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9. ABSTRACT

This paper has attempted to isolate the sources of labor absorption performance and increased earnings inequality Brazil. To do so, we relied on a linear input-output model augmented by an investment requirements matrix. The focus has been on the impact of demand, and output performance is tied to derived labor demands by use of the"job competition" model. The heterogenity of labor is explicitly recognized by disaggregating labor input in each sector into eight skill levels. The distribution of earnings is determined both by the distribution of employed workers between these skill classes and by the unemployment rate.

The procedure was first to test the plausibility of the model by comparing its simulated predictions with Brazilian historical experience, 1949-62. Since the model seemed to perform very well, we then explored four counterfactual experiments, comparing the results with the "historic" simulation. The counterfactuals represent alternative policy regimes not only available to the Brazilian government during the '50s, but, in the case of two, actually pursued by Brazil in the '60s. By comparing the behavior of labor absorption rates and earnings distribution under these alternative policy regimes, we have been able to isolate the sources of Brazilian economic performance in these crucial social dimensions.

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THE IMPACT OF DEMAND ON LABOR ABSORPTION AND THE DISTRIBUTION OF EARNINGS THE CASE OF BRAZIL

by

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Spring, 1973

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The Impact of Demand on Labor Absorption and the Distribution of Earnings: The Case of Brazil

1. Labor Absorption and Income Distribution

The Development Problem

Although the labor absorption issue has been a main factor in the development literature at least for two decades only recently has it been recognized as a "problem." Two explanations can account for this shift. First, the conflict between growth and distributional goals has become increasingly apparent, and nowhere has this conflict attracted more attention than in the last two decades of Brazilian development. Second, the conventional dualistic models, and policy upon which they are based, treated labor absorption in modern, high-skill and high-wage sectors as a passive respondent to overall successful capital accumulation. In this simplistic view, the only constraint on rapid rates of labor absorption was the domestic savings effort. The performance of the late 1950s and 1960s dashed that optimism as high rates of aggregate growth and industrialization failed to generate equivalently rapid rates of labor absorption.[1] Brazilian experience up to 1960 is representative of this disappointing performance since manufacturing employment growth was only 2.6 percent per annum while output growth rates were in excess of 9 percent.[2]

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[1] See W. Baer and M. Hervé, "Employment and Industrialization in Developing Countries," Quarterly Journal of Economics, 82 (July, 1966), 88-107, and D. Turnham, The Employment Problem in Less Developed Countries (Paris: OECD Development Centre, 1971).

[2] See Baer and Hervé, op. cit.

As a means of accounting for the disappointing labor absorption performance, development economists have since turned their attention to policy-induced price distortions and/or technological biases in industrial development.[1] A large number of empirical studies have accumulated which have established (1) the labor-saving bias in new industrial technologies and (2) the price distorting effects of government policy which have served to raise artificially the real cost of labor and lower the real user cost of capital. These supply-oriented explanations appear to account for a significant portion of the low observed labor absorption rates in developing economies. The present paper does not deny the importance of these supply-oriented explanations. Yet it seems to us that demand-oriented explanations have failed to receive equal attention. As a result, this study takes these supply effects as established and explores instead the impact of demand on labor absorption performance.

Although an understanding of the correspondence between labor absorption expansion and changes in the distribution of income is well embedded in the literature, the emphasis has almost always been on the functional distribution. This focus is inevitable given the character of the models employed. First, private savings are normally viewed to be positively related to the property income share.[2] Indeed, this behavioral assumption underlies the classic conflict between capital accumulation and equity.[3] Second, whether the analytical

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[1] See J.G. Williamson, "Capital Accumulation, Labor Saving, and Labor Absorption Once More," Quarterly Journal of Economics, 85 (February, 1971),40-65; and J.R. Behrman, "Sectoral Elasticities of Substitution between Capital and Labor in a Developing Economy," Econometrica, 40 (March, 1972), 311-26.

[2] See J.G. Williamson, "Personal Savings in Developing Nations: An Intertemporal Cross-section from Asia," Economic Record, 44 (June, 1968),194-210.

[3] See W.R. Cline, Potential Effects of Income Redistribution on Economic Growth (New York: Praeger, 1972).

devices employed are elegant but simple dualistic general equilibrium or pragmatic but detailed programming models, they all share the same common attribute: labor is treated as homogeneous. By default, these models have nothing to say about the size distribution of income in general and the distribution of earnings in particular. This seems especially surprising given Kuznets' observation[1] almost two decades ago that the dynamics of income distributional changes are to be found (1) in the increased importance of non-agricultural employment where earnings are far more unequally distributed and (2) in the increasing inequality of earnings distribution within the non-agricultural sector. It follows that a firm analytical and empirical bridge between labor absorption performance and the distribution of income can only be constructed if the heterogeneity of labor is explicitly recognized. The present paper attempts to construct such a bridge.

Finally, it should be noted that the human capital theorist seems to be adopting an approach to the distributional issue diametrically opposite from that of the development analyst. The former views the issue from the supply side and attacks the problem from the vantage of individual decision-making regarding investment in human capital. The latter views the problem from the employment or demand side. Clearly, an integrated general equilibrium approach to the labor absorption and income distribution problem is essential.[2] The present paper offers a modest attempt to integrate these two approaches. We

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[1]See Simon Kuznets, "Economic Growth and Income Inequality," American Economic Review, 45 (March, 1955), 1-28.

[2]The integration is a simple two-factor, two-sector model and can be found in A.C. Kelley, J.G. Williamson and R.J. Cheetham, Dualistic Economic Development: Theory and History (Chicago: University of Chicago Press, 1972). The focus there is on functional income distribution. In the present paper, our interest lies with the size distribution of wage income and thus with heterogeneous labor and n factors.

take as our case in point Brazilian development over the past two decades--and in particular the period of rapid industrialization up to 1962--but the results may have greater generality.

Recent Brazilian Experience with Income Distribution

The most comprehensive documentation of post-World War II Brazilian experience with the size distribution can be found in two recent papers by Fishlow.[1] Based on analysis of the 1960 Census, Fishow notes that computed measures of inequality--the Gini coefficient--ranks Brazil with the rest of Latin America, very high levels of inequality when compared with the United States, Canada, Japan and Western Europe. This result holds whether the unit of observation is the individual "economically active" member of the labor force or the household. Furthermore, relative inequality remains a Brazilian attribute even when income is defined to include imputed in-kind income and is deflated by regional cost-of-living indices. Second, regional characteristics by themselves do not contribute much to observed Brazilian inequality. The heavy rural incidence of poverty in the Brazilian Northeast is well known and has been the focus of policy for some time.[2] Yet when other individual characteristics are held constant, regional attributes do not add additional explanatory power. As we shall see below in section 2, this implies that regional wage and productivity gaps are not to be explained by labor immobility

[1] A. Fishlow, "Some Reflections on Post-1964 Brazilian Economic Policy," (Working Paper No. 19, Department of Economics, University of California, 1971; and "Brasilian Size Distribution of Income," American Economic Review, 62 (May, 1972, 391-402.

[2] For a more general documentation of regional inequality in the low income economies, see J.G. Williamson, "Regional Inequality and the Process of National Development," Economic Development and Cultural Change, 13 (July, 1965), 1-84.

or labor market imperfections. It also implies that the issue of the Brazilian size distribution can be confronted without explicit attention to regional inequality. Third, and most important, Fishlow finds that it is the traditional variables--age and formal education--which "account for" a large share of the high incidence of Brazilian poverty and inequality. It follows that Fishlow's results may be viewed by some as a vindication of the neo-classical skill-school model of human capital theory where the distribution of formal schooling is viewed as a key determinant of earnings distribution.

Fishlow then speculates on the secular changes in inequality during the 1960s by utilizing fragments of the still unprocessed 1970 Census data.[1] The period 1968-1972 has been described as the "Brazilian Miracle" since impressive real rates of output expansion approximating 9 percent have been achieved. Yet a disturbing attribute of the 1960s, according to Fishlow, is the increased inequality in the size distribution of income during the decade. Furthermore, he attributes most of the shift toward greater inequality to the stabilization period 1964-67 rather than to Brazilian long-run industrialization itself. However, many commentators have raised the possibility that a deeper force may be at work. In the words of Celso Furtado:

> An unequal income distribution gives rise to specific demands of a particular character--in this case, consumer's durables--whose production is in turn capital intensive. This reduces employment opportunities and ratifies the concentration of income. Because the narrow range of consumers will soon find their tastes satiated, the demand for such commodities will not grow continuously.[2]

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[1] Fishlow's analysis has been received with skepticism by some. See, for example, R.P. Hipskind, "The Measurement of Brazilian Incomes and Income Distribution and Implications for Government Policy," 1972. (Mimeographed).

[2] Fishlow, "Some Reflections on Post-1964 Brazilian Economic Policy," p. 34.

