WAGE INEQUALITY CHANGES IN BRAZIL: MARKET FORCES, MACROECONOMIC INSTABILITY AND LABOR MARKET INSTITUTIONS (1981-1997)

by

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Abstract

In this paper I examine the sources of wage inequality changes among prime age male workers in Brazil during the 1980's and 1990's. Inequality increased in the 1980's and decreased in the 1990's. I begin by decomposing these changes into three effects. First, the effect due to changes in the skill distribution of the workers; second, the effect due to changes in skill prices and premiums; and third, the residual effect which is interpreted as due to changes in the distribution of unobservable skills and their prices. I find that most of the sources of these changes are due to changes in (i) the unobservable skill prices and (ii) the observable skill prices associated to industry, occupation and occupation status. After showing that these changes in skill prices are not consistent with the changes in the supply of and demand for labor during these periods, I examine the possibility that the minimum wage policy and the macroeconomic instability of the period can explain these changes. I find that inflation is strongly associated with inequality mainly due to its unanticipated component. This may be interpreted as an indirect evidence that the indexation system adopted in Brazil during the high-inflation years may be a mechanism through which inflation affected wage inequality.

Key words: Wage Inequality, Skill Premium, Inflation, Indexation.

JEL Codes: E64, J30, J31, O10.

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I. Introduction

It is well documented that wage inequality has increased in many industrialized countries in the last decades. This inequality increase is most commonly associated with the rise of the workers' skill premium. However, there remains a dispute about the latter's primary cause. The economic literature has focused on distinct sources of change in the supply of and demand for skills such as changes in workers' demographic characteristics, skill biased technological innovations, modifications in the terms of trade and globalization, and differences in wage setting and labor market institutions.[1]

Other authors have also provided evidence of the growth of inequality during the same period among a group of developing countries, including Latin American nations.[2] Particularly, some studies find an increase in earnings and wage inequalities among Brazilian workers during the 1980s and 1990s. In general, most of these studies conclude that the change in the distribution of workers' attributes, particularly education, is not the main factor explaining the increase in inequality observed in the period. For instance, Lam and Levison (1991) argue that schooling reduces male earnings inequality from 1976 to 1985 due to a decrease in both the variance of educational attainment and the returns to schooling. These improvements, though, are eclipsed by increases in other sources of inequality. Bonelli and Ramos (1993) show that the increase in earnings inequality between 1977 and 1989 was not primarily driven by changes in education but rather due to changes in the distribution of occupation status of workers such as the increase in the number of self-employed and informal

[1] See the collection of articles edited by Katz and Freeman (1995). Also, various authors have emphasized distinct aspects such as Katz, Loveman and Blanchflower (1995) on demographic characteristics; Juhn, Murphy and Pierce (1993) and Bound and Johnson (1992) on technological innovations; Borjas and Ramey (1994) and Wood (1998) on terms of trade and globalization; and Blau and Kahn (1996), DiNardo, Fortin and Limieux (1996), and Freeman (1993) on differences in wage setting and labor market institutions.

[2] For instance IDB 1998-1999 Economic Report, Fishlow et al. (1993) on Brazil and Argentina; Cragg and Epelbaum (1996) on Mexico; Beyer et al. (1999) on Chile, among others.

workers. The Brazilian household surveys commonly used in these studies assign each worker in the sample a variable 'occupation status' according to the Brazilian labor market legislation. Precisely, the workers are classified as formal wage worker; informal wage worker, self-employed or employer. Fishlow et al. (1993), on the other hand, argue that rising earnings inequality in Brazil and Argentina during the 1980's is related to fluctuations in economic activity and the wage policies adopted in these countries during this period.

Other studies concentrate on the wage dimension of rising Brazilian inequality. Ramos (1991) and Ramos and Trindade (1991) find that, despite the fact that the distribution of schooling for Brazilian prime age workers widened between 1977 and 1989, this dispersion is not strongly associated with changes in the wage inequality observed in the period. Among the most recent studies Menezes Filho et al. (2001) shows that the rising wage inequality between 1977 and 1997 is more associated with changes in inequality within education-age groups than among them. Moreover, they find the returns to education remain relatively stable over the period. As a consequence, they conclude that the effects of the returns of the workers' observable attributes (schooling and experience) did not contribute to an increase in the wage dispersion.

In this paper, I analyze the determinants of the changes in the wage inequalities among the Brazilian prime age workforce between 1981 and 1997. The advantage of looking at the wage inequality is that wage is closely connected to the productivity characteristics of workers and so one is able to develop a more sophisticated view of the link between labor market forces and their outcomes. More fundamentally, the levels of wage inequalities in a low-income economy are closely associated to poverty and the economic incentives facing workers. Thus, understanding the changes of the wage inequalities may shed some light on the role of the labor market in affecting workers' economic conditions.

This study builds onto the existing literature investigating the changes of Brazilian earnings and wage inequalities. So far, previous studies have tackled the question of why inequality increased in Brazil by applying some type of decomposition methodology. Although informative, most of these methodologies do not separate the skills' price effects and the distribution of the skills themselves (e.g., Bonelli and Ramos (1993)). The few studies that do account for these effects separately are limited to the returns to education (Lam and Levison (1992)) or the returns to education and experience (Menezes Filho et al. (2001)).

I begin my investigation of the changes in wage inequalities by applying a complete decomposition methodology developed by Juhn, Murphy and Pierce (1993). This methodology allows me to disentangle the change of the joint distribution of the workers' attributes from the changes in the prices associated with them. Also, this decomposition permits me to look at a more complete set of individual characteristics beyond education and experience. As shown below, the wage inequality among Brazilian male workers increased between 1981 and 1997. However, the inequality did not increase uniformly; rather, two distinct patterns emerged. Inequality increased steadily from 1981 to 1989 but decreased from 1989 to 1997, although 1997 inequality level remained higher than that of 1981. Similarly to previous studies, I found that changes in the distribution of schooling and potential experience and the returns associated to them do not explain the inequality changes. However, when industry, occupation and occupation status are added an interesting pattern emerged. The rising wage inequality between 1981 and 1989 were due to increases in the observable skill prices, increase in the dispersions of observable skill and of the joint distribution of unobservable skills and their associated prices. On the other hand, the decreasing inequalities between 1989 and 1997 were the result of decreases in the dispersion of the joint distribution of the

unobservable skills and their prices and to a decrease of the observable skills' prices as well. Contrarily, the inequality of observable skills continues to increase in the 1990s.

Taking one step further, this study also explores the role of supply and demand forces in explaining the observed pattern of the returns of the workers' attributes. Recent studies have shown that the increased wage inequality in some Latin American countries is associated with the rising skills' premia due to an increase in the relative demand of more skilled workers.[3] Similar to Katz and Murphy (1992) and Blau and Kahn (1996), I construct relative supply and demand indices for workers in different skill groups and examine whether these changes in the net-supply forces can explain the observed behavior of the skills' prices. The results suggest that the supply and demand changes are not consistent with the observed changes in the workers attributes' prices during the 1980s and 1990s.

Finally, I investigate whether the minimum wage policy and the macroeconomic conditions of the period, particularly the inflation rate, unemployment rate and real minimum wage can explain the changes in inequality. Results show that both rising inflation and declining real minimum wage are associated with increases in wage inequality. Also, my results may suggest that wage indexation rules can explain how inflation affects inequality changes.

This paper is divided into five parts. The household data used for this study is described in part two. In part three, basic facts about changes in the wage structure among prime-age male workers are presented. The roles of skill prices and observable productivity characteristics in explaining these changes are discussed in part four. Part five presents the supply and demand indexes. Part six discuss the effects of inflation, unemployment and minimum wage and part seven summarizes the main conclusions.

[3] See, e.g., Michael and Epelbaum (1996) for the Mexican case, Beyer and Vergara (1999) for the Chilean case, Wood (1997) for a comparison between South Asian counties and Latin American countries and Berman et all. (1998) for evidences in developed and developing economies.

II. Data Description

The data sets used in this analysis are selected years between 1981 and 1997 of the Brazilian Household Surveys called Pesquisa Nacional por Amostragem a Domicilio (PNAD) conducted by Instituto Brasileiro de Geografia e Estatística (IBGE), the Brazilian census bureau.[4] The PNAD is an annual labor force survey much like the Current Population Survey in the U.S.. Covering all urban areas and the majority of rural areas in Brazil (with the exception is the rural area of the amazon region), the survey generates annual samples of approximately 100,000 households.

The sample selected to this study consists of men aged twenty-five to fifty years old who participate in the labor market. Since I am interested in the role of labor market variables in explaining the inequality changes, I concentrate the analysis on this more restricted sample of prime age male workers because their decisions about labor market participation are less likely to impact their wages compared to younger male or female workers.

The earnings variable used is the primary job labor earnings in the month of reference.[5] The wage variable is an estimated hours-adjusted earnings. The PNADs provide information on the worker's monthly labor earnings in his primary job and the usual weekly hours worked in this job. Since there is no information on the number of weeks worked, I estimate hours-adjusted earnings similar to Blau and Kahn (1996). For each worker i in year t, I estimate the following regression:

$$\text{Ln } E_{it} = \alpha_{t0} + \alpha_{t1} PT_{it} + \alpha_{t2} HPT_{it} + \alpha_{t3} HFT_{it} + \boldsymbol{\delta}_t' \mathbf{X}_{it} + \varepsilon it \qquad (1)$$

[4] The years used are 1981, 1982, 1987-1990, 1992, 1993, 1995-1997.
[5] The PNAD is a yearly survey conducted every September of a year.

where Ln E is the log of earnings; PT is a dummy variable for part-time work (less than forty hours per week); HPT and HFT are interactions of hours worked with part- full time status; **X** is a vector of explanatory variables including years of schooling, potential experience[6] and its square, one-digit industry and occupation dummies, indicator variables for informal worker, self-employed and employer.

