

The Sheepskin Effects Evolution from 1982 to 2002 in Brazil: The roles of labor supply and demand changes

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Abstract:

This paper seeks to analyze the evolution of the sheepskin effect on the Brazilian labor Market from 1982 and 2002. Since the structure of the Brazilian economy changed substantially during this period – as the supply of more educated workers increased and the technological progress required the demand of more skilled workers – it is expected to observe some changes on the sheepskin effect over time. This paper explores the differences in the economic structure between the Southeast and Northeast regions in Brazil and the fact that changes in the education level had been similar for both level of education of worker increased in order to analyze how changes on the labor demand and supply influenced the sheepskin effect. The results show that despite the reduction of this effect over time, changes were smaller for the higher level degrees. The same happens for the Southeast in comparison with the Northeast, as the first region is characterized by higher economic development, and probably with a higher demand for skilled workers.

Resumo:

Este artigo procura analisar a evolução do efeito-diploma sobre os rendimentos no Brasil durante o período de 1982 a 2002. De acordo com a literatura, a obtenção de um grau ou um diploma implica em um aumento extra nos rendimentos. Com a estrutura da economia brasileira mudou substancialmente durante o período analisado, com o aumento na oferta de trabalhadores mais escolarizados e novas exigências por parte dos empregadores quanto a qualificação dos seus empregados, esperamos que o efeito-diploma tenha mudando ao longo do tempo. Neste artigo, exploramos as diferenças na estrutura econômica entre o Sudeste e Nordeste e o fato das variações na educação terem sido semelhantes nessas duas regiões para analisar como as mudanças na demanda e na oferta de trabalho influenciaram o efeito-diploma. Os resultados mostram que apesar da redução desse efeito ao longo do tempo, as variações foram menores para os graus mais elevados e para a região Sudeste, onde o nível de desenvolvimento econômico é maior, o que é consistente com o aumento na demanda por trabalhadores mais qualificados.

JEL classification: I20, J30.

I. Introduction

There are many papers analyzing the positive relationship between earnings and education in the literature (see Card, 1999). Some of them focus on the sheepskin effect hypothesis. According to this hypothesis, an additional year of schooling has an even stronger impact on earnings if it corresponds to the diploma or degree completion. The argument is that employers may use the information offered by a diploma or degree as a signal positively related to workers' unobserved productivity. Therefore, sheepskin effects imply in a non-linear and discontinuous relationship between education and log of earnings opposed to the standard linear earnings function established by Mincer (1974)

Evidences for different countries are consistent with the presence of sheepskin

effects¹. In Brazil, estimates reported by Lam and Schoeni (1993) and Ramos and Vieira (1996) show that returns to schooling are highly non-linear, with the completion of a degree representing a substantial earnings gain. Ramos and Vieira (1996), using PNAD data for 1990, found that a primary school degree (8 years of completed schooling) increases earnings by 6%, and secondary school (11 years of schooling) and college (15 years of schooling) degrees increase earnings by 18%. Comparing 1976 with 1990 these authors show that sheepskin effects are very stable across time, except for the primary degree which reduced slightly.

Since the structure of Brazilian economy has been changing considerably in the last decades, this may also have influenced the sheepskin effects through changes in demand and supply for more skilled workers. During this period the labor force have increased substantially its education level. For example, in 1982 about 35% of the workers in the labor force did not have completed the first segment of primary school, which require four years of completed schooling. In 2002, this proportion reduced to 22%. Also, the educational distribution modifications during this period were much more intense across workers with complete degrees than for other individuals who did not have a credential. These facts may have changed the signal values represented by the completion of a given degree, and then it is expected that sheepskin effect have been losing its importance. A primary degree could be a positive signal about individual non observed characteristics in 1982, since one third of the workers did not reach this level of education, but probably, it offers a very different kind of information for employers in 2002.

On the other hand, important changes occurred on the demand side, especially after the nineties, when the country went through trade liberalization process intensification and the technological progress was amplified. Autor et al. (2003) argues that technological progress implies changes in the composition of job tasks, influencing job skill demand. According to these authors, technological progress substitutes workers in performing cognitive and manual tasks and complements workers in performing non routines and more complex tasks. The information provided by completion of a degree could be more important for workers performing complex tasks, since it represents a signal positive correlated with unobserved characteristics. In this way, the technological progress could have contributed to increase the sheepskin effects for high level degrees, and to decrease for low level ones. Also, the fact that firms may have increased the minimal level of education required for their workers may have exacerbated the non-linearity pattern of schooling-earnings relationship.

