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Interindustry Wage Differentials

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SUMMARY

INTERINDUSTRY WAGE DIFFERENTIALS

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1. INTRODUCTION

Income inequality in Brazil is among the highest in the world. The country's outstanding economic performance throughout the 50s, 60s, and most of the 70s, however, overshadowed this problem by reducing poverty and enhancing social welfare, notwithstanding the absence of improvements in income distribution. This picture has changed substantially since the beginning of the 80s. Since then, not only has the pace of growth slowed down, but also the division of income has become more unequal. Needless to say, the combination of these two factors led to a sharp decline in the well-being of the poor, as well as to an increase in the number of people that lack satisfaction of their most basic needs.

The magnitude of the distributive problem, as well as the urgency to ameliorate it, have motivated a number of studies geared to identifying the mechanisms at work to produce skewness in the distribution of income and to subsidizing policies aimed at smoothing it [see Sedlacek and Barros (1989), Ramos and Reis (1989), and Camargo and Giambiagi (1991)]. This paper fits well into this line of research. In particular, our objective is to test the existence of segmentation in the Brazilian labor market and to assess the extent to which it contributes to inequality in Brazil.

Segmentation occurs when equally endowed workers are differently rewarded. If it is present, the labor market is generating inequality, rather than just revealing it (as when wages differ because workers have distinct skills).[1] Segmentation may arise in several fashions, associated with different partitions of the labor market, such as by region, industry, institutional traits, and so on. Here we are interested in industry segmentation. Thus, besides appraising the extent of interindustry wage differentials and its contribution to inequality, we test the hypothesis that these differentials are not entirely due to dissimilarities in the workers' productive endowments.

Segmentation seems to be, in principle, incompatible with profit maximization under perfect competition. Therefore, the observation of equally endowed workers receiving different wages induced the development of a series of models to explain this outcome, including the efficient-wage theory -- an elegant attempt at reconciling the empirical evidence with the major implications of the neoclassical theory. There are at least five different efficient wage models. The first relates higher wages to lower turnover rates. Two others rely on a positive relation between higher wages and workers' effort and productivity. A fourth espouses the idea that under asymmetric information higher wages are an efficient way of sorting out the most productive workers. A final fifth model draws on equity considerations inside the firm, that lead to low dispersion of wages among different occupations. Dickens and Katz (1987), as well as Krueger and Summers (1988), review the efficient wage literature in the context of segmented labor markets.

[1]These situations are distinct not only from an ethical standpoint, but also because they require different kind of policies to reduce the associated inequality. Therefore, it is important to develop a notion of their relative importance in order to achieve an adequate diagnosis of the nature of the inequality generation process in Brazil.

Moreover, Dickens and Katz (1987) examine their consistency *vis-à-vis* the empirical evidence for the US economy.

Besides verifying the existence of wage differentials, several studies show that the intersector wage structure is stable over time and quite similar across countries [**e.g.**, Dickens and Katz (1987), Krueger and Summers (1988), Katz and Summers (1989), Abuhadba and Romaguera (1993), Gittleman and Wolff (1993)]. These findings apparently cannot be explained by differences in the quality of either workers or jobs, rates of return to schooling, strength of unions, discrimination, or measurement errors, reinforcing the hypothesis of segmentation.

An alternative explanation was advanced by Krueger and Summers (1988), according to whom industry segmentation is explained by the fact that "workers in high wage industries receive noncompetitive rents". The existence of such rents raises important questions, related not only to the workings of the labor markets, but also to the optimality of government intervention via industrial and trade policies. In this line, Katz and Summers (1989) show that imperfections in the labor market may be more important to the design of strategic trade policies than the existence of monopoly rents in the product market, a **rationale** espoused by Dixit (1989) in his analysis of the American automobile industry. Therefore, segmentation is important not only from a distributive point of view, but also from the standpoint of industrial and trade policies, both undergoing significant change in Brazil. We touch lightly on this topic.

This study is organized in four sections. The coming one contains an evaluation of the contribution of interindustry wage differentials to earnings inequality through a decomposition exercise. Next, we estimate the magnitude and significance of industry segmentation via regression analysis. Here we also examine the temporal stability of wage differentials and compare its structure to those observed in the USA and Sweden. A final section presents the paper's main conclusions.

2. INTERINDUSTRY WAGE DIFFERENTIALS AND WAGE INEQUALITY

This section evaluates the contribution of interindustry wage differentials to earnings inequality in Brazil. The idea is to measure the reduction in inequality that results from eliminating the differences in average earnings among workers employed in different industries. We call this term the *gross contribution* of the variable industry to the overall wage inequality.

2.1. Methodology and Data Basis

Assuming a partition of the population in **g** groups (according to sectors of activity, for instance), a measure of inequality is said to be additively decomposable when it can be written as:

$$I = I(p_g, R_g, I_g) = I_B(p_g, R_g) + \sum_g w(p_g, R_g) I_g \qquad (1)$$

where $\mathbf{p_g}$ represents the fraction of the labor force employed in the g-th group, $\mathbf{R_g}$ is its relative mean income, and $\mathbf{I_g}$ is the wage dispersion within this group as measured by the index I . The term $\mathbf{I_B}$ in the right side of (1) corresponds to the inequality **between** groups (**i.e.**, the amount of inequality that would be observed in the case of a wage redistribution in the interior of each group, in such a fashion that, at the end, all workers in a group would receive the same wage). The second term in the right-hand side -- from here on called $\mathbf{I_W}$ -- reflects the inequality **within** groups; **i.e.**, the share of overall inequality that is associated to factors other than those involved in the particular partition under study. It represents the degree of inequality that would be observed if all groups had the same average wage. Notice that $\mathbf{I_w}$ is the weighted average of the internal inequalities, the weights -- $\mathbf{w(p_g,R_g)}$ -- being a function of the population share and average earnings of each group.

One can thus estimate the contribution of interindustry wage differentials to the overall wage inequality at a given point in time as the fraction of this inequality that would be eliminated if the average wages of all groups were equalized, while keeping the internal dispersions unchanged. The **rationale** behind this exercise is that all the effect of this sort of segmentation would be captured by differences in average wages at sector level.

Amongst the most commonly used inequality indices -- the Gini coefficient, the variance of the logarithms of income, the coefficient of variation, and the Theil measures T and L -- the last three are the only additively decomposable. In this paper we work with the Theil T, mainly because of its widespread use in the literature [see Ramos (1990)].

Our data come from the 1981, 1985, and 1990 PNADs, a household survey conducted yearly by IBGE, the Brazilian Bureau of Statistics. By examining these three years, we are able not only to assess the stability of the wage structure, but also its sensitivity to changes in the macroeconomic, political, technological and managerial environment that took place in the 1981/90 period. The working sample is made up of males, aged between 18 and 65, working at least 20 hours per week in their main occupation, living in urban areas, and who were not

employers[2] (see Table 1 for sample screening: the fall in the number of observations between 1985 and 1990 is due to a change in the survey's sample weights). One and two digit aggregations, with 11 and 45 industries, respectively, are used in the analysis.[3]

Table 1

Sample Screening (number of workers after each filter)

Year	1981	1985	1990
Initial Sample Size	357.485	390.161	235.589
Urban Regions	280.833	305.889	784.881
Males	133.378	145.213	87.569
Age (between 18 and 65)	94.157	104.857	62.855
Positive Income	78.074	88.716	52.610
Hours Worked ≥ 20	77.237	87.966	52.034
Not Employers	72.056	81.864	47.612
Other -- Final Sample Size	71.710	80.958	47.293

2.2. Results

Before presenting our results, it is interesting to look at the outcomes of similar studies, for distinct variables (**i.e.**, partitions of the labor force), so as to have a benchmark for comparison. Table 2 displays the main findings in the literature. Differences in education are by far the most relevant cause of earnings inequality in Brazil. This variable's gross contribution ranges from 30 to 50% of overall inequality, depending on the period and sample of each study. Among the other variables, geographic region and sector of activity were found to be relatively important by Langoni (1973), each explaining between 11 and 15% of overall inequality (the latter, however, looses importance in more recent periods). Age has shown a consistently low contribution, while gender, somewhat surprisingly, explains almost nothing of the dispersion of earnings. More recent studies considered the role of position in occupation (**i.e.**, the partition according to classes of workers: employers, employees, and self-employers), which has a contribution a bit above that of age, ranging from 8 to 13% in the eighties and late seventies.