The essential idea seems to be that growth tends to follow a relatively capital-intensive path since the products with high income elasticities also tend to be the most capital-intensive. This induced capital-intensive sectoral expansion implies low labor absorption rates and thus a reinforcement of income inequality. It is this connection between industrialization or demand in general, and income inequality which interests us, and which we wish to investigate here.

Survey of the Terrain

The question investigated in this study is the impact of alternative development policies on skilled job creation, employment, and the distribution of wage income in Brazil. A simple general equilibrium framework is constructed in section 2 which makes it possible to explore counterfactual regimes for comparison with actual Brazilian experience 1949-1962. The model is defended by reference to the structure of the Brazilian economy in section 2. The framework is more in the "job competition" theoretical tradition than the conventional neoclassical "wage competition" tradition. A dynamic, linear, input-output model is utilized which is first "tested" by fitting it to the actual historical experience of this phase of recent Brazilian economic history. In section 3, we show that both the aggregate and the sectoral growth patterns conform quite closely with actual data, so we have some confidence that the alterations in the economy, which are produced by varying key policy parameters, are a close approximation of what would have occurred. The experiments reported in section 4 are based on the construction of alternative simulated growth paths for Brazil on which the reliance on foreign investment, import substitution, and aggregate growth performance are allowed to vary. The actual and hypothetical patterns of employment and earnings distribution are then compared to

isolate the role of demand on the asserted "disappointing" labor absorption and distributional patterns which appeared in Brazil up to 1962. Section 4 also applies the framework to the more recent Brazilian experience with stabilization (1964-67) and rapid growth (1968-72).

2. The Framework

Earnings Distribution and the Role of Demand

> Historically both the governmental policies and economic analysis have concentrated on supply side efforts to alter the distribution of earnings... [To make] programs work it is necessary to alter the demand for labor.[1]

Our approach to the distribution of earnings relies on the "job competition" model in which job characteristics and vacancies rather than formal education are the basic determinants of market earnings.[2] In the job competition model labor skills do not exist prior to employment. New entrants to the labor market appear with a variety of background characteristics and skills. These characteristics--education, age, sex, etc.--affect the cost of training. But the model asserts that most job skills, whether general or specific in the Becker sense, are acquired on-the-job. Workers with background characteristics which yield minimum expected training costs

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[1] U.S. Congress, 92nd Cong., 2nd Session. Joint Economic Committee. The American Distribution of Income: A Structural Problem, by L.C. Thurow and B. Lucas (Washington, D.C.: Government Printing Office, 1972), 1-2.

[2] Ibid., p. 2.

will be selected first. Existing job skills from previous employment are relevant in the selection process to the extent that they lead to lower training costs.[1] In an economy where no one is trained unless a job is available, where strong seniority provisions exist, and where wage inflexibility insures that there is no danger of wages being bid down competitively, employees may, in fact, more freely transmit information to new workers and can more readily accept new techniques.[2] This is an important point since it establishes yet another justification for inflexibility in a developing economy's wage structure even under competitive conditions.

Finally, the demand for job skills creates its own supply in the job competition framework since the structure of demand determines which job skills are taught. In periods of labor scarcity induced by demand, training extends farther down the queue as firms are forced to train more "costly" workers to fill new vacancies. Obviously, if there are an inadequate number of jobs at high wage (skill) levels, those at the end of the labor queue will be left unemployed (e.g., employed at low wage jobs).[3] Thus, the framework asserts that changes in earnings distribution over time are better explained by the derived demand for heterogeneous labor skills and labor absorption rates than by the supply determinants of formal education.

The job competition framework is the maintained hypothesis embedded in the interindustry model constructed in section 2. Before turning to these details, it might prove helpful to stress three key assumptions. First, the model implies that production technologies are such that different labor skills

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[1] Ibid., pp. 20-21.
[2] Ibid., p. 25.
[3] Ibid., p. 23.

are poor substitutes for each other. That is, it appears to assert that the elasticities of substitution between pairs of different skills are very low.

Stated in another way, the thesis argues that relative wages are not very important in allocating labor and that for a given output mix the structure of labor requirements are only marginally related to any change in the relative wage structure. Although there are no Brazilian econometric studies available to confirm or deny this hypothesis, a recent paper by Gramlich[1] offers a strong confirmation in the case of American manufacturing. Second, the job competition or labor absorption model of earnings distribution implies that occupational attributes should contribute much to the explanation of individual earnings in Brazil. Here we appeal to Fishlow's analysis of the 1960 Census for confirmation. More than one third of the variance of income between the nine monthly income groups in Fishlow's classification can be attributed to "sector."[2] Given that the sectoral definitions are very gross proxies for occupational characteristics,[3] this cross-section evidence appears to us quite consistent with the job competition model. This seems especially true given that the job competition model was primarily designed to explain short and medium term <u>changes</u> in earnings distribution by appealing to the shifting structure of employment demands. Third, the job competition model implies that the occupational-skill wage structure is relatively inflexible.

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[1] E.M. Gramlich, "The Demand for Different Skill Classes of Labor," Office of Economic Opportunity, Washington D.C., 1972. (Mimeographed).

[2] A. Fishlow, "Brasilian Size Distribution of Income."

[3] <u>Ibid</u>., p. 396. Fishlow considers five sectors and does not attempt to control for labor and occupational heterogeneity within sectors. We shall do so in the remainder of this paper. Fishlow's five sectors are: (1) agriculture and extractive; (2) industry and construction; (3) services; (4) merchandise commerce, transport, and communications; (5) financial services, independent professions, and public administration.

Although the assumption of wage inflexibility is common in the development literature, it could, of course, be debated for the Brazilian case. This discussion is deferred to the section below where we shall argue that the rigid wage structure assumption sets a lower bound on our empirical estimates of the impact of demand on earnings distribution.

A Brazilian Interindustry Model with Heterogeneous Labor

The Labor Market: inflexible wages and the "training" process. Our goal is to translate changes in an economy's final demand first into changes in production and then into changes in labor demand by skill levels. Having done so, we shall be in a position to isolate the impact of final demand on the distribution of labor income and employment. This section discusses the assumptions utilized to link the pattern of production to the pattern of labor demand and the distribution of earnings.

To begin with, we assume zero substitutability between different skill classes of labor. This assumption permits us to ignore changes in relative wages or training costs in calculating sectoral labor requirements by skill. The direction of bias which this assumption may impart to our results cannot be identified *a priori* since it depends on relative factor substitution rates between skills.[1] In addition, Brazilian data limitations necessitate the further assumption that the elasticity of labor demand with respect to output in each industry is equal across skill classes. To simplify the analysis still further, the supply of each labor skill is taken to be perfectly elastic. This does not seem unreasonable given that the majority of the additional supply of labor skill class j comes from less skilled or lower earnings classes in the same industry. The assumption of stability in the wage structure is well embedded in the labor surplus literature, and in our case it implies that skills are

[1] It may also affect the demand for capital, thus influencing indirect labor demand in the capital goods industries.

learned on the job, and not financed by the employee. If the employee bore training costs, wages would have to rise to induce the necessary migration from less skilled occupations to pay for skill-creation in vocational schools and other non-job educational outlets. Note that our supply elasticity assumption does not imply that the effective supply curve facing the firm is horizontal. Obviously as the firm proceeds down the labor queue, training costs, and thus labor costs, rise. By our assumption of zero substitutability and inelastic labor demand differentially rising supply curves do not affect labor requirements.

In summary, our assumptions have converted a more general derived labor demand framework into a manpower requirements model which disaggregates labor by skill class and industry. Our model relies on the 1960 Census for a benchmark distribution of labor into what could be called an industry-skill matrix. The reader should note that the data are actually reported by earnings class, rather than by skill, and that labor units between each skill class are treated as separate factors of production.

From demand to the structure of production: a linear input-output model. The experiments performed in this paper involve exogenous changes in the final demand vector so as to identify the impact of demand on labor absorption and the distribution of income. There are a number of ways by which the production required to satisfy a given bill of final demand might be derived. Our choices were limited to a model which would reproduce Brazilian experience during the 1950s when the actual final demand parameters of that period were utilized, and which treated capital goods as intermediate inputs. This treatment appears to us to be particularly important given the controversy regarding the capital-intensive growth strategy apparently pursued by Brazil in the '50s. Capital goods are themselves produced, and by rather labor-intensive methods. When

the indirect labor required to produce capital goods is added to the direct labor requirements for each industry, the conventional conclusion that capital-intensive growth strategies imply low labor absorption rates could well be reversed. It is important that the model explore this possibility, since a growth strategy can hardly be identified as capital-intensive until one has investigated just how that capital is produced.[1]

The linear input-output model used in this paper represents one way in which we can take into account the fact that capacity may have to be created to satisfy final demand. A conventional input-output model is augmented by a capital requirements matrix to generate investment demand. The framework is developed in terms of growth rates since this has certain desirable properties with respect to variations in the import substitution parameter and seems less sensitive to measurement error on the coefficients. Growth for any industry is definitionally equal to a weighted average of the growth rates of final and intermediate demands, where the weights are each category's share in the total sales of the industry in question. The rate of output growth in each sector is forced to satisfy a given exogenous rate of growth in final demand.