The objective of this paper is to analyze the evolution of sheepskin effect in the Brazilian labor market from 1982 to 2002, exploring arguments about labor demand and supply changes. In order to access the roles of labor demand and supply changes, we explore differences between the two most distinct regions in Brazil - Southeast and Northeast. The economic structure of these regions is very diverse, and the recent development process increased even more these differences. There is also a high

¹ See, for example, Hungerford and Solon (1987), Belman and Heywood (1991), Jaeger and Page (1996) and Park (1999) for the United States, Ferrer and Riddell (2002) for Canada and Schady (2003) for Philippines.

disparity on the educational composition of the labor force between Southeast and Northeast. Comparisons of sheepskin effects evolution across regions, may give us insights of the impact of changes in the labor demand and supply.

In order to proceed with the analysis, this paper uses data from the PNAD – the Brazilian National Household Sample Survey. The empirical strategy adopted to identify the sheepskin effects follows the standard approach in Hungerford and Solon (1987) and Belman and Heywood (1996). It consists in estimating earning equations including linear years of schooling, and splines and discontinuous functions for completed degrees, using demographic and labor market experience controls. With this specification, the earnings equations are estimated for 1982, 1992 and 2002 in Southeast and Northeast, as well as for the whole country.

The empirical evidence shows that sheepskin effects represent a substantial gain on earnings. However, the patterns of sheepskin effects changed very much from 1982 to 2002, with their importance reducing over time. The lower degree, corresponding to the first segment of the primary, which influenced earnings in a significant way in the beginning of eighties, became minor in 2002. The effects of the higher degrees also reduced from 1982 to 2002, but they are still relatively elevated in this last period. The returns to schooling present also decreasing trend during this period, emphasizing the importance of changes in the educational level. For these higher degrees, however, the splines have a positive trend from 1982 to 2002, indicating that the non-linear patterns of the returns to education were exacerbated. The analysis by region show that in Southeast the sheepskin effects reductions are less pronounced than in Northeast for more advanced degrees. In 2002, despite the significant increase in the supply of more educated workers, the completion of secondary school or college represents an important gain in earnings in Southeast, but not in Northeast.

The structure of the paper is the following. The next section presents the PNAD data used in this paper, and describes educational distribution differences across periods and regions. Section 3 discusses the empirical strategy implemented in the paper. The subsequent section presents the results about the evolution of sheepskin effect during the considered period, and the last section summarizes and concludes the paper.

II. Data

This paper uses data from the 1982, 1992 and 2002 PNAD, which is the Brazilian National Household Sampling Survey. This survey is conducted each September by the Brazilian Census Bureau (IBGE) and the sample is representative of the Brazilian population. The sample used in this paper includes all the workers aged 25 to 60 years old, living in urban areas. All employers were excluded from the sample.

For each individual in the sample there is information about the following variables: earnings, age, gender, race, region, number of years of completed schooling and potential labor market experience. This last variable is calculated using the difference between the age and the age that the worker entered in the labor market². The

² In 1982 the information about labor market experience is available only for the head of the household

data contain information about 71,8146 individuals in 1982; 55,757 individuals in 1992 and 79,743 in 2002.

Table 1 below show descriptive statistics for some variables in each year considered in this paper. Earnings means reduced from R\$ 825 in 1982 to R\$ 607 in 2002, and years of schooling increase around 1 year for each decade. Age and experience increase slightly during the whole period, which may be due to the fact that individuals are staying longer in school.

Table 1 - Descriptive statistics

	1982	1992	2002
Earnings in the main job *	1042.19 (1487.40)	729.82 (1458.52)	766.56 (1215.96)
Years of schooling	5.61 (4.68)	6.57 (4.60)	7.59 (4.57)
Age	38.86 (9.25)	38.73 (9.00)	39.71 (9.03)
Experience	24.58 (10.67)	24.34 (10.27)	25.16 (10.18)
Number of observations	75,857	59,454	85,192

Source: PNAD

Standard deviations are in parentheses

* Earnings in 2002 Reais.

Four degrees are considered in this paper. The first degree (first segment of primary school) corresponds to 4 years of completed schooling. Although it had been vanished during an educational system reform in the beginning of the seventies, the first segment of the primary school is included in the empirical analysis because there is a great share of workers with exactly 4 years of completed schooling, specially in older generations. The second degree is the second segment of primary school, which corresponds to 8 years of completed schooling. The next degree (secondary school) is obtained with 11 years of completed schooling, and finally, the third degree (college) is acquired with 15 years of completed schooling. Post-graduated degree corresponds to 17 years of schooling in PNAD data, but it is not possible to distinguish between Master and Ph.D. degree, so this group is not used in the paper to account for sheepskin effects. In addition there are very few individuals with these levels of education.

