

Some Stylized Facts of the Informal Sector in Brazil in the Last Two Decades¹

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RESUMO

Dois fatos caracterizaram a evolucao do setor informal no Brasil nas ultimas duas decadas: o aumento na proporcao de trabalhadores sem registro e a reducao no diferencial de salarios entre trabalhadores registrados (com carteira) e trabalhadores sem registro (sem carteira). Neste artigo, nos documentamos tanto o aumento da informalidade quanto a reducao do diferencial de salarios. Adicionalmente, investigamos quais fatores foram responsaveis pela reducao no diferencial de salarios entre o setor formal e informal e como esta reducao contribuiu para a diminuicao da desigualdade salarial total entre 1981 e 1999. Entre os resultados encontrados, nos destacariamos: 1) a coincidencia entre estes dois fenomenos e as reformas pro-mercado do inicio dos anos 90; 2) a reducao do diferencial de salarios formal/informal foi o segundo fator mais importante para a reducao da desigualdade de salarios, apos educacao. De todo modo, porque e como isto ocorreu ainda e um topico aberto ao debate, de todo modo, especulamos que o impacto da abertura comercial sobre o setor informal e os efeitos da crescente indexacao dos salarios do setor informal ao salario minimo podem estar por tras deste fenomeno.

ABSTRACT

Two facts have characterized the evolution of the informal sector in Brazil during the last two decades: the increase in the proportion of non-registered workers and the diminishing wage gap between non-registered and registered workers. In this paper, we document both the increase of the informal sector and the fall in the wage gap in Brazil. Besides, we investigate which factors were responsible for the fall in the wage gap and how this reduction has contributed to reduce wage inequality between 1981 and 1999. Among our findings, we would highlight: 1) the coincidence between these two movements and the market-oriented reforms of the early 1990's; 2) that the fall in the formal/informal wage gap has substantially contributed to the decrease in wage inequality. After education, the fall in the wage premium due to the possession of a work-card was the main responsible for bringing down wage inequality. Why and how it happened is an open debate. We speculate that the trade liberalization process of the early 1990's and the increasing indexation of informal sector wages to the minimum wage may be behind these phenomena

JEL CODES: J21, J31, J42

Palavras-chaves: Setor Informal, Diferencial de Salarios, Desigualdade Salarial
Keywords: Informal sector, Wage Differential, Wage inequality

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1 INTRODUCTION

Brazil had 36 millions of private sector wage workers above the age of 10 years in 1999³. Out of that, 14 millions were in the informal sector, i.e., their job contract was not registered in their work card. In this paper, we aim to establish and analyze in depth some stylized facts such as the increase in the size of the informal sector during the 1980's and the 1990's and the fall in the wage gap between formal and informal workers in the mid-1990's. Therefore, it is mainly a descriptive paper on the evolution of the informal sector during the last two decades.

The size of the informal sector in Brazil - almost 40% of wage workers - is in itself something that demands an explanation. This figure means that a sizable portion of workers are not entitled to benefits such as the unemployment insurance and do not contribute to social security. This is both a social and a fiscal problem in a country that has been struggling to replicate the high growth rates witnessed until the 1970's. The proportion of the informal sector increased 10% during these 15 years. It did so even in the manufacturing sector in which it used to be relatively unimportant⁴. Paradoxically, the wage gap between formal and informal workers also decreased between 1981 and 1999. Most of the reduction in the wage gap occurred after the market-oriented reforms (e.g. privatization, trade liberalisation, deregulation) of the early 1990's and after the enactment of the new Federal Constitution of 1988⁵. It is true that there were some episodic reductions in the wage gap (e.g. 1986 and 1990), but it was only from 1992 onwards that this reduction was not significantly reversed by changes in the business cycle or by the melting down of price and wage controls of unorthodox stabilization plans. The reduction in the wage gap between formal and informal workers helped to reduce slightly wage inequality, but the latter is still extremely high when compared to other similar countries⁶. Furthermore, the wage package of formal workers contains, besides the mandatory benefit associated with the registration, several fringe benefits that are not readily accessible to non-registered workers (e.g. transport and food vouchers), so that the actual inequality is likely to be higher than the one reported in the raw estimates. The productive attributes of non-registered workers improved over the last two decades, and this fact can explain part of the wage gap reduction, but not all of it. Another interesting change that occurred during this period was the fact that non-registered workers became over-represented among the minimum wage earners. In addition to that, there is some evidence that their wage increases were linked to minimum wage hikes.

At this point it is necessary to clarify the concept of informal sector we will be using. Throughout this paper we will be referring to the informal sector as the set of workers whose contract is not registered in his/her work-card (*carteira de trabalho*). According to the Brazilian legislation, registered workers are the ones whose labour contract is registered on their work-card. This registration entitles them to several wage and non-wage benefits such as 30 days of paid holiday per year, contribution for social security,

³This is the aggregate figure for the whole country (except the rural North region) and excludes public sector wage workers (4.9 millions), self-employed workers (16.8 millions) and domestic workers (5.9 millions). This data is published by the National Statistics Office, IBGE - Instituto Brasileiro de Geografia e Estatísticas. Website: <http://www.ibge.gov.br/> and comes from the Annual Household Survey – PNAD.

⁴Many commentators argue that the fall in the proportion of workers in manufacturing industry and the increase in the proportion of workers in the service industry are the main culprit for the increase in the proportion of informal workers. However, Ramos (2002) show that the proportion of informal workers increased within the manufacturing sector, so that changes in the sectoral structure of employment cannot be entirely responsible for this phenomenon.

⁵The New Constitution created several new rights to formal workers and reduced the maximum workweek.

⁶According to the 2002 World Development Report published by the World Bank, Brazil Gini's index of 0.61 is among the highest in the world, comparable to Central African Republic (0.62), Sierra Leone (0.63) and Nicaragua (0.61), and well above Argentina (0.45) and Mexico (0.51).

right to request unemployment benefit in case of dismissal, monetary compensation if dismissed without a fair cause, maternity and paternity paid leave and so on. Differently, non-registered workers have informal contracts, which are illegal and not registered in their work-card; in general any benefit such as paid holiday must be agreed with the employer on a case-by-case basis. Moreover, non-registered workers do not have access to any of the government-administered benefits related to the labour market, such as unemployment benefit and severance payment.

It is important not to confound this classification with the *ILO* (International Labor Organization) or *ILO*-related definitions of the informal sector. In general, these definitions comprise non-professional self-employed, employers and employees in small firms with cut points varying from 5 to 15 employees and non-paid workers [Maloney (1997), Gong et al. (2000)]. Our classification of registered and non-registered workers is an institutional one, in which employers avoid some sort of regulation, in this case, compliance with the labour code. Other possible definitions in the institutional framework are: the lack of contribution for social security as in Verry and Araujo (1996) or working in the underground economy. We prefer the registered/non-registered classification because it allows us to concentrate on the labour market strictly defined, i.e., on employees who work for a firm and receive monetary payment. Differently to what happens when one puts together self-employed and small-firms owners, in which case managerial ability and entrepreneurial talent play a crucial role in the sector allocation decision, focusing on a sample of employee should reduce possible selectivity problems. Furthermore, it is widely recognised the difficulties in comparing wages of employees and earnings from self-employed and employers that, in general, contain more than their net remuneration.

