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DISCUSSION PAPER

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Federal Government of Brazil

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DISCUSSION PAPER

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REGIONAL WAGE DIFFERENCES AND SEGMENTATION IN BRAZIL'S URBAN LABOR MARKETS

William D. Savedoff*

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ABSTRACT

This paper investigates whether the workforce in Brazil is geographically segmented by analyzing variation in workers' earnings. It finds that standard market explanations for regional wage disparities, such as variations in the cost of living or workforce quality, can explain only a part of the disparities. The paper concludes that geographical obstacles to factor flows are not significant in Brazil. Rather, the persistence of regional wage differentials, in spite of the increasing integration of the Brazilian economy, can be largely attributed to regional variation in the composition of labor demand.

I. INTRODUCTION

Income varies widely across Brazil's diverse regions, as in many other countries, but the degree of regional inequality is more acute than elsewhere.[1] In the Northeast, where a majority of Brazil's impoverished citizens reside, wages are significantly lower than in the South and Southeast. An unskilled worker in the Northeast can almost double his or her earnings by obtaining comparable work in São Paulo. The persistence of large wage differentials challenges standard market theories of the labor market in Brazil and necessitates investigation in terms of theories of market segmentation and patterns of regional economic structures.

This paper investigates whether the workforce in Brazil is geographically segmented by analyzing variation in workers' earnings. It finds that standard market explanations for regional wage disparities, such as variations in the cost of living or the quality of the workforce, can explain only a part of the disparities. The regional composition and peculiarities of labor demand contribute significantly to the pattern of regional wage differentials and explain the persistence of these patterns of wage inequality, in spite of the increasing integration of the Brazilian economy. The paper concludes that geographical obstacles to factor flows are not significant in Brazil. Rather, the disparities in wages reflect other kinds of labor market segmentation--by sector, occupation, work card status, and perhaps also by differential access to education.

II. WAGE DETERMINATION IN BRAZIL AND APPROACHES TO REGIONAL DIFFERENTIALS

A variety of theories have been applied to explaining regional disparities in income in Brazil. Some argue that these regional disparities are temporary disequilibria in the national market, resulting from the isolation of regional labor markets with varying conditions of supply and demand (Morley 1984, Pfefferman and Webb 1982, Schmitz 1985:74). Such a view

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[1] Consider the United States, Italy, and India in works by Sahling and Smith, Dunford, and Mathur. Williamson compares Brazil and 23 other countries.

would expect regional wage differentials to diminish over time with the increasing integration of the national economy. A second view argues that the wage differences reflect regional variation in the productivity of the workforce, generally measured by the level of schooling (Dabos and Psacharopoulos 1987, Behrman and Birdsall 1983). A third approach argues that real wage differentials are probably the same across regions and that nominal differentials reflect the wide variation in cost of living (Thomas 1987:267). Finally, regional wage disparities may be a result of continuing differences in regional patterns of growth, labor demand, or mechanisms of wage determination (Baer 1964, Fishlow 1972, Storper 1984).

This paper will investigate these issues from a microeconomic perspective, using cross-sectional analysis of household survey data from the 1980s, to separate the various factors described above and to test the proposition that Brazil's urban labor markets are geographically segmented. It will show that the cost of living and composition of the workforce can explain only part of the variation in earnings across regions. Further, it will show the regional pattern to be stable in spite of the growing economic integration of the national economy. It will conclude that the structure of economic organization and opportunity is important to the generation and persistence of regional wage differentials in Brazil.

II.1 Wage Determination in Brazil's Urban Labor Market

The Brazilian economy has had extremely high inflation (over 60% annually since 1960 and over 100% annually since 1982) and extensive government intervention in the labor market since the 1930s. Nevertheless, wages and employment responds to shifts in demand and prices. This responsiveness of the labor market to changes in supply and demand has been documented in various studies (e.g. Luque and Chahad). Private sector firms appear to follow government guidelines and policies of indexation, in particular making use of the indexation of the minimum wage to organize their pay scales in the context of imperfect information about general inflation (Souza and Baltar).

On the other hand, firms use numerous strategies to evade government restrictions on their ability to adjust wages when it is to their advantage to

do so (Macedo 1974). The relative ease with which firms can dismiss workers under the FGTS system, and the pervasive and high rates of turnover, make it possible for firms to recontract labor almost continuously and thereby reshape their wage bill. My interviews with people active in business and unions confirmed that market conditions are an important part of contract negotiations and wage determination. Based on these studies, then, the process of wage determination will be treated largely as a market process in which profit maximizing firms organize production and employ workers such that the wage paid is equal to the marginal productivity of a particular class of worker.

The presence of segmentation between formal and informal sectors, industries, and occupations leading to divergent wages is widely observed in modern market and mixed economies--a consequence of supervision costs, efficiency wages, lumpy technology, organizational forms, and selection problems under imperfect information (Doeringer and Piore 1971, Stiglitz 1987, Lang and Edwards, eds. 1987). In Brazil, segmentation of labor opportunities is also apparent along many dimensions--formal vs. informal (Paes de Barros 1988), Internal Labor Markets (Morley 1979), Private vs. Public (Macedo 1986), technique of production (Schmitz 1985). In my interviews with managers, negotiators, and union leaders in Rio de Janeiro and Recife, these agents indicated that they are themselves aware of such segmentation of opportunity: primarily between small firms which have short promotion ladders and little latitude for paying much more than negotiated wage floors, and larger "dynamic" firms which pay premia over the negotiated settlements to ensure stability in their labor force and to reduce intra-firm tension. In addition, all those interviewed discussed market conditions only in the context of particular well-defined categories. That is, agents referred to market conditions for particular occupational, sectoral and geographical subgroups of the working population, and not for the labor force as a whole.

Brazilian workers are clearly motivated to better themselves economically. A key motivation for migration in Brazil is economic, as shown by the net flows of people toward high income areas (Ablas and Fava 1985:61), and the higher average earnings for migrants relative to non-migrants (Medeiros 1982:88). Furthermore, a large part of labor turnover and searching for new jobs is a result of voluntary separations. A great deal of mobility between self-employed and employed positions shows active searching for income

opportunities all the way from the bottom of the income scale (Sedlacek)--perhaps even stronger there, driven by the abysmally low wages and income received by this portion of the population.

For this part of the study, then, workers are treated as individuals who seek to do the best for themselves as they can, given constraints presented by opportunities in the labor market. For this, certain choices (e.g. amount of schooling, choice to migrate) are relatively more open to them than others (e.g. absence of employment in a high wage industry) which are constrained by external conditions.

II.2 Details of Estimation and Assumptions

The wage differences between regions were estimated here with an earnings function, and were further evaluated through analysis of covariance. The regional wage variation was also studied by disaggregating the sample into various subgroups, and by testing it for temporal stability. The variables used in the analysis are listed in Appendix C, Table C.1, and the specific regressions are shown in the same appendix, Table C.2.

As described above, the worker's wage is taken to be determined by the conjunction of the worker's own characteristics and the premia associated with the labor market segment in which he or she is employed. The log hourly wage is regressed on explanatory variables which include education and experience as proxies for a worker's own skills and productivity. These variables may be interpreted as measures of "human capital" (Mincer 1975; Dabos and Psacharopoulos 1987). The interpretation of these variables is difficult, however, because of the high correlation of education with social status and with parent's income class (Medeiros 1982). The variables will be employed here as controls for individual variation which may or may not be linked to productivity.

