Labor Unions and Wages in Brazil[†]

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Abstract:
This paper estimates the union relative wage effect in Brazil. In contrast to previous studies, we pool data for several decades, so that we are able to examine the union relative wage effect for the entire period 2003-2015. The empirical strategy compares the (benchmark) mean regression effects using OLS with the results using quantile regressions, a more flexible estimator—where the latter allows for the union relative wage effect to differ across the conditional wage distribution. This is potentially particularly important for the application here, as a priori unions can be expected to be bargaining especially on behalf of the lower part of the wage distribution. At the same time, these workers also frequently are among the less skilled/less educated workers, thus highlighting at the same time the importance of upskilling/educating this segment of the Brazilian workforce. We establish four main results regarding the union wage premium in the formal Brazilian labor market. First, the union wage premium is substantial—and relatively constant—roughly around 15 percent over the entire period 2003-2015. Second, the union premium is both more volatile over time in rural than in urban areas, and also exhibit greater differences across quantiles (with a larger union premium for the higher quantiles than for the lower quantiles in rural areas). Third, the union wage premium is again both relatively more volatile over time in Northern than in Southern Brazil, and also exhibits greater differences across quantiles (with a larger union premium for the higher quantiles than for the lower quantiles in the Northern states). Fourth, estimating the union premium separately simultaneously across both urban and rural areas and Northern and Southern states reveal that it is the relatively more affluent urban areas in the Southern states that account for the overall constant union wage premium across both time and wage quantiles for Brazil as a whole.

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1. Introduction

Do unions help improve the wages of workers? This question has a long history in Economics, dating back at least to the seminal work of Lewis (1963). While the consensus seems to be that unions do indeed improve wages (Bryson, 2014; Freeman and Medoff, 1984; Lewis, 1986) much of previous research has been for developed countries, especially for the US and Europe. The evidence for developing countries is therefore still limited, though it has started to emerge in recent decades (Blunch and Verner, 2004; Schultz and Mwabu, 1998, Xavier et al., 2009).

If unions help improve the wages of workers, this seems especially important for developing countries, since workers in developing countries may need additional "voice" even more than workers in developed countries due to the historically less supportive labor markets legislation more generally in these countries. This seems particularly true for disadvantaged workers, here especially workers in the lower part of the earnings distribution—since these workers may be particularly in need of a "voice" to speak on their behalf.

On the other hand, if unions do not seem to help improve workers' wages, especially in the bottom of earnings distribution, maybe unions should not be regarded as a potentially important voice for (especially the disadvantaged) workers (anymore). Rather, what would seem to be called for is improved labor market legislation more generally, including improving—as well as ensuring adherence to—minimum wages.

To shed light on some of these issues we examine the possible existence and nature of a union wage gap in Brazil. Brazil is a particularly interesting country to study the possible importance of unions for workers' wages—not just because of its immense size and importance in the world economy both economically and otherwise but also because of the institutional set-up in Brazil. The Consolidated Labor Laws and numerous complementary laws and regulations govern the quite complex labor relations in Brazil. In particular, the 1988 constitution contains several labor provisions that pertain specifically to labor unions: legalizing labor unions, collective bargaining, and the right to strike in both the public and private sectors—as well as sets overtime rates, provides for a monthly minimum wage, and regulates working hours. In addition, it specifies a variety of labor entitlements, including maternity leave, vacation, worker's

compensation, social services, medical assistance and unemployment benefits.[1] On the one hand, one would expect an impact of labor unions in such a seemingly labor union favoring political environment. On the other hand, with such seemingly substantial and varied legal provisions to workers regardless of whether or not labor unions are active and/or effective in terms of improving workers' conditions, one might also expect that there might be less of a role to play for labor unions to begin with.

Examining the possible existence and nature of the union wage gap in Brazil therefore would help shed light on whether labor unions still have a role to play in an environment where (a) labor unions are allowed to operate, including exclusive rights to conducting collective bargaining and rights to strike and (b) workers are legally ensured many of the provisions that labor unions may otherwise be thought to be the providers of. If labor unions are able to increase wages even in such an environment it would seem that unions still have a role to play—possibly even more so in environments without such more generally legally mandated worker provisions (i.e., (b), above). This seems therefore like an almost ideal context for examining the role of labor unions, especially for the case of developing countries—where labor unions may be even more needed, due to the lack of more generally legally mandated worker provisions.

The remainder of this paper is organized as follows. In the next subsection, we first present the theoretical/conceptual framework and then link this to Brazilian context, by outlining the pertinent issues in the recent history of labor unions in Brazil. In section three we then present the data and outlines the empirical methods applied in this analysis. Section four then presents the results, while section five concludes and discusses policy implications and provide directions for future research.

2. Theoretical/conceptual Framework for Examining Labor Unions and Wages & the Brazilian Context

In this section we first review the theoretical/conceptual framework for the analysis of the trade union in general. This will then be followed by a brief overview of the history of labor unions in Brazil in the context of this theoretical/conceptual framework.