The PT, HPT and HFT coefficients from (1) are used to adjust each worker's earnings of year t for work hours by assuming a 40-hour work week. That is, for each worker i and year t, I obtain

$$Yit = Ln\ E_{it} - \alpha_{t1}\ PT_{it} - \alpha_{t2}\ HPT_{it} - (\alpha_{t3}\ HFT_{it} - 40) \qquad (2)$$

where Y_{it} is the log of hours-adjusted earnings, the α's are coefficients estimated from equation (1), and the remaining variables are defined above. I include part-time workers in order to create a representative sample of prime age male workers in all years. Part-time workers represent 8.0, 10.5 and 11.4 percent of the 1981, 1989 and 1997 samples, respectively.

Finally, real wages are calculated using the consumer price index INPC (Indice Nacional de Precos ao Consumidor) provided by the IBGE and converted to September 1997 Reals value (the Brazilian currency). This wage is thus the monthly wage that a worker earns if he works forty hours per week in 1997 Reals.

III. The Changing Wage Structure

The 1980's witnessed a steady increase in wage dispersion among prime-age male workers in Brazil. In the 1990's, however, wage inequality declined. Table 1 shows the Lorenz curves for the male wage distributions for selected years confirming this pattern. The Lorenz curve depicts the

[6] Potential experience is defined as follows: Potential Experience = age – years of schooling - 6.

percentage share of wage accounted by a percentile share of the workforce, ranked from the poorest to the richest worker. For instance, Table 1 shows that all workers located in the fifth decile and below in the wage distribution (that is, half of the prime age male workers' population) earned sixteen percent of all wages in 1981. This share decreased to 12.5 percent in 1989 and increased to 14.9 percent in 1997. Note that the1989 Lorenz curve lies everywhere below the 1981 and 1987 Lorenz curves. Also, the 1989 Lorenz curve lies everywhere below the 1993 and 1997 Lorenz curves. This implies that the 1989 wage distribution is more unequal than the 1981 and 1987 wage distributions, as well as more unequal than the 1993 and 1997 wage distributions.

- INSET TABLE 1 -

Table 2 presents several commonly applied inequality measures for the wage distributions. The standard deviation of log-wages, the Theil index and the Gini coefficient all confirm the pattern described above: Overall wage inequality increased between 1981 and 1989 and decreased between 1989 and 1997. However, these changes were not evenly spread throughout the wage distribution. In fact, the 90th-50th and the 50th-10th log-wage differentials increased by 0.163 and 0.033 log-points, respectively, between 1981 and 1989. In other words, the increase in inequality was more accentuated at the top of the wage distribution. Similarly, the decrease in inequality between 1989 and 1997 was greater at the top compared to the bottom of the wage distribution. In fact, the inequality seems to increase at the bottom. For example, between 1989 and 1997, the 90th-50th and the 50th-10th log-wage differentials changed by -0.112 and 0.022 log-points between 1989 and 1997.

-INSERT TABLE 2-

In summary, both the increase in wage inequality among prime-age male workers observed between 1981 and 1989 and its subsequent decrease between 1989 and 1997 were mainly due to

changes in the spread of the wages at the top of the distribution. The next section begins to identify the sources of these changes.

IV. The Role of Prices and Individual Characteristics

One way to gauge changes in wage inequality is to evaluate the changes in wage determinants, particularly the workers' productive characteristics and the market prices of (and the premia associated with) these attributes. Juhn, Murphy and Pierce (1993) develop a decomposition methodology to analyze the changes in wage inequality in the U.S. economy that accounts for them separately. This methodology was also applied to international differences in male wage inequality by Blau and Kahn (1996). Under this scheme it is possible to account for the changes in inequality due to changes in the following three components: the observable characteristics or attributes of individuals (education, potential experience, etc.), hereafter referred to as observable quantity effect; the observable prices of these observable attributes, hereafter referred to as the observable price effect; and the unobservable prices and attributes, hereafter referred to as the wage equation residual effect.

This scheme makes it possible to isolate the impact of the changes of the joint skills' prices and premiums from the changes in the joint distribution of the productive characteristics and the residual distribution taking into account the entire wage distribution. Thus, it allows one to evaluate each effect at different parts of the wage distribution.

The Juhn, Murphy and Pierce decomposition is described as follows. Let the wage equation for individual i at year t be:

$$Y_{it} = \mathbf{X}_{it}\,\boldsymbol{\beta}_t + u_{it} = \mathbf{X}_{it}\,\boldsymbol{\beta}_t + F^{-1}(\theta_{it} \mid X_{it}) \qquad (3)$$

where Y_{it} is the log of the real wage, $\mathbf{X}_{it}$ is a vector of explanatory variables, u_{it} is the error term, θ_{it} is the individual's percentile in the residual distribution and $F^{-1}(. \mid \mathbf{X}_{it})$ is the inverse cumulative residual distribution for workers with characteristics $\mathbf{X}_{it}$ in year t.[7]

Two hypothetical wage distributions are then constructed: $Y(1)_{it}$ and $Y(2)_{it}$. $Y(1)_{it}$ is built in the following way: for each year t a set of wages is constructed by assigning the estimated wage function (β^*) of a base year and the base year residual $F^{*-1}(. \mid \mathbf{X}_{it})$ to each worker i:

$$Y(1)_{it} = \mathbf{X}_{it} \boldsymbol{\beta}^* + F^{*-1}(\theta_{it} \mid X_{it}) \qquad (4)$$

where $Y(1)_{it}$ is calculated for each individual in year t by: (i) valuing his measured characteristics $\mathbf{X}_{it}$ at the base year prices $\boldsymbol{\beta}^*$; and (ii) valuing his own position in his own year wage residual distribution at the corresponding position in the base year wage residual distribution. The difference between a dispersion measure of base year Y_i^* and $Y(1)_{it}$ indicates the extent to which the differences in wage inequality are due to differences in the measured characteristics, the observable quantity effect.
The hypothetical distribution $Y(2)_{it}$ is constructed by first assigning each worker i in year t the year t wage coefficients and second by giving him the base year wage residual corresponding to his position in his own year wage residual distribution:

$$Y(2)_{it} = \mathbf{X}_{it} \boldsymbol{\beta}_t + F^{*-1}(\theta_{it} \mid X_{it}) \qquad (5)$$

The differences between the $Y(1)_{it}$ and $Y(2)_{it}$ distributions are due entirely to the differences between year t observable prices (β_t) and those of the base year (β^*).

Finally, the impact of the changes in the wage residuals on inequality change is captured by the difference between Y_{it}, the actual distribution at year t, and $Y(2)_{it}$, the second hypothetical distribution. This impact is interpreted as the effect of unmeasured prices (e.g., returns to unobservable skills) and unmeasured characteristics (e.g., ability or unobservable productive attributes) on the wage inequality change.

The specifications of the wage equation use the human capital variables - years of schooling, years of potential experience and its square - and also add indicator variables for industry, occupation, and occupation status.[8] Previous studies have emphasized the role of occupation status in explaining the changes in inequality in the 1980's. For instance, Bonelli and Ramos (1993) found that the inequality increase in the 1980's among prime age male workers was more associated with changes in the composition of occupation status than changes in the distribution of educational attainment.

IV.1. The Joint Impact of Schooling and Potential Experience on Wage Inequality Changes

In order to evaluate the role of schooling and potential experience in explaining the inequality changes I first apply the decomposition using a basic human capital specification, allowing for non-linearity and interactions between variables. The regressions include years of schooling and its

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[7] As suggested by Juhn et al. (1993), we can think of the residual as two components: an individual's percentile in the residual distribution, θ_{it}, and the cumulative distribution function of the wage equation residuals, F(.). By definition of cumulative distribution function, we have $F(u_{it} \mid X_{it}) = \theta_{it}$ so that $u_{it} = F^{-1}(\theta_{it} \mid \mathbf{X}_{it})$.

[8] The industry and occupation follow the division presented in the PNAD. The industry categories are agriculture; transformation industry; civil construction; other industrial activities; commerce; services; auxiliary services; transport and communication; social activities; public administration; and others. The occupation categories are technical; administrative; agricultural; transformation industry; commerce; transport and communication; services; and others. The occupation status are formal worker, informal worker, self-employed and employer.

square, potential experience and its square, an interaction of years of schooling and potential experience and an interaction of their squared terms.

Table 3 shows the changes in wage inequalities between 1981 and 1989 and their decomposition into the three effects described above for different measures of inequality using both 1981 and 1989 as the base year price. These results clearly show that the overall wage inequality increased in this period and that this increase was greater at the top of the wage distribution.