In addition to education and experience, gender and head of household status were included as personal characteristics which affect earnings--indicative of discrimination and attachment to the labor force, respectively. Indicators of the individual's place within the structure of labor demand included occupation, sector of economic activity, place of residence, and work card status. Finally, the regional price level is

included as an explanatory variable--accounting for the difference between the real and nominal wage.

Deflating wages by a regional price index is a key part of the analysis and deserves some attention since the results may be highly sensitive to this. Since we are interested in real and not nominal wages, it is necessary to include an adjustment for regional variations in the price level. In particular, a worker's nominal wage should be deflated by an index of the cost of living faced by that particular worker in his or her region, relative to the cost of living that would be faced by the same worker if relocated to another region. To do such an adjustment rigorously would require specification of the utility function for each individual or group of similar individuals, derivation of the corresponding price index, and data on the necessary weights and prices for each individual and region. Even if such were possible, it would be impossible to determine a unique index, since the choices of base weights for comparison--whether a particular region or a national average--are numerous. The choice of base weights is likely to yield widely differing estimates of relative inflation in a country like Brazil with high and accelerating rates of inflation.

The regional price index used in this study can be found in Vinod Thomas (1982). The regional comparison of the cost of living in Thomas' paper was derived from the household expenditure survey of 1974-75 (ENDEF). For the present work, Thomas' index was updated to account for regional variations in the pace of inflation, using price indexes calculated by the Fundaçao Getulio Vargas and the IBGE. The resulting index is shown in Table 1.[2]

[2]Details of the calculation of the regional price index are available in a technical appendix which is available from the author upon request.

Table 1

Calculated Comparison of Price Levels across Metropolitan Regions
Updated with Price Indices and with 1974/75 as Base Year

Metropolitan Region	Levels 1974-75	IGP 1977	IGP 1978	IGP 1979	INPC 1980	INPC 1981	INPC 1982	INPC 1983	INPC 1984	INPC 1985	INPC 1986	INPC 1987
Belem	132	123.0	125.0	125.8	123.8	119.6	116.6	116.8	120.7	116.8	121.2	122.9
Fortaleza	103	99.8	98.0	97.2	97.9	98.6	98.8	101.2	103.8	105.9	103.8	109.9
Recife	111	105.7	108.2	108.5	108.4	108.6	110.0	110.6	115.0	112.2	112.4	116.6
Salvador	130	130.0	134.5	137.7	138.3	139.9	137.1	134.4	137.2	139.6	139.2	132.8
Belo Horizonte	127	127.9	124.3	124.6	124.7	121.4	122.2	126.7	126.1	131.6	130.3	124.7
Rio de Janeiro	165	166.5	163.6	169.4	170.6	171.8	170.9	170.0	171.3	167.1	165.7	163.7
Sao Paulo	179	181.6	184.6	180.8	180.8	180.5	179.8	178.0	174.5	176.5	177.5	185.3
Curitiba	125	125.7	123.1	124.8	123.2	122.8	126.3	127.5	125.9	126.7	129.4	127.2
Porto Alegre	144	154.0	155.8	149.9	151.3	149.9	153.1	154.9	155.3	152.3	151.6	128.7
Brazil	100	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

NOTE: Base level from Vinod Thomas, WB, 1982. Ave. National and 40th percentile basket. Base updated by splicing the Indice Geral de Precos ao Consumidor por Capitais for 1974-1979 to the Indice Nacional de Precos ao Consumidor por Capitais for 1974-1979 to the Indice Nacional de Precos ao Consumidor por Regioes Metropolitanas (IBGE).

While the index is not theoretically rigorous, it does correlate significantly with deviations of nominal wages across metropolitan regions, and appears to capture most of the impact of the cost of living on wages. The elasticity of nominal wages to the price index in 1984 is 0.61, when controls are introduced for human capital, personal characteristics, occupation and sector of activity. Although the hypothesis of an elasticity equal to one is rejected easily by an F-test at the 0.1% level, the price index still accounts for considerable variation in nominal wages, as will be shown below.

An additional problem arises in deflating by the price index when the dummy variables for metropolitan regions are included--the data matrix becomes singular since the regional price index is a linear function of the intercept

and the included dummy variables. To address this, I chose to estimate the elasticity of nominal wages with respect to regional price level with one sample (1984) and to restrict the parameter to this value for the other years analyzed. As a result of this two step process, the standard errors for 1984 are underestimated, however the accuracy of the standard errors for the other samples is maintained.

The function to be estimated, then, including price adjustments, characteristics of labor supply and segmentation of labor demand is:

$$\text{Log } W = \alpha + \beta_1 \cdot \text{PRECO} + \beta_2 \cdot \text{HC} + \beta_3 \cdot \text{PC} + \beta_4 \cdot \text{CARTA} + \beta_5 \cdot \text{OCC} + \beta_6 \cdot \text{RAMO} + \beta_7 \cdot \text{METROPO} + \mu,$$

$$\text{and } \mu = \varepsilon_3 + \log \varepsilon_{1j} + \log \varepsilon_{2i} ,$$

where: HC is a vector of variables representing human capital--years of schooling and its square, potential years of experience in the labor force and its square, and an interaction term of years of schooling and years of potential experience;
PRECO is the negative log of the ratio between the regional price index for the region of residence to the regional price index for the excluded region;
PC is a vector of personal characteristics, namely gender and whether the individual is a head of household;
CARTA is a dummy variable which equals one if the individual has a work card;
OCC is a vector of 9 dummy variables for occupational categories;
RAMO is a vector of 37 dummy variables for sector of economic activity; and
METROPO is a vector of 8 dummy variables for the 9 metropolitan regions in the study.
(See Appendix C for details of occupational and sectoral classifications.)

The error term has three components corresponding to the individual error in measuring observed variables, the regional error in the price index and the individual-specific error in the price index, respectively.[3]

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[3]The error contains several terms as a consequence of errors in

The vector of coefficients β_2 represents the returns to schooling and experience, while β_4, β_5, and β_6 represent wage premia attached to obtaining employment in a particular segment. The vector β_3 shows the wage advantage attached to personal characteristics. The coefficient β_1 is restricted to 0.61, i.e. the elasticity estimated in the 1984 sample for reasons discussed previously. The earnings function will be used to test whether the vector β_7 is different from zero, and thus provide evidence of regional segmentation of the labor market. Since the coefficients measure the wage premia relative to the excluded sector, occupation, or region, a simple linear transformation is applied to aid interpretation of the results.[4] The transformed coefficients will be presented in tables, showing the deviation of wages from the mean, rather than from the excluded classification. This function will also be used

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the price index. In particular, the price index for region j (P_j) is an incorrect measure of the relative prices faced by individual i in region j (ρ_{ij}) because of errors common to all members of the region, and errors specific to the individual. Write the observed index P_j as,

$$P_j = \rho_{ij} * \varepsilon_{1j} * \varepsilon_{2i}$$

where ε_{1j} is the region specific error and ε_{2i} is the individual-specific error. The error terms are assumed to be distributed log normal with mean 1 and covariance Σ_1 and Σ_2 respectively. When the estimated price index is substituted for the true index in deflating the log wage, two additional error terms are generated: log ε_{1j} and log ε_{2i}.