2. Formal and Informal Sector in Brazil: Some Stylized Facts

The literature on the informal sector in Brazil has basically three approaches. The first considers the informal sector as comprised of self-employed and small firm workers, the second considers informal sector as workers whose labour contract does not respect the labour code (non-registered), and the third puts together self-employed and non-registered workers. In this paper, we treat as informal sector only the second group. For this reason, we use the term registered and non-registered as synonymous with formal and informal sectors. In this section we will give an overview of what happened to these two groups of workers during the 1980's⁷ and 1990's, in order to set the scene for the other three discussion papers.

2.1. Data

The data used in this paper come from the Annual Household Survey (PNAD – *Pesquisa Nacional de Amostragem Domiciliar*) carried out by the Brazilian Statistics Office (IBGE – *Instituto Brasileiro de Geografia e Estatísticas*). We use data from 1981 to 1990, 1992, 1993 and from 1995 to 1999. There is no data for years when the national census is carried out, such as 1991, and in 1994 the survey was not conducted due to lack of funds. The representative sample consists of around 100.000 households covering the whole country with the exception of North rural area (Amazon area).

The main difficulty in working with the whole series of the PNAD is to filter the sample in order to disentangle non-registered workers from public (civil and military) servants for the period 1981 to 1988. As public servants do not have a registered work-card, they were classified as non-registered workers in the earlier surveys. Such problem did not happen in the surveys from 1989 onwards, because the individuals were directly asked whether they were public servants or not. In order to overcome this difficulty we filter possible public servants using the information on the worker's occupation and industry affiliation. To keep the consistency of the procedure, we ignored the actual information on the registration status available for the period 1989 to 1999 and applied the same filter we used for the 1981 to 1988 period.

⁷For an excellent analysis of the changes in the informal sector - understood as self-employed plus non-registered workers - during the 1980's see Barros et al. (1993).

2.2. Some Descriptive Statistics

One of the distinguishing features of the Brazilian labour market is the existence of a large number of workers whose job contract is not regulated by the legal labour code, i.e, they do not have a “signed work-card”⁸. These contracts are informal and illegal but make up something around 40% of the “wage workers”⁹ and seem to have increased since the early 1990’s.

Table 1 shows the mean and the standard deviation for several variables separately for registered and non-registered workers¹⁰ in three selected years: 1981, 1990 and 1999. Non-registered workers are more likely to be younger and less educated than registered workers, but these differences between the two groups have decreased over time, particularly, in relation to education. The average age of non-registered workers was 30(28) years in 1999(1981), whereas the registered average age was 33(31) years and the average years of schooling for non-registered workers was 5.9(3.1) and for registered, 7.8(6.2). Registered workers earned more than non-registered workers, but the gap narrowed considerably during the 1990’s. The two groups used to work similar hours in 1981 and 1990, but in 1999 non-registered workers worked fewer hours than registered workers. However, the standard deviation of the working hours was much higher for non-registered workers. The presence of women increased in both groups, particularly, among the non-registered: in 1999 they represented 50% of the total non-registered workers. The regional distribution of the two groups remained quite stable over this period. Non-registered workers, however, seem to be over-represented in the Northeast.

The participation of the agricultural sector as a proportion of registered workers increased a lot between 1981 and 1999, while its participation in the non-registered sector (which was the largest in 1981) decreased. Surprisingly, the manufacturing and the productive service sectors increased their participation in the pool of non-registered workers and reduced it in the pool of registered. The retail sector, the social services, and the lodging, food and other services expanded their participation among both registered and non-registered workers, whereas the constructing sector squeezed their participation among registered and remained relatively constant among non-registered. Despite being less prevalent in metropolitan areas, the participation of non-registered workers in those areas increased during this period. Differently, the participation of registered workers decreased in metropolitan areas. It seems that there were two opposite movements in this period: the rural sector, due to changes in agriculture, became less “informal”, and the urban sector, due to the increase in informality in several sectors, became less “formal”.

	1981		1990		1999	
	non-registered	registered	non-registered	registered	non-registered	registered
Years of schooling	3.07 (3.15)	6.17 (4.12)	3.82 (3.40)	6.87 (4.16)	5.85 (3.63)	7.78 (3.86)
Gender (male=1)	0.65 (0.48)	0.72 (0.45)	0.63 (0.48)	0.68 (0.47)	0.49 (0.50)	0.61 (0.49)
Age	28.01 (13.96)	31.06 (11.06)	28.28 (13.83)	31.86 (11.06)	30.26 (12.68)	32.87 (10.78)
Experience (years)	18.94* (14.90)	18.89 (12.62)	18.46 (14.87)	18.99 (12.58)	18.40 (13.87)	19.08 (12.33)
Log hourly wage (R\$ Sept. 1998)	-0.26 (0.81)	0.83 (0.85)	-0.36 (0.88)	0.60 (0.91)	0.04 (0.81)	0.67 (0.76)
Hours	46.21	47.15	44.74	44.00	41.86	44.78

⁸The possession of a "signed work-card" (registration) gives workers several rights in terms of access to job-related public funds (e.g. unemployment benefit) and also to legally mandatory fringe benefits (e.g. paid vacations).

⁹Wage workers means remunerated employees.

¹⁰This sample excludes self-employed, non-remunerated workers, and public servants.

	(13.62)	(10.45)	(13.32)	(9.11)	(15.00)	(9.50)
Northeast	0.33	0.19	0.35	0.20	0.30	0.20
	(0.47)	(0.39)	(0.48)	(0.40)	(0.46)	(0.40)
North	0.06	0.06	0.08	0.07	0.08	0.04
	(0.23)	(0.24)	(0.28)	(0.26)	(0.28)	(0.20)
Southeast	0.35	0.45	0.30	0.44	0.34	0.43
	(0.48)	(0.50)	(0.46)	(0.50)	(0.47)	(0.50)
South	0.11	0.20	0.10	0.19	0.15	0.23
	(0.32)	(0.40)	(0.30)	(0.39)	(0.36)	(0.42)
Midwest	0.15	0.10	0.17	0.10	0.13	0.10
	(0.35)	(0.30)	(0.37)	(0.30)	(0.34)	(0.29)
Agriculture	0.35	0.03	0.27	0.05	0.19	0.06
	(0.48)	(0.18)	(0.45)	(0.22)	(0.39)	(0.23)
Manufacturing	0.09	0.35	0.12	0.33	0.11	0.27
	(0.29)	(0.48)	(0.32)	(0.47)	(0.31)	(0.44)
Constructing	0.11*	0.11	0.09	0.07	0.10	0.05
	(0.32)	(0.31)	(0.28)	(0.25)	(0.30)	(0.22)
Retail	0.08	0.14	0.10	0.16	0.11	0.17
	(0.27)	(0.35)	(0.30)	(0.37)	(0.31)	(0.37)
Lodging, food and other services	0.29	0.12	0.31	0.13	0.37	0.20
	(0.45)	(0.32)	(0.46)	(0.33)	(0.48)	(0.40)
Productive services	0.05	0.19	0.06	0.19	0.08	0.16
	(0.22)	(0.39)	(0.24)	(0.39)	(0.27)	(0.37)
Social Services	0.03	0.07	0.05	0.08	0.04	0.10
	(0.17)	(0.25)	(0.21)	(0.27)	(0.21)	(0.30)
Metropolitan area	0.31	0.63	0.30	0.55	0.43	0.55
	(0.46)	(0.48)	(0.46)	(0.50)	(0.50)	(0.50)
Race (white=1)			0.40	0.57	0.45	0.59
			(0.49)	(0.50)	(0.50)	(0.49)
Size (more than 10 = 1)			0.25	0.81	0.21	0.69
			(0.43)	(0.39)	(0.41)	(0.46)
Tenure (years)			2.96	4.79	3.12	4.78
			(5.98)	(6.02)	(4.95)	(5.63)
Union					0.02	0.24
					(0.12)	(0.43)
% earning less than mw	0.61	0.07	0.48	0.05	0.35	0.01
% earning the mw	0.01	0.04	0.06	0.09	0.13	0.08
% earning more than mw	0.39	0.90	0.47	0.86	0.53	0.91
N	38895	61840	27506	41261	25885	37706

