnover and absenteeism were lowered. There is apparently considerable interdependence between how much management expects workers to produce, how much they were willing to produce, and the level of their earnings. Workers on incentive systems, who would have resisted a simple increase in output standards, as a "speed-up," often accepted such an increase cheerfully when it was offset by a proportionate rise in their minimum wage.

Thus labor requirements per unit of product were reduced, not so much through larger capital inputs as through larger (or higher-quality) *inputs of management effort*. Anyone familiar with industry realizes that this is possible in some measure. The Puerto Rican experience dramatizes the magnitude of the productivity gains which can be achieved in this way during the early stages of industrialization.

It is not clear how one should rationalize this process in terms of production theory. If one defines the production function as embodying *median current practice*, one would have to say that the production possibilities frontier moved outward as the wage level rose. If on the other hand one defines the production function in terms of *best available techniques* (say, in this case, the performance of a superior mainland plant in the same industry), one would have to say that most Puerto Rican plants started off well within their production frontier and moved toward it as a result of wage pressure. (Some plants, of course, failed to adapt rapidly enough and passed out of existence.) Alternatively, one could define management as a separate input; but the difficulty of quantifying this input would be a serious bar to statistical analysis.

It would be interesting to know, not just that wage increases had a negative effect on employment, but the approximate size of this effect. So an attempt was made to estimate the elasticity of demand for labor in Puerto Rican manufacturing.<sup>11</sup> The procedure involved a basic assumption that, within each of the subperiods for which the elasticity was estimated (1949-54 and 1954-58), the production function of the Puerto Rican manufacturing sector was homogeneous of degree one.

<sup>11</sup>The method used was devised by my colleague, Peter Gregory, who also supervised the statistical calculations. Both the method and the results are described in greater detail in the forthcoming volume.

fact that actual and anticipated wage increases may have deterred plants from locating in Puerto Rico. Our estimate of employment in the terminal year of each period at the base-year wage was based on *actual output* of goods rather than what output might have been in the absence of a rise in wages. Locational effects are thus excluded. We have already given reasons for thinking that these effects may have been substantial.

On the other hand, two factors may have led us to overestimate the association of wage and employment changes. We assumed a homogeneous production function in order to estimate potential employment at the base-year wage level. If the actual function yields increasing returns to scale, then we will have overestimated the amount of employment that should have been associated with the output of year 1, and hence the employment forgone as a result of the rise in the wage. Moreover, the assumption of a stable production function within each time period ignores the likelihood that even without wage shocks management would have achieved economies in the use of labor through normal learning.

It must be remembered also that the elasticity estimates are averages for all manufacturing. Elasticities in different Puerto Rican industries can be expected to vary widely because of differences in product market conditions and production functions. That these elasticities do vary widely has been recognized implicitly by Congressional reluctance to apply an across-the-board general wage minimum to Puerto Rico, and by the actions of the industry committees which have tried to weigh the probable effects of varying wage increases in different industries.

#### V. *Unlimited Labor, Wages, and Employment*

Unlimited supply of labor has been and is a reality in Puerto Rico. Employers in the modern sector have never had serious difficulty in recruiting labor, and it has not taken long to transform raw recruits into competent industrial workers. This labor has come from the sources which Lewis enumerated: agriculture, trade, domestic service, other service industries, and new entrants to the labor force.

Employment has not expanded, however, along the constant real wage line in Figure 1. The wage level has been raised repeatedly, and this has stimulated management responses which have restricted the rise of employment.

The actual course of events may be interpreted with the aid of Figure 2. The industrial wage level at time  $t_0$  is  $OW$ , the schedule of marginal labor productivity is  $MPL$ , and employment is  $OE$ . Suppose that by time  $t_1$  there has been new industrial investment which, by itself,