[4] In particular, the regression yields the coefficients f_i which estimate by what percentage the average wage in metropolitan region i differs from the average wage in the excluded metropolitan region. Let **f** be a vector of 9 coefficients, where $f_k = 0$ for the excluded metropolitan region. Then a simple linear transformation makes it possible to adjust the coefficients to show the deviation of regional wages from the mean, i.e.

(9) $\phi_i = f_i - (1/N) \Sigma\, n_j \circ f_j$ where n_j is the number of workers in department j, and

$N = \Sigma\, n_j$

Let A be a square matrix whose elements in each column j are the share of observations in region j, that is $a_{ij} = n_j/N$. Then equation (9) can be rewritten in matrix form as:

(10) $\phi = (I - A)\, \mathbf{f}$.

The variance of the coefficients, the diagonal elements of the covariance matrix $\mathbf{D_f}$, then must be adjusted as

(11) $\Delta = (I - A)\, \mathbf{D_f}\, (I - A)'$

The square root of the diagonal elements of matrix Δ are then the adjusted standard deviations for ϕ, the new coefficient vector. The adjusted vector, showing the regional wage structure for 1986, for example, appears in Table 5.

in an analysis of covariance to determine the upper and lower bounds of the explanatory power of these variables in the determination of the dispersion of wages.

The estimates may be biased, depending on the degree of codetermination of included variables--such as education and occupation. This problem will be dealt with through analysis of covariance below. Furthermore, the estimators will not be least variance estimators, due to heteroscedasticity in the error term as a consequence of income dependent variance of measurement errors in the cost of living. A General Linear Model estimation would be preferable, but extremely difficult. The use of rather large samples (between 20,000 and 50,000) yields Ordinary Least Squares estimators with very low variance, regardless.

III. FINDINGS

III.1 Nominal Wages in Brazil and Sample Characteristics

The sample considered here comprises non-agricultural private sector employees in Brazil's nine major metropolitan regions.[5] The sample was restricted to urban workers in the metropolitan regions for three reasons. First, it is difficult to compare wage data between urban and rural areas because of non-monetary payments in rural areas which systematically underestimate earnings. Secondly, cost-of-living comparisons are difficult across metropolitan regions, but would present even greater problems in comparing across urban and rural areas. Finally, since this paper is testing the proposition that wage differentials may persist across regions in spite of integration, taking the urban areas which are more clearly linked in a national economy allows me to test the proposition where it theoretically

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[5]The ten metropolitan regions distinguished in IBGE surveys are Belém, Fortaleza, Recife, Salvador, Belo Horizonte, Rio de Janeiro, São Paulo, Curitiba, Porto Alegre, and the Distrito Federal. The Distrito Federal is not analyzed in this paper because its economy is heavily dependent on the public expenditures associated with the seat of the federal government and hence represents a special non-comparable case.

should hold most strongly.

The data analyzed are from the Pesquisa Nacional de Amostra de Domicílios (PNAD), a household survey collected by the Instituto Brasileira de Geografia e Estatisticas (IBGE) in the third quarter of every year, using sampling based on the decennial census. The surveys of 1977 through 1987 were all analyzed, with special attention to 1985 and 1986. The survey for 1986, which will be used extensively, included 255,554 individuals of whom 27,575 were included in the sample studied in this paper. This sample of non-agricultural employees in Brazil's nine major metropolitan regions represents 14% of the working age population surveyed, and 28% of the remunerated labor force (See Table 2). Some general characteristics of the sample are shown in Table 3.

Table 2

Selection and Representativity of Sample
PNAD 1986

	Number	Percent of Total	Percent of Remunerated
Total Persons	255,554	100.0%	
Less than 10 Years of Age	(64,441)		
10 Years and Older	191,113	74.8%	
Unremunerated	(88,834)		
Remunerated	102,279	40.0%	100.0%
Not Employee	(36,884)		
Employee	65,395	25.6%	63.9%
Primary or Public Sector	(11,206)		
Included Sectors and Occupations	54,189	21.2%	53.0%
Not Resident in Metropolitan Region	(23,065)		
Resident in Metropolitan Region	31,124	12.2%	30.4%
Missing Data	(3,549)		
Sample	27,575	10.8%	27.0%

Table 3

Sample Characteristics
All Workers--PNAD 1986

Total in Sample	27,575
% Male	62.8%
% Head of Household	46.1%

Variable	Mean	Standard Deviation
Log Wage	2.28	0.95
Education (Years)	6.38	3.89
Age (Years)	30.52	12.70

Metropolitan Regions:	
Belem	7.0%
Fortaleza	7.6%
Recife	8.4%
Salvador	7.8%
Belo Horizonte	14.6%
Rio de Janeiro	14.2%
Sao Paulo	19.9%
Curitiba	7.8%
Porto Alegre	12.6%

Occupations:	
Administrative	3.2%
Clerical	17.0%
Technical	4.0%
Professional	2.7%
Supervisory	1.0%
Blue Collar	27.9%
Transportation	5.1%
Retail	9.5%
Personal Service	22.4%
Miscellaneous	7.1%

Average nominal wages vary widely across the metropolitan regions (See Table 4). At the extremes, average nominal wages are some 37% higher than the national mean in São Paulo while they are 44% below the national mean in Fortaleza. The weighted standard deviation of these regional differentials is 0.240. Nominal monthly income is distributed similarly with slightly lower variance, indicating that to some degree workers in lower wage areas work more hours.

Table 4

Effects of Adjustments for Cost of Living and Controls
on Regional Wage Differentials
PNAD 1986 -- All Employees -- N=27,575
(Differences from Sample Mean)

--------Without Controls for Other Characteristics--------

	Nominal Hourly Earnings Difference	STD	Real Hourly Earnings Difference	STD	N
Belem	-21.1%	2.0%	-11.7%	2.0%	1,941
Fortaleza	-43.5%	1.9%	-24.5%	1.9%	2,116
Recife	-32.3%	1.9%	-18.2%	1.9%	2,323
Salvador	-10.7%	1.9%	-9.6%	1.5%	2,177
Belo Horizonte	-7.7%	1.3%	-2.5%	1.3%	4,068
Rio de Janeiro	-0.7%	1.4%	-10.2%	1.4%	3,944
Sao Paulo	36.8%	1.1%	23.1%	1.1%	5,536
Curitiba	9.8%	1.5%	15.4%	1.9%	2,172
Porto Alegre	11.7%	1.5%	7.6%	1.5%	3,500
Standard Deviation of Differentials	24.0%		15.4%		

--------With Controls for Other Characteristics--------

	Nominal Hourly Earnings Difference	STD	Real Hourly Earnings Difference	STD	N
Belem	-17.3%	1.2%	-7.8%	1.2%	1,941
Fortaleza	-25.1%	1.2%	-6.0%	1.2%	2,116
Recife	-25.7%	1.1%	-11.6%	1.1%	2,323
Salvador	-11.9%	1.2%	-10.8%	1.2%	2,177
Belo Horizonte	-1.0%	0.8%	4.1%	0.8%	4,068
Rio de Janeiro	-7.4%	0.8%	-16.9%	0.8%	3,944
Sao Paulo	29.9%	0.7%	16.2%	0.7%	5,536
Curitiba	6.8%	1.1%	12.4%	1.1%	2,172
Porto Alegre	7.4%	0.9%	3.3%	0.9%	3,500
Standard Deviation of Differentials	18.2%		11.7%		

STD = Standard Deviation of Estimated Differential
Control Characteristics include years of education and its square; experience and its square; interaction of education and experience; gender; head of household; work card status; 9 occupation dummies; and 37 sectoral dummies.