[1] This paragraph builds extensively on Deloitte (2017), where further details can be found.

Labor Unions and Wages: Theoretical-Conceptual Framework

A natural starting point in the analysis of unions would be to ask: "what do unions do?" (Freeman and Medoff; 1984). [2] The answer to this question is not straightforward, however. The theoretical literature traditionally states two main objectives of the union, namely to maximize (1) employment, and (2) wages of union members. Hence, here already we see that the answer to "what do unions do?" is not clear-cut. Indeed, there is an obvious trade-off at work between union objectives, since higher wages would seem to bring about higher unemployment and vice versa, ceteris paribus[3]. These objectives have traditionally been taken as exogenously given in the literature, although some attempts have been made to introduce endogenous elements. Most notably, the level of union-membership has been argued to be an endogenous component of the union's objective function, due to unemployed members possibly leaving the union (Pencavel, 1991).

As a consequence of the union objectives as stated above, it follows that for the forming of a union to be possible (unless maximization of members' employment were the exclusive objective), there must exist some rents in the product market(s) that can be shared between the firm and the union, and, ultimately, the workers (note how this seems to contradict the implication of perfect competition, under which a given firm earns zero profits – or, alternatively, the firm's production function exhibits decreasing returns to labor in a neighborhood around the equilibrium[4]). However, there may be a case for the existence of unions generating the rents, which are subsequently shared with the union members—this is something that we will return to later. Second, the union must have some bargaining power that enables it to obtain part of these rents. When the union, i.e. group of workers, is large or strong enough that a threat of strike is credible, it will have the bargaining power that is necessary, but not sufficient, to obtain rents. In addition, namely, it is required that there be no or only minor alternative, i.e., unorganized, labor available. Hence, the union must have some degree of monopoly power in the supply of

[2] This sub-section relies heavily on Booth (1995), as presented in the working paper version of Blunch and Verner (2004).

[3] Naturally, the tradeoff depends on the elasticity of the demand for labor in the sector of interest: the more elastic is labor demand, the larger the "price" in terms of increased unemployment for an increase in wage demands. Similarly, the more inelastic is labor demand in a given sector, the smaller the loss in terms of unemployment.

[4] See Ulph and Ulph (1990).

labor. Ultimately, when an entire sector is organized, a "closed shop" arrangement is said to be effective in the sector in question.

Once in place, the existence of the union has several potential effects. First, the union may impose allocative costs through the distortion of factor prices, coming about through the increase of wages over and above what they would otherwise have been. In the absence of unions, allocative efficiency comes about as an allocation of identical factor inputs such that their marginal products are equalized across sectors. However, when unions are present, the wages of the unionized sector(s) is higher, relative to the non-unionized, which, in turn, leads to an employment level in the unionized sector below what it would otherwise have been. Next, this results in an influx into the non-unionized sector of formerly organized workers, in turn adversely affecting the wages in this sector.

Unions may also bring about technical inefficiencies. The reason for this is that in addition to the level of wages, the unions may also affect the restrictive practices of an industry, such as manning agreements or rules about work pace. Additional adverse effects on output may come about if the strike threat is actually carried out (and substitution with non-organized labor is not possible or limited).

Note, however, that while the above discussion implicitly assumes perfect markets (prior to the emergence of the union), many product markets are characterized by imperfect competition, arising from bargaining power of labor due to specific training, mobility costs, and/or hiring and firing costs (Stewart, 1990). In this case, it is not certain whether the replacement of individual bargaining with collective bargaining will bring about additional inefficiencies or, rather, *reduce* the preexisting inefficiencies.

This brings us to the second of the "two faces" of unionism, in Freeman and Medoff's (1979) terminology: there is a potential for *positive* effects coming about as a consequence of unionism. Hence, rather than merely obtaining part of an already existing surplus, a union may be able to *generate* a surplus. First, it may act as an information provider, sharing information on workers' preferences for wages, personnel practices and so on between workers and management; that is, information which may not otherwise have been shared. The reason for this is that while each individual may fear retaliation from management from expressing an opinion, a collection of workers - in

a union - may not. Hence, the union may act as the workers' "voice", Hirschman (1970). Second, the existence of unions may work as a "pool" of labor, in turn resulting in lower turnover and negotiating costs, since management now only needs to employ centralized bargaining, which is less costly than bargaining with each worker individually.

The discussion above is what underlies the notion of the so-called "union relative wage effect", originating with the seminal work by Lewis (1963). Lewis defines the union-nonunion wage differential ("the union relative wage effect") as:

$$r_i = \frac{W_i^u - W_i^n}{W_i^n} \qquad (1)$$

Hence, referring to the above discussion, the possible existence and magnitude of the wage differential will depend on the extent to which the union is able to affect the wages of members relative to the wages of nonmembers, e.g., through bargaining, at one extreme, where the union through its bargaining power merely extracts and subsequently shares already existing rents (in the form of profits) of the firm with its members, to the other extreme, where the union generates rents through its potential adverse effects on labor-turnover and costs of wage-negotiations between management and workers (in reality, however, rather than any one of these two "pure" cases, it is likely that what we will see in reality is a *combination* of these to effects). However, as to the exact *empirical implementation* of this notion of a union relative wage effect, the theory is silent. This is left to the researcher, and there are several possibilities, with their advantages and disadvantages, as we shall see in the discussion on econometric methodology below. But first we turn to a discussion of the Brazilian experience in the context of the conceptual framework we have just presented.