Following Morley and Smith,[2] the growth identity for each industry can be written formally as:

$$s_i = \sum_j d_{ij}x_{ij} + d_{ic}c_i + d_{ig}g_i + d_{iz}z_i + d_{ie}e_i \qquad (1)$$

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[1]Obviously, we do not view the domestic savings rate as binding.

[2]See Samuel A. Morley and Gordon W. Smith, "The Effect of Changes in the Distribution of Income on Labor, Foreign Investment and Growth in Brazil" (Program of Development Studies, Rice University, Paper No. 15, 1971). The remainder of this section relies heavily on Morley and Smith.

where

s_i growth rate of total supply in industry i

d_{ij} percentage of total sales of industry i going to industry j

x_{ij} growth of demand by industry j for intermediate product of industry i

d_{ic} percentage of total sales of industry i consumed

c_i growth rate of consumer demand for output of industry i

d_{ig} percentage of sales of industry i bought by government

g_i growth rate of government demand

d_{iz} percentage of sales of industry i to satisfy investment demand

z_i growth rate of investment demand for i

d_{ie} percentage of sales of industry i exported

e_i growth rate of exports

The d_{ij}'s are obtained from an input-output table by dividing each item in a row by the row sum. Thus $\sum_j d_{ij} + d_{ic} + d_{ig} + d_{iz} + d_{ie} = 1$.

Setting exogenous import substitution targets allows us to convert the growth rate of total supply into a growth rate of domestic supply:

$$s_i = \pi_i x_i + (1-\pi_i) m_i \tag{2}$$

$$m_i = u_i s_i$$

where

$(1-\pi_i)$ = relative importance of imports in total supply

u_i = import substitution target ($u_i = 1$ indicates no import substitution)

m_i = growth rate of imports

Assume that the demand for capital goods in each sector is a log-linear function of output (i.e., an accelerator relationship). Assume also that the composition of capital is invariant by sector. This allows us to write:

$$k_{ij} = \tau_j x_j$$

k_{ij} is the growth rate of capital goods supplied by sector i to sector j

τ_j is the capital output elasticity in sector j

The growth rate of investment is related to the growth rate of capital by:

$$z_{ij} = k_{ij} + \dot{k}_{ij}/k_{ij}$$

$$= \tau_j x_j \qquad \text{(under constant rates of growth)}$$

For each sector producing capital goods we calculate the growth in investment as a weighted sum:

$$z_i = \sum_{j=1}^{n} E_{ij}\tau_j x_j \tag{3}$$

where E_{ij} is the percent of total sales of capital goods by sector i to sector j.

Substituting (2) and (3) into (1) we have a system of n simultaneous equations which can be solved for each industry growth rate consistent with the rates of final demand growth:

$$\begin{bmatrix} x_1 \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ x_n \end{bmatrix} = \underbrace{\begin{bmatrix} \frac{\pi_1}{1-(1-\pi)\mu_1} & -a_{11}d_{11} - d_{1z}E_{11}\tau_1 & \cdots & -a_{1n}d_{1n} - d_{1z}E_{1n}\tau_n \\ \cdot & \cdot & & \\ \cdot & & \cdot & \\ \cdot & & & \cdot \\ \cdot & & & \cdot \\ -a_{n1}d_{n1} - d_{nz}E_{n1}\tau_1 & & & \frac{\pi_n}{1-(1-\pi_\mu)\mu_n} - a_{nn}d_{nn} - d_{nz}E_{nn}\tau_n \end{bmatrix}}_{[D]}^{-1} \begin{bmatrix} f_1 \\ \cdot \\ \cdot \\ \cdot \\ \cdot \\ f_n \end{bmatrix} \qquad (4)$$

x_i = growth rate of industry i.

The ij^{th} element of $[D]^{-1}$ denotes the effect of a one percent change in the growth rate of final demand for industry j on the rate of growth of industry i. (It is the elasticity of output i with respect to the final demand for j.)

The final demand vector is a weighted sum of the growth rates of consumption, government demand and exports:

$$t_i = d_{ic}c_i + d_{ig}g_i + d_{ie}e_i \qquad (5)$$

where t_i is the growth rate of final demand for industry i's products.

To calculate the rate of growth of final consumption demand (the c_i's) we relied on the cross-section consumption functions estimated by van Rijckeghem[1] supplemented by time series estimates in cases where there appeared to be a serious inconsistency between time series and cross-section elasticities. The growth rate of government was assumed to be equal in all

[1] W. van Rijckeghem, "An Intersectoral Consistency Model for Economic Planning in Brazil," in H.S. Ellis (ed.), The Economy of Brazil (Berkeley: The University of California Press, 1969).

sectors (except machinery and transportation equipment), with the overall rate equal to the rate of growth of government in the national accounts. The derivation of export growth rates is described in the data appendix.

Given the t_i's, equation (4) is used to calculate the vector of rates of growth of output, from which it is a simple matter to estimate the employment and income distribution statistics of interest. The labor share matrix in the final year of the simulation (1962) is derived from the base year by applying the industry rate of growth, corrected for differences in labor requirements per unit of output:

$$L_{ij}^{t} = [(1+x_i)\ell_i]^t L_{ij}^{o} \tag{6}$$

L_{ij}^{t} amount of labor in skill (income) class j, industry i, year t

ℓ_i labor/output elasticity, equal to the ratio of output and employment growth in industry i, over the period 1949 to 1959

L_{ij}^{o} $n_{ij}L_i^o$ where n_{ij} is the proportion of labor in industry i, in skill (income) class j, as reported in the 1960 Demographic census. L_i^o is the labor force in industry i, in 1949.

We can then get the share of labor in each skill (income) class by summing across industries:

$$s_j^t = \frac{\sum_i L_{ij}^t}{\sum_j \sum_i L_{ij}^t} . \tag{7}$$

Labor absorption rates by separate skill classes can also be derived, as can Gini coefficients by summing across industries so as to construct earnings distributions by skill (income) class.

This completes our description of the basic model used. To summarize, we start with a vector of final demand growth rates. We fix import substitution parameters and use the I-O inverse augmented by the capital requirements matrix to get the rates of growth of internal production necessary to satisfy this final demand vector. These growth rates of internal production are then fed into a labor requirements matrix to generate a hypothetical labor force distributed by industry and skill.

3. A Reconstruction of Brazilian Experience 1949-62

Reconstructing a Decade of Development

The model is well suited for exploring the effect of changes in final demand and import substitution on employment and the distribution of income. This paper will explore primarily the distributional impact of the import substitution policies pursued during the 1950s. We wish to estimate the extent to which the observed distributional changes and labor absorption rates were the inevitable product of industrialization per se (e.g., the stagnationists), versus the extent to which they resulted from the policy regime actually followed (e.g., Fishlow). In order to perform this analytical decomposition, we first simulate Brazilian experience from 1949 to 1962--i.e. recreate history if you will, by setting the import substitution parameters at their actual levels. The model's predictions are then compared with fact to see if they will generate a pattern of growth corresponding to the one actually observed. Once the model passes this test, we shall be free to perform counterfactual policy experiments: that is, to examine what the economy, the labor force and earnings distribution would have looked like under alternative growth strategies.

In most simulation exercises, the analyst constructs a model which he feels is representative and then generates time paths for the hypothetical economy under different policy alternatives. The model is rarely tested. One such test is to require that the simulation track the actual economy when the policy parameters are set at their historic levels. There are no statistical standards by which to judge how close tracking must be before the model passes the test, but we may nevertheless have an intuitive feeling for what acceptable performance is.

The main complication in making our model track the economy is that all of the market shares on which it depends change over time because of differential sectoral growth rates. This means that all the matrices in equation (4) must be dated and their elements recalculated each year. E.g.,

$$X^t = D^t F^t_{\cdot} \tag{4'}$$

In order to generate the a^t_{ij} of matrix D we assumed unitary elasticity of input demand as a first order approximation. This means that sales from sector i to sector j grow at the same rate as total purchases by sector j. However, the sum of the s_{ij} was in general not consistent with the adding up constraint, implying that the unitary elasticity assumption is inappropriate in some sectors. To guarantee consistency the following adjustment was made:

$$a^t_{ij} = \frac{a^{t-1}_{ij} \dfrac{(1+x_j)}{(1+x_i)}}{\sum\limits_j a^{t-1}_{ij} \dfrac{(1+x_j)}{(1+x_i)}} \left[1 - \sum_{k=1}^{3} d^t_{ik}\right]. \tag{8}$$

In effect this correction preserves the relative position of growing and declining sectors but sets the absolute level such that $\sum\limits_j a^t_{ij} + \sum\limits_{k=1}^{3} d^t_{ik} = 1.$

The dated final demand shares were calculated year by year according to:

$$d_{ic}^{t} = \frac{d_{ic}^{t-1}(1+c_{i}^{t-1})}{1 + x_{i}^{t-1}}. \tag{9}$$

The growth rate of consumer demand, c_i^t, was generated by the consumption functions. The government and export shares were adjusted by substituting the exogenous variables, g_i and e_i, for c_i in equation (9).