III.2 Impact of Adjustments for Cost of Living

When regressed against a price index to reveal the regional differences in real hourly wages, the regional wage variation does decline significantly. The standard deviation of average nominal wages across metropolitan regions is 0.240 as against only 0.154 for real wages. The elasticity of wages to regional price level was restricted to 0.61 as described above, and the test on the restriction shows it to be extremely robust--it cannot be rejected with a t-test at the 0.01% level. The regional effects are diminished by the correction for cost of living, but they nonetheless remain.

Adjustments for regional differences in the composition of the labor force and in labor demand also significantly reduce the variation of wages across metropolitan regions. Specifically, the controls for worker characteristics, work card, occupation, and sector reduce the weighted standard deviation of regional wage diferentials from 0.240 to 0.182 for nominal hourly earnings, and from .154 to .117 for for real hourly earnings. Therefore, between 28% and 35% of the variation in nominal wages can be accounted for by differences in regional prices, while an additional 25% to 39% of variation in nominal earnings can be attributed to differences in labor force characteristics and composition of labor demand.

After these adjustments, the remaining regional differentials are smaller but still significant. An average worker in São Paulo has real earnings which are 16% higher than the mean while a the same worker in Fortaleza would have real wages which are some 6% below the mean. In Salvador, Recife, and Rio de Janeiro average real wages are even further below the mean. Belo Horizonte and Porto Alegre have wage premia slightly above the mean, 4% and 3% respectively, while an average worker in Curitiba receives a real wage premium comparable to São Paulo. An F-test on the joint hypothesis that the coefficients on the Metropolitan Region variables are zero is easily rejected at the 0.01% level.

In addition, the regional differences are extremely robust in the sense that the regional wage pattern--not its variance--is relatively unaffected by the inclusion of other variables. Comparing the coefficients from regressions 1 and 10 (See Appendix C, Table C.2), shows how much the regional effects are modified by taking into account variation in personal characteristics, human

capital, occupational categories, and industry composition. The correlation of the adjusted and unadjusted regional wage structure is shown for the 1986 sample in Table 4, and is a highly significant 0.883. The correlations for other years are equally significant.

Because the regional wage differentials before adjusting for covariates are closely correlated with those adjusted for covariates, some part of the regional influence on wages must be entirely independent of the other factors. This makes it difficult to argue that the remaining regional differentials are caused by unobserved differences in worker productivity, since this would require virtually no covariance between observed and unobserved worker characteristics. Similar arguments may be made about unmeasured effects of industrial and occupational composition of labor demand to the degree that they are also unaffected by the introduction of covariates.

The regional wage structure shown above reflects the history of spatial economic development in Brazil. The dynamic, high productivity regions of the south and southeast have higher than average wages, while the metropolitan regions in the northeast have lower than average wages. The migration flows reflect this pattern, as well, with the largest net flows aiming for São Paulo and originating in Recife, Fortaleza and Salvador. The one unexpected result is the extremely low position of Rio de Janeiro in the regional wage structure. After São Paulo, Rio de Janeiro and Belo Horizonte represent the most dynamic economies of Brazil (Ablas and Fava 1985). Rio de Janeiro's low position is not apparent in the nominal wage averages--where it is close to the national mean. The cost of living in Rio de Janeiro, however, is comparable to that of São Paulo without the compensation of proportionally higher nominal wages. In addition, when adjustments are made for education (Rio has one of the highest average levels of education) and for industrial composition (Rio has a highly diversifed and high-wage industrial structure) the real adjusted wage is reduced further (Compare Rio de Janeiro to São Paulo and Recife in Table 5).

Table 5

Characteristics and Composition of the Labor Force
by Selected Metropolitan Regions for 1986

	Recife	Rio de Janeiro	Sao Paulo	---Relative to Sao Paulo--- Recife	Rio de Janeiro
Wage (Ave. Cz$/Hour)	7.69	10.66	15.01	0.51	0.71
Monthly Salary (Ave. Cz$)	676	1876	2643	0.26	0.71
Price Level (%)	-18%	22%	31%	-0.58	0.71
Education (Ave. Years)	6.2	6.9	6.52	0.95	1.06
Potential Work Experience (Ave. Years)	21.0	21.9	19.7	1.07	1.11
Age (Ave. Years)	33.2	34.8	32.22	1.03	1.08
% Male	63%	61%	62%	1.02	0.99
% Head of Household	50%	50%	48%	1.04	1.04
% With Signed Work Card	65%	69%	74%	0.87	0.93
Occupations:					
Administrative	2%	3%	3%	0.67	1.00
Clerical	12%	15%	17%	0.71	0.88
Technical	4%	5%	5%	0.80	1.00
Professional	5%	6%	5%	1.00	1.20
Supervisory	1%	1%	1%	0.85	0.85
Production	23%	24%	30%	0.77	0.80
Transportation	5%	4%	4%	1.20	0.96
Retail	15%	12%	11%	1.33	1.06
Personal Service	22%	24%	17%	1.27	1.39
Miscellaneous	10%	8%	7%	1.36	1.09
Sectors:					
Non-Metallic Process.	1.2%	1.1%	2.1%	0.59	0.51
Metalurgical Manuf.	3.4%	2.6%	4.3%	0.79	0.59
Mechanical Manuf.	0.2%	1.0%	3.0%	0.08	0.33
Elect. & Comm. Manuf.	1.0%	1.2%	4.5%	0.22	0.27
Transport Manuf.	0.5%	1.7%	7.2%	0.07	0.24
Wood Manuf.	1.0%	0.4%	0.2%	4.94	1.78
Furniture	1.1%	1.2%	1.7%	0.63	0.69
Paper & Cardboard	0.7%	0.4%	1.2%	0.62	0.36
Rubber	0.2%	0.4%	1.1%	0.22	0.32
Leather	0.0%	0.1%	0.0%	0.00	1.43
Chem. & Petro.	0.9%	1.9%	1.9%	0.44	0.99
Pharmac. & Vetrinar.	0.1%	0.7%	0.7%	0.18	1.02
Perfume, Soaps & Candles	0.1%	0.5%	0.6%	0.19	0.77
Plastics	0.6%	0.9%	2.1%	0.29	0.44
Textile	4.0%	1.1%	2.4%	1.70	0.48
Clothing	1.7%	4.7%	6.1%	0.28	0.77
Footwear	5.4%	2.3%	3.4%	1.57	0.68
Beverages	0.7%	0.9%	0.4%	1.65	1.90
Tobacco	0.2%	0.1%	0.0%	4.94	2.85
Editorial & Graphics	1.1%	2.0%	2.3%	0.48	0.87
Civil Construction	10.1%	9.1%	5.0%	2.00	1.81
Public Utilities	2.8%	1.2%	0.8%	3.55	1.52
Retail Sales	9.6%	9.1%	8.4%	1.13	1.07
Wholesale Commerce	5.6%	5.1%	3.9%	1.46	1.32