-INSERT TABLE 3-

Three main results arise from the decomposition. First, the residual effect is generally the strongest in explaining the inequality changes. Second, the observable quantity effect does not explain much of the inequality change and, in some cases, moves in the opposite direction of the overall change. Third, the observable price effect is negative at the bottom of the wage distribution and positive at the top. Thus, most of the change in wage inequality between 1981 and 1989 cannot be explained by changes in the joint distribution of schooling and potential experience nor by the changes in the observable prices of these skills. In fact, most of these changes are accounted for by the positive wage equation residual effect. Under 1989 base year prices in Table 3, the wage equation residual effects in the 90th-50th and 50th-10th log-wage differentials are 0.173 and 0.098 log-points, respectively.

In contrast, overall wage inequality among prime age male workers steadily decreased between 1989 and 1997, due mostly to a decrease in the wage dispersion at the top of these distributions. Actually, the bottom of the distribution presents slight increases in inequality.

Table 4 presents the inequality changes and the decomposition results under the basic human capital specification for wage distribution. The results show that the decrease in wage inequality is solely explained by the negative wage equation residual effect. Further, the observable quantity effect

is positive and greater at the bottom of the distribution. The observable price effect is also positive and contributes to the widening of the wage gap slightly.

-INSERT TABLE 4-

In comparing the decomposition results in Table 3 to the decomposition results in Table 4 one major pattern stands out. That is, the joint changes in the unobservable skill prices and unobservable skills distribution are the main driving forces behind both the increase in inequality between 1981 and 1989 and the decrease in inequality between 1989 and 1997. In other words, the changes in the joint distribution of schooling and potential experience and their returns are not associated with the inequality changes of the 1980's and 1990's.

IV.2. The Joint Impact of Industry, Occupation and Occupation Status on Wage Inequality Changes

The wage equation residual effects imply that the joint distribution of the unobservable skills and their returns became more unequal during the 1980s and less unequal during the 1990s. A possible explanation for these findings is that there are changes in the heterogeneity of unobservable skills among workers for which years of schooling and potential experience, used as proxies for workers' skills in the human capital specification, are not complete controls. One way to investigate this possibility is to perform the same decomposition using a specification that includes more explanatory variables that may potentially improve the control for heterogeneity.

Table 5 presents the decomposition results for wage inequality changes using a regression specification that includes years of schooling, potential experience and its square, industry, occupation and occupation status dummies. This specification will be referred to as the augmented human capital specification. Even though some results are sensitive to the base year price, three

consistent findings emerge from this augmented specification. First, the wage equation residual effect is still an important component to explain the wage inequality changes between 1981 and 1989. Second, the observable quantity is in general positive. Third, the observable price effects are positive and in become more important in explaining the inequality changes when compared to the basic human capital specification. This suggests that the changes in the returns associated to industry, occupation and occupation status adversely affect those workers at the lower part of the wage distribution.

-INSERT TABLE 5-

Table 6 presents the decomposition results using the augmented human capital specification to the 1989-1997 period. Again, the most important single component in explaining inequality changes is the negative wage equation residual, particularly at the top of the distribution. Also, the observable quantity effect is positive which reaffirms the previous finding under the basic human capital specification that the dispersion of the observable skill distribution increased between 1989 and 1997. However, with the exception of the 50th-10th log-differential, the joint observable price effect becomes negative once the industry, occupation and occupation status dummies are introduced. In contrast to the results under the basic human capital specification, the joint skills' prices effect in the standard deviation of log-wage change, the Theil index change and 90th-10th log-wage differential change is negative between 1989 and 1997. This implies that during this period the joint returns to schooling and experience increased while the joint returns associated to industry, occupation and occupation status decreased. Moreover, the observable price effect reduced the gap between the top and the middle but widened the gap between the middle and the bottom of the distribution. Interestingly, the observable price effect is positive for the 50th-10th differential change under both the human capital and augmented human capital model. Coupled with the increase in the

dispersion of the observable skill distribution, this observable price effect explains the increase in wage inequality at the bottom of the distribution.

-INSERT TABLE 6-

In summary, some strong regularities are revealed by these decompositions. The wage inequality changes are primarily a result of changes in the unobservable skills' prices and unobservable skill distribution and, secondarily, due to changes in the observable skills' prices taking into account the augmented specification. Precisely, the returns to schooling and potential experience cannot explain these changes. The prices and premiums related to industry, occupation and occupation status are the components associated to the inequality changes.

It seems that the key elements in explaining the increase in inequality in the 1980's as well as the decrease in inequality in the 1990's are the changes in the prices of the observable and unobservable skills of the workers, particularly those associated to industry, occupation and occupation status. One cannot rule out the change in the distribution of the unobservable skills as well. However, it is more plausible that the unobservable prices changes play a more important role than unobservable characteristics for two reasons: (i) the observable price effects and residual effects move in the same direction in most cases, and (ii) the observable characteristic effects move in the opposite direction of the residual effect in the 1990s.

Why do the joint observable skill prices and premiums associated to industry, occupation and occupation status and plausibly the unobservable skill prices increase in the 1980's and decrease in the 1990's? It is possible that the changes in the supply of and demand for workers with different skills can explain these patterns. In other words, it may be that the net-supply of lower skill workers increased in1980's and decreased in the 1990's so that it caused the prices' movements unveiled by the decomposition above. The next section investigates this hypothesis.

V. The Supply and Demand Explanation

Recent studies have investigated the sources of the increased wage inequality observed in some Latin American countries in the 1980's and 1990's. They show that this increase is associated with a rise in the skill premiums potentially related to a shift in labor demand towards more skilled workers.[9] Some argue that this increase is due to the trade liberalization experienced by these countries in the 1980's.[10] Others emphasize the role of skill-biased technological change.[11]

The decomposition results above present evidence of changing skill premium in Brazil. If one interprets the wage equation residual effect as the effect due to changes in the unobservable skill prices, coupled with the observable price effect under the augmented human capital specification, one may argue that the skill premium increased in the 1908's and decreased in the 1990's. If this is so, the increase in the skill premium in the 1980's and their subsequent decrease in the 1990's may be due to changes in the relative supply of and demand for higher skill workers. It maybe that the net-supply of lower skill workers increased and/or the net-supply of higher skill workers decreased such that their relative prices change favorably for higher skill workers in the 1980's but not in the 1990's.

In order to check if the findings above are consistent with changes in labor supply and demand, I construct supply and demand indices for various skill groups of workers following Katz and Murphy (1992) and Blau and Kahn (1996). The supply and demand indices are built assuming that the relative wages of the skill groups are generated by the interaction of the labor supply of these groups and the associated demand schedules generated from an aggregate production function. To the extent that these groups are imperfect substitutes for each other, changes in their relative wages are

[9] Wood (1997) presents a summary of findings for some Latin American countries.
[10] Cragg and Epelbaum (1996), Hanson and Harrison (1999), Ravenga (1997) examine the Mexican case and Beyer et al. (1999) investigate the Chilean case.

considered to be generated by shifts in relative supplies and demands. Here, it is only required that price and quantity be "on the demand curve".

The demand index reveals whether the composition of output by industry (and so its derived labor demand) favors one skill group over another in 1989 relative to 1981 (or 1997 relative to 1989). Occupation-industry cells are built such that the "output" of a particular occupation group is viewed as an intermediate product. A demand index, $\ln(1 + \Delta D_k)$, is constructed for each skill group k for, e.g., 1989 relative to 1981, where

$$\Delta Dk = \Sigma_o \, c_{ok} \, (\Delta E_o / E_k) \qquad (6),$$

and o refers to occupation-industry cell, c_{ok} is skill group k's share of employment in occupation-industry cell o in 1989, ΔE_o is the difference between 1989 and 1981 share of total labor input employed in cell o, and E_k is the 1981 share of total labor input accounted for by skill group k. These demand indices reflect the extent to which the occupation-industry structure favors skill group k in 1989 (1997) relative to 1981 (1989), with 1989 weights in both comparisons. The labor inputs are measured either in total hours or total number of workers.

The supply indices ΔSk are calculated as follows:

$$\Delta Sk = \ln E_{kt} - \ln E^*_k \qquad (7),$$

where E_{kt} and E^*_k are the share of 1981 and 1989 (or 1997 and 1989) labor input represented by skill group k, respectively. The supply index measures the relative representation of each skill group in the

[11] See, e.g., Berman et al. (1998) for cross-country comparisons and Pavcnik (2000) for the Chilean case.

1981 (1997) workforce in comparison to that of 1989. Again, the labor inputs are measured either in total hours or total number of workers.[12]

Finally, the net supply indices are computed as follows:

$$\Delta NS_k = \Delta S_k - \ln(1+\Delta D_k) \qquad (8).$$

In a partial equilibrium model one expects that the differences across years in the relative wages of each skill group will be negatively related to differences in the net supply ΔNS_k. Simply stated, the smaller the supply of skill group k relative to demand in 1981 (1997), the better the members of this group will fare in 1981 (1997) compared to 1989.

The skill groups are defined by education and potential experience cells. There are five education groups (illiterate, 1 to 4 years of schooling, 5 to 8 years of schooling, 9 to 11 years of schooling and 12 or more years of schooling) and four potential experience groups (0 to 8 years of experience, 9 to 17 years of experience, 18 to 26 years of experience and 27 or more years of experience).