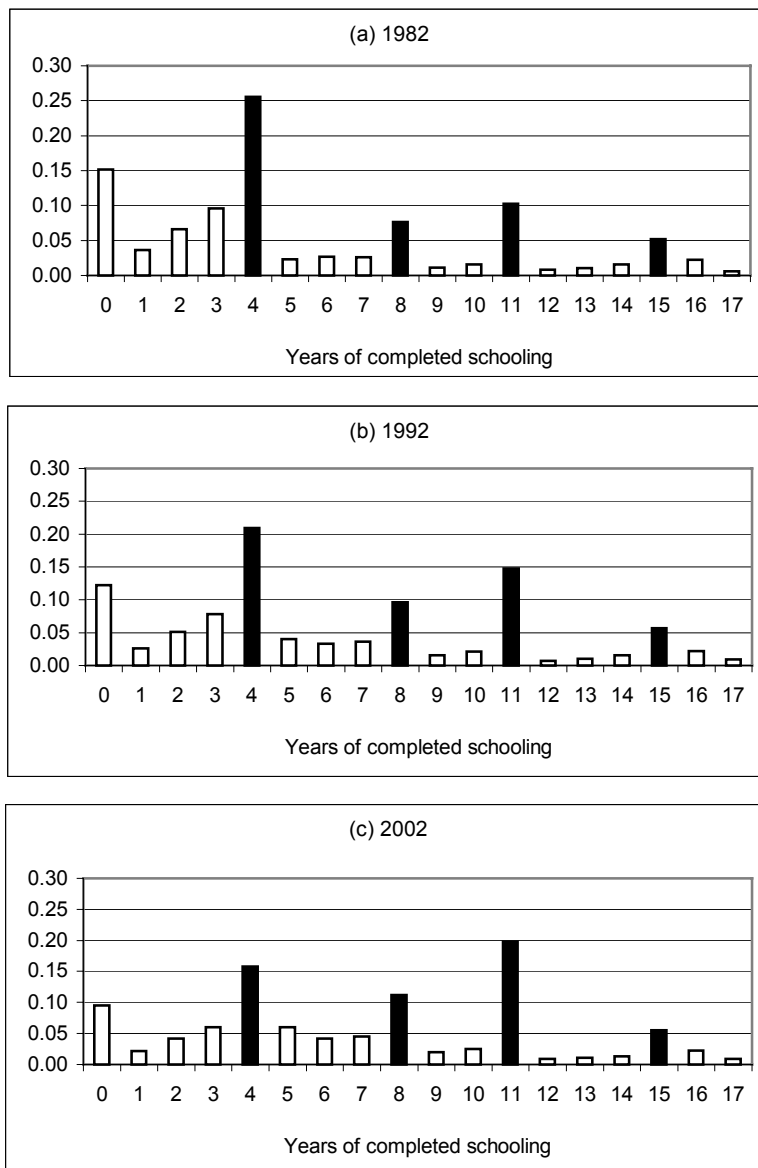
Figure 1 shows the fraction of workers in the labor force with each number of completed years of schooling in 1982, 1992 and 2002. Completed degrees or diplomas are represented by dark bars. The educational level among Brazilian workers was extremely low in 1982. Around 35% had less than 4 four years of completed schooling and 78% had less than 11 years of education. From 1982 to 2002 the labor force educational level increased, although it was still considerably low in 2002. The proportions with less than 4 and 11 years of schooling reduced to 22% and 68%.

It is interesting to also notice that there are spikes in years corresponding to completion of a degree in all periods. In 1982, the higher concentration occurred for

and their spouse or husband. So the same filter is applied for 1992 and 2002. Estimates for these last two years are very similar including or not others individuals in the household.

those with a first segment of primary degree - near one quarter of the labor force. The proportion of workers with less than one year of education was also very high (about 15%). In 1992, the proportion with a first segment of primary degree decreased to 21%, which corresponds to the highest share of workers, followed by individuals with a secondary degree, a group that increased from 10% in 1982 to 15% in 1992. From 1992 to 2002 the change in educational distribution was basically a reduction on the share for workers with 4 years of schooling from 21% to 16% and an increase in the proportion of workers with a secondary degree from 15% to 20%.

Figure 1: Proportion of workers on the labor force by years of schooling



Source: PNAD
Completed degrees are represented by dark bars.