(continued)

Characteristics and Composition of the Labor Force
by Selected Metropolitan Regions for 1986
(continued)

	Recife	Rio de Janeiro	Sao Paulo	---Relative to Sao Paulo--- Recife	Rio de Janeiro
Transport	6.1%	6.2%	4.3%	1.42	1.44
Communications	0.7%	1.1%	1.0%	0.74	1.14
Restaurants & Hotels	4.8%	5.0%	3.0%	1.58	1.66
Repair Services	3.7%	2.8%	1.8%	2.00	1.54
Personal Services	1.0%	1.0%	0.7%	1.41	1.43
Domestic Services	17.1%	16.2%	9.4%	1.81	1.72
Misc. Serv.	0.5%	0.9%	0.7%	0.71	1.22
Professional Serv.	1.2%	2.6%	2.5%	0.49	1.03
Aux. Econ. Serv.	2.7%	1.8%	1.8%	1.47	1.00
Community Service	0.0%	0.0%	0.0%		
Priv. Medical Service	3.6%	3.5%	1.9%	1.84	1.79
Private Educ.	1.7%	3.0%	2.3%	0.75	1.33
	100.0%	100.0%	100.0%		

This section has shown that nominal wage differences across Brazil's metropolitan regions reflect an underlying real wage difference that is statistically robust. The magnitudes of these regional wage differences are somewhat diminished by adjustments for variations in the cost of living, characteristics of the labor force, and the composition of labor demand; however, the pattern of wage differences is strongly invariant to these adjustments. The strength of these results leads to the expectation that adjusted real wage differentials may account for a significant amount of variation in Brazilian wages. The following section shows that, in spite of being statistically significant, the adjusted regional wage differentials are overshadowed by the influence of other factors in accounting for wage variation.

III.3 Decomposing Wage Variation: Analysis of Covariance

How much of an effect do the regionally-specific factors have on the overall variation in wages? This section uses analysis of covariance to determine upper and lower bounds for the contribution of human capital, personal characteristics, occupation, work card, industry composition, and regions on the overall distribution of wages.

Analysis of covariance makes it possible to decompose the variation in log wages so as to estimate an upper and lower bound for the impact of any particular variable. The upper bound is the proportion of wage variance accounted for in a regression which includes only one particular set of variables (e.g. Human Capital, Work Card Status, or Occupation), measured by the R-squared. The lower bound is proportion of wage variance which the particular set of variables contributes to the model after all other variables have already been included. The lower bound, then, measures how much the model's predictive power improves with the addition of a particular variable. The results of this analysis of covariance appear in Table 6.

Table 6

Analysis of Covariance
Household Survey Data for Various Years

(All bounds statistically significant at the 0.1% level)

	Human Capital	Personal Charact.	Carta	Occup.	Sector	Metro. Region
	------PNAD-1986 (N=27,57-- Adjusted R-Square = 0.67					
Lower Bound	0.11	0.02	0.00	0.03	0.02	0.01
Upper Bound	0.51	0.16	0.16	0.39	0.33	0.06
No. of Variables	5	4	2	10	38	9
# of Covariate Cells	5028	2910	4433	1898	632	1569
Ave. Observations per Cell	4.78	9.20	6.07	14.17	42.56	17.15
	------PNAD-1985 (N=50,64--- Adjusted R-Square = 0.69					
Lower Bound	0.09	0.02	0.02	0.02	0.03	0.01
Upper Bound	0.48	0.15	0.23	0.41	0.38	0.04
No. of Categories	5	4	2	10	38	9
	------PNAD-1981 (N=48,09--- Adjusted R-Square = 0.68					
Lower Bound	0.12	0.02	0.01	0.02	0.02	0.01
Upper Bound	0.52	0.15	0.12	0.39	0.33	0.04
No. of Categories	5	4	2	10	38	9
	------PNAD-1977 (N=80,42--- Adjusted R-Square = 0.56					
Lower Bound	0.09	0.03	0.01	0.03	0.01	0.08
Upper Bound	0.30	0.05	0.10	0.23	0.09	0.08
No. of Categories	5	4	2	10	9	9

As can be seen for selected years, the proxies for human capital[6] contribute significantly to the overall observed variation in wages, from 11% to 51% of the total variation. When personal characteristics are analyzed, they contribute from 2% to 16% of the total nominal wage variation. The remaining factors--work card, occupation, sector, and metropolitan region--have lower bounds which range from 1% to 3%. The upper bounds, however, show that dividing the workforce between those with and without signed work cards may contribute as much as 16% to the variation in wages; while occupational and sectoral segmentation may each contribute as much as one-third of the variation. By contrast, the division between metropolitan regions explains at most 6% of the variation in earnings.

This difference in upper bounds does not automatically mean that regional differences are less significant than the other factors. Instead, this apparently small contribution has more to do with independence of the regional wage structure and the consequent compression of the range of its contribution to wage variance. As mentioned above, the correlation in 1986 between the unadjusted regional wage differentials and the differentials after adjustment for potential covariates is 0.883. This explains why, although the upper bound contribution of regional variation appears low relative to other factors, it is still a significant influence on wage variation. That is, because the regional wage structure is not strongly diminished by controls for personal characteristics, occupation and sector of activity, its range of contribution is tighter. Thus, the apparently high contribution of other factors like occupation and sector--apparent because of the high upper bound--may have more to do with their covariance with human capital and personal characteristics than with their own importance per se.

On the other hand, the combination of education, experience, gender, and head of household status are not necessarily the major contributors to wage variation. When combined, these variables can account for 57% of the total variation in log hourly wages, but a large part of this explanatory power can be attributed to covariation with the labor demand variables. After attributing all of the variation possible to occupation, sector, work card

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[6]Reminder that the interpretation of the human capital proxies is problematic, since it is difficult to discern social selection mechanisms from returns to embodied productivity.

status, and region, the individual's characteristics when combined account for an additional 16% of variation, significantly lower than the upper bound.

III.4 Temporal Stability of The Regional Wage Differentials

How then are we to view these remaining regional differentials? Do they represent a temporary disequilibrium across labor markets in 1986? Or if a permanent phenomena, why does anyone remain in a region where their earnings are as much as 15% or 20% lower than for a comparable worker elsewhere?

An easy explanation for the regional wage differentials are that they represent a temporary imbalance or disequilibrium in the national economy. For example, regions respond to different parts of the business cycle depending on their composition of exports and industry. Within industries, fluctuations in product demand will influence the fortunes of different regions based on the prosperity of particular firms. To test whether the regional wage differentials described above are a temporary phenomena, correlations were calculated across several years.