[2]The chief reasons for such choice are related to selectivity, nature of the earnings formation process, and survey coverage.

[3]See Tables 4 and 5 for a list of the one- and two-digit industries considered in our analysis.

Table 2

Contribution to Inequality: Results from Other Studies

Variable	Source	Number of Groups	Period	Contribution (%)
Education				
	Langoni (1973)	5	1960/70	35-43
	Reis and Barros (1990)	5	1976/86	35-50
	amos and Trindade (1991)	5	1977/89	30-36
Age				
	Langoni (1973)	8	1960/70	7-10
	Ramos (1990)	5	1977/85	8-9
	Bonelli and Ramos (1993)	5	1977/89	7-9
Industry				
	Langoni (1973)	3	1960/70	13-15
	Ramos (1990)	9	1977/85	5-7
	Bonelli and Ramos (1993)	9	1977/89	5-7
Gender				
	Langoni (1973)	2	1960/70	2-3
Region				
	Langoni (1973)	6	1960/70	13-14
Position in Occupation				
	Ramos (1990)	3	1977/85	8-11
	Bonelli and Ramos (1993)	3	1977/89	9-13

The estimates for the contribution to inequality of interindustry earnings differentials resulting from the decomposition exercise described before are shown in Table 3.[4] Considering the one-digit aggregation, for which results are more readily comparable with those in Table 2, we may conclude that industry segmentation ranks second only to education as an explanation to inequality.[5] This picture is reinforced when the thinner two-digit partition is used, with the explanatory power jumping to 20% and over. This is an indication that there are sizable differences in average earnings within the groups that form the more aggregate, and traditional, partitions considered before, which drives up the relevance of industry differences to the understanding of earnings inequality. In other words, pending a more detailed examination, there is evidence that the interindustry earnings differentials matter for inequality, and it might be the case that they are reflecting a phenomenon of segmentation of the economy. A closer

[4]The parameters related to each taxonomy are shown in the Appendix.

[5]Due basically to the exclusion of employers from the sample, the one-digit aggregation yields higher figures than those found in Ramos (1990).

inspection of this possibility is at stake in the following section, when the sector distribution of other determinants of income will be taken into account.

Table 3

Contribution of Industry Segmentation to Earnings Inequality (%)

Aggregation/Year	1981	1985	1990
One-Digit Industries	14,4	14,0	13,0
Two-Digit Industries	22,5	21,5	19,6

3. STRUCTURE AND STABILITY OF INTERINDUSTRY SEGMENTATION

The objective of this section is to assess the existence of industry segmentation in Brazil's labor market. We also try to appraise the temporal stability of wage differentials and its compatibility with results obtained in similar studies for the American and Swedish economies. Given the contrast in size, income distribution, state intervention and competition policies among these three economies, our study should shed light on the causes and consequences of these interindustry wage differentials.

The literature on interindustry wage differentials has boomed in recent years. Although most of it is concerned with the American case, studies for other developed countries are also available [**e.g.**, Edin and Zetterberg (1992) and Gittleman and Wolff (1993)]. Abuhadba and Romaguera (1993) present and analyze the available evidence for Latin America, while Gatica, Mizala and Romaguera (1991) estimate the interindustry wage differentials in Brazil. The four main extensions accomplished by our analysis relative to the latter are: **a**) it covers the entire country, as opposed to the city of São Paulo; **b**) it examines a wide array of sectors, as opposed to the manufacturing industry; **c**) it looks at hourly wages, as opposed to monthly wages; and **d**) it covers three different years, as opposed to a single one.

3.1. Methodology

Two kinds of interindustry wage differentials are estimated in this subsection. The first reflects the "gross", or no-controls, difference in average wages among industries. This was the variable used in last section's analysis. We call this measure total wage differentials. To estimate these we run the following regression:

$$\ln S = c_0 + c_1 D_1 + c_2 D_2 + \ldots + c_k D_k + u_d \qquad (2)$$

where S is the income per hour worked received in the main occupation and $\mathbf{D_1}$, $\mathbf{D_2}$, ..., $\mathbf{D_k}$ are sector dummies.

The second measure, which we call wage premium, reflects the wage differentials among workers equally qualified employed in different sectors; that is, with-controls differentials. To appraise these premiums we regress the worker's hourly income in the main activity on a set of variables reflecting his human capital, family position, geographical situation, and labor market status, besides industry affiliation. Formally:

$$\ln S = b_0 + b_1 D_1 + ... + b_k D_k + f_1 E + f_2 E^2 + f_3 I + f_4 I^2 + f_5 I.E + \\ + f_6 Rg + f_7 L + f_8 M + f_9 H + u_p \qquad (3)$$

where, E= number of years of schooling; I = age (years); Rg = region dummies [North/Center-West, South, Southeast and Northeast (base)]; L = legal status dummy,[6] formal versus informal (base); M = dummy to indicate residence in metropolitan area or not (base); and H = dummy to indicate whether head of family or not (base).

Equations (2) and (3) were estimated by OLS for 1981, 1985 and 1990 using data from PNAD (see previous section). The wage differentials ($\mathbf{d_i}$) and premiums ($\mathbf{p_i}$) are measured as the deviation from the employment-weighted average of the coefficients of the sector dummies in equations (2) and (3). Formally:

$$d_i = c_i - \mathbf{a'c}; \qquad i = 1,k \qquad (4)$$

$$p_i = b_i - \mathbf{a'b}; \qquad i = 1,k \qquad (5)$$

where **c** and **b** are the vectors of dummy coefficients in (2) and (3) and **a** is the vector of sector shares in the labor force. The standard deviations of these variables may be estimated according to:

$$\text{var } (\mathbf{d}) = (I - \mathbf{1.a'}) \text{ var } (\mathbf{c}) (I - \mathbf{1.a'})' \qquad (6)$$

$$\text{var } (\mathbf{p}) = (I - \mathbf{1.a'}) \text{ var } (\mathbf{b}) (I - \mathbf{1.a'})' \qquad (7)$$

where **1** is a vector of ones and the matrices var (**c**) and var (**b**) are obtained directly from the output of the OLS regressions.

To measure the degree of interindustry variation in differentials and premiums we use the weighted interindustry standard deviation, corrected to purge the sample

[6] This variable reflects the possession or not of work cards, which grant access to social security, unemployment benefits and the alike.

variation of the OLS estimators. Formally, the interindustry dispersion is measured by:

$$s_d^* = [\Sigma_i a_i d_i^2 - \Sigma_i a_i w_{ii}^2 + \Sigma_i \Sigma_j a_j a_i w_{ij}]^{1/2} \quad (8)$$

$$s_p^* = [\Sigma_i a_i p_i^2 - \Sigma_i a_i v_{ii}^2 + \Sigma_i \Sigma_j a_j a_i v_{ij}]^{1/2} \quad (9)$$

where $\mathbf{w_{ii}}$ and $\mathbf{v_{ii}}$ are the OLS estimates of the variance of $\mathbf{d_i}$ and $\mathbf{p_i}$, respectively, and $\mathbf{w_{ij}}$ and $\mathbf{v_{ij}}$ are the OLS estimates of cov($\mathbf{d_i}$, $\mathbf{d_j}$) and cov($\mathbf{p_i}$, $\mathbf{p_j}$), respectively.[7] In addition to using the interindustry standard deviation, we test the hypothesis that there is not segmentation using a **F** test for the null that the coefficients of all sector dummies are jointly zero.

3.2. Empirical Results

The results obtained for the log-wage differentials and premiums, estimated according to (4) and (5), are presented in Tables 4 and 5 for one and two-digit industry aggregations, respectively. The results make clear that workers in some sectors are better paid than in others, even when they share the same personal attributes and job characteristics.