Table 2 presents descriptive statistics comparing Southeast and Northeast. Earnings and years of schooling difference between regions are impressive. In 1982 earnings in Southeast are 45% higher than in Northeast, and in 2002 this ratio increased to 60%. From 1982 to 2002 Southeast keeps one more year of schooling relative to Northeast. In Northeast, the proportion of workers in manufacture decreased from 16% in 1982 to 12% in 2002. In Southeast the proportion of workers in manufacture reduced from 23% to 18% during this period.

Table 2 - Descriptive statistics for Northeast and Southeast regions

	1982	1992	2002
Northeast			
Earnings in the main job*	775.75 (1200.33)	536.51 (869.70)	547.52 (949.53)
Years of schooling	4.69 (4.65)	5.93 (4.86)	6.91 (4.77)
Age	39.42 (9.36)	38.76 (9.08)	39.45 (9.08)
Experience	24.78 (10.96)	23.96 (10.55)	24.62 (10.40)
Proportion of workers in manufacture	0.16	0.13	0.12
Number of observations	16,002	14,012	22,167
Southeast			
Earnings in the main job*	1123.28 (1620.96)	816.03 (1170.12)	870.38 (1299.99)
Years of schooling	5.81 (4.60)	6.78 (4.63)	7.92 (4.46)
Age	39.08 (9.29)	39.12 (8.96)	40.22 8.980227
Experience	25.05 (10.57)	24.66 (10.18)	25.65 (10.01)
Proportion of workers in manufacture	0.23	0.20	0.18
Number of observations	29,691	22,594	28,163
Earnings ratio: Southeast/Northeast	1.45	1.52	1.59

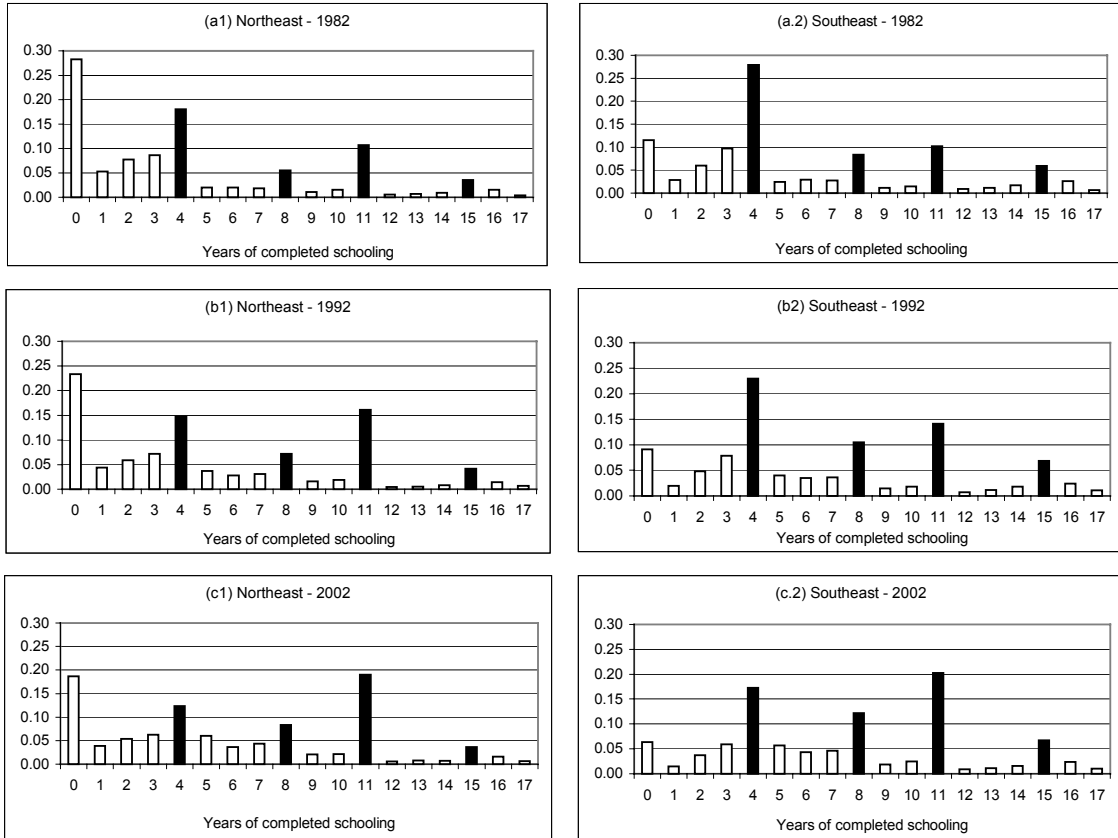
Source: PNAD

Standard deviations are in parentheses.