The supply, demand and net-supply indices are presented in Tables 7 and 8 and are measured in log-points. Tables 7 and 8 present the indices measured in hours and number of workers, respectively. The results of the two tables are remarkably similar. The supply indices in both tables show a steady increase of relatively more educated and less experienced workers during the 1980's and 1990's. In contrast to the supply indices, the demand indices present a steady decrease in the relative demand of higher educated/more experienced workers throughout the last two decades. The

[12] For individuals not working in the week of reference, I obtain estimated hours using coefficients from a regression of hours worked on schooling, potential experience and potential experience squared from a sample of working individuals.

interactions of these two movements are shown in the net-supply indices presented in the last two columns of Tables 7 and 8. Clearly there was an increase in the net-supply of higher educated/more experienced workers compared to lower educated/less experienced workers.

-INSERT TABLE 7-

-INSERT TABLE 8-

If these indices, in fact, reflect the labor supply and demand forces in Brazil during the 1980's and 1990's then one would expect, ceteris paribus, a steady decrease of the skill premiums during these decades. However, as shown above, this is not the case. The skill premiums increased in the 1980's but their movements are ambiguous in the 1990's. The observable skill prices rose when skills were measured by schooling and experience and declined when measured by schooling, experience, industry, occupation and occupation status. The most one can argue is that supply and demand forces were not consistent with wage movements in the 1980's but may be consistent with relative wage changes in the 1990's. Still, one has to reconcile this argument with the finding that the observable skill prices unambiguously increased the gap at the bottom of the wage distribution during the 1990's as revealed by the 50th-10th log-differential changes. Yet, this still leaves open the question of why the inequality increased in the 1980's.

Thus, this supply and demand story does not seem to plausibly explain the changes in wage inequality in Brazil during the 1980's and 1990's. Nevertheless, one cannot completely rule out this hypothesis since the supply and demand indices of Tables 7 and 8 only capture variations across industry/occupation cells. It has been argued by others (e.g., Katz and Murphy (1992)) that these changes may occur within industry/occupation cells.

Given that the supply and demand shifts as measured by equations (6), (7) and (8) are not entirely consistent with the changes in the observable skill premiums and that the residual equation

effect explains most of the changes in wage inequality in both periods. I will look elsewhere to identify other hypotheses. It may be that the minimum wage policy and/or the macroeconomic instability of the 1980's and 1990's contributed to the wage inequality changes in Brazil. These hypotheses are explored below.

VI. The Roles of Minimum Wage Policy and Macroeconomic Instability

There is an established literature on the impact of labor policies and institutions such as minimum wage policy and collective bargaining on labor market outcomes (see Blau and Kahn (2000) for a survey of this literature). Particularly, a consensus appears to have been reached that declining minimum wages are associated with rising wage inequality. If this is so, the minimum wage policy adopted in Brazil seems to be a reasonable candidate in explaining the changes in inequality during the past two decades. In fact, the real minimum wage declined by twenty-one percent from 1981 to 1989, a period of increasing inequality, and it increased by twenty percent from 1989 to 1997, a period of decreasing inequality. Cardoso (1993) found that decreases in the minimum wage were associated with increases in earnings inequality in Brazil during the 1980's.

There is also a branch of economic literature which focuses on the relationship between macroeconomic variables and income inequality for developed and developing countries. Starting with the study by Blinder and Esaki (1978), two findings have been consistently confirmed for the U.S. and the United Kingdom: (i) unemployment increases inequality significantly and (ii) inflation reduces inequality slightly (e.g., Blank and Blinder (1986), Mocan (1999) and Nolan (1998)). In contrast, the studies that examine the impacts of inflation and unemployment on income inequality in Brazil show that inflation increases inequality in the 1980's and 1990's but that the unemployment effect is ambiguous (Ferreira and Litchfield (1999) and Barros et al. (1998)). Although focusing

primarily on income inequality, these previous results suggest that macroeconomic instability can also explain the changes in wage inequality observed in Brazil in the 1980's and 1990's. For instance, Cardoso et al. (1995) finds that inflation and unemployment can explain one third of the variation in earnings inequality in Brazil between 1981 and 1991. These latter studies refer to three well-accepted hypotheses for establishing the causal relationship of inflation on inequality. First, long-duration, high-inflation economies like Brazil often develop some type of indexation mechanism that, if not perfect, can increase inequality. A perfect indexation system involves instantaneous wage adjustment in accordance with the exact change in inflation for every worker. A complex system of formal and informal indexation was instituted, primarily for wages and salaries in Brazil. There is empirical evidence that this indexation is less than perfect and thus some groups of workers are more able to defend themselves against inflation than others (Neri, 1995).

The second hypothesis is that the inflationary tax reduces disposable income. Although individuals with low incomes may not be affected by this tax due to their negligible average cash holdings, those of moderate incomes may be affected by having their savings rapidly depleted, increasing the number of poor and thus widening income inequality.

Third, inflation may redistribute assets between creditors and debtors, implying that those more able to play the financial markets can better protect themselves. Usually it is accepted that high-income groups are better informed and have more access to technical advice, thereby enabling them to possible gain from inflation compared to middle and low-income groups.

The second and third hypotheses cited above affect income but not wage inequality. By focusing solely on wages I can examine the first hypothesis closely, the pure labor market effect. Table 9 presents selected wage inequality measures, the real minimum wage in 1997 Reals, a measure of the annual inflation rate and national unemployment rate for selected years. The inflation rate,

based on the Consumer Price Index INPC-IBGE, is the geometric mean of a yearly inflation rate of a month, calculated from October of a year to September of the following year.[13] The choice of September as the reference point is because PNAD household surveys are conducted in that month. Thus, I obtain an inflation rate which is close in time to the earnings and hours information. I opt to use this moving average measure since Brazilian workers have their wages adjusted in different months of the year according to previous period inflation.

As displayed in Table 9, the upward trend of inflation and wage inequality in the 1980's and the downward trend in the 1990's, although not perfectly synchronized, do move largely in tandem. The real minimum wage, measured in 1997 Reals value, also exhibits a similar pattern. Unemployment oscillates between two and three per cent in the 1980s and increased to around eight to nine per cent in the 1990s.[14]

-INSERT TABLE 9-

VI.1. A Base-Line Estimation

Before investigating the role of indexation on inequality, I estimate the impact of the minimum wage, inflation itself and unemployment on wage inequality in order to obtain a base-line estimate. I conduct a cross-state analysis using aggregate state level data. Brazil is divided into 26 states and there are eleven annual surveys selected from 1981 to 1997 providing this particular analysis with 286 observation points.[15]

[13] This index is obtained in *Conjuntura Economica*, various issues. The INPC is monthly collective among the main important metropolitan areas in Brazil and so it is not nationally covered. However, there is no inflation index nationally collective in Brazil and INPC is the one with the broadest coverage.

[14] This sharp rise of unemployment in the 1990s may be due to changes in the PNAD's questionnaire introduced in the 1990s. Nevertheless, the Brazilian economy seemed to have experienced an increase in the unemployment rate as it is captured by other labor market surveys.

[15] There were 26 states in Brazil until 1989 when a new state was created, increasing this number to 27. I keep the aggregation of the previous 26 states in order to be consistent through the 1980's and 1990's. The Survey years are 1981, 1982, 1987 to 1990, 1992, 1993 and 1995 to 1997.

A high degree of heterogeneity exists among regional labor markets in Brazil. Similar to Blank and Card (1994), I exploit this variability across state and time to estimate the impact of minimum wage and macroeconomic variables on wage inequality. The basic rationale is twofold: (i) the unemployment rate differs across regions and (ii) inflation impacts workers' wages in each region differently, although inflation is a national phenomenon, due to variation in local markets. Particularly, the degree of informality and the extent of the coverage of collective contracts differ across regional labor markets. These two elements are related to the degree of indexation in each labor market as will be described below.

Using information for year t, inequality (S_{jt}) for each state j, the unemployment rate (UR_{jt}) in each state j, the log of inflation (I_t) and the real minimum wage (MW_t), I estimate the following model:

$$S_{jt} = a + b\, I_t + c\, UR_{jt} + d\, MW_t + \theta_j + \mathbf{B'X}_{jt} + \varepsilon_{jt} \qquad (9)$$

where θ_t is a state fixed effect; $\mathbf{X}_{jt}$ is a vector of year t state j characteristics of males aged twenty-five to fifty years old and includes year t state j averages and standard deviations of years of schooling and potential experience, and year t state j proportion of individuals living in urban areas; I_t and MW_t as defined above; UR_{jt} is the year t state j unemployment rate among males aged twenty-five to fifty years old; and ε_{jt} is the random term.[16]

This error term has an associated variance-covariance structure that assumes heteroscedasticity across states, correlation across states and specific serial correlation AR(1) for each state. Given heterogeneity among states in Brazil, it is possible that the variance of the error term can vary across

states which may be due to differences in state characteristics. In addition, it is also possible that economic shocks impact all states concomitantly and, given the proximity between states, shocks experienced by one state may have spillover effects into other states. It is for this reason that I allow for different covariance across states within a year. Finally, the year by year inequality in a state is likely prone to serial correlation which is the reason why I impose an AR(1) process in the error structure. The assumed variance-covariance structure controls for potential bias in the estimation generated by these problems.

Table 10 presents the estimation results of model (9) for some wage inequality measures. The first and second columns show the impacts of log-inflation, the unemployment rate and the minimum wage in the standard deviation and 90th-10th differential of log-wages. Unemployment and the minimum wage decrease overall inequality while inflation increases overall inequality.