The model proceeds sequentially. Given a base year set of shares, it generates D^1 and F^1 which it uses to produce the vector of output growth rates in the base year. Given the base year growth rates we can calculate the second year I-O table, D^2, and so on, at each step making the consistency check. Eventually, and tediously, 13 years of sectoral growth rates are accumulated. These are reported as compound annual growth rates in Table 1A. Aggregate growth rates for employment, manufacturing output, GNP and imports are reported in Table 1B. A full description of data sources, weights, etc. is relegated to the data appendix where the avid reader may walk the long trail of numbers by which we arrived at the estimates reported in Table 1.

Plausibility and Performance: Output and Employment, 1949-62

Table 1 compares our simulated Brazilian "history" with actual history. The model appears to have done quite well in reproducing Brazilian experience. It does tend to understate somewhat growth in the most dynamic sectors in manufacturing while overstating agricultural growth, but the general pattern of simulated growth rates is remarkably close to the actual pattern. Particularly striking is our apparent success in capturing investment requirements, although the model seems to overstate slightly capital requirements as shown by positive errors in four out of five of the capital goods sectors. Given that the structure of the Brazilian economy was undergoing dramatic changes in this period, this

TABLE 1A: A Comparison of Actual and Simulated Growth Rates: 1949-62

Industry	Actual Growth 1949-62	Simulated Growth 1949-62	Import Substitution parameter
Veg. Products	4.49%	5.66%	1.070
Animal Products	4.49	5.32	1.000
Elect.	7.40	7.78	1.000
Commerce	6.08	6.38	1.000
Services	7.79	7.83	1.000
Mining	8.12	7.26	1.516
Non-Metallic Min.	8.30	8.78	- .379
Metals	10.12	11.03	.739
Machinery	10.52	15.63	.292
Elec. Mach.	27.50	23.99	.055
Trans. Eq.	27.75	21.92	- .245
Lumber	6.03	7.92	.527
Furniture	7.75	8.04	1.000
Paper	7.66	8.52	.441
Rubber	10.26	9.13	-1.010
Leather	1.98	5.18	-3.744
Chemicals	21.30	15.28	.104
Drugs	6.55	8.46	- .283
Cosmetics	6.55	5.56	1.000
Plastics	32.55	25.91	1.000
Textiles	5.87	6.58	- .75[illegible]
Clothing	8.45	8.26	1.000
Food	6.51	5.23	.211
Beverages	4.17	5.58	-1.944
Tobacco	8.98	9.14	1.000
Publishing	7.33	8.10	.510
Miscellaneous	7.63	8.68	.145
Construction	6.10	7.58	1.000
Transportation	8.24	5.85	1.000
Manufacturing	9.49	8.73	n.a.
Imports	2.56	2.71	n.a.
GNP	6.93	6.94	n.a.

TABLE 1B: A Comparison of Actual and Simulated Growth Rates: 1949-62

Employment growth	Actual Employment growth 1949/50-1959/62	Simulated Employment growth 1949-62
Total[1]	2.84%	3.77%
Manufacturing (A)[2]	4.06	3.54
Manufacturing (B)[3]	3.18	-
Urban[1]	4.39	4.72
Agriculture[1]	1.68	3.16

Notes: (1) 1950-60 from the Demographic Census.
(2) 1949-62: Growth rate computed using the 1949 Industrial Census and the 1962 Industrial Register, adjusted for firms employing less than five employees.
(3) 1949-59 from the Industrial Census.

consistency test is quite stringent and gives us a good deal of confidence in the conclusions we will make based on comparisons between various alternative growth policies.

If the model performs adequately at the sectoral output level, it must also do so for employment: the sectoral trends in employment requirements per unit of output (1949-59) were imposed exogenously on the model in (6). As a result, we do not report the model's performance on sectoral employment: As a result, we do not report the model's performance on sectoral employment: the predictions will be as good or as bad as the output comparison shown in Table 1A. For the remainder of this section, we shall focus instead on aggregate employment performance.

There is a good deal of confusion in the Brazilian literature regarding actual employment performance up to 1962. Data from the demographic and

industrial census are not in agreement. Nor do the various data sources on manufacturing employment appear to be consistent. In Table 1B growth rate Variant A for manufacturing (1949-62) implies a significantly higher rate of employment growth than Variant B (1949-59). The large difference between them cannot be explained entirely by the acceleration between 1959 and 1962. We cannot resolve the discrepancy but our prediction for manufacturing employment growth lies right between them: a reassuring result. For the urban sector as a whole, the model is very close to actual employment figures. The predicted rate is somewhat higher than that for 1950-60 reported in the demographic census, but since an acceleration of growth in the 1960-62 period took place in both services and industry, the model can be judged to have performed very well indeed. As expected, we overstate the employment growth in agriculture, since we overstate the rate of output growth, and this biases upward predicted total employment growth. In general, it appears that the model is a plausible empirical representation of the Brazilian economy and can be used with some confidence to generate counterfactual growth paths which can then be compared with our "actual" simulated history.

Plausibility and Performance: Inequality and Labor Absorption, 1949-62

Of particular interest is the history of the distribution of wage income over this period of rapid Brazilian industrialization. The simulated employment growth rates by skill, and the resulting Gini coefficients, are shown in Table 2. We include a separate estimate of the Gini coefficient corrected for unemployment. The correction is made by taking the 14.7% of the economically active population earning no income in 1960 and augmenting our base year labor force by the same percentage.[1] Then we simply subtracted our predicted 1962

[1]There were no adequate unemployment estimates available to us for 1949 or 1950.

TABLE 2A: Annual Rates of Growth of Employment
by Income Class and Gini Coefficients
Simulated History, 1949-62

Rate of Growth by skill class of:	Skill and Income Class								
	1	2	3	4	5	6	7	8	Total
Total Employment	4.18%	3.61%	3.47%	3.54%	3.73%	4.21%	5.11%	5.48%	3.77%
Urban Employment	5.56	5.22	4.77	4.26	4.19	4.74	5.25	5.48	4.72
Manufacturing Employment	3.59	2.99	2.97	2.95	3.43	4.67	4.74	4.28	3.54

TABLE 2B

Group	Simulated Gini Coefficients	
	1949	1962
Employed Labor Force	.4110	.4255
Employed Labor Force Plus Unemployment	.4389	.4391
Urban Labor Force	.4508	.4645
Manufacturing Labor Force	.2494	.2567

employment level from the 1962 labor force, the latter being set equal to the 1949 estimate augmented by the rate of population growth. While we do not have enormous confidence in the absolute labor absorption rates reported in Table 2, we are willing to rely heavily on the comparisons between Table 2 and the counterfactuals reported in the next section as well as comparisons between skill classes. Some bias has undoubtedly crept into our simulation estimates, but we assert that the bias is constant across simulations. This allows us to

isolate the impact of alternative Brazilian policy regimes on earnings distribution and labor absorption with a good deal of confidence.

Consider first the labor absorption rates by skill or earnings class implied by the model for the period 1949-62. Whether our interest is in total, urban or manufacturing labor absorption rates by skill class, Table 2A documents a strikingly consistent bimodal distribution. The highest skill classes (classes 5 through 8) were indeed favored during the period, but relatively high labor absorption rates are also apparent in the lowest skill category (class 1). That is, the lowest skill catgory had a higher rate of labor absorption in both economy-wide and manufacturing employment, while for urban employment the rate for skill classes 1 through 3 exceed the urban employment average. One could hardly argue that the growth up to 1962 was biased against the absorption of lowest skill classes on the basis of this evidence. Nor can this result be attributed to our suspected overestimate of agricultural employment expansion during the period, since, as we have seen in Table 2A, the high labor absorption rates at the lowest skill class holds for urban and manufacturing employment. True, a stronger case can be made for urban employment when the supporting service sector is included and we shall have more to say about this in section 4.