(*) indicates that the mean of the variable is not statistically different between the two sample at 5% of significance

Table 1. Descriptive Statistics for Non-Registered and Registered Workers in Selected Years

Data about race, unionization, tenure and size of the firm were only available in more recent surveys. White workers are predominant among registered workers, whereas non-white workers are predominant among the non-registered. However, the proportion of whites among non-registered workers increased from 1990 to 1999. Non-registered workers were more likely to be employed by small firms. In 1990, only 25% of non-registered workers worked in firms with more than 10 employees, this figure was down

to 21% in 1999. This contrasts with the sample of registered workers: 81% of which worked in firms with more than 10 employees in 1990, however, in 1999 only 69% were in this situation. Non-registered workers had less seniority than registered workers and were extremely less likely to be unionized: only 2% of non-registered workers were unionized, whereas 24% of registered workers were unionized in 1999.

Overall non-registered workers have a significant disadvantage in terms of productive attributes. They are less educated, more likely to be employed in smaller firms and in low productivity sectors. They are also less likely to be unionized and more prone to be discriminated against since female and non-white workers are over-represented among them.

On the bottom of Table 1 we report the proportion of workers whose wage was lower, equal and higher than the minimum wage. Non-registered workers exhibit a high degree of non-compliance, however, non-compliance decreased considerably during the period under investigation¹¹. At the same time, there was a rise in the proportion of non-registered workers whose wages were equal to the minimum wage: 13% in 1999 compared to 1% in 1981.

Overall it seems that changes in the composition of the two groups between 1981 and 1990 may explain at least part of the fall in the wage differential between the two groups. In the next subsections we will analyze the effects of these changes more thoroughly.

2.3. Changes in Employment Structure during the 1980's and the 1990's

In the 1980's the proportion of registered workers in the occupied population followed very closely the behaviour of the business cycle. During the recession of the early 1980's it decreased sharply, but after 1984 as the economy recovered, it slightly increased. The recession of the early 1990's led to another reduction in the proportion of registered workers, but this time, even with the recovery of the economy after 1993, the proportion of registered workers did not react. In contrast, the proportion of non-registered had a counter-cyclical behaviour - as expected by the buffer interpretation of the informal sector - during the early 1980's, peaking in 1983 and reaching its lowest level in 1990. After that, the proportion of non-registered workers increased slightly and has remained rather constant since 1995¹².

The increase of the proportion of non-registered workers was more intense in the non-agricultural industries. In fact, the agriculture industry experienced an increase in the proportion of registered workers, in spite of its initial and still high level of non-compliance (see Table 1). However, since the proportion of agricultural sector jobs has decreased continuously over time, the aggregate figure is dominated by the changes in the non-agricultural sector. Looking only at this latter group the proportion of non-registered workers increased from 30% in 1981 to 40% in 1999 (see Figure 1), and the bulk¹³ of this increase was concentrated after 1990, just after the country started the market-oriented reforms, such as privatization and the process of trade liberalisation.

¹¹Notice that in 1999 the non-compliance among registered (non-registered) workers was down to 1% (35%), compared to 7% (61%) in 1981.

¹² The increase in the number of self-employed seems to have accounted for the major part of the decrease in the proportion of registered workers. However, as the reduction over the period was higher for the proportion of registered workers than for non-registered workers, this led to a lower proportion of registered workers in the pool of employees.

¹³ We are not taking into consideration here the isolated peak observed in 1983 due to the severe recession observed then.

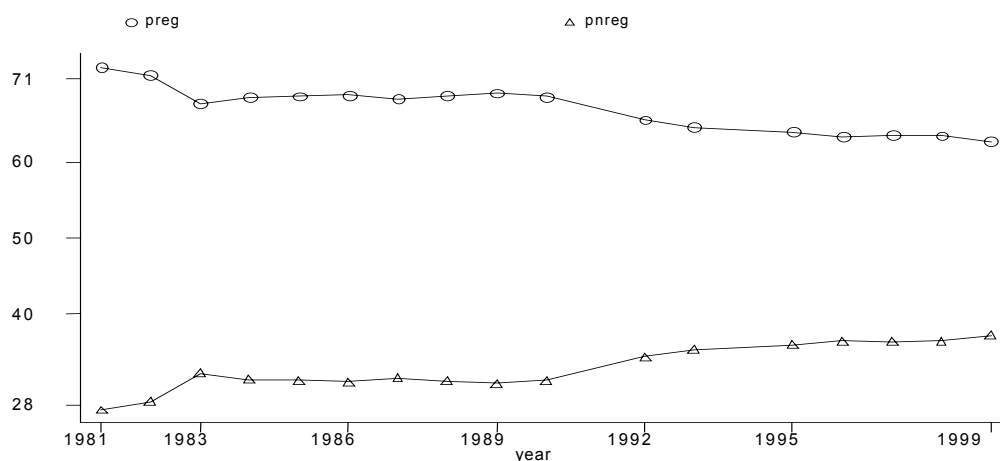


Figure 1. Proportion of Registered and Non-Registered Workers (in %) - 1981 - 1999

While the proportion of non-registered workers increased, the raw wage gap between registered and non-registered workers fell between 1981 and 1999. As shown in Figure 2, in 1981 the raw ratio of log real hourly-wage between registered and non-registered workers was 1.08, but in 1999 it was down to 0.71¹⁴. Many factors may have triggered such decrease: composition effects (due to the improvement of non-registered workers productive attributes in comparison to their registered counterpart), higher returns to attributes in the non-registered sector due to changes in the economic environment, and so on. In order to have a clear view of what happened with the wage gap once one controls for the observable characteristics of workers and firms, the following subsections will discuss the main results of a set of regressions for registered and non-registered workers and present some decomposition exercises for changes in average wages and changes in wage inequality.