-INSERT TABLE 10-

The negative impact of the minimum wage on wage inequality reflects the reduction in the spread of inequality at the bottom of the distribution. In fact, the 50th-10th log-wage differential decreases as the minimum wage increases. In addition, the minimum wage seems to have spillover effects on the entire wage and earnings distributions given that it negatively impacts the 90th-50th log-wage differentials. This might be due to the wage laws of the period, which allowed for changes in nominal wages by wage levels, where wage levels were defined by multiples of the minimum wage. Unemployment has a negative impact on wage inequality as well. That is, increases in unemployment lead to decreases in the standard deviation of log-wage and the 90th-10th log-wage differential. Interestingly, unemployment decreases the spread at the top of the wage distribution but increases the spread at bottom.

[16] An individual is defined as unemployed if he is not working and looking for a job in the week of reference.

Turning to inflation, it has a positive impact on wage inequality, a result consistent with Cardoso (1993, 1995) for earnings and Barros et al. (1998) and Ferreira and Litchfield (1999) for income. Moreover, inflation has distinct impacts on different parts of the wage distribution. It increases the dispersion at the bottom (the 50th-10th differential). Although not significant, it decreases the dispersion at the top (the 90th-50th log-wage differential) of the wage distribution. Previous studies' findings on the impact of inflation on income inequality in Brazil are in sharp contrast with the findings for the U.S. and the United Kingdom. In the latter nations, inflation reduces income inequality. The most common explanation for this finding is rooted in differences in the sources of income for individuals or families at the bottom and top of the income distribution. In more developed countries, individuals in the bottom of the income distribution derive a proportionally larger portion of their income from transfers while those at the top of the income distribution derive income from capital gains. Since transfers are protected by indexation while capital gains are usually not similarly safeguarded, inequality is reduced.

The findings for income and earnings inequalities in Brazil from previous studies taken together with the results shown above for wage inequality, suggest another mechanism through which inflation may affect inequality and may operate through a labor market institution. One possible candidate, the indexation system, will be analyzed below.

VI.2. The Indexation System

Intended to perform as income policy tools, wage indexation laws were introduced in Brazil in 1965. Until 1979, these wage laws established that nominal wages of year t should be adjusted by three components: (i) the inflation of a past period t-1, (ii) the expected inflation of year t and (iii) a productivity gain determined by the government. The new level of wages should be fixed for the next

twelve months. These wage laws had a binding effect in all collective wage negotiations, leaving no degree of freedom for employers or employees. The promulgation of wage laws by the military government of this period, combined with the repression of collective bargaining, created in fact a centralization of the wage determination process in Brazil. In practice, the underestimation of the expected inflation generated a compression of real wages, particularly for blue-collar workers that depended on collective bargaining.

Enacted in 1979, a new indexation law was introduced which combined the same elements of past inflation and productivity but instituted three major reforms: (i) the adjustment interval was reduced to six months, (ii) the indexation degree was made a function of the wage level; that is, different wage levels had different indexation levels, and (iii) it allowed the productivity gains to be freely bargained between employers and employees. Most of the wage indexation laws between 1979 and 1996 shared, to some degree, these three reforms which, taken together with a more freely collective bargaining process, resulted in indexation rules that set a floor but not a ceiling to collective wage negotiations.[17] Moreover, the collective bargaining system reflected this more relaxed structure. Collective contracts were now negotiated in a non-synchronized way, by sector or occupational category such as metallurgic workers, mining workers, etc., at the city level, on an annual basis.[18] With soaring inflation in the 1980's and the early 1990's, informal workers also established informal agreements with employers that incorporated some type of wage indexation. Since generally based on past inflation, non-synchronized across groups of workers and locations and dependent on the relative bargaining power of unions, the Brazilian indexation system was imperfect. It generated a staggered wage structure such that wage changes did not mirror actual inflation. Wages were

[17] From 1979 to 1994 Brazil six different stabilization plans introduced different wage policies. However, their failures were followed by subsequent inflation increases and new indexaton laws.

calculated differently across groups of workers and thus generated changes in the short run wage and earnings distributions. In fact, Cardoso (1993) calls attention to the correlation between highly volatile earnings and inflation in the 1980's. On the other hand, Arbache (1999), finds that unions' workers in the manufacturing sector have higher wages but a more dispersed wage distribution compared to non-union workers in the 1990's. He suggests that it may be due to the fact that unions are more concerned in obtaining higher unions' premiums than establishing a more equal distribution across members.

VI.2.1. An Indirect Assessment of Indexation

An ideal experiment to test the impact of indexation on wage inequality changes would involve obtaining information on indexation clauses in the collective bargaining contracts by occupation, industry, union, city and year. Since this information is not available in the household surveys used in this study, I will proxy the indexation by estimated expected inflation based on information about the actual inflation of the previous period. Since the indexation is based on previous period inflation usually calculated by the Price Consumer Index INPC/IBGE, I estimate the following equation:

$$I_t = \alpha_0 + \alpha_1 I_{t-1} + d\,R + \eta_t \qquad (10)$$

where I_t is the log of inflation in year t, I_{t-1} is the previous year log of inflation and R is a dummy variable which assumes value equal one if the years are from 1995 to 1997, and η_t is the random term. The dummy variable R is included since a successful stabilization plan was implemented in 1994

[18] For a description of the indexation mechanism in Brazil see, e.g., Simonsen (1995 and 1986) and Macedo (1986). For a synthetic presentation of the collective bargaining structure in Brazil, see Camargo (1997) and Cacciamali (1994).

which resulted in an abrupt reduction in inflation. I assume that log-inflation follows an AR(1) process with a structural change from beginning in 1995. Thus, the predicted value of log-inflation in year t is the expected log-inflation and the predicted residual is its unexpected component.

Moreover, although PNADs is state and nationally representative, it does not provide a representative sample at the city level. The smallest representative units are the ten metropolitan areas. Since I want to capture the indexation effect, I restrict the sample to male individuals aged twenty-five to fifty years old and living in these ten metropolitan areas. This guarantees a more homogenous sample of workers and allows to capture reliably the effect of the indexation system since the labor contracts and unions' agreements are more likely to bind in this region.

I re-estimate a slight different version of model (9) which splits inflation into two components: the expected and unexpected components.

$$S_{jt} = a + b_1 I_t^e + b_2 I_t^u + c\, UR_{jt} + d\, MW_t + \theta_j + \mathbf{B}'\mathbf{X}_{jt} + \nu_{jt} \qquad (9')$$

where I_t^e and I_t^u and the expected and unexpected log-inflation, and the other variables were defined above. To control for metropolitan areas' heterogeneity, I also introduce a metropolitan area fixed effect.

The intuition is that if indexation affects inequality then this effect can be captured by the unexpected component of inflation. The greater the uncertainty on future prices, more likely risk-averse workers and firms are to establish indexation clauses in their contract. The elasticity of indexation on inflation may depend on the parameters of the firms' production functions, workers' and owners' preferences, as well as on the relationship between firm-specific prices and aggregate

price index (e.g., Card (1986), Ehrenberg et al. (1983), Hamermesh (1986), Hendricks and Kahn (1985)).[19]

Table 11 presents the results for expected and unexpected inflation, unemployment rate and minimum wage. The effects of unemployment and minimum wage remains similar to the previous ones. Expected inflation decreases the standard deviation but increases the 90^{th}-10^{th} log-wage differential. Both effects are statistically significant. It does not affect the 90^{th}-50^{th} differential but significantly increase the 50^{th}-10^{th} differential. It seems that the overall effect on standard deviation is due to the impact on the extreme top of the wage distribution. Interestingly, the unexpected inflation is the most important component to be positively associated with increases in inequality, as hypothesized above. It increases overall inequality with stronger impact on the top of the wage distribution.

-INSERT TABLE 11-

The unexpected inflation results support the idea that workers located in the lower part of the wage distribution are less able to protect themselves against inflation. This 'indexation effect' is expected to operate through prices and premiums associated to industry, occupation and occupation status. On the other hand, the findings of the previous sections reveal that the changes in wage inequality are mainly due to changes in the skills' prices associated to industry, occupation and status of occupation. Thus, it can be argued that if inflation affects inequality through the indexation mechanism then its effect should be captured by the skill's price changes. Since the regional inequality measures based on the workers' wages in each metropolitan area reflect differences on workers productivity characteristics as well as different regional prices faced by these workers I may

[19] For comparison purposes, I replicate model (9) in Table A.6 in the Appendix. It shows similar results of table 5.3. The impacts of inflation, unemployment and minimum wage on wage distribution of the national sample of male workers are

not adequately control for workers' skills and may be capturing other effects above indexation in Table 11.

In order to minimize these potential biases, I also perform similar analysis of Tables 11 using hypothetical regional wage distributions where the observable and unobservable productivity characteristics are held constants and the differences in wages are solely due to differences in observable prices. That is, for each worker in São Paulo state in 1989 I assign the observable prices faced by workers in each metropolitan area and year, separately. These prices are obtained by separate regressions of log-wages on schooling, potential experience and its square, industry, occupation and occupation status dummies.