Given the evidence of bimodal distributions on labor absorption rates by skill, the implications for income distributional statistics are not intuitively obvious, especially when the unemployed are included in the calculation. Yet, Table 2 documents a small but consistent increase in inequality in all segments of the labor force. This reflects the rapid rate of growth of urban-related industries relative to agriculture. The tendency towards increased inequality within manufacturing is apparent in Table 2B. Presumably, there are two explanations for this result: policy makers favored those sectors which

were relatively skill intensive, and these sectors in addition tended to undergo relatively dynamic growth with industrialization. These industries--machinery, chemicals, transportation equipment and metals, employ a relatively high proportion of skilled labor, compared to the traditional industries, textiles, food products, clothing and leather products. This implies, of course, that the mean income, the average wage unadjusted by skill, in the dynamic sectors is far higher than that of the traditional agriculture and services. The evidence presented in Table 2C suggests that the Gini coefficients for these sectors are higher too, but the higher mean income of the rapidly expanding sectors is the main driving force behind the rising Gini coefficients for manufacturing as a whole. Suppose we ignore the urban service sector for the moment, and focus on agriculture and manufacturing. We note from Table 2C that the Gini coefficient in the latter is far lower than the former,[1] although the mean income is higher. As a result, when the share of manufacturing in total employment increases, the aggregate Gini coefficient may rise simply due to an augmentation in the number of workers at the top of the overall distribution. Eventually, the trend should reverse as the share of the total work force in the low wage, high Gini coefficient sector diminishes. During early development phases, increases in employment tend to be concentrated in the upper strata of the income distribution since higher skill classes of labor tend to produce products with higher income elasticities of demand and inter-industry requirements.

The above paragraph suggests that some caution be taken in inferring welfare implications from a rise in the aggregate Gini coefficient. By assumption, the average wage for each skill category is invariant. Our model takes new entrants to the labor force and generates jobs for them across the

skill matrix. If those jobs are concentrated in the upper end of the distribution, as indeed they were from 1949 to 1962, the Gini coefficient will rise even if the sectors which are absorbing labor have lower than average Gini coefficients. (Compare the manufacturing and agriculture Gini coefficients in Table 2C). It is not obvious, therefore, that the 1950s were truly a period of regressive development. One could argue the opposite, namely that new job opportunities were more favorable for new entrants to the labor force than the 1949 structure was. The same comment obviously applies to the entire economy. The Gini coefficient rises since growth is concentrated in the urban sector, particularly manufacturing. New job opportunities again are relatively concentrated at the upper end of the distribution as the data in Table 2A clearly

TABLE 2C: Annual Rates of Growth of Employment
by Income Class and Gini Coefficients
Simulated History, 1949-62

Industry	Estimated Gini coefficients 1962	Industry	Estimated Gini coefficients 1962
Vegetable Products	.3219	Leather	.2779
Animal Products	.3219	Chemicals	.2837
Electricity	.2933	Drugs	.2837
Commerce	.4253	Cosmetics	.2837
Services	.5212	Plastics	.2837
Mining	.2714	Textiles	.2022
Non-Metalic Minerals	.2407	Clothing	.3111
Metals	.2190	Food	.2038
Machinery	.2837	Beverages	.2038
Electrical Machinery	.2837	Tobacco	.3185
Transport Equipment	.2837	Publishing	.2919
Lumber	.2296	Misc. Manufacturing	.3185
Furniture	.2296	Construction	.2588
Paper	.3185	Transportation	.3264
Rubber	.3185		

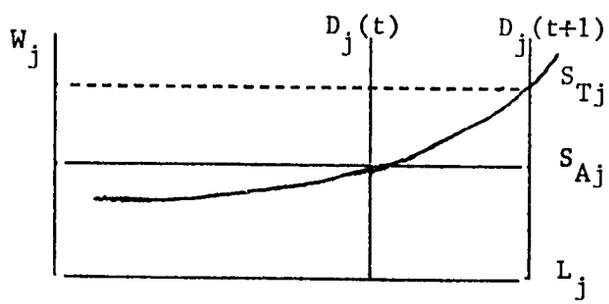
[1]This observation may appear to be inconsistent with the empirical income literature (see Kuznets, "Economic Growth and Income Inequality"). Yet the literature asserts that the distribution in rural areas is less than that in urban areas. The evidence presented in Table 2C is <u>not</u> inconsistent with this characterization, but it is the urban service sector that produces this

indicate. Had new jobs been provided in a sector with the attributes of the economy-wide mean income and Gini coefficient, the coefficient would not have changed, but it is not obvious that the Brazilian work force would have been better off than it was under the actual growth pattern. If we had information on relative wage movements, in response to the differential rates of growth of employment by skill, the resultant Gini coefficients would probably show an even larger increase over the period.[1] Then one could say with more justification that the pattern of growth was biased in favor of the upper portion of the distribution, or in other words was relatively regressive. But in our simulation a change in the Gini coefficient does not necessarily imply greater regressivity. It simply means that the distribution of new jobs is more concentrated at the upper end of the distribution than the 1949 job structure.

As one might expect, the inequality index behaves quite differently when unemployment is included. Since the rate of growth of employment (3.77%) exceeds the rate of growth of the labor force (2.96%) the pool of unemployed falls dramatically over the period (from 14.7% to 6.1% of the labor force).

result, not manufacturing.

[1]This can be seen in the following diagram which shows the change in the wage bill for a given skill class in a given sector. S_A denotes perfectly elastic labor supply assumed in our empirical analysis, while S_T represents the "true" supply curve for this skill in this sector.



The measured increase in the jth skill's wage bill is $W_j \Delta L_j$. The "true" increase is $\{ W_j \Delta L_j + \Delta W_j L_j (t+1) \} > W_j \Delta L_j$. The difference between these measures is clearly dependent upon the elasticity of S_j in response to W_j, an elasticity about which we have little or no information.

This is only another way of illustrating that rapid growth, regardless of the kind of jobs it provides, is progressive, while stabilization, whatever else its justification, is regressive. One has only to compare the Gini coefficients in Table 2B to see the effect of the diminished unemployment rate on the distribution statistics.

The reader should note that the absolute size of the Gini coefficient which includes unemployment (Table 2B) is a good deal lower than the .59 figure found by Fishlow for 1960.[1] There appear to be three explanations for this discrepancy. First, Fishlow's data include salary income of managers and property income. Income distribution is well known to be more unequal than that of wage earnings. Yet it is generally agreed that movements in the earnings distribution over time closely correspond to that of income.[2] Second, the simulation generates a higher rate of employment growth than actual history primarily because of our overstatement of agricultural output growth. The net result is that predicted unemployment declines from 14.7% of the labor force in 1949 to 6.1% in 1962. Since unemployment is determined as a residual, it tends to pick up all the errors in the simulation. The estimated Gini coefficient for 1962 (including unemployment) reflects this. Fortunately, it shall be seen in section 4 that the agricultural growth rate is not particularly sensitive to the policy counterfactuals performed below. Thus, the comparison of Gini coefficients across simulations should not be much affected by the apparent error in the absolute level of the inequality estimates. A third explanation for the difference between our predicted Gini

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[1] See Fishlow, "The Brazilian Size Distribution of Income," Table 1, p. 392.

[2] See J. Mincer, "The Distribution of Labor Incomes: A Survey with Special Reference to the Human Capital Approach," Journal of Economic Literature, 8(March, 1970), pp. 1-26.

coefficient and Fishlow's estimate is that he allocates a far larger share of the economically active population to the bottom skill or income category than we do. In part, this is explained by our inclusion of the North.[1] It may also be due to the fact that the only available sample states which we used to derive our distribution may be unrepresentative of the entire population, particularly for agriculture. For example, our weighting procedure generates the prediction that only 15.6% of the agricultural labor force should be allocated to the lowest income class, and this might be viewed an understatement. But it should be emphasized once more that our primary interest is distributional changes over time, rather than absolute levels at a given point in time.

4. The Sources of Inequality and Labor Absorption Performance

Policy Counterfactuals

Four counterfactual experiments were applied to the industrialization period, 1949-62. These experiments were designed to predict the structure of output, employment and income under alternative growth strategies. From the literature of the period it is clear that policy makers regarded import substitution as an engine of growth, or as a method of guaranteeing adequate demand. Industry was viewed as the only feasible dynamic leading sector. The policy implications were high protection, subsidies to foreign investment, and other industrialization-fostering devices. One may well wonder why this approach to development should have survived for so long. With the advantage of hindsight it is now apparent that import substitution need not have been regarded as the only possible way to generate growth. Import substitution

[1] Fishlow excludes both the Center-West and the North in his analysis. These regions accounted for 7.7 percent of the population in 1960.

could have been treated as a consequence of growth, freeing the Brazilian government to follow any number of alternative demand generating policies. Even in the absence of overt import substituting policy, the balance of payments constraint would have forced a certain amount of import substitution to maintain import demand at a level consistent with the performance of slow-growing exports. We shall now explore several of these alternative demand strategies in detail. By exploring these alternative strategies, we should gain insight into the extent to which the observed employment and distribution patterns were the result of growth *per se*, and to what extent they were the result of the particular kind of growth policy actually adopted.

The counterfactual policy alternatives are the following:

(1) *A Keynesian government expenditure policy*. Import substitution is neutral, exports grow at their historic rate in each sector, and government expenditures are set so as to insure the historic growth rate of GNP. Given these constraints, government expenditures would have to have grown at 14% per annum to generate the appropriate 6.9% growth in GNP. This describes a conventional policy of deficit spending as a way of generating employment. Imports are treated as a residual, so that an unlimited foreign borrowing capacity is assumed.