Labor Unions and Wages: The Brazilian Context

Based on the more theoretical/conceptual discussion of the previous sub-section, we now specifically discuss the Brazilian context for examining issues related to the potential relationship between labor unions and wages. Labor unions have a long history in Brazil.

Specifically, unions in Brazil date back to 1903, when the Decree Law 979 makes possible the organization of agriculture and industry professionals in unions. In 1943, the Consolidation of Labor Laws ("Consolidação das Leis do Trabalho", D.L. 5.452/43) defines the main regulations of Brazilian labor market. In particular, the most recent Federal Constitution of 1988 (CF 88) stipulates that unions have to defend any individual belonging to its professional category, and these individuals are obligated to contribute to unions with Syndical Contribution equivalent to a day's earnings, regardless their affiliation status. Affiliation, in turn, is optional and requires a supplementary Membership Fee. Eventually, the Brazilian labor reform of 2017 extinguishes the compulsory requirement of the Syndical Contribution, although legal resources and maneuvers from unions are still on course to reverse or contour it. Besides the Syndical Contribution and Membership Fee, unions may charge affiliates and non-affiliates[5] a specific fee (Assistencial Contribution) endorsed by collective negotiations between unions and employers. Thus, unions may negotiate with employers' associations and the resulting Collective Convention ("Convenção Coletiva") has to be extended to the entire professional category. Alternatively, unions may negotiate with specific firms and the resulting Collective Agreement ("Acordo Coletivo") is restricted to the workers of those firms.

So far, the benefits from unions come from collective negotiations that any worker may benefit from, so why individuals affiliate to unions? One possible explanation is that unions can intervene for a single person, although it is less usual and controversial. For example, some unions offer legal assistance only for affiliated workers (or cheaper assistance). However, according to the law and law interpretation, unions cannot treat differently affiliated and non-affiliated; in fact, certain legal decisions reverted favored treatment to affiliated and enforced unions to provide legal assistance equally to non-affiliated individuals. Another possible explanation is the effective application of negotiations outcomes by firms. Arbache (2005) casts some doubt that the benefits of union's bargaining are extended to the entire category: "The empirical verification of union wage premiums suggests that pay raises obtained by unions are not always being

[5] The Assistance Contribution may not be charged if individuals make formal opposition.

extended to non-union workers. This would imply non-compliance with the law, suggesting that the legislation regulating collective bargaining, along with many other employment laws, are not being observed."

Based on the above we can identify the following three main channels through which unions may potentially affect individual worker wages in Brazil:

(1) collective convention
(2) collective agreement
(3) individual worker union negotiation

All three channels potentially can affect the individual worker wages through individual union affiliation. Channel (1), however, additionally has a likely large common component, which affects all workers for a given occupational category identically regardless of their union status. What this latter does is that there may be union effects on wages that cannot be empirically identified, so that the estimated union relative wage effect (through individual membership status) thus will yield a conservative lower level bound of the effect of unions on wages in Brazil.

3. Data & Methods

This section first presents the data and discusses related potential issues and then goes on the present the econometric methodology of this study and related issues.

The Data

The data originates from Pesquisa Nacional por Amostra de Domicílios (PNAD), a nationally representative multi-purpose cross-section household survey, which is collected annually (during the third quarter of each year) by the Brazilian Institute for Geography and Statistics (IBGE), except for the years when the Census takes place. We use the years 2003-2015[6] for the analysis here. The household survey contains information on individual wages, union membership, educational attainment, as well as information on background variables such as age, gender, and geographical variables, which are also important factors in analyses of human capital processes. The respondent

[6] Except for 2010, which was a Census year (again, the PNAD is not collected whenever there is a Census the same year; and unfortunately the Census does not include information on union membership, so we cannot use that for the analysis here).

in the survey is the person him or herself (if available) or else a knowledgeable person in the home at the time of the survey. In the analysis here we focus on formal sector prime age male adults, 25-55 years of age (more on this and other sample restrictions, below).

The regressions estimated here are basic Mincer regressions in the tradition of the Human Capital framework (Becker, 1964)—but augmented with union membership as the main focal explanatory variable of interest. Wages, the dependent variable for the analysis here, is defined as (the log of) monthly after tax labor income from the main job. Union membership, the focal explanatory variable in this analysis, is constructed as a dummy variable, which is one if a given individual is member of a labor union and zero otherwise. Educational attainment is defined as years of formal education. Additional potentially important explanatory variables include education (measured in years), age and age squared (as a proxy for potential general experience), ethnicity, state of residence, and rural-urban location. Except for education, these are all included as sets of dummy variables. Basic descriptive statistics for the estimation samples are shown in Table A1 in the Appendix [NOT YET: TO BE COMPLETED].