Interindustry wage differentials are significant in the three years and, as expected, are more salient for the thinner two-digit aggregation. The weighted standard deviation $\mathbf{s_d^*}$ indicates that interindustry wage dispersion increased significantly from 1981 to 1985, coming down in 1990, although remaining higher than in 1981. Controlling for differences in workers' education, age, family position, geographic situation, and labor market status reduces the dispersion in hourly wages to less than half of its no-controls level. This suggests that there are relevant differences in the characteristics of the labor force in distinct sectors and that firms value these differences.

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[7] In the case of wage premiums, we have that $\mathbf{p_i} = \mathbf{p_i^*} + \mathbf{e_i}$, where $\mathbf{p_i^*}$ is the true wage premium, $\mathbf{p_i}$ its unbiased estimator and $\mathbf{e_i}$ the estimator's sampling error. Then,

$\Sigma_i a_i (p_i - p)^2 = \Sigma_i a_i (p_i^* - p^*)^2 + \Sigma_i a_i (e_i - e)^2 + 2 \Sigma_i a_i (p_i^* - p^*) (e_i - e)$

where $e = \Sigma_i a_i e_i$, $p^* = \Sigma_i a_i p_i^*$ and $p = \Sigma_i a_i p_i = 0$. Using the fact that

$Cov(p_i^*, e_i) = 0$ and that

$E(e^2) = \Sigma_i \Sigma_j a_i a_j E(e_i e_j) = \Sigma_i \Sigma_j a_i a_j Cov(p_i, p_j)$;

we derive an unbiased estimator of the true interindustry variance from

$E(\Sigma_i a_i (p_i^* - p^*)^2) = E(\Sigma_i a_i (p_i - p)^2) - E(\Sigma_i a_i (e_i - e)^2) = E(\Sigma_i a_i p_i^2) - E(\Sigma_i a_i e_i^2) + E(e^2) = E(\Sigma_i a_i p_i^2) - \Sigma_j a_i Var(p_i) + \Sigma_i \Sigma_j a_i a_j Cov(p_i, p_j)$.

Table 4

Estimated Log-Wage Differentials and Premiums for One-Digit Industries

Industry	1981		1985		1990	
	Dif.	Prem.	Dif.	Prem.	Dif.	Prem.
1 - Agribusiness[c]	-0.736	-0.269	-0.693	-0.243	-0.807	-0.346
2 - Mining	0.295	0.387	0.294	0.427	0.141	0.267
3 - Heavy Industry	0.390	0.234	0.343	0.208	0.302	0.134
4 - Light Industry	-0.136	-0.043	-0.169	-0.055	-0.207	-0.075
5 - Construction	-0.320	-0.054	-0.396	-0.107	-0.304	-0.042
6 - Commerce	-0.151	-0.077	-0.137	-0.070	-0.145	-0.072
7 - Finance and Insurance	0.978	0.493	0.978	0.481	1.072	0.542
8 - Transport.Communic.	0.084	0.071	0.153	0.138	0.162	0.158
9 - Services	0.010[a]	-0.071	-0.043	-0.102	-0.055[a]	-0.104
10 - Public Administration	0.275	-0.046	0.354	0.026	0.385	0.111
11 - Other	0.204	0.095	0.026[a]	0.003[a]	-0.004[a]	-0.012[a]
Weighted SD	0.345*	0.155*	0.361*	0.162*	0.353*	0.161*
Sample Size	71710	71710	80958	80958	47293	47293

[a]Not statistically different from 0 at 5 percent significance level.
[b]Not statistically different from 0 at 1 percent significance level.
[c]Agriculture and livestock, and animal and vegetal extraction.
* F-Test rejects hypothesis that all differentials/premiums are simultaneously equal to zero.

In spite of this, significant differences in workers' earnings remain. About half of the interindustry wage differentials is not explained by characteristics of the workers or their jobs: the ratio between the highest (Oil Extraction) and lowest premiums (Services to Families and Agriculture and Livestock) is three, as against a ratio of five between the highest and lowest wages. This result implies that there are workers apparently equally qualified receiving different remuneration, suggesting that industry segmentation may be an important source of income inequality in Brazil. Considering the reduction of wage dispersion achieved with the introduction of controls, we may roughly estimate that the ***net*** contribution of industry segmentation to inequality ranges from 7 to 11% of total earnings variance (using the two-digit sector aggregation).

Table 4 shows there are considerable differences in wages among one-digit industries. One group of sectors, comprising finance and insurance, heavy industry and mining, pay wages far above market average and positive premiums, whereas the opposite happens to agribusiness, light industry, construction, commerce and services. This contrast supports the case for rents as an explanation of wage premiums: the former sectors are characterized by high market power and extra-profits derived from inflation or the exploitation of the subsoil, whereas the latter are much more atomized sectors. Note, also, that in both groups of sectors, except for mining, the introduction of controls lowers the **absolute value** of differentials.

Table 5

Estimated Log-Wage Differentials and Premiums for Two-Digit Industries

	1981		1985		1990	
Industry	Dif.	Prem.	Dif.	Prem.	Dif.	Prem.
1 - Vegetal and Animal Extraction	-0.578	-0.177	-0.655	-0.177	-0.669	-0.168
2 - Agriculture and Livestock	-0.759	-0.318	-0.699	-0.283	-0.834	-0.402
3 - Fuel Extraction	0.882	0.718	0.904	0.723	0.860	0.705
4 - Non-Fuel Mining	0.030[a]	0.199	0.103	0.324	-0.099[a]	0.113
5 - Cement, Clay, Glass, Ceramics	-0.224	-0.064	-0.326	-0.113	-0.360	-0.132
6 - Metallurgy	0.324	0.260	0.280	0.225	0.235	0.146
7 - Machinery, Excluding Electrical	0.569	0.344	0.466	0.282	0.502	0.221
8 - Electrical Machinery and Equip.	0.597	0.295	0.567	0.282	0.561	0.207
9 - Transport Equipment	0.566	0.356	0.540	0.345	0.512	0.233
10 - Paper	0.413	0.299	0.262	0.173	0.211	0.122
11 - Rubber	0.463	0.246	0.350	0.245	0.299	0.119[b]
12 - Plastic Products	0.262	0.076[b]	0.197	0.094	0.276	0.102
13 - Chemical	0.451	0.271	0.412	0.219	0.405	0.150
14 - Oil Refining	1.011	0.579	1.302	0.632	0.870	0.411
15 - Pharmaceuticals	0.816	0.354	0.837	0.339	0.517	0.125[a]
16 - Printing	0.311	0.086	0.160	0.042[a]	0.220	0.060[a]
17 - Wood	-0.369	-0.138	-0.411	-0.189	-0.395	-0.161
18 - Furniture	-0.160	-0.059	-0.185	-0.063	-0.213	-0.044[a]
19 - Leather	-0.229	-0.198	-0.292	-0.192	-0.361	-0.078[a]
20 - Perfumary, Soaps and Candles	0.444	0.218	0.316	0.175	0.070[a]	-0.011[a]
21 - Textiles	0.037[a]	0.034[a]	-0.047[a]	0.032	-0.084[b]	-0.038[a]
22 - Apparel	0.114[b]	0.006[a]	-0.035[a]	-0.056[a]	-0.097[a]	-0.006[a]
23 - Footwear	-0.074[a]	0.075[b]	-0.113	0.051[a]	-0.119[b]	0.034[a]
24 - Food	-0.199	-0.083	-0.215	-0.086	-0.253	-0.124
25 - Tobacco	0.404	0.227	0.551	0.240	0.520	0.304
26 - Beverages	0.035[a]	0.026[a]	0.092[b]	0.035[a]	-0.091[a]	-0.053[a]
27 - Construction	-0.320	-0.069	-0.396	-0.122	-0.304	-0.051
28 - Trade	-0.151	-0.081	-0.137	-0.072	-0.146	-0.072
29 - Financial Institutions	0.991	0.538	0.982	0.516	1.094	0.581
30 - Insurance	0.792	0.387	0.912	0.402	0.756	0.282
31 - Road Transportation	-0.065	0.009[a]	-0.014[a]	0.082	0.054	0.140
32 - Rail and River Transportation	0.534	0.276	0.541	0.347	0.568	0.293
33 - Air Transportation	1.076	0.488	1.034	0.569	0.885	0.471
34 - Communications	0.490	0.210	0.695	0.235	0.479	0.112
35 - Boarding and Eating	-0.376	-0.259	-0.394	-0.253	-0.429	-0.278
36 - Repair Services	-0.187	-0.053	-0.170	-0.018[a]	-0.156	-0.001[a]
37 - Private Health Services	0.682	0.075	0.726	-0.015[a]	0.604	-0.032[a]
38 - Private Education Services	0.542	0.060[b]	0.403	-0.078	0.361	-0.168
39 - Real State	0.437	0.135	0.214	-0.013[a]	-0.035[a]	-0.154
40 - Private Household	-0.449	-0.331	-0.544	-0.362	-0.501	-0.335
41 - Business Services	0.471	0.149	0.481	0.123	0.471	0.122
42 - Welfare Services	0.131	-0.078	-0.029[a]	-0.211	-0.140	-0.270
43 - Public Health and Education	0.400	-0.112	0.523	-0.044[b]	0.576	0.005[a]
44 - Public Administration	0.198	-0.067	0.273	0.012[a]	0.306	0.109
45 - Public Utilities	0.556	0.286	0.672	0.323	0.676	0.325
46 - Other	0.204	0.101	0.026[a]	0.007[a]	-0.004[a]	-0.009[a]
Weighted SD	0.411*	0.200*	0.432*	0.203*	0.417*	0.196*
Sample Size	71710	71710	80958	80958	47293	47293