(2) *Export led growth*. Government expenditure is set at the historic rate assumed in the simulation of the preceding section, import substitution is again neutral, and the rate of growth of exports is manipulated so as to generate the historic rate of GNP. As for the sectoral pattern of exports, the actual Brazilian performance achieved in the 1964-70 period was utilized to get plausible relative rates. These were then multiplied by a constant to get the required aggregate export growth rates consistent with the GNP growth target. In fact, an export growth rate half of that achieved in the '60s was sufficient

to guarantee the 6.9% target growth rate of GNP. As in experiment one, imports are treated residually.

(3) A passive import substitution policy. Export growth rates are set at their historic levels. Government expenditure growth and the rate of import substitution are jointly determined so as to generate the actual GNP growth rate of 6.9%. Imports are not allowed to exceed their historic growth rates. To yield this result, each IS parameter is initially set at one, and then each is multiplied by a constant whose size is such as to generate the appropriate growth rate of aggregate imports. One could view this policy experiment as one in which the Brazilian government guaranteed internal growth while using devaluation to keep the growth rate of imports down. As it turns out, the growth targets and import constraints are satisfied by a 6.5% growth in government expenditures coupled with an IS policy making each sector's imports grow about one-third as fast as total supply. The rates of import substitution of all sectors are equal in this experiment. This is equivalent to the assumption that supply in each sector is equally responsive to changes in the relative prices of competitive imports. If we had greater knowledge of supply elasticities, this characterization could be made more realistic but the experiment does explore in a provisional way the results of a policy in which the government reacts passively *ex post* to an import bottleneck by across-the-board policy measures, rather than selecting *ex ante* those sectors in which import substitution will be encouraged.

(4) No internal demand target. Experiment four explores the growth implications of the actual import substitution policy in Brazil. Here import substitution is neutral so that imports are permitted to grow as fast as demand in all sectors. Government expenditures and exports grow at their historic rates. Thus, the economy is left to depend on internal

final demand for its growth stimulus, and we shall measure the fall in GDP growth and employment under these conditions.

In each experiment, the counterfactuals are compared with our simulated history rather than actual history. This procedure should eliminate most of the biases which may have crept in to our calculations of the absolute levels of income distribution and employment growth. The simulation results are shown in Tables 3 and 4. Table 3 displays the sectoral growth patterns for the various counterfactual simulations. Table 4 shows their employment and distributional implications.

Alternative Policies and Output Mixes

Comparing experiment three with history, it is striking how similar the growth patterns are. This suggests that under any growth scheme, if Brazil really could not have expanded exports and had been forced to the low rate of growth of imports actually observed, then the results of deliberate or "passive" import substitution would have been practically identical. Growth itself is a sufficient condition for import substitution. Special protection policies were not required. Now it is obvious that the reason for the similarity is that Brazil had already by 1949 reached self sufficiency in most non-durable consumer goods and intermediate products. She was still importing durable consumer goods, capital goods and oil. If she were going to grow rapidly, the supply of all these products had to be rapidly expanded. If they could not be imported they had to come from domestic sources. Whether a deliberate policy of protection and subsidies was necessary for domestic production or whether devaluation would have been sufficient to balance imports and exports is a policy issue which our model is not equipped to answer. However, unless one is willing to argue that across-the-board policies (like devaluation) would not have been effective, then the policy of deliberate IS was unnecessary. IS

TABLE 3: Growth Rates of Output in Four Counterfactual Experiments

Industry	Simulated history	Experiment 1: Keynesian government expenditure policy	Experiment 2: export led growth	Experiment 3: passive IS policy	Experiment 4: no internal demand target
Vegetable Products	5.66%	5.84%	6.29%	5.80%	5.34%
Animal Products	5.32	6.17	6.56	5.33	5.17
Electricity	7.79	8.08	7.09	7.72	6.45
Commerce	6.38	7.43	7.14	6.40	6.04
Services	7.83	7.64	7.57	7.75	7.03
Mining	7.26	9.33	7.46	13.26	7.69
Manufacturing	8.73	7.00	7.32	8.35	6.26
Non-Metallic Mining	8.78	8.20	7.28	8.30	6.80
Metals	11.03	8.75	6.75	11.19	6.17
Machinery	15.63	8.45	7.40	14.87	6.56
Elec. Machinery	23.99	9.94	9.20	21.81	8.80
Transport Equipment	21.92	10.58	9.87	19.10	8.94
Lumber	7.92	7.84	7.31	7.81	6.83
Furniture	8.04	7.64	7.57	7.95	7.44
Paper	8.52	7.71	7.34	8.53	6.63
Rubber	9.13	9.32	9.31	8.90	8.24
Leather	5.18	4.55	6.69	4.71	4.33
Chemicals	15.28	8.07	7.30	14.13	6.70
Drugs	8.46	7.31	7.04	7.99	6.82
Cosmetics	5.56	6.07	5.56	5.58	5.55
Plastics	25.91	25.95	25.82	25.89	25.81
Textiles	6.58	6.24	6.23	6.40	6.05
Clothing	8.26	8.41	8.26	8.26	8.24
Food	5.23	5.16	7.67	5.20	5.04
Beverages	5.58	4.78	4.77	5.13	4.67
Tobacco	9.14	9.13	9.22	9.13	9.13
Publishing	8.09	8.46	7.85	8.12	7.56
Miscellaneous	8.68	8.18	7.13	8.49	7.05
Construction	7.58	8.03	7.33	7.54	6.87
Transportation	5.85	7.79	8.09	5.93	5.52
GNP	6.94	6.96	6.88	6.91	5.98
Imports	2.71	8.43	7.80	2.71	7.05

TABLE 4: Employment and Income Distribution under Four Counterfactuals

	Simulated history	Experiment 1	2	3	4
1. 1949-1962 Per Annum Growth					
Employment	3.77%	4.02%	4.23%	3.81%	3.25%
Urban Employment	4.72	4.83	4.72	4.64	3.85
Manufacturing Employment	3.54	2.24	2.18	3.27	1.45
2. 1962 Gini Coefficients					
Total Employed	.4255	.4232	.4210	.4246	.4234
Total Labor Force	.4391	.4308	.4225	.4375	.4455
Urban Employed	.4645	.4633	.4635	.4647	.4673
Manufacturing Employed	.2567	.2522	.2501	.2556	.2517

need not have been a prerequisite for growth. Essentially the same patterns would have occurred as a result of any policy which guaranteed the growth in demand, given the export growth constraint.

Without an active or passive IS policy, the pattern of manufacturing growth would have changed dramatically. Yet the remainder of the urban sector is fairly insensitive to the absence or presence of IS. This is particularly true of services. As a result, urban employment growth is fairly constant across experiments even though manufacturing employment is not (Table 4). Employment in manufacturing is sensitive to the degree of import substitution while urban employment seems to be more a function of the growth rate of income. Given the high elasticity of demand for the output of the urban sector, if the growth rate of income is high so too is urban employment.

Alternative Policies, Labor Absorption and Earnings Inequality

Turning now to the distributional implications of the various counterfactual experiments, the first conclusion which stands out is that slow growth is regressive. Consider experiment four in Table 4 where government does nothing to generate demand and in which there is no import bottleneck. That policy generates the least overall employment growth and the biggest upward shift in the Gini coefficient measured across the entire active labor force. Given the central issue of employment, one can understand the overriding concern with growth: any policy which generates income growth is better than one which does not. This result appears to be quite consistent with Fishlow's tentative analysis of the 1964-67 stabilization phase of more recent Brazilian performance. Fishlow has asserted from incomplete data that the increasing inequality between 1960 and 1970 can be traced to the stabilization period itself. The results in Table 4 strongly confirm his assertion. Yet, Fishlow's argument is based primarily on an analysis of government wage policy as it affected wage structure. Our results suggest that the same conclusion can be reached under conditions of a stable wage structure, but where the derived demand for labor by skill and overall is allowed to respond to sharply changing output growth associated with stabilization.[1]

If labor absorption and distribution are viewed as primary goals, experiment two shows export expansion to be a very potent policy indeed. The export-led counterfactual generates the highest employment growth rate, a fall in the overall Gini coefficient, and the least skill-intensive increments to manufacturing labor (Col. (3), Table 4). Once again, this result appears

[1] It should be emphasized that the observed real growth performance during the stabilization period (1964-1967) was far below that implied by experiment 4 reported in Table 3, where GNP growth rates diminish by only one percentage point from the "historic" rate. Any attempt to apply our measured

consistent with Fishlow's analysis of the "Brazilian Miracle" since 1968. The post-stabilization phase of rapid growth with export expansion has been viewed as a miracle shared more equally, with tendencies toward equality and high labor absorption rates. Table 4 confirms this position. We assume unlimited foreign borrowing in both experiments one and two. Thus, one could view foreign aid as allowing the government to engage in public works projects for employment reasons without having to force the system into less labor-intensive import substitution.