Estimation Strategy and Related Issues

Ordinary least squares (OLS) remains the workhorse in empirical work and is therefore also first, "go-to" estimator for our analysis here. Additionally, it is quite robust and it also serves as a good benchmark/comparison estimator, to enable comparison of our results with previous results from the labor union relative wage effects literature. The estimations will also incorporate sampling weights and adjust for within-community correlation/clustering (Wooldridge, 2010).

As discussed in the background section reviewing the Brazilian context as pertaining to labor unions and wages, however, it can be expected that labor unions in Brazil particularly bargain on behalf of the lower part of the wage distribution. This observation directly leads to additionally considering using quantile regression for the empirical analysis of the Brazilian labor union premium, as this method allows for the estimated regression coefficients to differ across the conditional (wage) distribution. Further—though this is not the main objective for the analysis here—it seems likely that the returns to education and experience, for example, would differ across the wage

distribution. For example, education might be thought to be a more important determinant at higher quantiles than at lower quantiles.[7]

The method has other virtues, as well. Allowing the parameter estimates for the marginal effects of the explanatory variables to differ across quantiles of the dependent variable achieves greater robustness both to potential heteroskedasticity and to extreme observations (outliers) of the dependent variable. This contrasts with ordinary least squares (OLS) regression analysis, which requires homoskedasticity (though many researchers, us included, routinely incorporate Huber-White heteroskedasticity corrected standard errors) and which can also be quite sensitive to extreme observations (outliers) of the dependent variable. Additionally, when the error terms are non-normal, for instance, quantile regression estimators may be more efficient than least squares estimators.

The method, developed by Koenker and Basset (1978), can be formulated as:

$$Y_i = X_i \beta_\theta + u_{\theta i} = Quant_\theta(Y_i \mid X_i) = X_i \beta_\theta \qquad (1)$$

where $Quant_\theta(Y_i \mid X_i)$ denotes the θ^{th} conditional quantile of Y given X for individual i. In general, the θ^{th} sample quantile $(0 < \theta < 1)$ of Y solves:

$$\min_\beta = \frac{1}{n}\left\{ \sum_{i:Y_i \geq X_i'\beta} \theta \mid Y_i - X_i'\beta \mid + \sum_{i:Y_i < X_i'\beta} (1-\theta) \mid Y_i - X_i'\beta \mid \right\} \qquad (2)$$

[NOT YET—WORK IN PROGRESS! Additionally, the estimator incorporates the sample design—that is, it takes into account that workers are clustered within enumeration areas by bootstrapping the standard errors at the enumeration area level (so it is a bootstrap of enumeration areas rather than individual workers). If clustering is not taken into account, the resulting standard errors are potentially seriously misleading, especially for finite sample standard errors like the bootstrap.]

So as to enable tracking the development in the labor union wage premium (UWP) across time in Brazil, the analysis is carried out for each survey year individually.

[7] This turns out to be the case (see Appendix B).

As also mentioned in the data description, we use a core set of explanatory variables. This has been purposely chosen as the minimum set of relevant explanatory variables, as based on previous research. The reason for this is two-fold. First, to keep the analysis simple and also making sure the same explanatory variables are available for all the PNAD surveys examined here, thus ensuring comparability of the results across the survey years. Second, some additional variables that may initially seem relevant in studies of wage determinants (e.g., industry, occupation, and/or sector) may be "problematic controls" due to creating selection issues (Angrist and Pischke, 2009: XX), here, specifically vis-à-vis the focus on the labor union premium.

All estimation samples are of working formal sector employees 25-55 years of age. The age-restriction ensures that all individuals are of legal working age (lower bound) and also are not "too old" to be active in the labor market. This leads to initial sample sizes of between 22,799 and 29,612 observations for each of the survey years. For some individuals information on one or more variables is missing, so that those individuals are dropped from the final estimation sample. This sample drop is mostly quite low, however—typically around 0.2 to 0.5 percent (though never more than 1 percent). Such relative modest drops in the estimation sample size should not be of concern for the analysis here. Basic descriptive statistics for the estimation samples are shown in Table A1 in the Appendix.

4. Results

This section reviews the results from the quantile regression estimations for formal sector males 25-55 years of age, focusing at the results for the labor union premium.[8] From Figure 1, there is a large and roughly constant—both across time and across quantiles (though perhaps with a slightly decreasing trend)—union wage premium, roughly around 15 percent (full details in Tables A2-A3).

Considering just the aggregate union wage premium, however, disregards the possibility of asymmetries in the union wage premium across some sub-national dimension. Specifically, since labor unions presumably seek to improve wages for the

[8] The full set of results is shown in Tables A2-A4 in the Appendix.

less well off in society, it seems likely that there would be more of an effect in relatively poorer geographical areas. Two geographical splits that address this are (1) rural vs. urban and (2) North vs. South, where in each case the former denotes the relatively poorer geographical dimension.