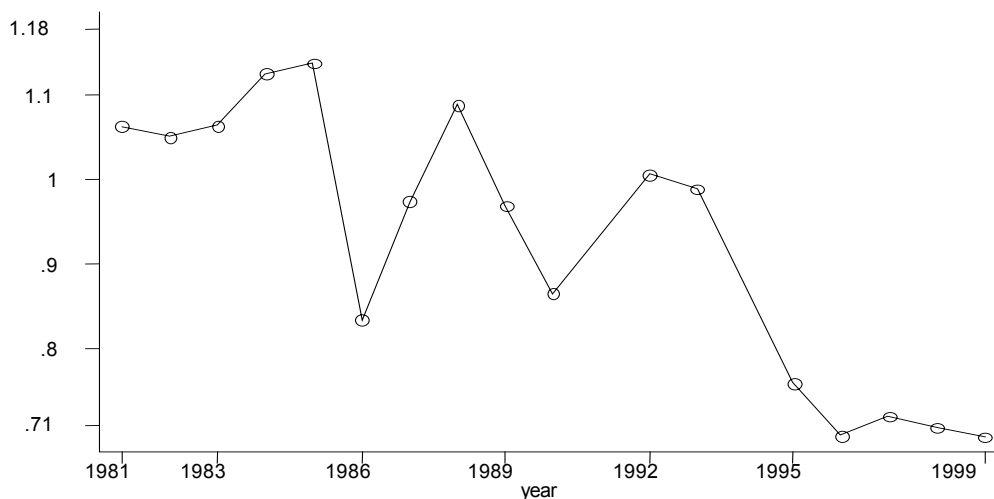


Figure 2. Wage Premium for Registered Workers - 1981 - 1999

¹⁴It is true that there is a major dip in 1986, but this episodic movement can be explained by the effect of the unorthodox plan (Plano Cruzado)- which froze wages and prices - on the dynamics of the Brazilian labour market. As wages and prices in the informal sector are not easily controlled as wages and prices in the formal sector, the increase in the demand for non-tradables observed in that period benefited informal workers both in terms of employment and wages, leading to a sharp fall in the wage differential between formal and informal workers, see Camargo and Ramos (1988) for a discussion of this point.

2.4. Evolution of Wage Differential Between Registered and Non-registered Workers

All regressions in this subsection are run for workers who worked at least 20 hours in the week immediately before the interview, had positive earnings, were not employed in farming activities, and were between 14 and 65 years. In order to check different patterns of segmentation according to gender we run separate regressions for men and women. In the same vein, wage equations for registered and non-registered workers are run separately so that we can follow the evolution of the gender wage gap and of the returns to skills for both groups.

The dependent variable in all specifications is the log of hourly real wage¹⁵ and the regressors are group of years of schooling (illiterate – *yos1*, some primary – *yos2*, complete primary and some elementary – *yos3*, complete elementary and some secondary – *yos4*, complete secondary and some college – *yos5*, and complete college and post-graduation – *yos6*)¹⁶; potential experience (*age – years of schooling – 6*); potential experience squared; dummies for four regions; dummy for metropolitan area and, when appropriated, dummies for gender; work-card (registration); size of the firm, tenure and race.

Figure 3 shows that the log hourly real wage for both registered and non-registered workers followed a similar path over time. The differences are concentrated in the period 1988-1993, when the average wage for the registered workers declined moderately, whereas the average wage for the non-registered increased from 1988 to 1990 and then decreased continuously until 1993. Despite sharing the same trend, the intensity with which each group's wage react to changes in the business cycle varied a lot. The wage recovery after 1993, for instance, was sharper for the non-registered than for the registered workers¹⁷. This pattern led the ratio of log real wage between registered and non-registered workers to decline from 1992 onwards as shown in Figure 2.

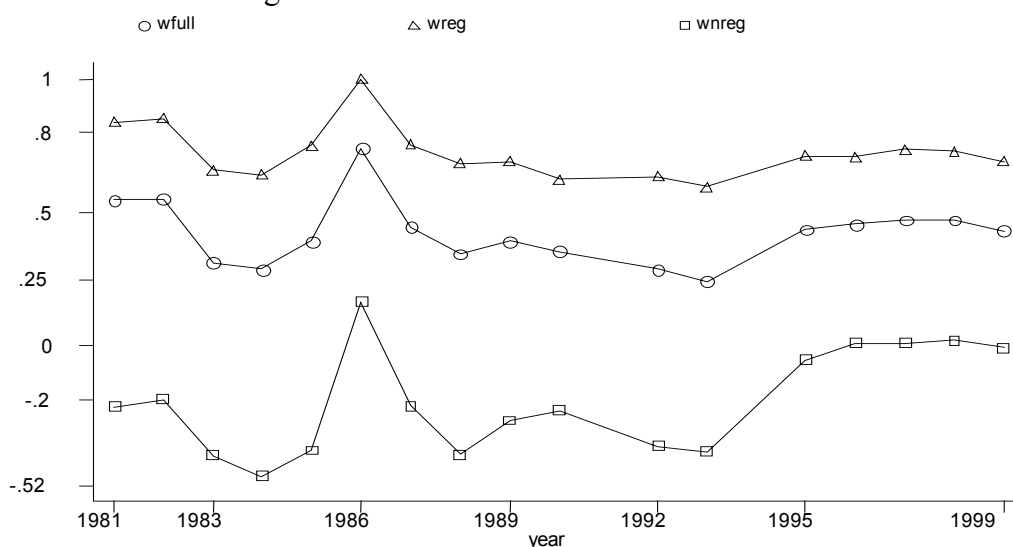


Figure 3. Log Hourly Real Wage Rate - 1981 - 1999

According to the regressions based on the filter-based sample, the 1990's witnessed a lower volatility of wage differential¹⁸ when compared to the 1980's, in particular, the differential seems to have stabilised

¹⁵The nominal wages were deflated by the INPC (Consumer Price Index) based on September 1998.

¹⁶We choose to enter the education variable as groups and not as a continuous variables in order to capture the non-linearities of the return to education and to have a clear picture of the evolution of the return for different groups.

¹⁷ The peak for both registered and non-registered workers observed in 1986 was due to the *Plano Cruzado*, an unorthodox stabilization plan, which froze wages and prices.

¹⁸ Wage differential is measured as the antilog of the coefficient of a dummy variable coded 1 for registered workers and 0 for non-registered workers.

around 36% since 1995¹⁹ (Figure 4). This threshold contrasts sharply with the peaks observed in 1985, 1988 and 1992, when the wage differential reached something around 70%, after controlling for age, education, region, metropolitan area, potential experience and gender. However, the evolution of the controlled wage differential is quite similar to the one observed for the raw wage differential, in particular, the dips observed in 1986, 1990 and 1995 are not attenuated.