* Earnings in 2002 Reais.

Remarkable differences in the educational distribution between Southeast and Northeast are showed in figure 2. Notice, for example, that in 1982 near 30% of the labor force in Northeast had less than one year of schooling, while this proportion was 10% in Southeast. However, the changes from 1982 to 2002 were not so different between the two regions. For individuals with 8, 11 and 15 years of schooling, the shares in the labor force increased in a similar magnitude. For workers with 4 years of schooling the reduction was more intense in Southeast.

Figure 1: Proportion of workers on the labor force by years of schooling (Northeast and Southeast)



Source: PNAD
Completed degrees are represented by dark bars.

III. Empirical framework

The framework used to investigate the sheepskin effects follows the standard approach adopted by Hungerford and Solon (1987) and Belman and Heywood (1991). It consists on estimate earnings returns to education that allows for a discontinuous spline function with discontinuities at years of completed schooling corresponding to completed degrees or diplomas.

The dependent variable in the regressions is the logarithm of the earnings in the main job³. The regressions include years of completed schooling (S), experience (Exp), experience squared (Exp^2) and interaction term between schooling and experience. The sheepskin effects are estimated including four dummies corresponding to completed degrees. The first dummy (D_4) is equal to 1 if $S \geq 4$, the second (D_8) is equal to 1 if $S \geq 8$, the third (D_{11}) is equal to 1 if $S \geq 11$ and finally, there is a dummy (D_{15}) which is equal to 1 if $S \geq 15$. In order to allow for slope changes in the returns to the first segment of the

³ Regressions that use the logarithm of the hourly earnings as dependent variable show very similar results.

primary school, $D4$ is interacted with a variable equal to years of schooling minus 4. The same procedure is used for splines in primary, secondary and college degrees. A dummy variable for individuals with 16 years of schooling is also included. The regressions include controls for gender, race and region.

Belman and Heywood (1997) show that sheepskin effects are important signals of productivity for younger cohorts, but once workers accumulate experience in the labor market, the returns to these signals reduce, because employers have more information about employees' productivity. In this way, the dummies $D4$, $D8$, $D11$ and $D15$ are interacted with labor marker experience.

Representing the log of earnings by w , the basic specification is the following:

$$(1) \ln(w_i) = \beta_0 + \beta_1 S_i + \beta_2 Exp_i + \beta_3 Exp_i^2 + \beta_4 Exp_i * S_i + \beta_5 D8_i + \beta_6 D11_i + \beta_7 D15_i \\ + \beta_8 D8_i * (S_i - 8) + \beta_9 D11_i * (S_i - 11) + \beta_{10} D15_i * (S_i - 15) + \beta_{11} S_{16} \\ + \beta_{12} Exp * D8_i + \beta_{13} Exp * D11_i + \beta_{14} Exp * D15_i + \gamma X_i + \varepsilon_i$$

X_i represents the vector containing gender, race and region variables for individual i . The regressions are estimated for 1982, 1992 and 2002 for Brazil as a whole, and later separately for Southeast and Northeast regions for all these years. As discussed above, since technological development affected the regions in different ways, we may expect that the changes in the labor demand caused by technological progress were different across regions. The idea is that less developed regions, that have been facing a slower growth process, would present a slower decrease in the sheepskin effect, while the inverse would be verified in faster growing regions. The results of these regressions are presented and discussed in the next two sections.

IV. Empirical evidences

This section presents and interprets the results estimated using the model explained above. The first subsection reports the results for the total sample of workers in Brazil. The next subsection presents the evidences for Northeast and Southeast regions.

IV.1 The Evolution of sheepskin effects in the Brazilian Labor Market

Table 3 presents the results estimated for equation (1) in 1982, 1992 and 2002. It is possible to notice that there is a decreasing trend in years of schooling coefficients over time. In 1982, each additional year of schooling increases earnings in 6.6%, according to regressions. In 1992 one more year of education leads to an increase in 4.7% on earnings and in 2002 this coefficient drop to 3.9%.