Table 12 presents the effects of expected and unexpected inflation, unemployment and minimum wage on inequality measures based on these hypothetical distributions. Note that the variations in inequality are now entirely due to differences in the observable skill prices only, which include industry, occupation and occupation status premiums. Again, unexpected inflation increase inequality (and now with a bigger impact) and its impact operates at the lower end of the distribution. Contrarily, unemployment and minimum wage do not seem to affect inequality. Thus unexpected inflation is positively associated with changes in inequality entirely due to changes in observable skill prices and premiums.

-INSERT TABLE 12-

VII. Conclusion

In this paper I show that the changes in inequalities associated with changes in observable and unobservable workers' skill prices in the 1980s and 1990s cannot be consistently explained by

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similar to those effects on the wage distribution of male workers in metropolitan area. Particularly, inflation increases

changes in the observed patterns of labor supply and labor demand. I suggest that macroeconomic instability can explain the inequality changes observed in the last two decades. Moreover, the indexation scheme is a possible candidate to explain the mechanism through which inflation affects inequality.

In analyzing inflation and income distribution, Blank and Blinder (1986) find that unexpected inflation is the main and maybe the only component of inflation with distributive consequences. In other words, expected inflation plays no role. My results seem to follow their conclusion too, although the expected inflation is also positive and significant in some case. Even though the above exercise does not provide direct evidence of the effect of indexation on inequality, it does suggest, by first approximation, that it may be a possible mechanism through which inflation affects inequality.

An additional result is that workers at the bottom of the wage and earnings distributions are the most affected by macroeconomic instability. On the one hand, these workers have improved their productivity attributes during the 1980's and the relative net-demand for low skill workers increased throughout the 1980's and 1990's periods. These would lead to an increase in the relative wages of workers located at the bottom of the distributions. On the other hand, the macroeconomic instability of the last two decades negatively impacted their labor market outcomes so that the net result was relatively lower wages, a sad outcome for those that otherwise would have improved their relative economic conditions had the macroeconomic performance of Brazil improved.

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inequality mainly due to its adverse effect on the bottom of the wage (earnings) distribution.

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Table 1: Lorenz Curves of Male Wage Distribuition

Deciles	1981	1987	1989	1993	1997
1	0.014	0.012	0.010	0.011	0.012
2	0.037	0.033	0.028	0.032	0.032
3	0.069	0.061	0.051	0.059	0.062
4	0.109	0.099	0.083	0.096	0.100
5	0.160	0.148	0.125	0.142	0.149
6	0.223	0.211	0.180	0.201	0.211
7	0.306	0.293	0.254	0.277	0.290
8	0.415	0.404	0.361	0.381	0.399
9	0.579	0.572	0.529	0.541	0.566
10	1.000	1.000	1.000	1.000	1.000

Table 2: Male Wage Inequality Measures

Year	Std Dev	90th-10th	90th-50th	50^{th}-10th	75th-25th	Theil	Gini
1981	1.006	2.444	1.335	1.109	1.251	0.542	0.512
1982	0.968	2.477	1.394	1.083	1.279	0.558	0.517
1987	1.012	2.533	1.375	1.159	1.356	0.580	0.545
1988	1.082	2.672	1.495	1.176	1.396	0.661	0.587
1989	1.086	2.640	1.498	1.143	1.494	0.724	0.595
1990	1.049	2.637	1.412	1.225	1.435	0.615	0.558
1992	1.007	2.462	1.338	1.125	1.273	0.584	0.549
1993	1.038	2.489	1.418	1.071	1.310	0.690	0.573
1995	1.006	2.558	1.395	1.164	1.343	0.586	0.559
1996	0.993	2.573	1.416	1.157	1.292	0.594	0.552
1997	1.017	2.550	1.386	1.164	1.294	0.603	0.561

Table 3: Male Wage Inequality Change Decomposition : 1981 – 1989

Basic Human Capital Specification				
Log Wages Inequality Measures	**Overall Change**	**Observable Quantities Effect**	**Observable Prices Effect**	**Wage Eq. Residual Effect**
		1981 Base Year Prices		
Theil	0.182	0.000	0.020	0.163
Std. Dev.	0.079	-0.009	0.002	0.087
90^{th}-10th Diff.	0.196	0.011	-0.018	0.203
90^{th}-50th Diff.	0.163	0.052	0.013	0.097
50^{th}-10th Diff.	0.033	-0.041	-0.031	0.106
		1989 Base Year Prices		
Theil	0.182	0.056	0.016	0.110
Std. Dev.	0.079	0.026	0.000	0.054
90^{th}-10th Diff.	0.196	-0.055	-0.020	0.271
90^{th}-50th Diff.	0.163	-0.020	0.010	0.173
50^{th}-10th Diff.	0.033	-0.035	-0.029	0.098

Table 4: Male Wage Inequality Change Decomposition : 1989 – 1997

Basic Human Capital Specification				
Log Wages Inequality Measures	**Overall Change**	**Observable Quantities Effect**	**Observable Prices Effect**	**Wage Eq. Residual Effect**
		1981 Base Year Prices		
Theil	-0.121	0.014	0.003	-0.139
Std. Dev.	-0.069	0.008	0.008	-0.084
90^{th}-10th Diff.	-0.090	0.111	0.018	-0.218
90^{th}-50th Diff.	-0.112	0.030	0.009	-0.151
50^{th}-10th Diff.	0.022	0.081	0.008	-0.067
		1989 Base Year Prices		
Theil	-0.121	0.042	0.007	-0.170
Std. Dev.	-0.069	0.005	0.010	-0.084
90^{th}-10th Diff.	-0.090	0.037	0.034	-0.161
90^{th}-50th Diff.	-0.112	-0.035	0.019	-0.096
50^{th}-10th Diff.	0.022	0.073	0.014	-0.065

Table 5: Male Wage Inequality Change Decomposition : 1981 – 1989

Augmented Human Capital Specification				
Log Wages Inequality Measures	**Overall Change**	**Observable Quantities Effect**	**Observable Prices Effect**	**Wage Eq. Residual Effect**
		1981 Base Year Prices		
Theil	0.182	-0.024	0.044	0.162
Std. Dev.	0.079	-0.012	0.031	0.061
90th-10th Diff.	0.196	0.077	0.073	0.045
90th-50th Diff.	0.163	0.042	0.038	0.082
50th-10th Diff.	0.033	0.035	0.035	-0.037
		1989 Base Year Prices		
Theil	0.182	0.069	0.047	0.066
Std. Dev.	0.079	0.083	0.031	-0.035
90th-10th Diff.	0.196	0.053	0.082	0.060
90th-50th Diff.	0.163	0.024	0.035	0.104
50th-10th Diff.	0.033	0.029	0.047	-0.044

Table 6: Male Wage Inequality Change Decomposition : 1989 - 1997

Augmented Human Capital Specification				
Log Wages Inequality Measures	**Overall Change**	**Observable Quantities Effect**	**Observable Prices Effect**	**Wage Eq. Residual Effect**
		1981 Base Year Prices		
Theil	-0.121	-0.003	-0.034	-0.085
Std. Dev.	-0.069	0.006	-0.009	-0.066
90th-10th Diff.	-0.090	0.136	-0.050	-0.176
90th-50th Diff.	-0.112	0.057	-0.056	-0.112
50th-10th Diff.	0.022	0.079	0.007	-0.064
		1989 Base Year Prices		
Theil	-0.121	0.046	-0.025	-0.143
Std. Dev.	-0.069	0.008	-0.010	-0.068
90th-10th Diff.	-0.090	0.023	-0.012	-0.101
90th-50th Diff.	-0.112	-0.013	-0.043	-0.056
50th-10th Diff.	0.022	0.036	0.031	-0.045

Table 7: Labor Supply, Labor Demand and Net-Supply Indexes Male Workers
(Measured in Hours of Work)

	Supply Indexes		Demand Indexes		Net-Supply Indexes	
	1981-1989	1989-1997	1981-1989	1989-1997	1981-1989	1989-1997
Education Groups						
Illiterate	-0.210	-0.348	0.088	-0.037	-0.173	-0.311
1-4 Years of Schooling	-0.191	-0.189	0.037	0.017	-0.208	-0.206
5-8 Years of Schooling	0.252	0.213	-0.038	0.032	0.220	0.181
9-11 Years of Schooling	0.506	0.316	-0.099	-0.016	0.522	0.333
12 or more Years of Schooling	0.339	0.213	-0.130	-0.065	0.403	0.278
Potential Experience Groups						
0-8 Years of Experience	0.207	0.120	-0.119	-0.043	0.250	0.163
9-17 Years of Experience	0.200	0.059	-0.057	-0.001	0.201	0.059
18-26 Years of Experience	-0.009	0.033	-0.001	0.006	-0.015	0.028
27 or more Years of Experience	-0.094	-0.070	0.036	-0.002	-0.092	-0.068
Education x Potential Experience Groups						
Illiterate:						
18-26 Years of Experience	-0.223	-0.476	0.059	-0.032	-0.192	-0.445
27 or more Years of Experience	-0.204	-0.291	0.102	-0.039	-0.165	-0.251
1-4 Years of Schooling:						
9-17 Years of Experience	-0.445	-0.257	0.041	0.017	-0.462	-0.275
18-26 Years of Experience	-0.232	-0.217	0.044	0.020	-0.252	-0.236
27 or more Years of Experience	-0.114	-0.161	0.032	0.015	0.129	-0.176
5-8 Years of Schooling:						
9-17 Years of Experience	0.326	0.081	-0.034	0.033	0.292	0.048
18-26 Years of Experience	0.283	0.253	-0.032	0.038	0.244	0.214
27 or more Years of Experience	0.119	0.315	-0.054	0.020	0.099	0.295
9-11 Years of Schooling:						
0-8 Years of Experience	0.433	0.077	-0.095	-0.024	0.457	0.101
9-17 Years of Experience	0.481	0.151	-0.095	-0.010	0.492	0.162
18-26 Years of Experience	0.604	0.542	-0.103	-0.022	0.626	0.564
27 or more Years of Experience	0.427	0.499	-0.112	-0.027	0.454	0.526
12 or more Years of Schooling:						
0-8 Years of Experience	0.118	-0.037	-0.129	-0.052	0.170	0.015
9-17 Years of Experience	0.312	0.086	-0.126	-0.072	0.384	0.157
18-26 Years of Experience	0.545	0.374	-0.137	-0.066	0.611	0.440
27 or more Years of Experience	0.350	0.759	-0.131	-0.050	0.400	0.809