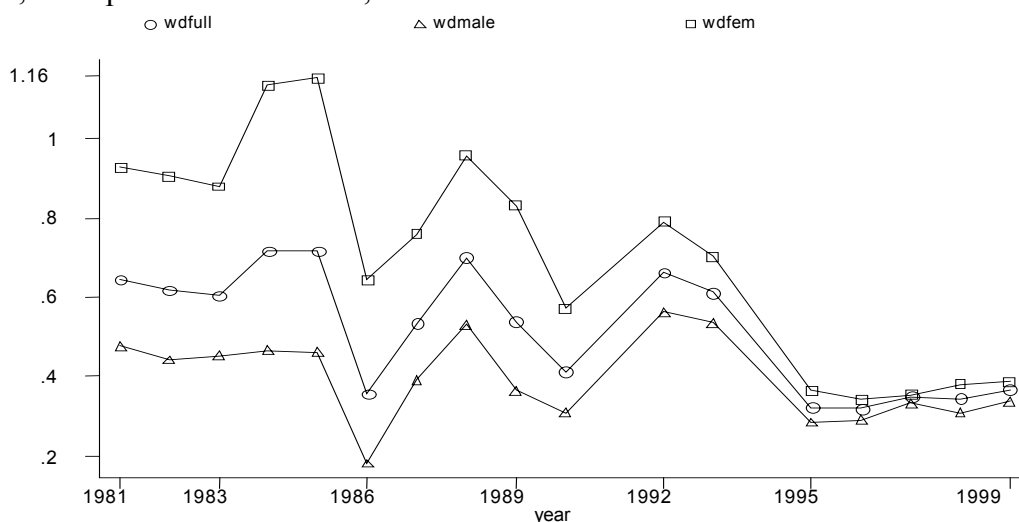


Figure 4. Wage Differential between Registered X Non-registered (Filter based) - 1981 - 1999

As noticed in the previous subsection, the increase in the participation of women in both registered and non-registered sectors was one of the main changes observed during this period. Figure 5 shows that the wage differential between male and female workers decreased substantially over time for both registered and non-registered workers.

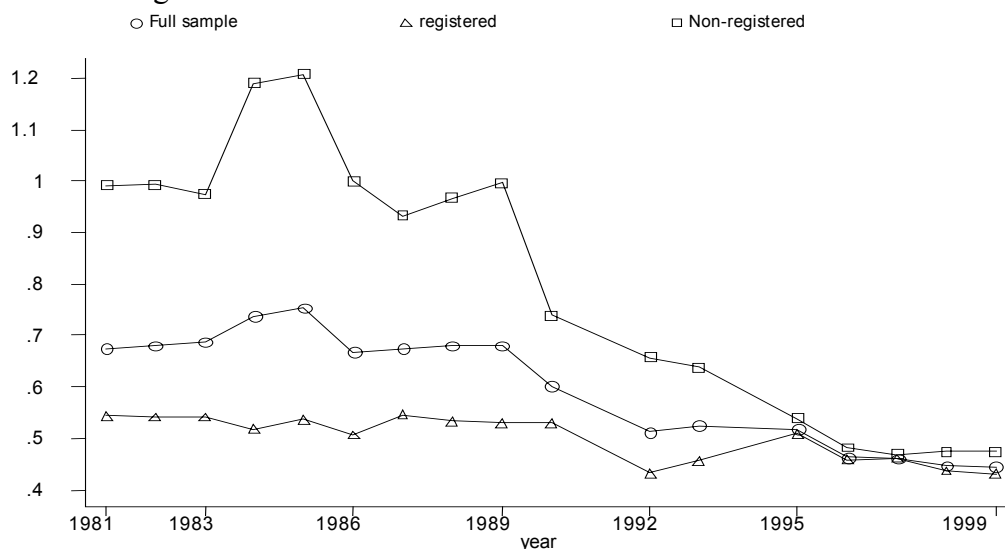


Figure 5. Wage differential between Male X Female (Filter based) - 1981 - 1999

Two striking features are revealed by the two Figures shown above. First, the wage differential among female workers was considerably higher than among male workers. However, such discrepancy has diminished over time and at the end of the sample period both measures were quite similar. Second, the gender wage gap was higher for non-registered workers than for registered workers. But here again, there has been some convergence over time.

¹⁹ This figure is half of raw wage differential that was around 70% since 1996 as shown in figure 2.

2.5. Returns to Education for Registered and Non-Registered Workers

The wage premium²⁰ for workers with complete college was quite stable during the early and middle 1980's. It peaked in 1988 and then started falling until 1992 to a level lower than the 1980's average. However, after 1992, the wage premium for college workers started increasing and achieved a level above the peak observed in 1988²¹ (Figure 6). Green et al. (2000) argue that such evidence is in line with the hypothesis that, somehow, the trade reform in the early 1990's has triggered an increase in the returns to education for high-skilled workers²².