Estimating first the union premium separately across urban and rural areas (Figures 2 and 3) we see both a more volatile union wage premium over time in rural than in urban areas, and also greater differences across quantiles (with a larger union premium for the higher quantiles than for the lower quantiles in rural areas).

Similarly estimating the union premium separately across the Northern (relatively poorer) and the Southern (relatively wealthier) Brazilian states (Figures 4 and 5) reveals that the union wage premium is both relatively more volatile over time in Northern than in Southern Brazil, and also exhibits greater differences across quantiles (with a larger union premium for the higher quantiles than for the lower quantiles in the Northern states).

Lastly, estimating the union premium separately simultaneously across both urban and rural areas and Northern and Southern states (Figures 6-9) reveal that it is the relatively more affluent urban areas in the Southern states that account for the overall constant union wage premium across both time and wage quantiles for Brazil as a whole.

5. Conclusion

[COMPLETE]

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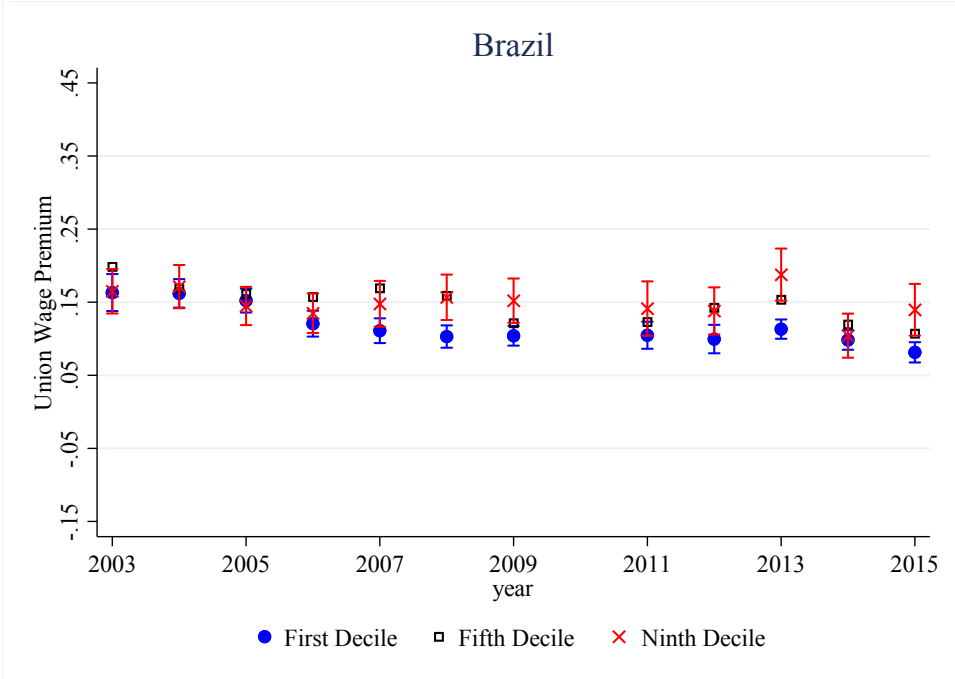
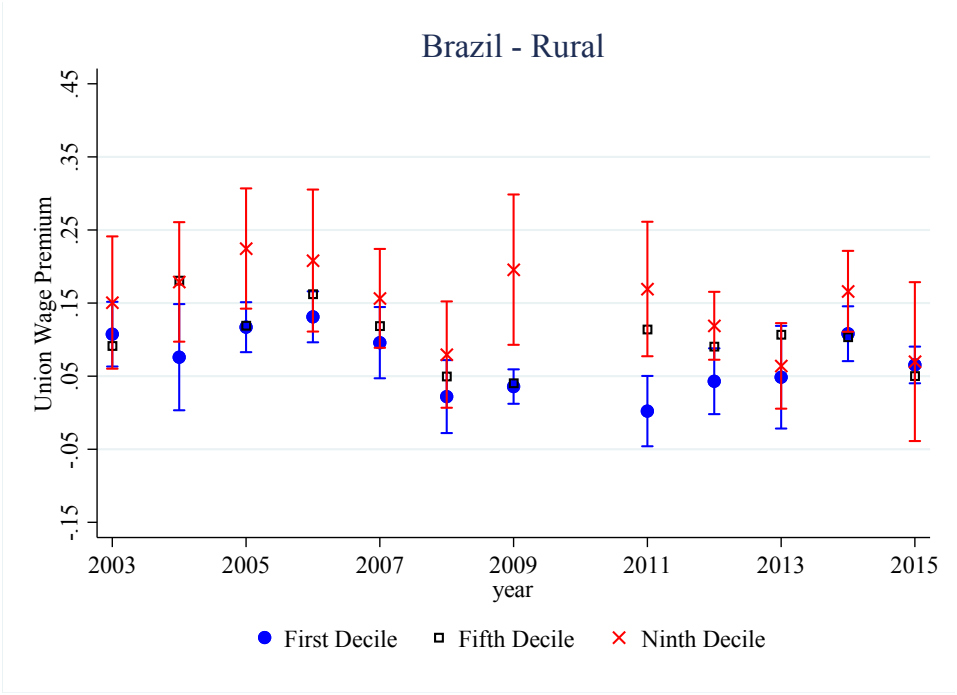
Figure 1. The Labor Union Wage Premium: Entire Brazil, 2003-2015.