Note: See footnotes to Table 4.

This suggests that in general **the workers that receive wage premiums are the most skilled ones**. Therefore, the non-competitive behavior of the labor market tends to reinforce, rather than attenuate, the unequal distribution of income in Brazil.

This conclusion is perhaps more striking when we examine the two-digit industries. Observe that sectors that concentrate less skilled workers -- as agriculture and livestock, vegetal and animal extraction, wood, leather, construction, and private household, among others -- also tend to show negative wage premiums. On the other hand, the segments more intensive in high-skilled labor display positive premiums. Again, the absolute value of these premiums is significantly reduced when the set of control variables is taken into account.

Oil refining, financial institutions, air transportation and fuel extraction are the sectors with largest mean wages, in this order, for the average of the three years. On average, they pay wages 2.5 times the market mean. These are also the industries with largest wage premiums, although the order changes to fuel extraction,[8] oil refining, financial institutions and air transportation. These industries share some common characteristics: they are dominated by very few firms, they are technology-intensive and, except for financial institutions, they are also very capital-intensive.

In addition, in all the four sectors state-owned enterprises play a very important role.[9] In fact, the two sectors with largest premiums, fuel extraction and oil refining, are state monopolies. Other sectors in which state-owned enterprises answer, or used to do so in the years covered here, for a significant share of output also show positive and usually high wage premiums: Non-fuel mining, metallurgy, chemical, rail and river transportation, public utilities and communications. These results match those obtained by Macedo (1986), who concluded that equally qualified workers are better paid in state-owned than in private enterprises. In spite of this, note that the same does not apply to traditional state activities: public administration and public health and education services.[10]

A noteworthy result, also observed in other studies, is that the structure of wage premiums and differentials are very similar. Spearman rank correlation coefficients between wage differentials and premiums are quite high, as shown following, and statistically significant for the three years. This implies that either wage premiums

[8] Notice that fuel extraction, a state monopoly, is the sector with the lowest difference between differentials and premiums among the highest paying industries.

[9] Air transportation, however, later became one-hundred percent private.

[10] Terrel (1993) analyzes the data for Haiti and reachs the conclusion that there the workers of state-owned enterprises earn a sizable rent too. Distinctly from the Brazilian case, though, public sector workers in Haiti also enjoy positive wage premiums.

are an important component of wage differentials, or wage premiums tend to accrue to workers that are best qualified, or both. The evidence disclosed by Tables 4 and 5 suggests that both phenomena take place in Brazil.

Spearman Rank Correlation Coefficients between Wage Differentials and Premiums

Aggregation/Year	1981	1985	1990
One-Digit	0.90	0.91	0.79
Two-Digit	0.91	0.86	0.84

Before concluding that wage premiums are due to segmentation it is necessary to exclude alternative explanations. One such explanation is that wage premiums reflect a compensation for differences in work disutilities, that is, the quality of job positions, as workers may require extra payment for jobs in unpleasant places, that risk their lives or compromise their health.[11] Another possible explanation is that wage premiums reflect unobserved differences in workers' skills. Following a practice in the literature (**e.g.**, Abuhadba and Romaguera (1993) we test these two hypotheses by running regressions (2) and (3) separately for different occupations. The underlying idea is that job disutilities are much more specific to certain occupations than to the sectors themselves. In the same fashion, it is unlikely that firms that need especially good managers also demand above average blue collar workers.

Table 6 presents wage differentials and premiums for the two-digit industry aggregation in 1985 for three different occupations: technical, managerial and blue collar.[12] Segmentation is also present within each occupation, even though, as expected, the dispersion of average wages among industries is less significant for individual occupations than for the total sample.[13] The Spearman rank correlation coefficients for the pairs technical versus managerial, technical versus blue collar and managerial versus blue collar range from 0.65 to 0.80 and are statistically significant in all cases. In short, the existence of wage premiums for individual occupations and the likeness of their structures constitute an indication that they are caused neither by unobserved differences in skills nor by differences in job quality.

[11] Krueger and Summers (1988) test -- and reject -- this hypothesis correlating wage premiums with a set of 10 measures of job quality.

[12] Results for the one-digit aggregation are reported in the Appendix.

[13] This is because workers' skills within occupations are more homogeneous than in the overall economy.

Table 6

Estimated Log-Wage Differentials and Premiums by Occupation for Two-Digit Industries — 1985