Table 3: Earnings equations
Dependent variable: log of earnings in the main job

	1982	1992	2002
	(1)	(2)	(3)
Years of schooling (S)	0.0656 [7.07]***	0.0465 [3.83]***	0.0385 [4.10]***
First segment of the primary (D4)	0.1149 [3.47]***	0.0339 [0.77]	-0.0601 [1.59]
Second segment of the primary (D8)	0.1224 [2.99]***	0.2078 [4.69]***	0.1423 [4.28]***
Secondary school (D11)	0.3163 [6.69]***	0.3989 [8.09]***	0.2495 [7.17]***
College (D15)	0.3131 [6.57]***	0.2179 [3.63]***	0.2588 [5.49]***
Experience	0.0172 [9.94]***	0.0206 [9.27]***	0.0156 [9.39]***
Experience squared	-0.0004 [13.83]***	-0.0004 [13.20]***	-0.0003 [12.12]***
Experience x schooling	0.0013 [4.39]***	0.0015 [4.10]***	0.0008 [2.97]***
Schooling=16	0.1508 [5.10]***	0.0745 [2.18]**	-0.0785 [3.29]***
D4 x (S-4)	-0.0036 [0.49]	-0.025 [2.95]***	0.0005 [0.08]
D8 x (S-8)	-0.0027 [0.18]	0.0324 [2.33]**	0.006 [0.62]
D11 x (S-11)	0.0397 [2.54]**	0.0626 [3.93]***	0.1314 [11.79]***
D15 x (S-15)	-0.0647 [2.79]***	0.0211 [0.91]	0.1002 [6.19]***
Experience x D4	0.0002 [0.15]	0.0018 [1.20]	0.0043 [3.41]***
Experience x D8	-0.0027 [1.59]	-0.0045 [2.34]**	-0.004 [3.02]***
Experience x D11	-0.0065 [3.73]***	-0.0116 [6.38]***	-0.0012 [0.93]
Experience x D15	-0.0102 [5.18]***	-0.0088 [3.78]***	-0.0088 [5.11]***
Woman	-0.8692 [120.78]***	-0.7231 [95.04]***	-0.596 [107.74]***
Black	-0.1511 [22.49]***	-0.1577 [20.19]***	-0.1451 [24.82]***
Constant	5.7187 [186.46]***	5.1572 [124.59]***	5.245 [169.12]***
Observations	71816	55757	79743
R-squared	0.54	0.46	0.49

Robust t statistics in brackets.

* significant at 10%; ** significant at 5%; *** significant at 1%.

All regressions have controls for region.

From these results we can observe evidences of sheepskin effects in all three years, but the patterns of these effects are very different over time. The sheepskin effects, which are higher for more advanced degrees, have a decreasing trend from 1982 to 2002. The first segment of primary school degree increases earnings 12% in 1982,

and became non significant in 1992 and 2002⁴. The second segment of primary degree effect is 12% in 1982, increased to 21% in 1992, and then reduced to 14% in 2002. The sheepskin effects reduction are intense for higher degrees, but they were still very impressive in 2002. The secondary degree, which was 32% in 1982, increased to 40% in 1992 and then reduced to 25% in 2002. The college degree represented an earning increase of 31% in 1982. In 1992 this effect reduced to 22% and increased to 26% in 2002.

Table 3 shows also that the interactive terms between completed degrees and experience are negative and significant in many of the regression. So, although workers with a diploma or a degree have an extra gain in their earnings, this effect reduces with labor market experience. Splines for secondary school and college present an increasing trend from 1982 to 2002, indicating the reduction in sheepskin effects was accompanied by an increase in non-linearity of earnings returns.

According to evidences there was a reduction in the returns to schooling during the period analyzed. The sheepskin effects also diminished from 1982 to 2002. These results could be explained by the fact that the proportion of more educated workers increased along time, reducing the signal value represented by the completion of a degree. However, could be a role played by changes in the structure of labor demand. The next section explores this topic through comparisons between regions.

IV.2 The Evolution of sheepskin effects by region

Regressions for Northeast and Southeast are presented in table 4. Returns to schooling are much higher in Northeast, reflecting the fact that education is scarcer in this region. During the period 1982-2002 the coefficients for years of schooling decreased from 8.3% to 4.3% in Northeast, and from 5% to 3% in Southeast.

The returns to the first segment of the primary school were similar across the two regions in 1982, while in 2002 became non significant for Northeast and negative for Southeast. The coefficient associated with the primary degree loose half of this value in Southeast during the period of analysis. In Northeast, on the other hand, this coefficient increased.

The completion of secondary school in Northeast represented an earnings gain of 43% in 1982, which reduced to 29% in 2002. In Southeast the coefficient for *DII* diminished slightly, from 28% in 1982 to 24% in 2002. College degree coefficients are non significant in Northeast for all three years. In Southeast, the extra earnings gain associated with the completion of college presents a decreasing trend, but was still very high in 2002 (25%).