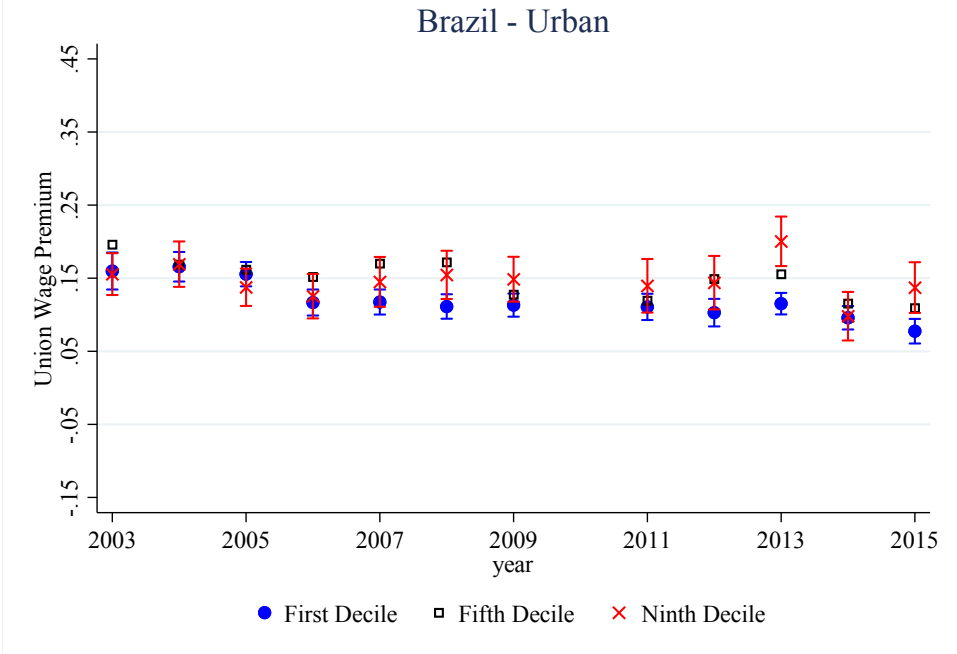
Source: Pesquisa Nacional por Amostra de Domicílios (PNAD), collected by the Brazilian Institute for Geography and Statistics (IBGE), 2003-2015.

Figure 2. The Labor Union Wage Premium: Rural Brazil, 2003-2015.



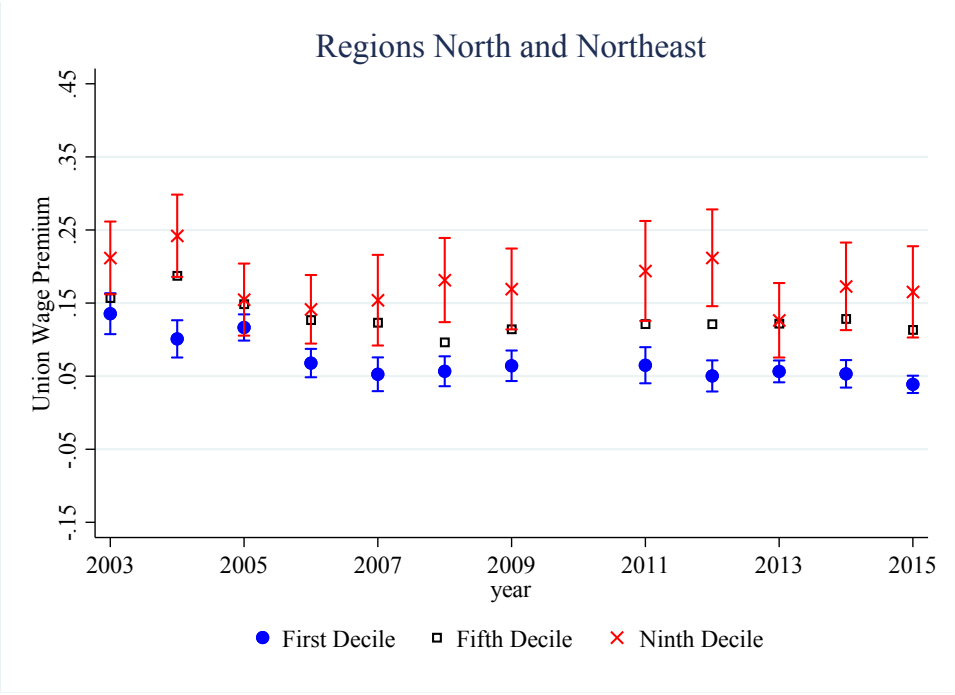
Source: Pesquisa Nacional por Amostra de Domicílios (PNAD), collected by the Brazilian Institute for Geography and Statistics (IBGE), 2003-2015.