Industry	Technical		Managerial		Blue Collar	
	Dif.	Prem.	Dif.	Prem.	Dif.	Prem.
1 - Vegetal and Animal Extraction	0.048	-0.131	-0.409	-0.309	0.047	-0.072
2 - Agriculture and Livestock	-0.076	-0.090	-0.563	-0.136	-0.189	-0.094
3 - Fuel Extraction	0.820	0.650	0.640	0.367	1.110	0.910
4 - Non-Fuel Mining	0.259	0.542	0.155	0.300	0.571	0.523
5 - Cement, Clay, Glass, Ceramics	-0.212	0.042	-0.111	-0.042	-0.299	-0.174
6 - Metallurgy	0.307	0.224	0.074	0.067	0.315	0.205
7 - Machinery, Excluding Electrical	0.122	0.155	0.166	0.163	0.522	0.291
8 - Electrical Machinery and Equip.	0.321	0.236	0.380	0.198	0.519	0.269
9 - Transport Equipment	0.434	0.270	0.285	0.228	0.625	0.343
10 - Paper	-0.056	0.171	0.065	0.018	0.403	0.187
11 - Rubber	0.464	0.567	0.186	0.099	0.398	0.191
12 - Plastic Products	-0.088	-0.025	0.357	0.045	0.187	0.050
13 - Chemical	0.233	0.208	0.214	0.088	0.454	0.256
14 - Oil Refining	1.057	0.677	1.010	0.468	1.207	0.726
15 - Pharmaceuticals	0.159	0.179	-0.014	-0.001	0.810	0.417
16 - Printing	-0.203	-0.091	-0.282	-0.130	0.283	0.108
17 - Wood	-1.135	-0.524	-0.343	-0.141	-0.275	-0.183
18 - Furniture	0.173	-0.178	-0.193	-0.123	-0.076	-0.072
19 - Leather	-1.560	-0.535	-0.294	-0.241	-0.247	-0.223
20 - Perfumary, Soaps and Candles	0.298	0.226	-0.026	0.097	0.420	0.145
21 - Textiles	-0.110	-0.037	-0.139	-0.103	0.057	0.027
22 - Apparel	0.102	0.036	-0.129	-0.194	-0.133	-0.143
23 - Footwear	-0.608	-0.088	0.082	0.216	-0.032	-0.005
24 - Food	-0.037	0.078	-0.190	-0.076	-0.185	-0.130
25 - Tobacco	0.419	0.081	0.383	-0.051	0.397	0.174
26 - Beverages	0.138	-0.035	0.113	0.070	0.183	0.058
27 - Construction	0.013	0.056	-0.302	-0.153	-0.294	-0.149
28 - Trade	-0.264	-0.196	-0.353	-0.193	-0.137	-0.141
29 - Financial Institutions	0.484	0.384	0.421	0.378	0.506	0.146
30 - Insurance	0.474	0.265	0.333	0.231	0.193	0.117
31 - Road Transportation	0.445	0.177	-0.407	-0.243	0.124	0.074
32 - Rail and River Transportation	0.608	0.391	0.065	-0.064	0.854	0.579
33 - Air Transportation	0.383	0.028	0.513	0.275	1.018	0.579
34 - Communications	0.016	0.079	0.394	0.118	0.881	0.462
35 - Boarding and Eating	-0.659	-0.006	-0.467	-0.313	-0.107	-0.136
36 - Repair Services	0.222	-0.055	-0.660	-0.311	0.000	0.035
37 - Private Health Services	0.013	-0.011	-0.425	-0.363	0.062	-0.113
38 - Private Education Services	-0.401	-0.247	0.029	-0.208	0.004	-0.133
39 - Real State	-0.236	-0.248	-0.459	-0.330	0.086	0.073
40 - Private Household	-0.924	0.016	-0.675	-0.404	-0.196	-0.214
41 - Business Services	-0.080	0.016	-0.315	-0.135	0.172	0.078
42 - Welfare Services	-0.675	-0.590	-0.310	-0.246	0.042	-0.083
43 - Public Health and Education	-0.063	-0.234	-0.043	-0.222	0.286	0.059
44 - Public Administration	0.186	0.015	0.047	-0.148	-0.083	-0.157
45 - Public Utilities	0.636	0.332	0.284	0.048	0.663	0.418
46 - Other	-0.370	0.019	-0.158	-0.124	0.100	0.018
Weighted SD	0.322*	0.204*	0.329*	0.235*	0.330*	0.192*
Sample Size	5099	5099	11501	11501	25936	25936

Note: See footnotes to Table 4.

Spearman Rank Correlation Coefficients between Wage Premiums for Different Occupations
(1985)

Aggregation/Year	Technical x Managerial	Technical x Blue Collar	Managerial x Blue Collar
One-Digit	0.80	0.76	0.65
Two-Digit	0.70	0.72	0.71

A third alternative is that wage premiums reflect the existence of discrimination in the labor market; **i.e.**, the fact that workers are being paid differently due to non-productive attributes. If employment composition according to these non-productive attributes varies from sector to sector, average industry wages will differ, even after controlling for skill differentials. Classic cases of this phenomenon are sex and color discrimination. Since we work only with male workers, the hypothesis of sex discrimination is discarded. To assess the importance of color discrimination, we have estimated equations (2) and (3) separately for white and non-white workers using 1990 data.[14] If there exists such a discrimination and it plays a prominent role in the explanation of the wage premiums, we should expect much smaller dispersion for these premiums within each group -- white and non-white workers -- than for the entire sample.

Table 7 shows the results we obtained for two-digit industries.[15] Note that the weighted standard deviations of the wage premiums do not change substantially for either group. As a matter of fact, it is even greater in the case of white workers. Spearman rank correlation coefficients between wage premiums for white and non-white workers, in 1990, is equal to 0.90 and 0.73 for one and two-digit aggregations, respectively. The presence of wage premiums for both white and non-white workers and their likeness for the two groups indicates we should discard discrimination as a major cause of the results previously observed.

A fourth alternative explanation is that wage premiums reflect a transitory situation of excess labor demand in certain sectors, coupled with a short-run rigidity in labor allocation among sectors. We try to assess the likelihood of this explanation by comparing the results obtained for 1981, 1985 and 1990. Note that this not only covers a 10-year period, long enough to allow for labor mobility, but also quite different points in the economic cycle (1981 and 1990 are years marked by the beginning of deep recessions, whereas 1985 shows a very good economic

[14] The only year for which this information is available.

[15] Results for the one-digit aggregation are reported in the Appendix.

Table 7

Estimated Log-Wage Differentials and Premiums by Color for Two-Digit Industries -- 1990

Industry	White		N. White	
	Dif.	Prem.	Dif.	Prem.
1 - Vegetal and Animal Extraction	-0.727	-0.269	-0.448	-0.091
2 - Agriculture and Livestock	-0.883	-0.441	-0.687	-0.360
3 - Fuel Extraction	0.631	0.562	1.183	0.914
4 - Non-Fuel Mining	0.012	0.242	-0.009	0.048
5 - Cement, Clay, Glass, Ceramics	-0.384	-0.139	-0.244	-0.105
6 - Metallurgy	0.163	0.131	0.304	0.174
7 - Machinery, Excluding Electrical	0.369	0.180	0.572	0.292
8 - Electrical Machinery and Equip.	0.438	0.179	0.645	0.256
9 - Transport Equipment	0.438	0.235	0.474	0.194
10 - Paper	0.126	0.123	0.222	0.096
11 - Rubber	0.266	0.122	0.198	0.093
12 - Plastic Products	0.318	0.120	0.253	0.098
13 - Chemical	0.400	0.137	0.301	0.162
14 - Oil Refining	0.864	0.399	0.821	0.431
15 - Pharmaceuticals	0.534	0.209	0.315	-0.085
16 - Printing	0.170	0.033	0.256	0.101
17 - Wood	-0.444	-0.132	-0.316	-0.194
18 - Furniture	-0.290	-0.060	-0.117	-0.026
19 - Leather	-0.440	-0.102	-0.278	-0.034
20 - Perfumary, Soaps and Candles	0.251	0.111	-0.200	-0.195
21 - Textiles	-0.015	0.007	-0.102	-0.076
22 - Apparel	-0.024	0.110	-0.156	-0.142
23 - Footwear	-0.219	0.030	-0.070	0.018
24 - Food	-0.260	-0.103	-0.272	-0.169
25 - Tobacco	0.545	0.353	0.418	0.233
26 - Beverages	-0.105	-0.067	-0.040	-0.038
27 - Construction	-0.375	-0.085	-0.131	0.006
28 - Trade	-0.192	-0.096	-0.089	-0.047
29 - Financial Institutions	0.967	0.550	1.127	0.612
30 - Insurance	0.600	0.206	0.857	0.449
31 - Road Transportation	0.013	0.129	0.111	0.145
32 - Rail and River Transportation	0.523	0.247	0.667	0.382
33 - Air Transportation	0.806	0.467	0.806	0.362
34 - Communications	0.456	0.135	0.404	0.049
35 - Boarding and Eating	-0.532	-0.328	-0.293	-0.222
36 - Repair Services	-0.212	-0.016	-0.041	0.029
37 - Private Health Services	0.643	-0.258	0.157	-0.087
38 - Private Education Services	0.420	-0.154	0.021	-0.216
39 - Real State	-0.169	-0.175	0.082	-0.155
40 - Private Household	-0.553	-0.342	-0.370	-0.318
41 - Business Services	0.446	0.123	0.342	0.088
42 - Welfare Services	-0.132	-0.287	-0.132	-0.232
43 - Public Health and Education	0.621	-0.016	0.463	0.059
44 - Public Administration	0.325	0.105	0.292	0.123
45 - Public Utilities	0.613	0.285	0.694	0.387
46 - Other	-0.064	-0.058	0.011	0.049
Weighted SD	0.426	0.203	0.342	0.186
Sample Size	24914	24914	22379	22379

performance). Moreover, dramatic changes in the political arena took place during this period, starting with the epilogue of the military dictatorship, with tight control over union activity, and moving towards a more open setting in 1985 and, especially, in 1990, when a new democratically elected government took office.