Table 7 shows the adjusted real wage differentials across regions for 1977 through 1987. As can be seen, the regional wage differentials are highly comparable through the 1980s. Table 8 shows weighted correlations of the regional wage differentials for all employees across the different years. The difference between the pre-1980 and post-1980 estimates has to do with the low level of sectoral disaggregation than was possible for the earlier years. Within the 1980s, in spite of the extreme changes in domestic growth and external trade experienced by the economy--from the recession of 1981-1983, through the recovery of 1984-1985, and the Plano Cruzado of 1986--the regional wage differentials are relatively stable. The weighted correlations for 1981 through 1987 are all statistically significant, with the exception of 1985. The significant correlations range as high as 0.97 between 1981 and 1982 and as low as 0.58 between 1981 and 1985. This stability is robust, holding even more strongly when using Spearman Rank Correlations. These high correlations across time make untenable the proposition that the regional wage

differentials are solely a phenomena of market disequilibria.[7]

Table 7

Adjusted Real Regional Wage Differentials

	1977#	1978#	1979#	1981	1982	1983	1984	1985	1986	1987
Belem	-0.15	-0.35	-0.47	-0.16	-0.12	-0.08	-0.02	0.05	-0.08	-0.12
Fortaleza	-0.51	-0.57	-0.65	-0.07	-0.06	-0.05	-0.04	-0.08	-0.06	-0.16
Recife	-0.37	-0.43	-0.52	-0.07	-0.04	-0.02	-0.06	0.04	-0.12	-0.13
Salvador	-0.07	-0.08	-0.13	-0.04	0.03	0.05	0.01	0.01	-0.11	0.04
Belo Horizonte	-0.03	0.05	-0.04	0.12	0.10	0.05	0.01	-0.00	0.04	0.04
Rio de Janeiro	0.33	0.22	0.11	-0.10	-0.13	-0.13	-0.14	-0.16	-0.17	-0.16
Sao Paulo	0.54	0.49	0.40	0.08	0.07	0.06	0.07	0.07	0.16	0.14
Curitiba	-0.00	-0.02	-0.15	0.12	0.10	0.11	0.10	0.10	0.12	0.17
Porto Alegre	0.22	0.14	-0.03	0.01	0.03	0.02	0.06	0.06	0.03	0.09
Standard Deviation	0.32	0.34	0.33	0.09	0.09	0.07	0.08	0.08	0.12	0.12

Table 8

Temporal Correlations of Adjusted Real Regional Wage Differentials

	1977#	1978#	1979#	1981	1982	1983	1984	1985	1986	1987
1977	1.00	***	***	-	-	-	-	-	-	-
1978	0.97	1.00	***	-	-	-	-	-	-	-
1979	0.96	1.00	1.00	-	-	-	-	-	-	-
1981	0.34	0.49	0.47	1.00	***	**	*	*	**	**
1982	0.24	0.38	0.36	0.97	1.00	***	**	*	***	**
1983	0.16	0.27	0.26	0.87	0.93	1.00	***	**	**	***
1984	0.23	0.27	0.24	0.72	0.83	0.91	1.00	***	**	***
1985	0.19	0.20	0.16	0.58	0.72	0.83	0.96	1.00	*	**
1986	0.48	0.53	0.50	0.83	0.88	0.83	0.89	0.81	1.00	**
1987	0.53	0.58	0.54	0.84	0.88	0.91	0.92	0.84	0.89	1.00

Note: * indicates statistically significant at the 5% level;
** indicates statistically significant at the 1% level;
*** indicates statistically significant at the 0.1% level.
# indicates years for which 9 aggregated Sectors of Economic Activity are used instead of 38 Sectors.

[7]This temporal stability of regional wage differentials also holds over longer periods of time as indicated by Industrial Census data (1949-1980) and Demographic Census data (1960-1980) (Savedoff 1989).

In addition, there is no secular trend in the variance of the regional wage differentials for the period encompassing 1981 to 1987. If anything, the evidence for this period indicates a widening of these disparities since the variance of the regional wage differentials increases by one-third, from 0.09 to 0.12.

It is important to note that 1984 and 1985 were atypical years, particularly 1985, in having regional wage differentials significantly different from the other surveys of the 1980s. Due particularly to the exceptional improvement in wages for work-card employees in Recife and Salvador, the regional wage differentials are less highly correlated with the other years. There are clearly some cyclical effects in the 1985 sample. If we look at Belo Horizonte through 1985, we can see the impact of that metropolitan region's poor performance during the recovery. Also, Belem improves in 1985, for employees with and without work cards. Nevertheless, the business cycle cannot account for the observed slight variation in the regional wage pattern since years of growth (consider 1985 and 1986) are sometimes correlated (1986) and sometimes not correlated (1985) with other years--including recessions (e.g. 1982).

If the pattern of regional wage differentials is relatively stable over time, what is its origin? Does it reside in the isolation of the metropolitan region labor markets? in the regionally-specific features of their sectoral composition or the quality of education? in the manner and process of contracting and utilizing workers in the workplace? The following section attempts to answer this question.

III.5 Accounting for the Regionally-Specific Effects

As can be seen above, the level of disaggregation in industrial composition had a large effect on the resulting regional wage differences for the pre-1980 and post-1980 samples. This section seeks to test whether this issue might explain the real wage differentials noted above. The analysis is applied to two very different years: 1986, whose regional wage differentials were highly correlated with other years, and 1985 which was shown to be atypical.

Once more, the earnings function was used, accounting for variation in log nominal wages with variables representing the price level, human capital, personal characteristics, work card status, occupation, sector, and region. This time, however, interaction terms were included--interaction of metropolitan region with human capital, personal characteristics, work card status, occupation, and sector (See Appendix C, Table C.2, Regression 3). This added 430 variables to the regression, but due to the large size of the samples, the reduction in degrees of freedom was not problematic. Joint-hypothesis tests were run to determine whether these various combinations of variables were signficant in accounting for wage variation.

The results are shown in Table 9. For 1986, which is the more typical year, the joint-tests on the interaction variables are all significant at the 0.01% level--with the exception of the regional dummies themselves. The 1985 data also shows that all the interaction variables are jointly significant--including the regional dummies. This indicates that the wage advantage attached to any of these factors varies systematically across regions. The coefficients on each term, however, were not statistically different from zero--due to the high degree of multicollinearity that enter with the extra terms--so that further analysis of these regionally-specific returns was not possible with the existing data and the current model.

Table 9

Significance Tests of Regional Variables and Interactions

From PNAD 1985:

	Degrees of Freedom	F	Prob > F
Model	494	250.132	0.0001
Error	50,148		
C Total	50,642	Adj. R-Square	0.71

Tests	Degrees of Freedom Numerator	Denominator	F-Value	Prob > F	Remark
METROi=METROj=...=0	8	50,148	3.93	0.0001	Reject Ho
MHCi=MHCj=...=0	56	50,148	30.79	0.0001	Reject Ho
MCARTAi=MCARTAj=...=0	8	50,148	11.12	0.0001	Reject Ho
MOCCij=MOCCkl=...=0	72	50,148	2.35	0.0001	Reject Ho
MRAMij=MRAMkl=...=0	272	50,148	3.31	0.0001	Reject Ho
METROi=MHCj=MCARTAk= MOCClm=MRAMOnp=...=0	416	50,148	11.42	0.0001	Reject Ho

From PNAD 1986:

	Degrees of Freedom	F	Prob > F
Model	492	119.8	0.0001
Error	27,083		
C Total	27,575	Adj. R-Square	0.68

Tests	Degrees of Freedom Numerator	Denominator	F-Value	Prob > F	Remark
METROi=METROj=...=0	8	27,575	1.61	0.117	Cannot Reject Ho *
MHCi=MHCj=...=0	56	27,575	3.9	0.0001	Reject Ho
MCARTAi=MCARTAj=...=0	8	27,575	3.52	0.0005	Reject Ho
MOCCij=MOCCkl=...=0	72	27,575	2.3	0.0001	Reject Ho
MRAMij=MRAMkl=...=0	270	27,575	1.97	0.0001	Reject Ho
METROi=MHCj=MCARTAk= MOCClm=MRAMOnp=...=0	414	27,575	5.44	0.0001	Reject Ho

It is possible to generate some hypotheses about the regionally-specific impact of some of the variables. For example, numerous studies have considered the possibility of regional variation in the returns to schooling, an issue which is highly complex. Behrman and Birdsall consider the impact that regional variation in the quality of education may have on the estimates. Dabos and Psacharapoulos argue that regionally different returns reflect varying conditions of scarcity for labor skills across regions. Medeiros argues the estimates are artifacts of the correlation of education to parental status; hence, interaction terms would capture the regionally differing impact of inherited social placement on earnings. Regardless of the approach, some regionally-specific impact of education would be an expected result.