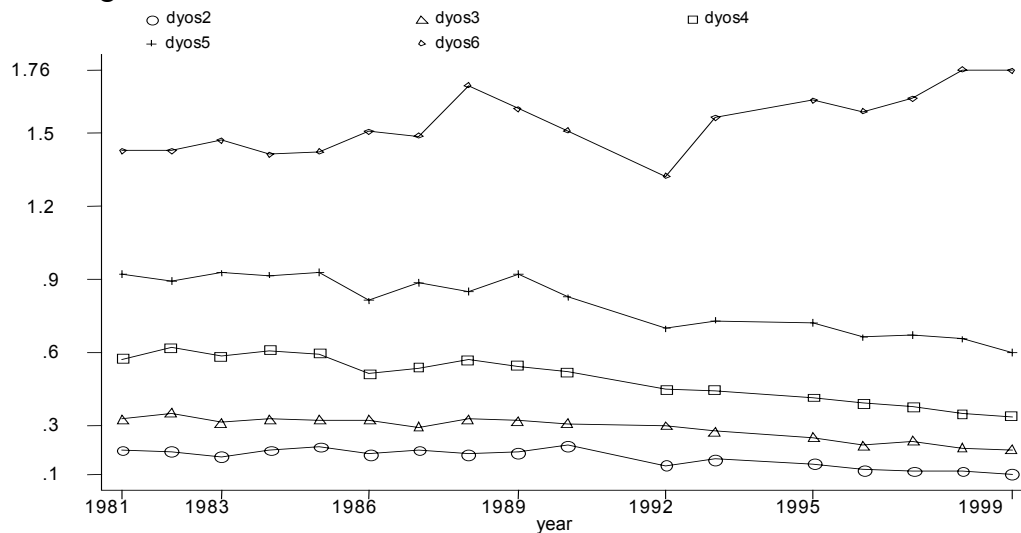


Figure 6. Relative Returns to Education (Full Sample) - 1981 - 1999

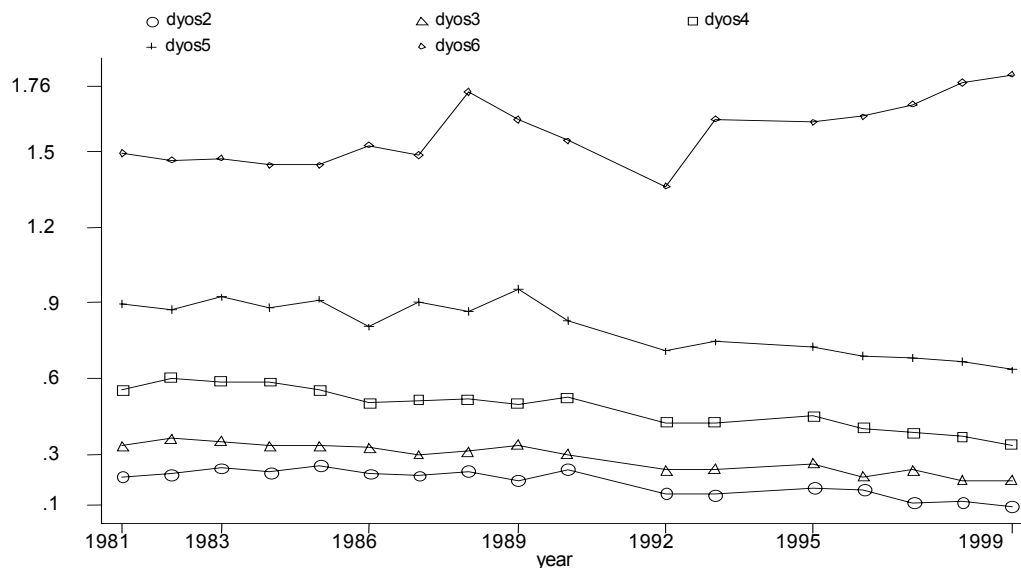


Figure 7. Relative Returns to Education (Registered Sample) - 1981 - 1999

²⁰ These figures depict the wage premium for each education level over and above the group immediately below. For that reason, the reference group for the group some elementary education (yos2), i.e., the illiterate group (yos1) does not appear in the graphs.

²¹ The conditional wage differential between college workers and complete high school or some college was 176% in 1999. In 1992, this differential was around 132%, the lowest level in the sample.

²² There is still no strong evidence of the direct links between trade liberalisation and increase in returns to education in Brazil. We will discuss this hypothesis in one of the forthcoming papers in this series.

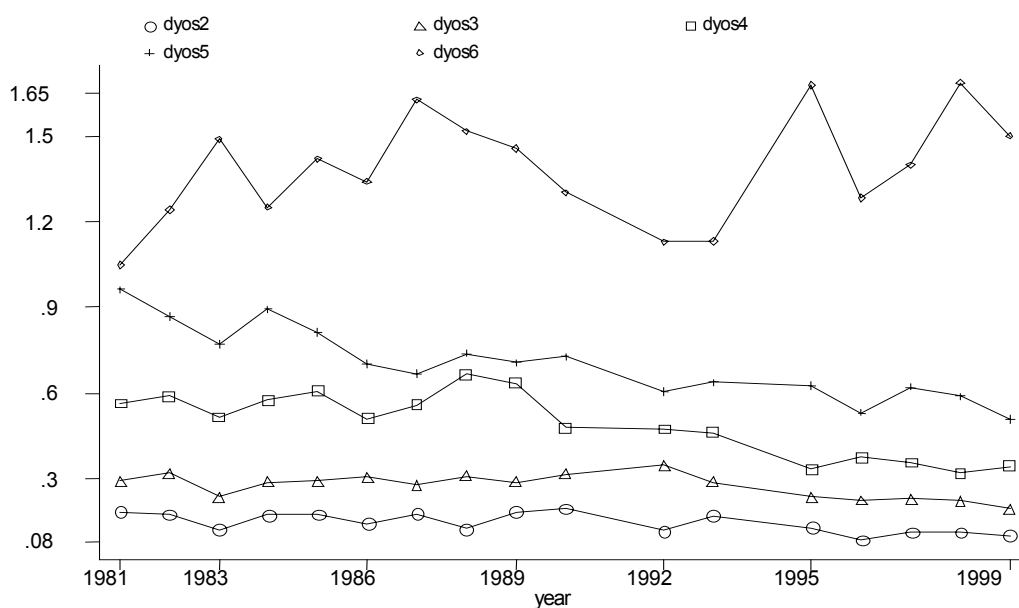


Figure 8. Relative Returns to Education (Non-Registered Sample) - 1981 - 1999

The complete high school or some college group was the big loser in this period. Its wage premium, over and above the complete elementary and some high school group (yos5), witnessed the sharpest decrease among all groups. Surprisingly, the illiterate group gained some ground and managed to reduce its wage differential in comparison with the group with incomplete primary education. The relative good performance of the lower education group is also found by Green et al. (2000) for all occupied population (including self-employed and agricultural sector) for Brazil²³ and by Behrman et al. (2001) for a panel of 18 Latin American countries. These two papers also report the increase in the premium for college education relative to secondary education. Fernandes and Menezes-Filho (2000) using Brazilian data conclude that the fall in the relative returns to education for all groups - with the exception of the college group - was the main factor triggering the reduction in wage inequality between 1983 and 1997.

Looking now at the returns to education for registered and non-registered groups separately, one can see that the aggregate pattern is determined by the behaviour of the returns to education for registered workers (Figure 7). The wage premium for non-registered workers (Figure 8) with some college is somewhat more volatile than the one observed for their registered workers counterpart. Its premium over and above the group with secondary or incomplete college is lower, having oscillated within the range of 100% and 150%. Nevertheless, despite the lack of a continuous pattern, it seems that there has been an increase in their wage premium after 1993, one year after the increase observed for registered workers group²⁴.

3. Decomposing Wage Differential and Accounting Inequality for Registered and Non-registered Workers: 1981-1999

In this subsection we will investigate the determinants of the narrowing in the wage gap through Junh-Murphy-Pierce (1991) extension of the Oaxaca-Blinder decomposition. We will also investigate how changes into the wage premium for registered workers and in its size have affected inequality. We will apply Fields' (2002) method to decompose both the level of income inequality and how it changed over time for the full sample and for registered and non-registered workers separately. The measure of inequality used here is the log variance of the wages. Additionally, we will apply Juhn, Murphy and

²³ The authors attribute this result to the reduction in the supply of illiterate workers over time in Brazil.

²⁴ Data not shown here reveal that for non-registered female workers with complete college the increase in the relative return to education for college workers after 1993 does not compensate the fall after 1987. The high returns observed in the early 1980's for this group may be due to its very small sample size. This appears to be the only major difference regarding gender pattern in returns to education.

Pierce (1993) decomposition in order to look at inequality at different parts of the wage distribution. This is important because non-registered workers are over-represented on the lower tail of the wage distribution.