In spite of all of this, we see that the structures of wage differentials and premiums remained quite stable. Spearman correlation coefficients for differentials and premiums are high and statistically significant.[16] These results indicate that inter-industry differences in hourly wages are not explained by short run factors and cannot be related to the economic cycle.[17]

Spearman Rank Correlation Coefficients for Wage Differentials and Premiums in Different Years

Aggregation/Year	1981 x 1985		1985 x 1990		1981 x 1990	
	Dif.	Prem.	Dif.	Prem.	Dif.	Prem.
One-Digit	0.95	0.92	0.98	0.93	0.91	0.87
Two-Digit	0.97	0.95	0.98	0.94	0.95	0.88

At last, it is interesting to examine to what extent the results obtained for Brazil conform with those reported in the literature for the USA and Sweden, as these countries are quite distinct in terms of size, income distribution, degree of state intervention, and competition policies. Table 8 presents wage differentials and premiums for the three countries for two-digit industries.[18] Visual inspection reveals that while the wage structures in Brazil and the USA are quite alike, the one for Sweden differs considerably from the other two. Brazil is by far the country with largest wage dispersion, both before and after controlling for worker and job characteristics. Sweden shows the most egalitarian wage structure, an outcome

[16] Although Spearman correlation coefficients are higher for the five-year differences than for the longer 10 year span, the latter is still quite high and significant.

[17] The interindustry wage premium dispersion is somewhat higher for the boom year of 1985 than for the recession years of 1981 and 1990, but while it increases from 1981 to 1990 for the one-digit aggregation, the opposite takes place for the two-digit aggregation.

[18] Results for the one-digit aggregation are reported in the Appendix.

that Edin and Zetterberg (1992) link to the way wages are negotiated in the country (collectively).[19] The reduction in wage dispersion with the introduction of controls is also largest for Brazil, with Sweden showing the smallest reduction, suggesting that differences in workers' characteristics or the value firms give to them are more substantial in Brazil.

A sector by sector comparison of wage differentials and premiums in Brazil and the USA confirms that the introduction of controls has a more significant impact in Brazil than in the USA. Three patterns are clearly visible. First, in several sectors, although wage differentials are considerably higher in Brazil, wage premiums do not differ much between the two countries. This is the case of printing, tobacco, communications, private education and health services and public utilities. Second, for other sectors -- including fuel extraction, electrical machinery, oil refining, financial institutions and insurance -- wage differentials and premiums are both much higher in Brazil than in the USA. As discussed before, these are sectors in which, except for electrical machinery, the share of state-owned enterprises in total output is very significant.

Finally, we observe that for most tradable sectors -- comprising mining, metallurgy, electrical and non-electrical machinery and equipment, transport equipment, rubber, plastics, oil derivatives, pharmaceuticals, textiles, apparel and footwear -- wage premiums are substantially lower in the USA than in Brazil. It follows, therefore, that the argument in favor of strategic trade policies -- raised by Katz and Summers (1989), based on the non-competitive behavior of the USA labor market -- also apply for the case of Brazil, even if wages in the latter answer for a much smaller share of total income than in the USA. Furthermore, considering that these are sectors for which Brazilian exports are significant, and increasingly more so, it also follows that wage premiums cause Brazil "to reap extra gains from trade". By the same token, the claim, voiced in some recent Gatt negotiations, that exports by developing countries rely on social dumping also seems misplaced, at least in the Brazilian case: wages may be, on average, lower in Brazil than in developed countries, but Brazilian exports are concentrated in sectors with relatively high wages. The results reported in Table 9 give more empirical substance to these assertions. For the three years considered here, workers employed in exporting industries received wages 21% above the economy's average, most of it the result of a 15-percent wage premium. Excluding agribusiness activities, these figures

[19] Note that the results for the USA do not include Agriculture and livestock, and Vegetal and animal extraction, that have negative wage differentials and premiums. Gittleman and Wolff (1993) estimate the wage in agriculture to be equal to half the average wage in the American economy. Thus, excluding those sectors reduces wage dispersion and lowers wage differentials and premiums for the other sectors. Notice, however, that because our sample contains only urban workers, our results can be compared to those for the USA with minor adjustments. For instance, excluding agriculture and livestock, and vegetal and animal extraction from our sample would reduce wage differentials and premiums in the remaining sectors by just 0.055 and 0.020, respectively.

Table 8

International Comparisons of Wage Differentials and Premiums for Two-Digit Industries

Industry	Brazil (1985)		USA (1984)		Sweden (1984)	
	Dif.	Prem.	Dif.	Prem.	Dif.	Prem.
1 - Vegetal and Animal Extraction	-0.655	-0.177			-0.120	-0.097
2 - Agriculture and Livestock	-0.699	-0.283			-0.160	-0.047
3 - Fuel Extraction	0.904	0.723		0.282*		
4 - Non-Fuel Mining	0.103	0.324		0.254*	0.036	0.024
5 - Cement, Clay, Glass, Ceramics	-0.326	-0.113	0.084	0.070	-0.009	0.008
6 - Metallurgy	0.280	0.225				
Primary Metals			0.269	0.169	0.017	0.011
Fabricated Metals			0.128	0.077		
7 - Machinery, excluding Electrical	0.466	0.282	0.299	0.149		
8 - Electrical Machinery and Equip.	0.567	0.282	0.177	0.085		
9 - Transport Equipment	0.540	0.345	0.375	0.211		
10 - Paper	0.262	0.173	0.220	0.168		
11 - Rubber	0.350	0.245	0.090	0.101		
12 - Plastic Products	0.197	0.094		0.041*		
13 - Chemical	0.412	0.219	0.343	0.192		
14 - Oil Refining	1.302	0.632	0.490	0.294		
15 - Pharmaceuticals	0.837	0.339		0.196*		
16 - Printing	0.160	0.042	0.055	0.033		
17 - Wood	-0.411	-0.189	-0.118	-0.030		
18 - Furniture	-0.185	-0.063	-0.120	-0.035		
19 - Leather	-0.292	-0.192		-0.103*		
20 - Perfumary, Soaps and Candles	0.316	0.175		0.264*		
21 - Textiles	-0.047	0.032	-0.146	-0.002		
22 - Apparel	-0.035	-0.056	-0.358	-0.153		
23 - Footwear	0.113	0.051		-0.140*		
24 - Food	-0.215	-0.086	0.039	0.052		
25 - Tobacco	0.551	0.240	0.248	0.236		
26 - Beverages	0.092	0.035		0.126*		
27 - Construction	-0.396	-0.122	0.163	0.113	0.066	0.069
28 - Trade	-0.137	-0.072				
Wholesale			0.108	0.040	0.073	0.044
Retail			-0.267	-0.139	-0.097	-0.054
29 - Financial Institutions	0.982	0.516	0.098	0.048	0.129	0.028
30 - Insurance	0.912	0.402	0.101	0.049	0.048	0.038
31 - Road Transportation	-0.014	0.082		0.121*		
32 - Rail and River Transportation	0.541	0.347				
Rail				0.268*		
River				0.114*		
33 - Air Transportation	1.034	0.569		0.367*		
34 - Communications	0.695	0.235	0.385	0.250	0.014	0.017
35 - Boarding and Eating	-0.394	-0.253	-0.605	-0.244	-0.223	-0.021
36 - Repair Services	-0.170	-0.018	-0.076	-0.085		
37 - Private Health Services	0.726	-0.015	-0.152	-0.034		
38 - Private Education Services	0.403	-0.078	0.078	-0.078		
39 - Real State	0.214	-0.013				
40 - Private Household	-0.544	-0.362	0.809	-0.339		
41 - Business Services	0.481	0.123				

(continua)

Industry	Brazil (1985)		USA (1984)		Sweden (1984)	
	Dif.	Prem.	Dif.	Prem.	Dif.	Prem.
42 - Welfare Services	-0.029	-0.211	-0.187	-0.203	-0.024	-0.030
43 - Public Health and Education	0.523	-0.044				
44 - Public Administration	0.273	0.012			0.048	0.028
45 - Public Utilities	0.672	0.323	0.349	0.201	0.029	0.006
46 - Other	0.026	0.007				
Standard Deviation	0.432	0.203**	0.270	0.144	0.083**	0.047**
Sample Size	80,957	80,957	135,595	135,595	1,340	1,340

Sources: Table 2, Katz and Summers (1989) and Edin and Zetterberg (1992).
*Estimated using Krueger e Summers (1988).
**Considers sectors not included in the table.

become even higher. Note, however, that the export-weighted average wage premium came down from 18.5% of the economy's mean wage in 1981 to 10.5% in 1990.