Figure 3. The Labor Union Wage Premium: Urban Brazil, 2003-2015.



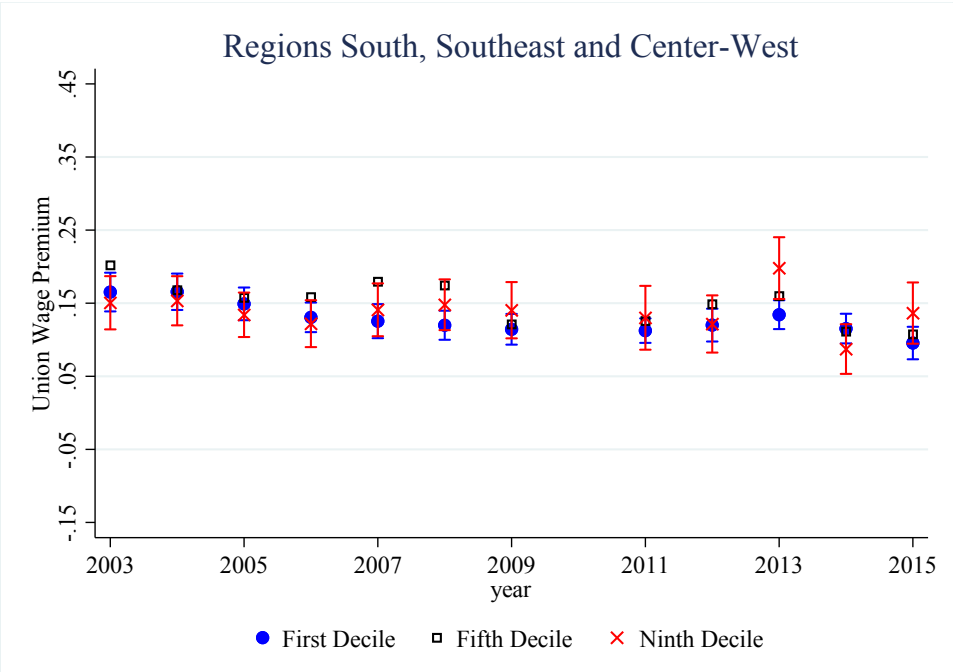
Source: Pesquisa Nacional por Amostra de Domicílios (PNAD), collected by the Brazilian Institute for Geography and Statistics (IBGE), 2003-2015.

Figure 4. The Labor Union Wage Premium: North and Northeastern Brazil, 2003-2015.



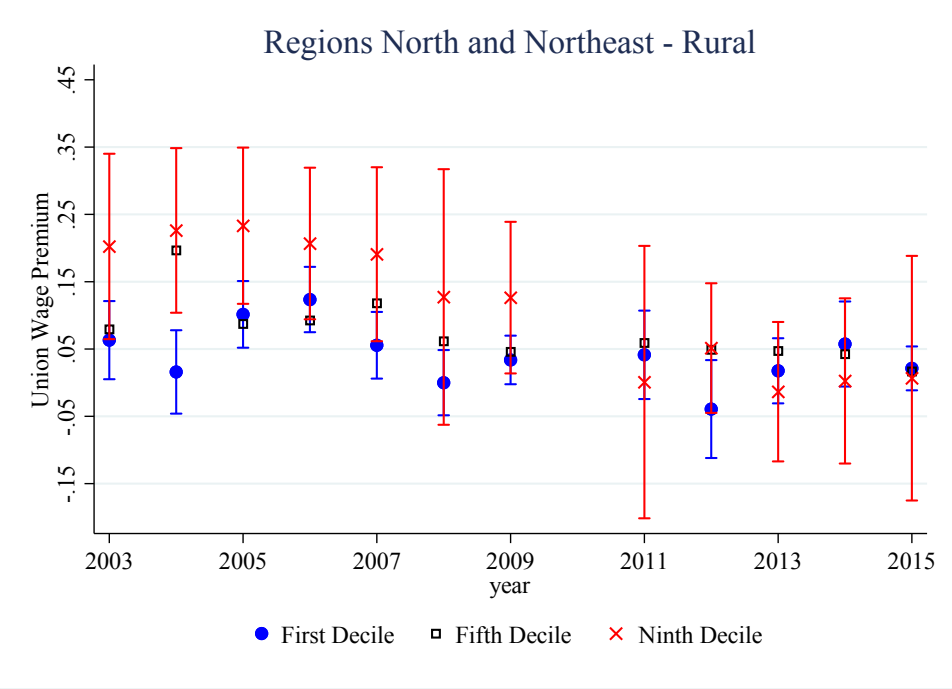
Source: Pesquisa Nacional por Amostra de Domicílios (PNAD), collected by the Brazilian Institute for Geography and Statistics (IBGE), 2003-2015.