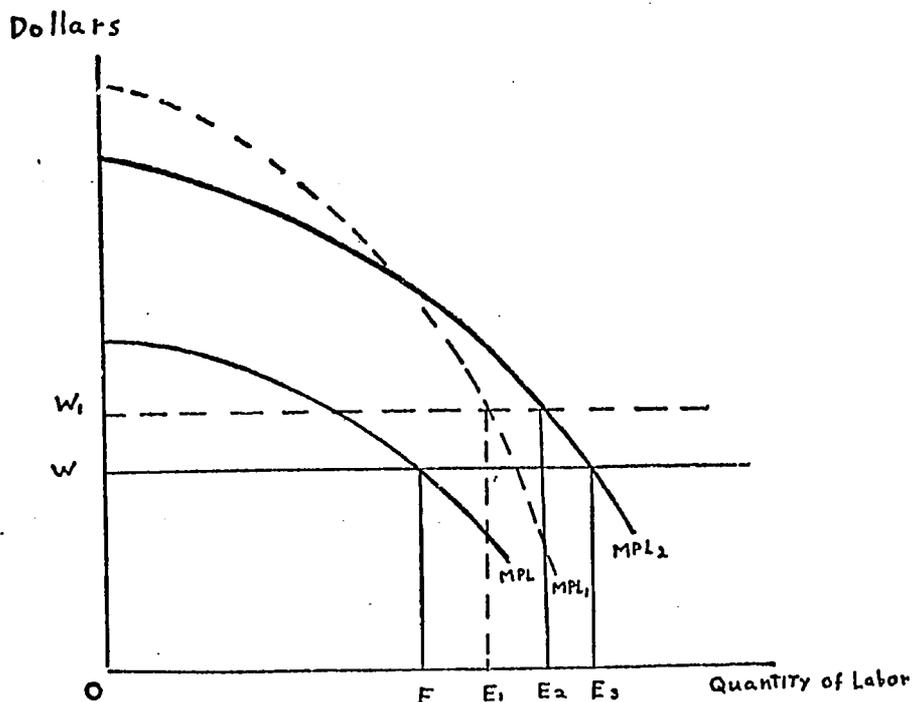


FIGURE 2

would shift the productivity schedule proportionately upward to  $MPL_2$  and, with no change in wages, would result in employment of  $OE_3$ . Meanwhile, however, government has raised the wage level to  $OW_1$ . Labor supply is unlimited, as before, but it is unlimited at a higher real wage level. (An interesting feature of the Puerto Rican case is that raising money wages does raise real wages as well, since product prices are largely determined in the mainland market. This would not necessarily be true in a more closed economy.)

The wage increase stimulates management to make labor-saving innovations so that, with the investment of  $t_1$ , the labor productivity schedule is tilted to the position  $MPL_1$ .<sup>13</sup> The potential employment  $OE_3$  is reduced on two counts. The wage increase alone would reduce it from  $OE_3$  to  $OE_2$ ; the labor-saving innovations cut it further to  $OE_1$ . Thus the substantial investment between  $t_0$  and  $t_1$  leads to only a slight increase in employment.

The upward shift of wages is repeated in the next time period, and similar management adjustments follow (Figure 3). Thus the wage-

<sup>13</sup> The shift from  $MPL_2$  to  $MPL_1$  would in fact be a *very* labor-saving innovation in the Hicksian sense, i.e., an innovation leading to reduced employment at the same wage level [4, Ch. 2] [9, Ch. 3].

employment locus, instead of moving horizontally to the right along path I moves upward to the northeast along path II. If government wage policy is aggressive, and if management is very successful in saving labor, path II may be quite steep—large wage increases, small employment increases. Path II looks like a conventional upward-sloping