Table 9 shows, in addition, that Brazil differs from developed countries with respect to the wage premiums of import industries. In this fashion, whereas Katz and Summers (1989) observe that in the USA, as in other developed countries, import penetration is relatively high in industries with negative log-wage premiums, we observe that in Brazil the import-weighted average log-wage premium is high and above the export-weighted average wage premium. This result subsists even when we use the USA log-wage premiums, which approximate better the rents received by workers in countries that export to Brazil. This result implies that Brazilian policy makers should, based on the non-competitive behavior of labor markets and the arguments lined up by Katz and Summers (1989), contemplate selective import substitution as a welfare increasing policy.

Table 9

Trade-weighted log-wage differentials and premiums

Sector Weights	1981		1985		1990	
	Dif.	Prem.	Dif.	Prem.	Dif.	Prem.
Exports	0.21	0.17	0.20	0.16	0.16	0.10
Exports Excluding Agribusiness	0.25	0.19	0.25	0.18	0.20	0.12
Imports[a]	0.38	0.34	0.38	0.34	0.30	0.18
Imports, using American log-wage premia[a]		0.21		0.21		0.18

Sources: Tables 4, 5 and 8 and Pinheiro (1992).
Note: The table was built using the two-digit aggregation, except for vegetal and animal extraction and agriculture and livestock, which were grouped under agribusiness, and fuel and non-fuel mining, which were aggregated under mining.
[a]Excludes vegetal and animal extraction, and agriculture and livestock.

4. CONCLUDING REMARKS

The literature on interindustry wage differentials has mushroomed in recent years. Several studies for different countries have shown there are sizable differences in sector average wages, even after controlling for worker's attributes and job characteristics. Sweden, of the countries studied, seems to be the only case in which this phenomenon is not observed.

Our results reveal that Brazil follows the rule rather than the exception. Wage differentials were found to be very significant and more disperse than in the USA, not to mention Sweden. The reduction in wage dispersion that resulted from the introduction of controls was very large and proportionately more substantial than the one verified in the two countries, confirming the idea, widespread in the literature, that returns to workers' productive attributes are higher in developing countries than in more developed economies. It is worth stressing that both high and low-paying industries had the absolute value of their wage differentials reduced after the introduction of control variables (which brings wage dispersion down to half of its initial value). This implies that, in general, wage premiums accrue to the most skilled workers, who already benefit from the high rates of return to their skills. Therefore, the non-competitive behavior of the Brazilian labor market reinforces the country's high wage inequality.

Regarding this point, we have shown that wage differentials account for a significant share of earnings inequality in Brazil. Depending on the aggregation adopted (one or two-digit industries) and the year considered (1981, 1985, and 1990), the contribution of interindustry wage differentials ranges from 13.0 to 22.5% of total inequality, ranking second only to education as an explanatory variable for income inequality in Brazil. As the introduction of control variables reduces by half the interindustry wage dispersion, we can roughly estimate the contribution of labor market segmentation to wage inequality as being in the 7-11% interval.

Our findings also match most of the literature with respect to the robustness of the wage structure. In this fashion, we have obtained large and statistically significant rank correlations between wage differentials and premiums for the three years considered here for different occupations, as well as for white and non-white workers. This evidence led us to downplay the role of unobserved differences in workers' skills, differences in job quality, and discrimination for the explanation of such non-competitive behavior of labor markets. In addition, the stability of the wage structure over the 1981/90 period, both without and with controls, implies that wage premiums are not the outcome of short-run excess demand for labor in some sectors. Also, it suggests that neither the intense process of increasing bargaining power of workers that accompanied the redemocratization of the country, nor the closing and later opening of the economy to imports had significant effects on the wage structure.

Oil refining, financial institutions, air transportation and fuel extraction are the sectors with largest mean wages. These are also the industries with largest wage premiums, though the order changes to fuel extraction, oil refining, financial institutions and air transportation. There are some common characteristics among them: they are dominated by very few firms, they are technology-intensive, their workers belong to strong union organizations, and, except for financial institutions, they are also very capital-intensive. In addition, in all the four sectors state-owned enterprises play a very important role. In fact, the two sectors with largest premiums are state monopolies.[20]

Brazilian wage structure, before and after controlling for workers' attributes and job characteristics, is very similar to that of the USA, although wage dispersion is higher in Brazil. We found, however, that in sectors with a high share of exports, wage premiums in Brazil are in general higher than in the USA. In Brazil, the export-weighted average wage is about 21% above the market mean, due to a 15-percent average wage premium. It follows that wage premiums may be in Brazil, as in the USA, an argument in favor of export promotion policies. Moreover, our results challenge the idea that export competitiveness in developing countries result from social dumping. Finally, our results reveal that, differently from developed countries, Brazilian imports concentrate on sectors with high wage premiums. This leaves open the possibility that selective import substitution policies be welfare increasing.

In sum, we have identified the existence of large interindustry wage dispersion in Brazil, that persists even after controlling for differences in workers' productive attributes and job characteristics. The wage structure is robust over time, and there is no evidence that wage premiums can be imputed to differences in job quality, to workers' heterogeneity, to discriminatory practices, to short-run excess demand in specific sectors, and to changes in the macroeconomic and political settings. Moreover, industry segmentation seems to contribute to further enhancing wage inequality in Brazil, as the workers who benefit from wage premiums are, in general, the most skilled ones.

[20]Note that this may be regarded as a further evidence against a relevant role of discriminatory practices for the explanation of wage premiums. The selection procedures for public enterprises tend to be neutral regarding non-productive characteristics, at least as far as direct biases are considered.

APPENDIX

Table A.1

Parameters of the Decomposition Analysis for One-Digit Industries

Year	1981			1985			1990		
Industry	R	p	T	R	p	T	R	p	T
1 - Agribusiness	0,427	0,069	0,436	0,448	0,073	0,502	0,390	0,059	0,476
2 - Mining	1,423	0,005	0,529	1,315	0,008	0,491	1,308	0,006	0,624
3 - Heavy Industry	1,380	0,138	0,428	1,288	0,134	0,461	1,221	0,135	0,450
4 - Light Industry	0,787	0,092	0,449	0,733	0,090	0,461	0,702	0,085	0,432
5 - Construction	0,590	0,149	0,327	0,537	0,124	0,381	0,599	0,122	0,367
6 - Commerce	0,762	0,125	0,401	0,804	0,132	0,492	0,805	0,140	0,487
7 - Finance and Insurance	2,455	0,031	0,376	2,370	0,038	0,395	2,484	0,029	0,343
8 - Transport./ Communic.	0,981	0,084	0,431	1,018	0,079	0,408	1,021	0,085	0,416
9 - Services	1,038	0,169	0,551	0,975	0,183	0,580	0,983	0,199	0,626
10 - Public Administration	1,352	0,115	0,488	1,477	0,121	0,588	1,521	0,122	0,566
11 - Other	1,220	0,017	0,506	0,956	0,013	0,470	0,963	0,012	0,510