Among the various growth policies which might have been adopted during the 1950s, the one actually pursued generated the least employment and hence the most regressive change in the distribution when the unemployed are included. Note that the same pattern appears in Table 4 when Gini coefficients for total employed alone are compared. The reason is that the import substitution policy actually pursued was most favorable to a subset of industries which had high mean labor earnings. It created a greater number of skilled jobs for new entrants to the labor force than either a growth policy relying on exports which would have been more favorable to agriculture, or government employment expansion which would have been more favorable to the urban service sector. The active IS policy is even slightly more regressive than the passive IS policy would have been. But can we conclude that the policy was, in some sense, "less fair"? Unless one subscribes to the idea that "misery loves company," such a conclusion may be over-zealous. By creating mostly agricultural employment, experiment two generates the lowest Gini coefficient, but it does not necessarily make the labor force better off.

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impact of stabilization on inequality (col. (5), Table 4) to the period 1964-67 must be augmented accordingly.

Among the employed labor force, each of the counterfactual policy regimes would have made the distribution at least slightly more unequal over time.[1] This secular trend seems inevitable because new jobs are concentrated at the upper skill levels given the relatively high income elasticity of demand for the products produced by skilled labor. This is a pessimistic result for those who feel that the increasing inequality and disappointing labor absorption rates in LDC's can somehow be reversed by an appropriate revision of policy. We have shown above that the size of the shift towards earnings inequality can be influenced by policy. We are now arguing that the results in Table 4 confirm that the direction towards increasing inequality is inevitably associated with early or middle development phases, at least for employed workers. The tendency towards inequality is obviously accentuated if, in a country at Brazil's stage of industrialization, an import substitution policy forces the system to satisfy industrial demands internally. Yet when the total labor force (and thus with the unemployed included) is analyzed, it seems to us that the counterfactual experiments demonstrate a marked insensitivity of the Gini coefficients to the way growth is generated. This is particularly true of the employed urban labor force.

A final inescapable implication of Table 4 is that employment growth really was not as unsatisfactory during pre-1962 period as some commentators have implied. Here we are appealing to results that are subject to greater error, but it seems to us that the labor absorption rates reported in Table 4 all point to the conclusion that we must consider the rates for the entire urban labor force, not just manufacturing. The highly important support sectors (services, commerce, construction and transportation) all have substantial absorption rates. The current gloom about manufacturing employment can be

[1] Recall from Table 2B that the Gini coefficient for all employed workers is .4110 in 1949.

attributed in part to an oft-quoted article by Baer and Hervé.[1] Recently published employment data for Brazil suggest that their conclusions about Brazil may have been unduly pessimistic especially over the entire period 1949-62, since an upturn in manufacturing employment growth greater than output growth seems to have taken place during 1959-62. Furthermore, while Baer and Hervé emphasize the substantial labor-saving bias in the '50s, that bias may have been due more to the nature of the goods produced than to the choice of processes to produce them. In any case, their analysis ignores the remainder of the urban sector and the labor-saving there was clearly much smaller than it was in manufacturing alone. In Brazil, the elasticity of employment with respect to output in all five urban sectors outside of manufacturing was about 0.98. Thus, as long as disposable income grows at 7% per year, the rate of growth of urban employment will be at least 4% per year, regardless of what happens in manufacturing itself. The crucial requirement is that aggregate growth continue. A growth rate of 4% may not be utopian, but it will certainly absorb a large quantity of labor from the agricultural sector if it can be maintained.

5. Summary of Findings and Future Research Possibilities

This paper has attempted to isolate the sources of labor absorption performance and increased earnings inequality Brazil. To do so, we relied on a linear input-output model augmented by an investment requirements matrix. The focus has been on the impact of demand, and output performance is tied to derived labor demands by use of the "job competition" model. The heterogenity of labor is explicitly recognized by disaggregating labor input in each sector into eight skill levels. The distribution of earnings is determined both by the

[1] Baer and Hervé, op. cit.

distribution of employed workers between these skill classes and by the unemployment rate.

The procedure was first to test the plausiblity of the model by comparing its simulated predictions with Brazilian historical experience, 1949-62. Since the model seemed to perform very well, we then explored four counterfactual experiments, comparing the results with the "historic" simulation. The counterfactuals represent alternative policy regimes not only available to the Brazilian government during the '50s, but, in the case of two, actually pursued by Brazil in the '60s. By comparing the behavior of labor absorption rates and earnings distribution under these alternative policy regimes, we have been able to isolate the sources of Brazilian economic performance in these crucial social dimensions.

Three key results emerge from this analysis. First, we question the conventional characterization of Brazilian pre-1962 labor absorption experience as "disappointing." We find evidence to the contrary. Second, it does indeed appear that the policies in fact pursued from 1949 to 1962 reinforced a secular tendency towards increased inequality. Alternative policy regimes were available to achieve the same internal GDP growth targets and they would have produced higher labor absorption rates and smaller increments in inequality. The experiments also confirm the sensitivity of the overall inequality measure to stabilization or growth. Because of unemployment, any high growth policy is likely to be more equitable than a relatively labor-intensive policy which produces a slower overall rate of growth. Third, in every policy experiment performed in this paper increased inequality among the employed took place. We conclude that this is an inevitable result of industrialization for a country with Brazil's initial labor force distribution. To some extent, this result is a statistical

inevitability given the differential in mean incomes between industry and agriculture. Therefore, we must take care in drawing policy conclusions from movements in the Gini coefficient alone.

Without further research, it is not at all clear that these results can be generalized to the LDC's as a whole. Not only may they vary markedly when the input-output structures of other economies are utilized, but our analysis stresses the investment requirements for final demand changes as well. Other LCD's at earlier stages of development import a far larger share of their capital goods, and this may have important implications for indirect labor demands and the inequality measures. In our future research, we hope to identify more explicitly the impact of these investment requirements on the results reported here. Finally, much more research is necessary to explore the labor supply functions by skill before the provisional findings of this paper can be accepted with confidence.

Data Appendix

This appendix describes the sources of the data inputs required for the simulation. The inputs are of several forms: first, base year weights or shares; second, model parameters--such as consumption elasticities; and third, exogeneous variables--such as export growth rates. The sources of all three inputs are described in turn.

Base Year Shares

Base year share information was required for imports, employment, manufacturing, total output, the base year input-output share matrix, and the distribution of final purchases among government, consumption and exports. For both the I-0 matrix and final demand distribution, 1959 estimates are available from van Rijckeghem.[1] To convert to a 1949 starting point, we first calculated the 1949 share of consumption, government and exports according to the formula:

$$d^{49}_{i,j} = \frac{d^{59}_{i,j}\, r_{ij}}{R_i} \tag{1}$$

where $d^{49}_{i_j}$ = share of final demand, type j, in total supply of product i, year 1959,

$$r_{i,j} = \frac{\text{Final demand}_{ij}}{\text{Final demand}^{59}_{i}}, \tag{2}$$

$$R_i = \frac{\text{Total supply}^{49}_{i}}{\text{Total supply}^{59}_{i}}. \tag{3}$$

[1] See W. van Rijckeghem, "An Intersectional Consistency Model for Economic Planning in Brazil," in H.S. Ellis, The Economy of Brazil (Berkeley: University of California Press, 1969).

The export growth rates were calculated from quantum indices by product published in the Conjuntura Economica and a Brazilian Ministry of Planning Publication.[1] Food products exports were the weighted growth rate of coffee, sugar and cocoa, agriculture was the weighted sum of cotton, tobacco and bananas, and mining was a weighted sum of bauxite, hematite and manganese.

The growth rate of government commodity expenditures was derived from the series "compras de bens e servicos" deflated by the wholesale price index excluding coffee.[2] In the I-O tables government employment and expenditure are shown separately, and the final demand vector for the sector shows purchases only. When varying the government growth rate in our simulations, we assumed that government employment grew at the same rate as government purchases, and included government employment in the services sector. 1949 consumer demand was estimated using the consumption elasticities described below, and the observed growth rates of disposable income between 1949 and 1959.

In order to construct a 1949 I-O shares matrix we assumed unitary elasticity of input demand as a first order approximation. This implies that sales from sector i to sector j grow at the rate of growth of sector j. Given the growth rates then the s_{ij}^{49} could be calculated from s_{ij}^{59} by

$$s_{ij}^{49} = \frac{s_{ij}^{59} r_j}{r_i} \tag{4}$$

when $$r_j = \frac{\text{Domestic Prod. } j^{49}}{\text{Domestic prod. } j^{59}}$$

[1] IPEA, Diagnostico Preliminar do Setor de Commercio Internacional, Rio de Janeiro, 1966. (Mimeographed).