It is also reasonable to expect regional differences in the advantage attached to work card status. Employees without signed work cards are concentrated in different jobs depending on which region is being considered. In Salvador, the majority of these workers are in low wage sectors--categories 29 through 32 include 58% of the Salvadoran workers without work cards while the same categories account for only 35% of those in São Paulo (See Table 10). The largest group of workers without work cards is concentrated in domestic service (category 32), accounting for 41% of those in Salvador and only 24% in São Paulo. Thus for the national sample, work card status tells a great deal about a workers expected income, but in each region, the explanatory power of the work card status will differ depending on where this group of workers is employed.

Table 10

Comparison of Workers Without Work Cards
Salvador and Sao Paulo in 1986

	Salvador	Sao Paulo	Salvador/ Sao Paulo
Real Wage (Ave. Cz$/Hour)	1.07	1.26	0.85
Education (Ave. Years)	4.49	5.38	0.83
Age (Ave. Years)	24.9	26.74	0.93
% Male	48%	45%	1.07
% Head of Household	21%	24%	0.88
Sectors:			
Non-Metallic Process.	0.5%	1.2%	0.39
Metalurgical Manuf.	0.5%	1.4%	0.32
Mechanical Manuf.	-	0.7%	-
Elect. & Comm. Manuf.	-	1.2%	-
Transport Manuf.	-	1.7%	-
Wood Manuf.	0.5%	0.2%	1.94
Furniture	0.5%	3.1%	0.15
Paper & Cardboard	-	0.5%	-
Rubber	-	-	-
Leather	-	-	-
Chem. & Petro.	0.9%	0.5%	1.94
Pharmac. & Vetrinar.	-	0.2%	-
Perfume, Soaps & Candles	-	0.7%	-
Plastics	-	1.4%	-
Textile	-	1.4%	-
Clothing	0.5%	7.6%	0.06
Footwear	0.9%	3.1%	0.30
Beverages	-	0.2%	-
Tobacco	-	-	-
Editorial & Graphics	0.5%	1.2%	0.39
Civil Construction	12.9%	6.9%	1.87
Public Utilities	0.5%	0.5%	0.97
Retail Sales	9.2%	9.5%	0.97
Wholesale Commerce	4.1%	6.0%	0.70
Insurance & Finance	0.9%	0.7%	1.29
Real Estate & Diverse	0.5%	1.7%	0.28
Transportation	1.4%	2.4%	0.58
Communications	-	-	-
Restaurants & Hotels	7.8%	4.5%	1.73
Repair Services	8.3%	4.3%	1.94
Personal Services	1.4%	2.1%	0.65
Domestic Services	40.6%	23.6%	1.72
Misc. Services	0.5%	2.1%	0.22
Professional Serv.	0.9%	2.6%	0.35
Aux. Econ. Serv.	1.4%	1.4%	0.97
Community Service	-	-	-
Priv. Medical Service	2.8%	3.3%	0.83
Private Education	0.9%	2.1%	0.43
	100.0%	100.0%	

Additionally, the degree of sectoral aggregation may seriously affect the ability of these variables to capture fully the impact of inter-industry differentials. For example, the chemical industry of Salvador is more highly concentrated than that of Rio de Janeiro, heavily influenced by federal investment in the "Petrochemical Pole". Furthermore, the plants operating in Salvador are newer and employ more recent technologies. These factors account for the unexpected observation that average measured levels of capital intensity are higher in Salvador than in São Paulo or Rio de Janeiro (Almeida 1981:292). As a group, chemical workers are among the most highly paid workers in Brazil; however, the aggregation may obscure intra-sectoral heterogeneity of wages in this industry--which produces a wide range of products from petrochemicals to household paints. The intra-industry differentials were not captured in this study. Rather, they affected the estimate of average regional wage differentials by attributing the unexplained advantage observed for the chemical workers in Salvador to the metropolitan region, instead of attributing it to the concentration of chemical workers in petrochemical refining.

In conclusion, the residual regional wage differentials shown in Table 7 appear stable through time and are the consequence of regionally-specific attributes of workforce characteristics and labor demand composition. The variation in nominal wages across regions is the consequence of variation in cost of living and the different composition of the regions with respect to other types of labor market segmentation--specifically those dividing the workforce on the basis of education and experience, and those dividing the workforce by occupation and sector. It remains for further research to determine whether the differential wage advantages of these personal and job characteristics have to do with differential returns or unmeasured quality of the included variables.

IV. CONCLUSIONS: RECOMPOSING THE DECOMPOSITION OF REGIONAL WAGE DIFFERENTIALS

The foregoing analysis decomposed nominal wages step by step through cost of living, work force characteristics, and labor demand composition. It then showed that the residual regional wage differentials may be themselves artifacts of the level of disaggregation or of unexplored regional differences

in rates of return.

In terms of the various perspectives on regional wage differentials presented in previous studies, this research has shown that regional differentials for comparable workers will not converge over time--to the degree that the distribution of work card status, economic sectors, and occupation remain spatially concentrated. Instead, the regional wage differentials were more widely dispersed in 1986 and 1987 than at the beginning of the decade.

The variation in the cost of living does affect the variation in nominal earnings across metropolitan regions, as has been hypothesized in various studies. However, the regional price variation can explain at most one-third of this variation. Human capital can account for a substantial portion of wage variation but it is highly correlated with the other variables and may contribute as little as 11% to total variation. Furthermore, the interpretation of the explanatory power of education is made difficult by its dependence on parental income and social status. Thus the recourse of standard market theories to cost of living differences and human capital variation is only part of the story of regional wage disparities.

Real wage differentials for comparable workers across Brazil's regions are a persistent fact of its recent history. The stability of this pattern must reside in the different composition of labor demand and structure of economic organization apparent across regions. Approaches within this framework, however, may vary widely.

One such approach focuses on differential bargaining power of labor across regions. High wage firms fleeing areas of sectoral concentration may find relief from worker resistance (See Storper 1984). This advantage in bargaining power should not be underestimated. On the other hand, these firms will probably still face wage premia requirements characteristic of their sectors. There appears to be little geographical segmentation which would allow firms to continue to profit from low-cost labor in <u>real</u> terms. Firms which sell in the national or export markets, however, can still gain through "arbitrage" in the sense of reducing the <u>nominal</u> cost of labor by producing in areas with lower consumer prices.