Table A.2

Parameters of the Decomposition Analysis for Two-Digit Industries

Year	1981			1985			1990		
Industry	R	p	T	R	p	T	R	p	T
1 - Vegetal and Aimal Extraction	0,461	0.008	0,309	0,424	0.010	0.403	0.417	0,010	0,371
2 - Agriculture and Livestock	0,422	0,060	0,455	0,452	0,062	0.517	0.385	0,049	0,499
3 - Fuel Extraction	2,202	0,001	0,361	2,201	0.002	0.372	2.235	0,001	0,399
4 - Non-Fuel Mining	0,992	0,003	0,560	1,038	0.006	0.466	0.998	0,005	0,661
5 - Cement, Clay, Glass, Ceramics	0,728	0,015	0,426	0,689	0.013	0.580	0.617	0,014	0,476
6 - Metallurgy	1.207	0,036	0,356	1,149	0.035	0.422	1.073	0,035	0,387
7 - Machinery, excluding Electrical	1.600	0.016	0,408	1,352	0.015	0.376	1.375	0,014	0,354
8 - Electrical Machinery and Equip.	1,729	0,011	0,451	1,633	0.010	0.480	1.549	0,011	0,407
9 - Transport Equipment	1,510	0,020	0,333	1,369	0.021	0.294	1.289	0,020	0,274
10 - Paper	1,395	0,005	0,452	1,126	0.004	0.426	1.015	0,005	0,368
11 - Rubber	1.453	0,002	0,404	1,249	0.003	0.400	1.142	0,003	0,375
12 - Plastic Products	1,255	0.004	0,475	1,100	0.005	0.479	1.260	0,006	0,506
13 - Chemical	1,555	0.09	0,469	1,473	0.010	0.557	1.615	0,010	0,616
14 - Oil Refining	2.669	0.003	0,406	3,488	0,003	0.398	2.317	0.002	0,448
15 - Pharmaceuticals	2.132	0.002	0.417	1,896	0.002	0.284	1.687	0.001	0,528
16 - Printing	1.174	0.008	0.315	0,979	0.007	0.377	1.177	0,009	0,553
17 - Wood	0.546	0.015	0.276	0,520	0.013	0.352	0.541	0.012	0.343
18 - Furniture	0.657	0.013	0.228	0,677	0.012	0.427	0.645	0.012	0.315
19 - Leather	0.721	0.001	0.453	0,658	0.001	0.503	0.507	0.001	0,219
20 - Perfumary, Soaps and Candles	1.475	0.001	0,403	1,244	0.001	0.425	1.155	0.001	0,633
21 - Textiles	0,943	0.013	0,439	0,812	0.012	0.399	0.833	0.011	0,501
22 - Apparel	1,175	0.003	0,566	0,864	0.004	0.478	0.828	0.004	0.493
23 - Footwear	0,801	0,005	0,402	0,735	0.006	0.387	0.695	0.006	0,313
24 - Food	0,773	0.030	0,525	0,718	0.031	0.507	0.672	0.029	0,412
25 - Tobacco	1,419	0.000	0,464	1,446	0.001	0.327	1.319	0,000	0,287
26 - Beverages	0.915	0.005	0,389	0,963	0.004	0.447	0.846	0,005	0,581
27 - Construction	0.590	0.149	0.327	0,537	0.124	0.381	0.599	0,122	0,367
28 - Trade	0.762	0.125	0,401	0,804	0.132	0.492	0.805	0.140	0,487
29 - Financial Institutions	2.482	0.029	0.372	2,382	0.036	0.396	2.536	0.027	0.340
30 - Insurance	2.048	0.001	0.421	2,159	0.002	0.365	1.728	0.001	0.328
31 - Road Transportation	0.762	0.064	0.276	0,805	0.059	0.333	0.888	0.066	0.392
32 - Rail and River Transportation	1.540	0.009	0.400	0,762	0.007	0.291	1.423	0.006	0.300
33 - Air Transportation	3.392	0.001	0,618	1.540	0.001	0.441	2.211	0.002	0.432
34 - Communications	1.519	0.009	0.429	1,746	0.010	0.372	1.417	0,009	0.396
35 - Boarding and Eating	0.587	0.025	0.340	0,555	0.029	0.325	0.545	0.032	0,369
36 - Repair Services	0,651	0,040	0,219	0,672	0.044	0.293	0.706	0,051	0,331
37 - Private Health Services	2,385	0.009	0,585	2,336	0.008	0.559	2.416	0,009	0.710
38 - Private Education Services	1.749	0.005	0,454	1,423	0.005	0.413	1.379	0.005	0,438
39 - Real State	1.449	0.005	0,391	1,289	0.007	0.554	0.901	0,007	0,472
40 - Private Household	0.502	0.031	0.233	0,449	0.035	0.276	0.490	0.034	0,326
41 - Business Services	1.617	0.042	0,465	1.634	0.043	0.493	1.645	0.047	0.547
42 - Welfare Services	1.136	0.009	0.503	0,922	0.009	0.501	0.901	0.011	0.608
43 - Public Health and Education	1.442	0.016	0.420	1,603	0.017	0.440	1.712	0.017	0,456
44 - Public Administration	1,267	0.083	0,500	1,414	0.090	0.610	1.469	0.091	0,626
45 - Public Utilities	1.713	0.015	0,461	1,724	0.013	0.393	1.623	0.013	0.327
46 - Other	1,220	0.017	0,506	0,956	0.013	0.470	0.963	0.012	0.510

Table A.3

Estimated Log-Wage Differentials and Premiums by Occupation for One-Digit Industries

Industry	Technical		Managerial		Blue Collar	
	Dif.	Prem.	Dif.	Prem.	Dif.	Prem.
1 - Agribusiness	-0.071	-0.090	-0.548	-0.145	-0.114	-0.076
2 - Mining	0.465	0.598	0.279	0.321	0.783	0.663
3 - Heavy Industry	0.245	0.211	0.182	0.111	0.376	0.190
4 - Light Industry	-0.223	-0.058	-0.136	-0.065	-0.011	-0.084
5 - Construction	0.013	0.062	-0.302	-0.151	-0.294	-0.133
6 - Commerce	-0.264	-0.189	-0.353	-0.191	-0.137	-0.149
7 - Finance and Insurance	0.484	0.381	0.417	0.369	0.491	0.106
8 - Transport./Communic.	0.104	0.118	-0.076	-0.093	0.644	0.352
9 - Services	-0.196	-0.077	-0.351	-0.208	-0.006	0.017
10 - Public Administration	0.124	-0.049	0.068	-0.130	0.187	0.039
11 - Other	-0.370	0.024	-0.158	-0.124	0.100	0.003
Weighted SD	0.201	0.132	0.293	0.218	0.280	0.144
Sample Size	5099	5099	11501	11501	25936	25936

Table A.4

Estimated Log-Wage Differentials and Premiums by Color for One-Digit Industries

Industry	White		N. White	
	Dif.	Prem.	Dif.	Prem.
1 - Agribusiness	-0.864	-0.400	-0.638	-0.294
2 - Mining	0.209	0.349	0.228	0.223
3 - Heavy Industry	0.261	0.131	0.286	0.134
4 - Light Industry	-0.225	-0.052	-0.190	-0.110
5 - Construction	-0.375	-0.072	-0.131	0.009
6 - Commerce	-0.192	-0.095	-0.089	-0.048
7 - Finance and Insurance	0.943	0.506	1.112	0.588
8 - Transport./Communic.	0.130	0.150	0.198	0.160
9 - Services	-0.058	-0.104	-0.077	-0.108
10 - Public Administration	0.405	0.100	0.352	0.137
11 - Other	-0.064	-0.060	0.011	0.048
Weighted SD	0.355	0.167	0.298	0.152
Sample Size	24914	24914	22379	22379

Table A.5

International Comparisons of Wage Premiums for One-Digit Industries

Industry	Brazil (1985)	US (1984)	Sweden (1984)
1 - Agribusiness	-0.243		-0.070
2 - Mining	0.427	0.222	-0.031
3 - Manufacturing	0.106**	0.091	0.008
4 - Heavy Industry	0.208		
5 - Light Industry	-0.055		
6 - Construction	-0.107	0.108	0.067
7 - Commerce	-0.070	-0.111	-0.024
8 - Finance and Insurance	0.481	0.055	0.067
9 - Transport./Communic.	0.138	0.145	0.010*
10 - Services	-0.102	-0.078	
11 - Public Administration	0.026		
12 - Other	0.003		
Weighted SD	0.162	0.094	0.031
Sample Size	80,935	11,512	1,340

Sources: Table 2. Krueger and Summers (1988) and Edin and Zetterberg (1992).

*Does not include Public Utilities, that have a log-wage premium of 0.005.

**Weighted average of light and heavy industries.

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