[2] This expenditure series is published in Fundação Getulio Vargas, O Setor Publico nos Ultimos Vinte Anos, Rio de Janeiro, 1968. (Mimeographed).

and s_{ij} is the percentage of sales by sector i to sector j as a proportion of total supply of sector i. In some case, however, the sum of the s_{ij}^{49} was inconsistent with the adding up constraint. Thus, the unitary elasticity assumption is inappropriate in some sectors. To guarantee consistency we adjusted the shares until the sum across all intermediate sales was equal to one minus the share of consumption, government and exports:

$$s_{ij}^{49} = \frac{s_{ij}^{59} \frac{r_j}{r_i} (1-\sum_{k=1} d_{ik}^{49})}{\sum s_{ij}^{59} \frac{r_j}{r_i}},$$

d_{ik} = share of total supply sold to final demand type k.

The other base year magnitudes required by the simulation were a matrix of labor by income class and sector, the distribution of the labor force in 1949, the sectoral composition of output in both manufacturing and the economy and the composition of imports by sector.

The labor shares matrix is shown in Table A.1. It was constructed from the 1960 Demographic Census. Since only five states have been published, these five were weighted by the shares of the labor force they were considered to represent. The results generally appear reasonable exept in agriculture where the share of labor in the bottom class seems altogether too low.

The base year labor force shown in Table A.2 is taken from the 1950 Demographic Census. However, there is substantial incompatibility between the Demographic and the Industrial Censuses on the composition of the labor force within manufacturing. We used the latter, partly because it seems more accurate, and partly for consistency with the labor output elasticities.

TABLE A.1: Labor Shares in 1960

	Skill Class							
	Monthly Incomes in NCR$							
	0-2.1	2.1-3.3	3.3-4.5	4.5-6.0	6-10	10-20	20-50	More than 50
1. Veg. Product	.156	.209	.250	.204	.139	.040	.002	.000
2. Anim. Product	.156	.209	.250	.204	.139	.040	.002	.000
3. Electricity	.004	.012	.014	.117	.464	.321	.067	.002
4. Commerce	.072	.090	.145	.209	.270	.155	.052	.006
5. Services	.344	.139	.097	.113	.145	.082	.062	.019
6. Wastes	.000	.000	.000	.000	.000	.000	.000	.000
7. Fuels	.000	.000	.000	.000	.000	.000	.000	.000
8. Packaging	.000	.000	.000	.000	.000	.000	.000	.000
9. Mining	.015	.030	.030	.239	.457	.208	.020	.001
10. Non Metallic	.009	.055	.029	.274	.487	.135	.011	.000
11. Metals	.007	.022	.022	.184	.519	.223	.002	.001
12. Machinery	.011	.020	.017	.127	.466	.310	.045	.002
13. Elec. Machinery	.011	.020	.017	.127	.466	.310	.045	.002
14. Trans. Equip.	.011	.020	.017	.127	.466	.310	.045	.002
15. Wood	.010	.013	.017	.161	.572	.211	.016	.001
16. Furniture	.010	.013	.017	.161	.572	.211	.016	.001
17. Paper	.015	.030	.030	.181	.457	.238	.043	.006
18. Rubber	.015	.030	.030	.181	.457	.238	.043	.006
19. Leather	.011	.032	.025	.264	.505	.158	.012	.008
20. Chemicals	.011	.020	.017	.127	.466	.310	.045	.002
21. Drugs	.011	.020	.017	.127	.466	.310	.045	.002
22. Cosmetics	.011	.020	.017	.127	.466	.310	.045	.002
23. Plastics	.011	.020	.017	.127	.466	.310	.045	.002
24. Textiles	.005	.043	.039	.284	.540	.081	.005	.001
25. Clothing	.041	.069	.047	.224	.436	.159	.023	.002
26. Food	.011	.016	.023	.231	.584	.126	.007	.001
27. Beverages	.011	.016	.023	.231	.584	.126	.007	.001
28. Tobacco	.015	.030	.030	.181	.457	.238	.043	.006
29. Publishing	.007	.027	.022	.127	.456	.308	.050	.002
30. Misc.	.015	.030	.030	.181	.457	.238	.043	.006
31. Construction	.020	.035	.148	.321	.386	.080	.010	.001
32. Transport	.017	.032	.121	.193	.383	.219	.032	.003

TABLE A.2: Shares and Parameters Used in Simulation

	Base Year Shares (in percent)			Growth rate in employment 1950-60	Labor output	Consumption elasticity	IS parameter
	GNP	Labor	Imports				
Vegetable Product.	19.98	43.33	10.59	1.68	.977	.52	1.07
Animal Products	06.75	14.62	.19	1.68	.977	.52	1.00
Electricity	.57	.22	--	2.00	.954	1.01	1.00
Commerce	16.33	5.61	--	4.73	.985	1.01	1.00
Services	29.52	16.49	--	5.03	1.003	1.20	1.00
Mining	.55	2.83	1.87	1.17	.939	--	1.52
Non-metallic Machinery	1.38	.97	2.97	2.35	.945	1.09	.38
Metals	2.02	.67	7.55	5.67	.982	1.09	.74
Mach'elec.	.64	.21	15.11	9.15	.993	1.09	.29
Elec. Mach.	.13	.04	9.68	13.66	.872	2.00	.05
Transport Equip.	.28	.09	15.49	15.56	.897	2.12	.25
Lumber	.72	.69	.13	5.58	.983	1.09	.53
Furniture	.47	.61	--	4.88	.972	1.09	1.00
Paper	.67	.16	1.68	5.17	.979	.73	.44
Rubber	.60	.07	.26	9.04	1.000	1.94	1.01
Leather	.36	.57	.45	1.54	.984	1.01	3.74
Chemicals	.58	.17	21.24	3.56	.851	1.01*	.10
Drugs	.57	.17	2.13	.75	.949	.90	.28
Cosmetics	.32	.09	--	1.68	.958	.60	1.00
Plastics	.03	.01	--	12.40	.868	6.28	1.00
Textiles	3.60	2.16	2.26	.34	.944	.68	.75
Clothing	.74	.17	--	2.46	.946	1.26	1.00
Food	3.81	1.44	4.84	1.40	.950	.89	.21
Beverages	.84	.25	1.16	1.50	.974	.29	1.94
Tobacco	.27	.15	--	.10	.915	1.50	1.00
Publishing	.59	.34	.32	2.14	.941	1.27	.51
Misc.	.46	.32	2.07	3.45	.974	1.00	.15
Construction	2.72	3.42	--	2.99	.959	1.02	1.00
Transportation	4.96	4.09	--	4.56	.981	.91	1.00

*In the I-O Table, fuels are handled as a separate demand entry, for which the consumption elasticity was set at 1.94.

The sectoral composition of output in 1949 was calculated from the 1959 input-output table, adjusted for the differential growth rates between 1949 and 1959. The I-O table rather than the National Accounts was used since it gave value added rather than gross product weights. The sectoral growth rates of output required to convert to a 1949 base were taken from the National Accounts except for certain sectors of manufacturing which are taken from unpublished worksheets available at the Fundacão Getúlio Vargas. Import weights and the ratio of domestic to total supply are based on the data underlying Table 1 in Morley and Smith.[1]

Model Parameters

The parameters required by the model are consumption elasticities, labor output elasticities, and the rate of import substitution over the period 1949-62. The consumption elasticities were taken in large part from a recent publication by Morley and Smith.[2] For sectors with no imports in 1949 and a high proportion of final demand to total sales, an alternative and more consistent estimate for some sectors seems to be the ratio of the growth in output of the sector to the growth in disposable income over the period. This alternative estimate was used for plastics, textiles, clothing, food, beverages, tobacco and transportation. The assumed elasticities are shown in Table A.2.

The model requires a correction factor to convert rates of growth of output to rates of growth of employment. Clearly this factor is related to technical progress and capital investment. Lacking information to make a better

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[1] S.A. Morley and G.W. Smith, "Import Substitution and Foreign Investment in Brazil," Oxford Economic Papers, Vol. 23 (March, 1971).

[2] Morley and Smith, "The Effects of Changes in the Distribution of Income on Labor, Foreign Investment and Growth in Brazil," op. cit.

approximation we simply calculated the observed difference between output and employment growth by sector between 1949-59 and called this the sectoral labor-output elasticity. The source for the sectoral output growth rates has already been described. The rate of growth of employment by sector was calculated from comparable figures from the 1950 and 1960 censuses. The Demographic Censuses were used for all sectors but manufacturing, for which the Industrial Censuses of 1949-59 were substituted. The employment growth rates and the labor output elasticities are shown in Table A.2.

To derive an historical import-substitution parameter for each sector we calculated the yearly growth rate of total supply and imports, 1949-62, and took the ratio between them. Data from the worksheets of S.A. Morley and G.W. Smith, "Import Substitution and Foreign Investment in Brazil," were used for this calculation. The _ex post_ IS parameters are shown in Table A.2.

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