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Another approach might focus on further disaggregating the industrial variation across regions and in analyzing the generation of inter-industry differentials. It is clear from this and other studies that sector of economic activity and education are the major correlates with the wage distribution, and overshadow regional differences (Fishlow 1972, Almeida dos Reis 1989). It is an open question, however, as to what generates and maintains labor market segmentation along these dimensions. The persistence of regional wage disparities in spite of the increasing integration of national factor and product markets implies some form of job rationing and differential restrictions on opportunities facing workers. This study then substantiates the need for further exploration of (1) educational opportunity in Brazil, (2) the interpretation of returns to education as rewards to productivity or screening, (3) the generation of inter-industry differentials, and (4) selection of workers by firms.

Public policy can take advantage of the regional deconcentration of poverty to target poverty programs. Public services which reduce the cost of living and/or improve quality of life can contribute significantly to the alleviation of regional concentrations of poverty. In terms of labor market outcomes, however, geographically distinct labor policies are likely to be an extremely indirect method of improving social welfare. The relative inefficacy of regional labor policies can be inferred from the stability of regional wage patterns over a period of time in which the federal government was gradually unifying the regionally differentiated structure of minimum wages. Rather, the improvement of work conditions, pay, promotion opportunities, and mobility should be pursued through programs which encourage all firms, regardless of location, to adopt technologies and organizational strategies that take advantage of the motivational impact of high-wages. Such policies may be direct, such as enforcing minimum wage laws, or indirect, such as strengthening the labor movement.[8] The regional aspects of a national industrial policy must take into account not only the encouragement of

[8] For example, until the early 1980s a majority of the workers in one large textile firm worked without official work card status and its associated benefits, at wages below the legal minimum, and for workdays which exceeded the legal maximum. The pressure of the textile workers union, taking advantage of slackened labor repression in this decade, was able to force the firm to regularize work conditions and improve wages (author's interviews in Recife, 1989).

regional growth (which is insufficient in itself, see Jatobá) and the implantation of high wage sectors, but also the advantages of sectoral and occupational diversity which make up the complex of higher productivity and pay. Finally the issue of differential access to education deserves greater attention than can be developed here.

The implications for public policy then are to deemphasize the spatial aspects of labor policy and stress instead the sectoral, occupational, and educational aspects of segmentation and restricted opportunities. Divisions of the labor market which are created by the complex interaction of sectors, occupations, work card status and region, need to be the focus of any study of opportunity for Brazilian workers. Regional comparisons of this complex should help elucidate its workings and reveal further possibilities for public policy.

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Appendix C

Table C.1
Variables Used in Regressions

Variable	Definition	Remarks
W	Nominal Hourly Wage	= Monthly Income/(4*Hours)
ESTUDO	Years of Education	
ESTUDSQ	Years of Education squared	
EX	Years of Job Experience	= age - (ESTUDO + 6)
EXSQ	Years of Job Experience squared	
ESTEXP	Interaction term	= EX * ESTUDO
PRECO	Comparative Cost of Living Index	= LOG (Pi/Pj)
SEXO	Sex	1 if Male; 0 if Female
CHEFE	Household Status	1 if head of household; 0 otherwise.
CARTA	Work Card Status	1 if have a signed work; 0 otherwise.
OCC0-OCC9	Occupation Dummies	See Table C.3
RAM10-RAM63	Sectoral Dummies	See Table C.3
METRO1-METRO9	Regional Dummies	See Table C.3
MESTUDO	Interaction term	= METROi * ESTUDO
MESTUDSQ	Interaction term	= METROi * ESTUDSQ
MEX	Interaction term	= METROi * EX
MEXSQ	Interaction term	= METROi * EXSQ
MESTEXP	Interaction term	= METROi * ESTEXP
MSEXO	Interaction term	= METROi * SEXO
MCHEFE	Interaction term	= METROi * CHEFE
MCARTA	Interaction term	= METROi * CARTA
MOCCi	Interaction term	= METROi * OCCi
MRAMi	Interaction term	= METROi * RAMi

Table C.2
Regressions and Included Variables

Variable	Basic	No Price Adjustment	Interactions	Estimate Price Elasticity	HC	PC	CARTA	OCC	RAMO	REGION	FHC	FPC	FCARTA	FOCC	FRAMO
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
W	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PRECO	R		R	X	R	R	R	R	R	R	R	R	R	R	R
HC	X	X	X	X	X							X	X	X	X
PC	X	X	X	X		X					X		X	X	X
CARTA	X	X	X	X			X				X	X		X	X
OCC	X	X	X	X				X				X	X		X
RAMO	X	X	X	X					X			X	X	X	
METROPO	X	X	X	X						X		X	X	X	X
MHC			X												
MPC			X												
MCARTA			X												
MOCC			X												
MRAMO			X												

Note: X=used in regression; R=used in regression with restricted coefficient.

Table C.3

Categories for Dummy Variables

Metropolitan Regions

METRO1 Belem
METRO2 Fortaleza
METRO3 Recife
METRO4 Salvador
METRO5 Belo Horizonte
METRO6 Rio de Janeiro
METRO7 Sao Paulo
METRO8 Curitiba
METRO9 Porto Alegre

Sectoral Categories for 1977-1979

RAM2 Manufacturing
RAM3 Construction
RAM4 Other Industrial
RAM5 Commercial and Marketing
RAM6 Services
RAM7 Transportation and Communication
RAM8 Social Services
RAM10 Other

Occupational Categories for 19779

OCC1 Technical, Scientific, and Relig
OCC2 Administrative
OCC4 Manufacturing and Civil Construc
OCC5 Commercial Activities
OCC6 Transportation and Communication
OCC7 Personal Service
OCC8 Other

Occupational Categories for 1977-1979

OCC0 Administrative
OCC1 Clerical
OCC2 Technical
OCC3 Professional
OCC4 Supervisory
OCC5 Blue Collar
OCC6 Transportation and Communications
OCC7 Retail Services
OCC8 Personal Services
OCC9 Miscellaneous

Sectoral Categories for 1981-1987

RAM10 Non-Metallic Process.
RAM11 Metalurgical Manuf.
RAM12 Mechanical Manuf.
RAM13 Elect. & Comm. Manuf.
RAM14 Transport Manuf.
RAM15 Wood Manuf.
RAM16 Furniture
RAM17 Paper & Cardboard
RAM18 Rubber
RAM19 Leather
RAM20 Chem. & Petro.
RAM21 Pharmac. & Vetrinar.
RAM22 Perfume, Soaps & Candle
RAM23 Plastics
RAM24 Textile
RAM25 Clothing
RAM26 Footwear
RAM27 Beverages
RAM28 Tobacco
RAM29 Editorial & Graphics
RAM34 Civil Construction
RAM35 Public Utilities
RAM36 Retail Sales
RAM37 Wholesale Commerce
RAM38 Insurance & Finance
RAM39 Real Estate & Diverse
RAM41 Transportation
RAM42 Communications
RAM52 Restaurants & Hotels
RAM53 Repair Services
RAM54 Personal Services
RAM55 Domestic Services
RAM56 Misc. Services
RAM57 Professional Services
RAM58 Aux. Econ. Services
RAM61 Community Service
RAM62 Priv. Medical Service
RAM63 Private Education

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