3.1. Oaxaca-Blinder Decomposition and the Juhn-Murphy-Pierce (1991) Extension

Juhn, Murphy and Pierce (1991) expand the simple Oaxaca-Blinder decomposition in order to take into account changes in the residual distribution. Their approach allows one to decompose changes in the wage gap between the formal and informal sector into changes in the observable components and changes in the unobservable components. The wage equation for formal and informal workers can be written, respectively, as:

$$W_{fit} = X_{fit}\beta_{ft} + \sigma_{ft}\theta_{fit} \quad (1)$$

$$W_{iit} = X_{iit}\beta_{it} + \sigma_{it}\theta_{iit} \quad (2)$$

where σ_{ft} and σ_{it} are the within-group standard deviation of wages in the formal and informal sectors in year t and θ_{fit} and θ_{iit} are the standardised residuals of each wage equation: $\theta_{fit} = \varepsilon_{fit} / \sigma_{ft}$. The wage gap between formal and informal sector workers is:

$$D_t = \bar{W}_{ft} - \bar{W}_{it} = (\bar{X}_{ft} - \bar{X}_{it})\hat{\beta}_{ft} + \hat{\sigma}_{ft}\Delta\theta_t \quad (3)$$

where $\Delta\theta_t$ is the mean difference in the average standardized residual for workers in the formal and informal sector. Then, changes over time in the wage gap can be decomposed as:

$$\begin{aligned} D_t - D_{t-1} = & [(\bar{X}_{ft} - \bar{X}_{ft-1}) - (\bar{X}_{it} - \bar{X}_{it-1})]\hat{\beta}_{ft} \\ & + (\bar{X}_{ft-1} - \bar{X}_{it-1})(\hat{\beta}_{ft} - \hat{\beta}_{ft-1}) \\ & + \hat{\sigma}_{ft}[\Delta\theta_t - \Delta\theta_{t-1}] + \Delta\theta_{t-1}(\hat{\sigma}_{ft} - \hat{\sigma}_{ft-1}) \end{aligned} \quad (4)$$

The first term captures the effect of changes in the quantity of the observables, X 's, the second term captures the effect of changes in the prices of the observables. The third term is called the “gap effect” and measures the effect of the changes in the relative position of informal workers in the formal wage distribution, i.e, it captures what would happen if the residual formal sector wage inequality were held constant between $t-1$ and t , but the percentile ranking of the informal wage residual had changed. If informal workers had moved up this distribution it can mean that they had increased their stock of unobserved characteristics or that they are less “discriminated” against. However, as being an informal sector worker is not the same as being “black” or “woman” in the labour market, since they do not have this “permanent” and “immutable” characteristics, it is hard to talk about a lessen in discrimination. It is much more likely that there had been some change in demand that somehow makes their “unobservable” characteristics more valued in the labour market. The last term is the so-called “unobserved prices” effect and measures the change in the wage gap due to the changes in inequality among formal sector workers. It means that a rise in inequality (over time) would increase the wage gap between formal and informal sector workers, even if the percentile ranking of informal sector wage residual had not changed over this period.

D ₉₉	1.06409
D ₈₁	0.69695
D ₉₉ -D ₈₁	-0.3671
Observable	
Quantity	-0.0801
Prices	-0.081
Unobservables	
Gap	-0.1906

Table 2. JMP Decomposition of Changes in the Wage Gap between Formal and Informal Workers: 1981-1999

The results of the JMP decomposition in Table 2 show that all components contributed to the narrowing of the wage gap. However, most of the reduction in the wage gap was due to the “gap effect” that contributed with 52% for the overall reduction. According to our interpretation this is a sign that returns to observables and the improvement on the productive endowments of informal workers were much less important than changes in the economic environment either via demand shocks or supply shocks that are not readily observable. It is not clear what sort of unobservables could have triggered this result. Among the hypothesis that will be assessed in forthcoming papers are the impact of the trade liberalisation and the minimum wage indexation of the informal sector wages.

3.2. Accounting for Inequality and Decomposing its Changes

Fields (2002) puts forward a methodology designed to account for inequality and to decompose it into the contribution of the explanatory factors²⁵ of a standard semi-log wage regression. The decomposition of the log-variance of wage can be written as:

$$s_j(\ln w) = \frac{\text{cov}[a_j, Z_j]}{\sigma^2(\ln w)} = \frac{a_j \sigma(Z_j) \text{cor}[Z_j, \ln w]}{\sigma(\ln w)} \quad (6)$$

where s_j is the ‘relative factor inequality weight’ of the explanatory factor j , a_j is the coefficient of the explanatory factor j in the wage equation²⁶, Z_j is the explanatory factor j , and $\sigma^2(\ln w)$ is the variance of the log wage.

This decomposition allows one to account for the level of wage inequality in a particular country at a particular time, and for a specific group of workers. In order to account for “differences” in inequality over time or between groups, Fields (2002) proposes the following decomposition:

$$\Pi_j(I(\cdot)) = \frac{s_{j,2} I(\cdot)_2 - s_{j,1} I(\cdot)_1}{I(\cdot)_2 - I(\cdot)_1} \quad (7)$$

where Π_j is the contribution of the explanatory factor j to the change in inequality as measured by the inequality index $I(\cdot)$ between period 1 and 2²⁷.

Table 3 shows both Fields’ decomposition in levels for 1999 and 1981, and the decomposition for changes between these two years. For the full sample the two most important factors explaining wage inequality in both years are the residual and education. The possession of the work-card (registered) is the third more important factor, but its contribution is rather modest when compared to the two other factors. The registered and non-registered samples display a similar pattern, but the residual seems to be more important for the non-registered than for the registered in order to explain the level of inequality.

As for changes in inequality, the first row in Table 3 shows that the inequality - as measured by the log variance of hourly real wages - fell for the full sample, and for both registered and non-registered workers. For the full sample the most important factor in reducing inequality was education (0.61)²⁸, the second most important was the possession of a work-card (0.38), and finally gender (0.28). The other factors played only a minor role in changes in inequality. Regional and the residual changes acted in the opposite direction and would have triggered more inequality. For the sample of registered workers, education is by far the most important factor, whereas for the sample of non-registered workers, the most

²⁵The explanatory factors include all the regressors and the residual of the wage equation.

²⁶ a_j is equal to 1 when the explanatory factor is the residual of the wage equation.

²⁷The index 1 and 2 also can indicate different groups of workers.

²⁸This result is in line with the ones presented by Fernandes and Menezes-Filho(2002).

important factor was gender. Thus, we can conclude that the possession of work-card was one of the main factors behind the fall in inequality between 1981 and 1999 after education²⁹.