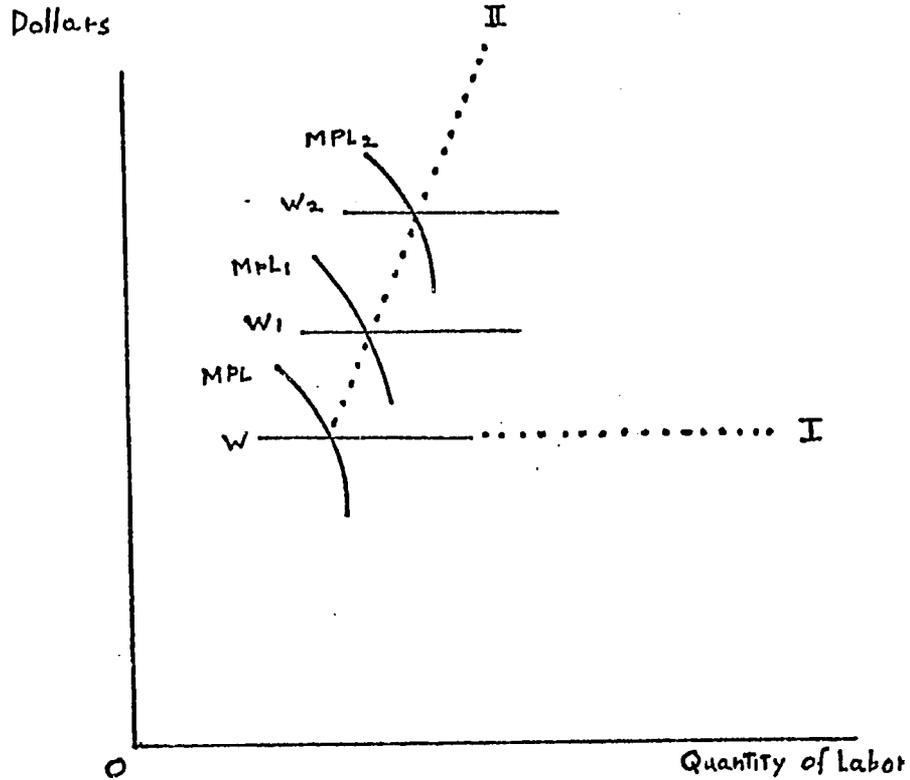


FIGURE 3

labor-supply curve; but it is actually the locus of demand-supply intersections in successive time periods, during each of which labor supply remains unlimited.

Is this behavior a peculiarity of the Puerto Rican case? Or are "premature" increases in the industrial wage level a general characteristic of today's industrializing countries? It would be useful to have evidence on this from other parts of the world.

The Puerto Rican experience is suggestive also as regards development policy. The objective of a development program is usually stated as a certain behavior of real per capita income. If employment objectives are included, this is usually as an afterthought. The plan document may assert optimistically that the number of new jobs created

will exceed projected additions to the labor force over the plan period. But the statistical foundation of these projections is typically weak, and there is little analysis of the kinds of action which would be needed to make them come true.

In a country which starts with a labor surplus, and which has a high population growth rate, employment objectives are important. The economy must transfer labor to the modern sector fast enough to cut into the labor surplus. Puerto Rican experience underscores the degree of effort required. The conjuncture of circumstances in Puerto Rico since World War II has been unusually favorable, yet progress in reducing the labor surplus has been slow. In countries less favorably situated, such as India and Pakistan, the tide of surplus labor is rising and will continue to rise over the foreseeable future.

Development of modern factory-style manufacturing makes only a limited contribution to employment. The Puerto Rican industrial development program has been unusually vigorous and successful; but from 1952-62 the average annual increase of employment in E.D.A.-sponsored plants was about 5,000 a year. With present labor force participation rates, and in the absence of net emigration to the mainland, annual additions to the Puerto Rican labor force would be of the order of 40,000. One hears reports also from other countries which, after a decade or more of accelerated industrialization, are surprised to find how little employment has been created. Manufacturing organized on Western lines, and particularly heavy manufacturing which is fashionable in the larger developing countries, is not very labor-using.

The moral is partly that there should be more energetic pursuit of employment opportunities outside the manufacturing sector: in agriculture, where new techniques which are land-saving rather than labor-saving may be able to absorb surplus labor without any physical transference; in labor-intensive public works programs organized along Norkse lines; and in other directions which require mainly education and organization rather than capital investment. Within manufacturing, there should be imaginative exploration of small-scale, more decentralized, more labor-using forms of organization such as have persisted in the Japanese economy to the present day and have contributed materially to its vigorous growth. It can be shown that, up to a certain point, techniques which are more labor-using will also be output-increasing [9, Ch. 3]. Development policies which are not oriented toward using the abundant labor supply will also fail to maximize national output.

The problem of what pattern of incentives might be used to persuade privately owned manufacturing concerns to develop in this di-

rection is too large to be explored here. It seems clear, however, that rapid increases in the real wage level would not form part of the prescription. A country which considers employment expansion important should ponder the wisdom of raising the price of labor. Modern Western reasoning about wages, in which labor is taken as a scarce factor, may be quite misleading. Poor labor-surplus countries are still living in a classical world. Perhaps they should follow the classical route toward fuller employment.

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