⁴ It is important to notice that this result was already expected as the primary diploma was abolished many years ago and only few workers nowadays keep only this degree.

Table 4: Earnings equations by region
Dependent variable: log of earnings in the main job

	Northeast			Southeast		
	1982	1992	2002	1982	1992	2002
	(1)	(2)	(3)	(4)	(5)	(6)
Years of schooling (S)	0.0828 [4.12]***	0.0675 [2.57]**	0.0433 [2.35]**	0.0495 [3.52]***	0.0404 [2.10]**	0.0303 [1.95]*
First segment of the primary (D4)	0.1311 [1.68]*	0.0228 [0.21]	-0.0285 [0.35]	0.1212 [2.52]**	-0.0219 [0.34]	-0.1312 [2.17]**
Second segment of the primary (D8)	-0.1487 [1.51]	0.2962 [2.84]***	0.1248 [1.75]*	0.2317 [3.86]***	0.1351 [1.99]**	0.1338 [2.53]**
Secondary school (D11)	0.4285 [3.82]***	0.4708 [4.15]***	0.2883 [4.10]***	0.2745 [3.85]***	0.3201 [4.08]***	0.239 [4.14]***
College (D15)	0.1161 [0.98]	0.0028 [0.02]	0.1678 [1.62]	0.3338 [4.88]***	0.2495 [2.77]***	0.2465 [3.36]***
Experience	0.0091 [2.47]**	0.0173 [3.71]***	0.0128 [3.91]***	0.0209 [7.92]***	0.0226 [6.57]***	0.0156 [5.63]***
Experience squared	-0.0002 [4.18]***	-0.0004 [4.71]***	-0.0002 [4.70]***	-0.0005 [11.12]***	-0.0005 [10.05]***	-0.0003 [7.70]***
Experience x schooling	0.0014 [1.96]*	0.0011 [1.31]	0.0009 [1.44]	0.0015 [3.24]***	0.0014 [2.32]**	0.0004 [0.84]
Schooling=16	0.1713 [2.50]**	0.0036 [0.04]	0.0255 [0.50]	0.1824 [4.28]***	0.1016 [2.00]**	-0.1085 [2.95]***
D4 x (S-4)	-0.0112 [0.65]	-0.0521 [2.58]***	0.0113 [0.83]	0.0059 [0.57]	-0.0083 [0.64]	0.0153 [1.42]
D8 x (S-8)	0.0031 [0.09]	0.0062 [0.17]	-0.0116 [0.55]	-0.0006 [0.03]	0.0369 [1.71]*	-0.0077 [0.50]
D11 x (S-11)	0.12 [3.00]***	0.1905 [4.41]***	0.1718 [6.87]***	0.0235 [1.02]	0.0479 [1.97]**	0.1527 [8.69]***
D15 x (S-15)	-0.1107 [2.01]**	-0.0434 [0.77]	0.1042 [2.99]***	-0.0656 [1.91]*	0.0129 [0.39]	0.0926 [3.85]***
Experience x D4	-0.0024 [0.81]	0.004 [1.03]	0.0035 [1.23]	0.0013 [0.77]	0.0038 [1.73]*	0.0076 [3.87]***
Experience x D8	0.0063 [1.55]	-0.0056 [1.24]	-0.004 [1.38]	-0.0062 [2.53]**	-0.003 [1.02]	-0.003 [1.44]
Experience x D11	-0.0119 [2.95]***	-0.0063 [1.52]	-0.0003 [0.12]	-0.0049 [1.98]**	-0.0115 [4.13]***	0.0000 [0.01]
Experience x D15	-0.0104 [2.22]**	-0.0087 [1.59]	-0.0105 [2.86]***	-0.0107 [3.85]***	-0.0096 [2.79]***	-0.0074 [2.82]***
Woman	-0.9439 [57.17]***	-0.7893 [43.37]***	-0.6052 [50.94]***	-0.8742 [84.25]***	-0.7195 [64.12]***	-0.5936 [68.53]***
Black	-0.0804 [5.36]***	-0.1271 [6.94]***	-0.1107 [8.91]***	-0.1833 [19.40]***	-0.1777 [16.20]***	-0.1629 [18.61]***
Constant	5.4242 [92.18]***	4.8617 [64.27]***	4.9113 [87.76]***	5.6956 [123.90]***	5.4535 [84.99]***	5.5284 [105.73]***
Observations	15424	13373	21001	27894	21164	26307
R-squared	0.50	0.40	0.42	0.53	0.44	0.48

Robust t statistics in brackets.