	Full Sample			Registered			Non-registered		
	Level		Changes	Level		Changes	Level		Changes
	1999	1981	1999-1981	1999	1981	1999-1981	1999	1981	1999-1981
log variance	0.84	0.97	-0.13	0.78	0.84	-0.06	0.77	0.87	-0.09
Education	0.32	0.36	0.61	0.38	0.44	1.13	0.20	0.19	0.12
Experience	0.04	0.04	0.03	0.03	0.02	-0.17	0.06	0.08	0.27
Region	0.06	0.02	-0.20	0.04	0.01	-0.27	0.08	0.04	-0.30
Metropolitan	0.02	0.02	0.02	0.01	0.01	0.03	0.03	0.02	-0.02
Gender	0.05	0.08	0.28	0.04	0.05	0.19	0.06	0.16	0.99
Registered	0.07	0.11	0.38						
Residual	0.45	0.38	-0.13	0.51	0.48	0.09	0.58	0.51	-0.05
Total	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table 3. Factor Contribution to Wage Inequality and to Change in Inequality: 1981 – 1999

3.3. Accounting for Full Sample Distribution Inequality

The estimates above offer only a partial view of what happened with the inequality during the sample period. In order to have a better understanding of what happened to inequality at different parts of the wage distribution and to assess the role of observable and unobservable components in shaping the evolution of wage inequality between 1981 and 1999, we will apply Juhn, Murphy and Pierce's (1993) decomposition (full-sample distribution accounting scheme). This decomposition allows one to distinguish which changes in inequality were due to changes in observed quantities (of skills), observed (skill) returns and changes in unobserved returns and quantities (of unobserved skills). The starting point is the estimation of standard earning equations:

$$w_{it} = X_{it}\beta_t + u_{it} \quad (8)$$

where w_{it} is the log hourly-wage of individual i in year t , X_{it} is a vector of observed individual characteristics in t , and u_{it} is the log wage residual, which is assumed to be an unknown function of prices and quantities of unobserved skills, measurement error and estimation error. Juhn et al. (1993) assume that the wage equation residual has two components: an individual's percentile in the wage distribution θ_{it} and the distribution function of the residuals $F_t(\cdot)$, which implies, by the definition of the cumulative distribution function, that one can write the residual as:

$$u_{it} = F_t^{-1}(\theta_{it} | X_{it}) \quad (9)$$

where $F_t^{-1}(\theta_{it} | X_{it})$ is the inverse cumulative residual distribution for workers with characteristics X_{it} in year t .

The decomposition is illustrated by the formula:

$$w_{it} = X_{it}\beta + X_{it}(\beta_t - \beta) + G^{-1}(\theta_{it} | X_{it}) + [F_t^{-1} - G^{-1}(\theta_{it} | X_{it})] \quad (10)$$

where β and G^{-1} are the returns to observable skills and the cumulative residual distribution for the base period, respectively. This formula allows one to recover the counterfactual wage distribution implied by holding fixed any subset of the components described above.

In practice, the procedure consists of running wage equations separately for two periods, one of which is the base period, and comparing what would the wage inequality have been if 1) the distribution of individual characteristics (X 's) in period 2 had remained the same as the distribution in period 1 (base

²⁹The aggregate result for education is completely due to changes for education level below the complete college group. Changes in the relative factor of the latter were in direction of more inequality.

period), holding returns and residuals as in period 2, counterfactual w_{it}^1 ; 2) both the distribution of individual characteristics and the returns have remained the same as in period 1 and the residuals as in period 2, counterfactual w_{it}^2 . Thus, differences in wage inequality between period 1 and 2 can be decomposed in differences due to changes in the observables (changes in w_{it}^1), due to changes in returns (additional changes caused by w_{it}^2), and due to changes in unobservables (changes in w_{it} beyond those found w_{it}^2).

Taking 1981 as the base period we applied the Juhn et al. decomposition to the full sample of employees and separately for registered and non-registered worker samples. As shown in Table 4, the 90–10 log hourly-wage differential fell for the full sample and both registered and non-registered workers. For the full sample and for registered workers the major contribution for this decrease in inequality came from changes in the returns, whereas for the non-registered workers it came from changes in observables. The residuals also had a positive, but less important contribution. For the full sample and for registered workers, changes in the observable characteristics, unlike the other components, would have contributed to an increase in inequality.

The inequality in the upper part of the wage distribution had different patterns for the different samples. The 90–50 log wage differential has decreased for the full sample and for registered workers, but has slightly increased for non-registered workers. Again, changes in the observables would have led to a higher wage inequality for the full sample and for registered workers. In the non-registered case, they would have contributed to a fall in inequality, but changes in returns and changes in unobservables were strong enough to compensate its effect and then worsen the wage inequality.

In the lower part of the wage distribution the changes in inequality were different from the ones observed in the upper part. The 50–10 log wage differential has decreased for the full sample and for non-registered workers and increased for registered workers. For the full sample, all three factors acted to deliver a reduction in inequality, but the main effect came from changes in returns. For the non-registered sample change in returns would have contributed to worsen wage inequality, whereas changes in observables and unobservables contributed to attenuate it. As for the registered sample, the small increase in wage inequality was entirely due to changes in observables.

	$w_{it}=1981$	$w_{it}=1999$	w_{it}^1	w_{it}^2	□ observable	□ returns	□ unobservables
90-10							
overall	2.435	2.058	2.483	2.081	-12.7%	106.6%	6.1%
registered	2.071	1.990	2.205	2.032	-165.6%	213.8%	51.8%
non-registered	2.186	1.903	1.816	2.109	130.9%	-103.6%	72.8%
90-50							
overall	1.360	1.195	1.411	1.203	-31.1%	126.1%	4.9%
registered	1.318	1.206	1.342	1.222	-20.6%	106.4%	14.3%
non-registered	1.071	1.088	0.918	1.055	-923.7%	824.5%	199.2%
50-10							
overall	1.075	0.863	1.072	0.877	1.5%	91.5%	7.0%
registered	0.753	0.784	0.864	0.810	350.7%	-168.7%	-81.9%
non-registered	1.115	0.815	0.898	1.054	72.3%	-52.1%	79.8%

Table 8. Juhn-Murphy-Pierce Changes in Inequality Decomposition

One possibility that could explain these results, mainly from 1995 onwards is the substantial reduction of non-registered workers earning less than the minimum wage. Besides, the surprising increase in the indexation of non-registered earnings to the minimum wage may have contributed to a decrease in the wage inequality among low wage non-registered workers³⁰.

³⁰ In a forthcoming paper we will discuss in depth the indexation of the wage of informal and formal sector to the minimum wage.

4. Concluding Remarks

Most of the empirical literature on segmentation between formal and informal sectors in developing countries focuses on the wage differential between these two groups. As shown above, a major problem in comparing these studies is the lack of homogeneity in the way the informal sector is defined. Another characteristic of the empirical literature is the great emphasis on the need to correct for selectivity bias when discussing the hypothesis of segmentation in the lines of formal/informal sector. In a forthcoming paper we will discuss selectivity issues in the context of a job queue for formal jobs. We will assess among other things, the role of the wage differential in determining sector allocation and evaluate how the results change once we take into account the individual “willingness” to switch from a informal to a formal job.

As documented above there were great changes in the proportion of registered/non-registered workers in the economy, in its wage differential and in the inequality within and between the two groups over the 1980's and the 1990's. According to Fields' (2002) decomposition scheme changes in the variable related to the possession of a work-card was the most important force, after education, driving down the variance of the log hourly real wage. The most striking and lasting changes in the wage gap occurred after 1990. Episodical changes such as the increase in the proportion of non-registered workers in 1983 or the sharp reduction in the wage gap in 1986 did not last. In contrast, the increase in the proportion of non-registered workers observed since 1990 and the diminishing wage gap after 1992 seem to be a more stable process triggered by recent moves in the Brazilian economy.

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