Table 8: Labor Supply, Labor Demand and Net-Supply Indexes Male Workers (Measured in Numbers of Workers)

	Supply Indexes		Demand Indexes		Net-Supply Indexes	
	1981-1989	**1989-1997**	**1981-1989**	**1989-1997**	**1981-1989**	**1989-1997**
Education Groups						
Illiterate	-0.175	-0.370	0.060	-0.018	-0.235	-0.352
1-4 Years of Schooling	-0.186	-0.151	0.033	0.032	-0.219	-0.183
5-8 Years of Schooling	0.171	0.198	-0.023	0.033	0.194	0.165
9-11 Years of Schooling	0.448	0.234	-0.069	-0.042	0.516	0.276
12 or more Years of Schooling	0.203	0.170	-0.083	-0.109	0.285	0.279
Potential Experience Groups						
0-8 Years of Experience	0.070	0.163	-0.082	-0.081	0.152	0.245
9-17 Years of Experience	0.186	0.020	-0.041	-0.012	0.227	0.032
18-26 Years of Experience	-0.008	0.032	0.001	0.005	-0.009	0.027
27 or more Years of Experience	-0.095	-0.054	0.028	0.007	-0.123	-0.061
Education x Potential Experience Groups						
Illiterate:						
18-26 Years of Experience	-0.191	-0.551	0.034	-0.023	-0.225	0.529
27 or more Years of Experience	-0.166	-0.285	0.073	-0.015	-0.239	-0.269
1-4 Years of Schooling:						
9-17 Years of Experience	-0.419	-0.206	0.037	0.041	-0.456	-0.247
18-26 Years of Experience	-0.210	-0.166	0.038	0.037	-0.248	-0.203
27 or more Years of Experience	-0.123	-0.131	0.028	0.028	-0.151	-0.159
5-8 Years of Schooling:						
9-17 Years of Experience	0.278	0.076	-0.023	0.040	0.302	0.036
18-26 Years of Experience	0.192	0.243	-0.018	0.037	0.210	0.206
27 or more Years of Experience	0.015	0.281	-0.030	0.017	0.044	0.265
9-11 Years of Schooling:						
0-8 Years of Experience	0.279	0.04	-0.073	-0.041	0.351	0.086
9-17 Years of Experience	0.436	0.056	-0.068	-0.035	0.505	0.091
18-26 Years of Experience	0.525	0.462	-0.068	-0.048	0.593	0.510
27 or more Years of Experience	0.401	0.449	-0.072	-0.067	0.473	0.516
12 or more Years of Schooling:						
0-8 Years of Experience	-0.014	0.022	-0.086	-0.100	0.073	0.122
9-17 Years of Experience	0.203	0.011	-0.080	-0.111	0.283	0.122
18-26 Years of Experience	0.346	0.323	-0.084	-0.110	0.430	0.433
27 or more Years of Experience	0.256	0.693	-0.085	-0.108	0.341	0.801

Table 9: Wage Inequality Measures, Inflation Rate, Real Minimum Wage, Real Average Wage and Unemployment Rate for Selected Years

Year	Wage Inequality		Yearly Average Inflation Rate	Real Minimum Wage	Real Average Wage	Unemployment Rate
	90^{th}-10^{th} Log-Diff.	50th-10th Log-Diff.				
1981	2.457	1.109	99.40	126.06	674.21	2.577
1982	2.526	1.083	96.42	127.15	699.01	2.515
1987	2.554	1.159	118.99	86.74	545.69	2.360
1988	2.590	1.176	426.25	97.75	630.13	2.527
1989	2.573	1.143	1000.37	99.41	911.18	2.252
1990	2.590	1.225	3437.13	92.40	701.48	2.874
1992	2.436	1.125	662.97	135.37	602.94	8.374
1993	2.459	1.071	1348.99	124.19	663.81	8.007
1995	2.485	1.164	183.98	117.93	813.47	8.247
1996	2.595	1.157	18.45	116.91	835.41	9.772
1997	2.526	1.164	7.24	120.00	810.77	9.562

Table 10: The Effects of Log-Inflation, Unemployment Rate and Minimum Wage on Inequality Measures Across States

	Male Wage Distribution							
	Std Dev.of Log-Wages		90th-10th Differential		90th-50th Differential		50th-10th Differential	
	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
Log-Inflation	0.1347	0.0588	0.0324	0.0085	-0.0082	0.0067	0.0185	0.0018
Unemployment	-0.1068	0.0257	-0.0123	0.0047	-0.0097	0.0023	0.0047	0.0021
Minimum Wage	-0.0066	0.0058	-0.0028	0.0007	-0.0027	0.0005	-0.0023	0.0002

Note: Additional variables include average and standard deviation years of schooling in each state and year, average and standard deviation of potential experience in each state and year and proportion of individuals aged twenty five to fifty years old living in urban areas by state and year, and a state fixed effect.

Table 11: The Effects of Expected Log-Inflation, Unexpected Log-Inflation, Unemployment Rate and Minimum Wage on Inequality Measures Across Metropolitan Areas

	Male Wage Distribution							
	Std Dev.of Log-Wages		90th-10th Differential		90th-50th Differential		50th-10th Differential	
	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
Expected Log-Inflation	-0.0265	0.0120	0.0052	0.0019	-0.0036	0.0024	0.0110	0.0018
Unexpected Log-Inflation	0.1614	0.0226	0.0552	0.0029	0.0225	0.0042	0.0138	0.0042
Unemployment	-0.0111	0.0092	-0.0227	0.0009	-0.0184	0.0013	-0.0052	0.0010
Minimum Wage	0.0010	0.0014	-0.0018	0.0001	-0.0002	0.0002	-0.0015	0.0002

Note: Additional variables include average and standard deviation years of schooling in each state and year, average And standard deviation of potential experience in each state and year and proportion of individuals aged twenty five to Fifty years old living in urban areas by state and year, and a state fixed effect.

Table 12: The Effects of Expected Log-Inflation, Unexpected Log-Inflation, Unemployment Rate and Minimum Wage on Inequality Measures of the Hypothetical Distributions in Metropolitan Areas

	Male Wage Distribution							
	Std Dev.of Log-Wages		90th-10th Differential		90th-50th Differential		50th-10th Differential	
	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
Expected Log-Inflation	0.00003	0.00043	-0.00101	0.00039	-0.00221	0.00135	0.00304	0.00087
Unexpected Log-Inflation	-0.00090	0.00052	0.00853	0.00030	-0.00378	0.00215	0.00721	0.00174
Unemployment	-0.00388	0.00030	-0.00735	0.00011	-0.00936	0.00056	-0.00182	0.00041
Minimum Wage	0.00027	0.00003	0.00000	0.00002	0.00072	0.00010	-0.00021	0.00008

Note: Additional variables include average and standard deviation years of schooling in each MAand year, average and standard deviation of potential experience in each MA and year, proportion of workers in each one-digit industry by MA and year, proportion of workers by one-digit occupation by MA and year.

Appendix

Table A.1: Basic Statistics – 1981
Male Workers Aged 25-50

Variables	Mean	Standard Deviation	Minimum	Maximum
Log-Wage	5.750	0.987	-4.286	10.023
Log-Earnings	5.785	0.985	-4.169	10.052
Schooling	4.723	4.395	0.000	17.000
Experience	24.952	8.924	2.000	44.000
Exp.-squared	702.251	459.373	4.000	1936.000
Occupation 1	0.071	0.257	0.000	1.000
Occupation 2	0.178	0.382	0.000	1.000
Occupation 3	0.221	0.415	0.000	1.000
Occupation 4	0.306	0.461	0.000	1.000
Occupation 5	0.105	0.307	0.000	1.000
Occupation 6	0.094	0.291	0.000	1.000
Occupation 7	0.019	0.137	0.000	1.000
Occupation 8	0.006	0.079	0.000	1.000
Industry 1	0.213	0.409	0.000	1.000
Industry 2	0.175	0.380	0.000	1.000
Industry 3	0.135	0.342	0.000	1.000
Industry 4	0.031	0.172	0.000	1.000
Industry 5	0.112	0.316	0.000	1.000
Industry 6	0.085	0.278	0.000	1.000
Industry 7	0.036	0.186	0.000	1.000
Industry 8	0.073	0.261	0.000	1.000
Industry 9	0.041	0.197	0.000	1.000
Industry 10	0.066	0.249	0.000	1.000
Industry 11	0.033	0.178	0.000	1.000
Formal	0.484	0.500	0.000	1.000
Informal	0.190	0.393	0.000	1.000
Self-Emp.	0.272	0.445	0.000	1.000
Employer	0.053	0.225	0.000	1.000
Obsevations	55347			