* significant at 10%; ** significant at 5%; *** significant at 1%.

All regressions have controls for region.

The evidences reported in this subsection shows that despite the fact that patterns of educational composition changes were very similar for Northeast and Southeast, the sheepskin effects coefficients variations were very difference when

comparing these two regions. For more advanced degrees the reductions were less pronounced in Southeast, and represented a significant earnings increase in 2002. These results are consistent with the argument that labor demand changes were more intense in Southeast, requiring more skilled workers and increasing the signal value of completion of a higher degree.

VI. Conclusion

This paper was concerned in analyzing the evolution of sheepskin effect and what was behind this evolution pattern. The main contribution was the analysis made in terms of labor supply and demand equilibrium. As discussed above results suggest that sheepskin effects have strong impact on earnings. However, the sheepskin effects changed considerably during the period analyzed - from 1982 to 2002. In general, the sheepskin effect basically disappeared for the first diploma (first segment of primary school), and reduced for the others, but they are still relatively elevated in the last period. For these higher degrees, however, the splines have a positive trend from 1982 to 2002. This indicates that the signal represented by a completion of a degree became less important over time, but the non linear pattern of the education returns was exacerbated.

The natural interpretation for these results is that, on the demand side, firms increased the necessity of hiring high skill workers as they adopted the new technologies. This leads to a decrease of the mainly primary school and secondary school degrees as signals for these firms. It means that they became more concerned about the signal related to higher level productive workers. This suggests that the premium for the completion of higher degrees should have increased.

However, it is also necessary to consider the labor supply side. Worker have been increasing their level of education and becoming more productive in this sense. Therefore, with a higher supply of skilled workers, the return to higher level of education have decreased as well as the importance of the higher degrees as a signal. In equilibrium, we observe that the sheepskin effect decrease even for high level degrees, but they are still important.

The results shown here by region gave us some insights about the labor demand side of this story. As shown in the previous section, for higher level of education degrees the Southeast presented a lower reduction in the sheepskin effect, as well as a higher reduction on lower level degrees premium. These results are consistent with the argument that labor demand changes were more intense in Southeast. With technological progress, firms start to substitute low skill tasks by more complex ones. For this reason the information problem about the productivity of high skill workers becomes more serious and the sheepskin effect tend to increase for this group because of the labor demand side. As it is expected the demand side should change faster than the supply, as the labor force usually takes longer to increase its education level. This seems to be what is going on in the comparison between the Southeast and northeast regions.

It is clear that this interpretation should be carefully done as we are not taking

into account other differences that may characterizes these regions, as well as the impact of migration in the labor market. For a more conclusive interpretation, it would be interesting to check if in more complex occupations the sheepskin effect is stronger. Also, the analysis about how sheepskin effect change in occupations that were simpler and changed over time to more complex ones could help to understand the evolution of sheepskin effect in the Brazilian labor market under the argument developed on this paper.

References

- Autor, D.; F. Levy and R. Murnane (2003). The skill content of recent technological change: and empirical exploration. *Quarterly Journal of Economics* 118 (4).
- Belman, D. And J. Heywood (1991). Sheepskin effects in return to education: an examination of women and minorities. *Review of Economics and Statistics* 73, pp. 720-724.
- Card, D. (1999). The casual Effect of Education on Earnings. In Ashenfelter, O. and Card, d. (eds.), Handbook of Labor Economics, vol. 3.
- Ferrer, A. and W. Riddell (2002). The role credentials in the Canadian labour market. *Canadian Journal of Economics* 35 (4).
- Hungerford, T. and G. Solon (1987). Sheepskin effects in the Return to Education. *Review of Economics and Statistics* 69, pp. 175-177.
- Jaeger, D. and M. Page (1996). Degrees Matter: New evidence on the Sheepskin Effects in the Return to Education. *Review of Economics and Statistics* 78, pp.733-740.
- Lam, D. And R. Schoeni (1993). Effects of family background on earnings and returns to schooling: evidence from Brazil. *Journal of Political Economy* 101 (4).
- Mincer, J. (1974). *Schooling, experience and earnings*, New York, Columbia University Press.
- Park, J. H. (1999). Estimation of Sheepskin Effects using the old and the new measures of educational attainment in the Current Population Survey. *Economics Letters* 62, pp.237-240.
- Ramos, L and M. L. Vieira (1996). A relação entre educação e salários no Brasil. *Texto para discussão do IPEA* 21/96.
- Schady, N. (2003). Convexity and Sheepskin Effects in the human capital earnings function: recent evidence for Filipino men. Mimeo.