Table A.2: Basic Statistics – 1989
Male Workers Aged 25-50

Variables	Mean	Standard Deviation	Minimum	Maximum
Log-Wage	5.913	1.085	-0.105	11.941
Log-Earnings	5.934	1.081	0.005	11.741
Schooling	5.599	4.596	0.000	17.000
Experience	24.119	9.014	2.000	44.000
Exp.-squared	662.978	457.487	4.000	1936.000
Occupation 1	0.062	0.241	0.000	1.000
Occupation 2	0.183	0.386	0.000	1.000
Occupation 3	0.168	0.374	0.000	1.000
Occupation 4	0.249	0.432	0.000	1.000
Occupation 5	0.099	0.299	0.000	1.000
Occupation 6	0.081	0.272	0.000	1.000
Occupation 7	0.020	0.139	0.000	1.000
Occupation 8	0.008	0.089	0.000	1.000
Industry 1	0.191	0.393	0.000	1.000
Industry 2	0.176	0.381	0.000	1.000
Industry 3	0.110	0.313	0.000	1.000
Industry 4	0.030	0.170	0.000	1.000
Industry 5	0.126	0.332	0.000	1.000
Industry 6	0.103	0.304	0.000	1.000
Industry 7	0.040	0.197	0.000	1.000
Industry 8	0.072	0.258	0.000	1.000
Industry 9	0.044	0.205	0.000	1.000
Industry 10	0.071	0.256	0.000	1.000
Industry 11	0.037	0.190	0.000	1.000
Formal	0.467	0.499	0.000	1.000
Informal	0.200	0.400	0.000	1.000
Self-Emp.	0.261	0.439	0.000	1.000
Employer	0.073	0.260	0.000	1.000
Obsevations	42666			

Table A.3: Basic Statistics – 1997
Male Workers Aged 25-50

Variables	Mean	Standard Deviation	Minimum	Maximum
Log-Wage	5.919	1.000	0.693	11.143
Log-Earnings	5.959	1.001	0.693	11.225
Schooling	6.446	4.424	0.000	15.000
Experience	23.738	8.732	4.000	44.000
Exp.-squared	639.755	439.422	16.000	1936.000
Occupation 1	0.064	0.244	0.000	1.000
Occupation 2	0.146	0.353	0.000	1.000
Occupation 3	0.158	0.365	0.000	1.000
Occupation 4	0.269	0.444	0.000	1.000
Occupation 5	0.117	0.321	0.000	1.000
Occupation 6	0.083	0.277	0.000	1.000
Occupation 7	0.022	0.148	0.000	1.000
Occupation 8	0.141	0.348	0.000	1.000
Industry 1	0.169	0.375	0.000	1.000
Industry 2	0.152	0.359	0.000	1.000
Industry 3	0.126	0.331	0.000	1.000
Industry 4	0.021	0.142	0.000	1.000
Industry 5	0.140	0.347	0.000	1.000
Industry 6	0.135	0.341	0.000	1.000
Industry 7	0.044	0.204	0.000	1.000
Industry 8	0.078	0.268	0.000	1.000
Industry 9	0.047	0.211	0.000	1.000
Industry 10	0.065	0.247	0.000	1.000
Industry 11	0.024	0.154	0.000	1.000
Formal	0.455	0.498	0.000	1.000
Informal	0.185	0.388	0.000	1.000
Self-Emp.	0.293	0.455	0.000	1.000
Employer	0.067	0.251	0.000	1.000
Obsevations	50510			

Table A.4: Log-Wage Equation. Basic Human Capital Specification

Ind. Variables	1981 Coeff.	1981 Std. Errors	1989 Coeff.	1989 Std. Errors	1997 Coeff.	1997 Std. Errors
Intercept	4.978720	0.070490	4.785380	0.096540	4.916860	0.088000
Schooling	-0.025730	0.009950	-0.022260	0.013030	-0.026890	0.012200
Schooling Squared	0.007390	0.000382	0.008170	0.000476	0.008080	0.000447
Potential Experience	0.008630	0.004530	0.022370	0.006150	0.000961	0.005480
Experience Squared	-0.000204	0.000070	-0.000326	0.000094	0.000052	0.000082
Schooling*Experience	0.007100	0.000373	0.006580	0.000492	0.007090	0.000451
Schooling Squared* Experience Squared	-0.000011	0.000001	-0.000011	0.000001	-0.000011	0.000001
R-Squared	0.3674		0.3692		0.4270	

Table A.5: Log-Wage Equation. Augmented Human Capital Specification

	1981		1989		1997	
Ind. Variables	**Coeff.**	**Std. Errors**	**Coeff.**	**Std. Errors**	**Coeff.**	**Std. Errors**
Intercept	4.77175	0.05671	4.64720	0.03944	4.56656	0.03407
Schooling	0.10361	0.00114	0.11819	0.00129	0.12101	0.00109
Experience	0.05047	0.00203	0.05402	0.00234	0.04460	0.00190
Exp.-squared	-0.00070	0.00004	-0.00070	0.00004	-0.00052	0.00004
Occupation 1	0.78733	0.04785	0.63803	0.02151	0.51685	0.01726
Occupation 2	0.55360	0.04658	0.51030	0.01674	0.35247	0.01408
Occupation 3	-0.06925	0.05006	-0.09013	0.02600	-0.14465	0.02386
Occupation 4	0.22964	0.04560	0.20245	0.01481	0.13622	0.01244
Occupation 5	0.37938	0.04744	0.30117	0.01986	0.16501	0.01563
Occupation 6	0.22165	0.04733	0.22835	0.02017	0.16937	0.01690
Occupation 7	0.12372	0.05222	0.14395	0.03010	-0.04523	0.02431
Industry 1	-0.66713	0.02896	-0.75286	0.03120	-0.48938	0.03004
Industry 2	-0.26122	0.02184	-0.28120	0.02360	-0.09342	0.02315
Industry 3	-0.53951	0.02349	-0.54094	0.02623	-0.16665	0.02483
Industry 4	-0.15186	0.03039	-0.12142	0.03187	-0.06993	0.03101
Industry 4	-0.53787	0.02296	-0.51210	0.02507	-0.25254	0.02349
Industry 5	-0.54666	0.02447	-0.54730	0.02550	-0.20989	0.02352
Industry 7	-0.33276	0.02651	-0.29793	0.02912	0.01170	0.02628
Industry 8	-0.25101	0.02604	-0.21961	0.02841	-0.03495	0.02620
Industry 9	-0.59927	0.02758	-0.61105	0.02935	-0.30768	0.02648
Industry 10	-0.53326	0.02654	-0.36509	0.02660	-0.10649	0.02478
Informal	-0.30101	0.01010	-0.19729	0.01137	-0.26627	0.00940
Self-Emp.	-0.06758	0.00909	0.11766	0.01107	-0.09484	0.00877
Employer	0.28227	0.01693	0.54703	0.01911	0.44705	0.01527
R-Squared	0.4925		0.4806		0.5209	

Table A.6: The Effects of Log-Inflation, Unemployment Rate and Minimum Wage on Inequality Measures Across Metropolitan Areas

	Male Wage Distribution							
	Std Dev.of Log-Wages		90th-10th Differential		90th-50th Differential		50th-10th Differential	
	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
Log-Inflation	0.0150	0.0049	0.0146	0.0031	0.0012	0.0019	0.0114	0.0015
Unemployment	-0.0182	0.0043	-0.0281	0.0008	-0.0181	0.0013	-0.0064	0.0006
Minimum Wage	0.0004	0.0006	-0.0015	0.0001	-0.0001	0.0002	-0.0014	0.0002

Note: Additional variables include average and standard deviation years of schooling in each state and year, average and standard deviation of potential experience in each state and year and proportion of individuals aged twenty five to fifty years old living in urban areas by state and year, and a state fixed effect.

Table A.7: The Effects of Expected Log-Inflation, Unexpected Log-Inflation, Unemployment Rate and Minimum Wage on Inequality Measures of the Actual Distributions in Metropolitan Areas (controlled by Industry, Occupation and Status of Occupation)

	Male Wage Distribution							
	Std Dev.of Log-Wages		90th-10th Differential		90th-50th Differential		50th-10th Differential	
	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error	Coeff.	Std. Error
Expected Log-Inflation	0.1456	0.0302	-0.0043	0.0052	-0.0014	0.0047	0.0071	0.0020
Unexpected Log-Inflation	-0.1050	0.0490	0.0423	0.0084	0.0040	0.0079	0.0298	0.0039
Unemployment	0.0480	0.0305	-0.0118	0.0047	-0.0103	0.0027	0.0044	0.0024
Minimum Wage	0.0235	0.0059	0.0008	0.0009	0.0002	0.0006	-0.0014	0.0004

Note: Additional variables include average and standard deviation years of schooling in each MAand year, average and standard deviation of potential experience in each MA and year, proportion of workers in each one-digit industry by MA and year, proportion of workers by one-digit occupation by MA and year, proportion of workers by status of ocupation by MA and year, and a metropolitan area fixed effect.