Figure 5. The Labor Union Wage Premium: South, Southeastern, and Center-Western Brazil, 2003-2015.



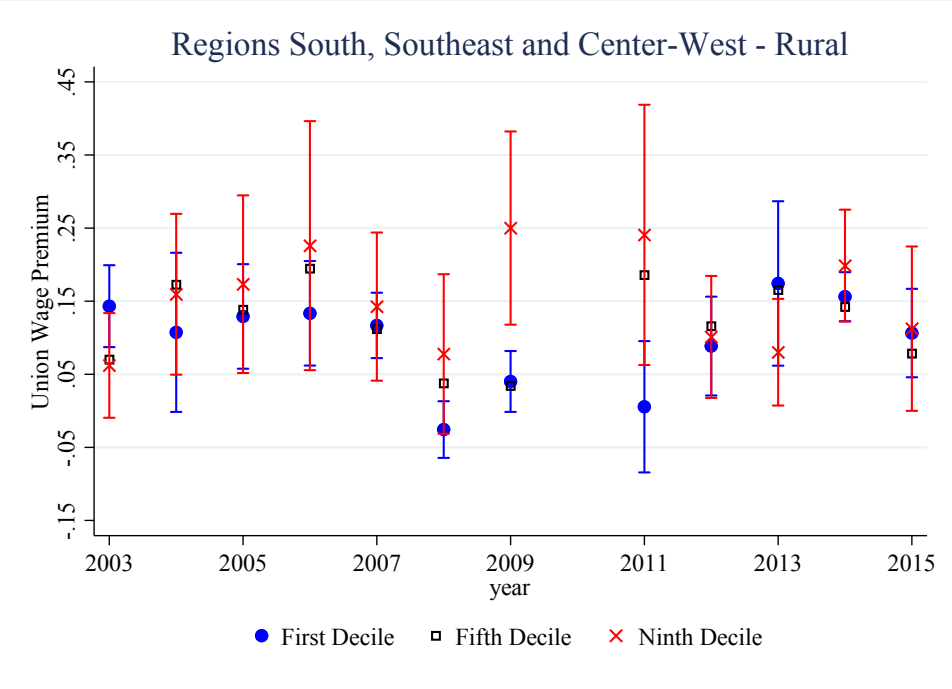
Source: Pesquisa Nacional por Amostra de Domicílios (PNAD), collected by the Brazilian Institute for Geography and Statistics (IBGE), 2003-2015.

Figure 6. The Labor Union Wage Premium: North and Northeastern Rural Brazil, 2003-2015.



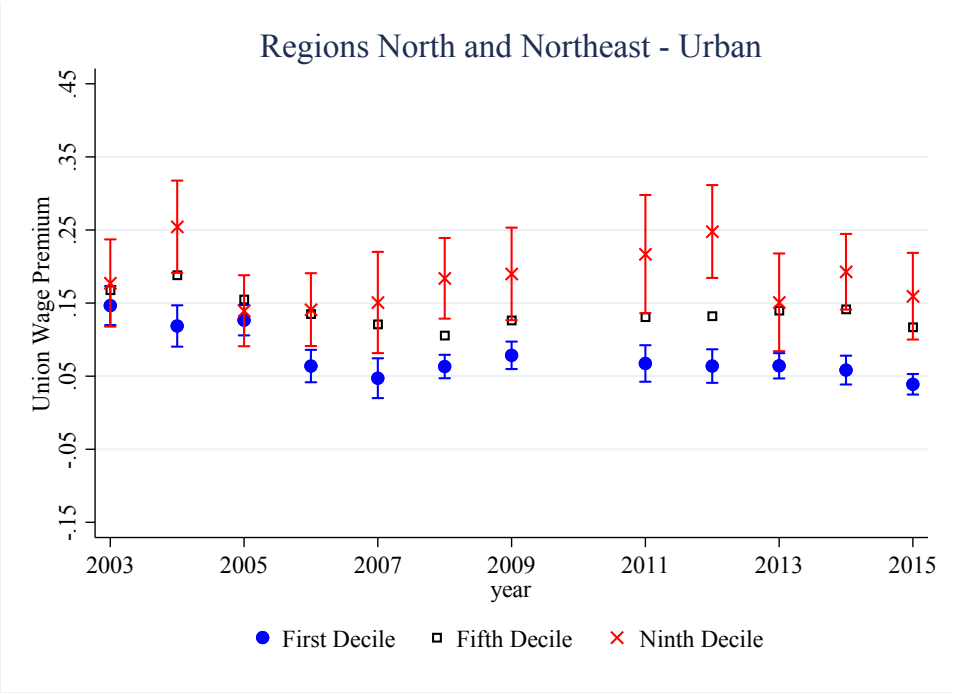
Source: Pesquisa Nacional por Amostra de Domicílios (PNAD), collected by the Brazilian Institute for Geography and Statistics (IBGE), 2003-2015.

Figure 7. The Labor Union Wage Premium: South, Southeastern, and Center-Western Rural Brazil, 2003-2015.



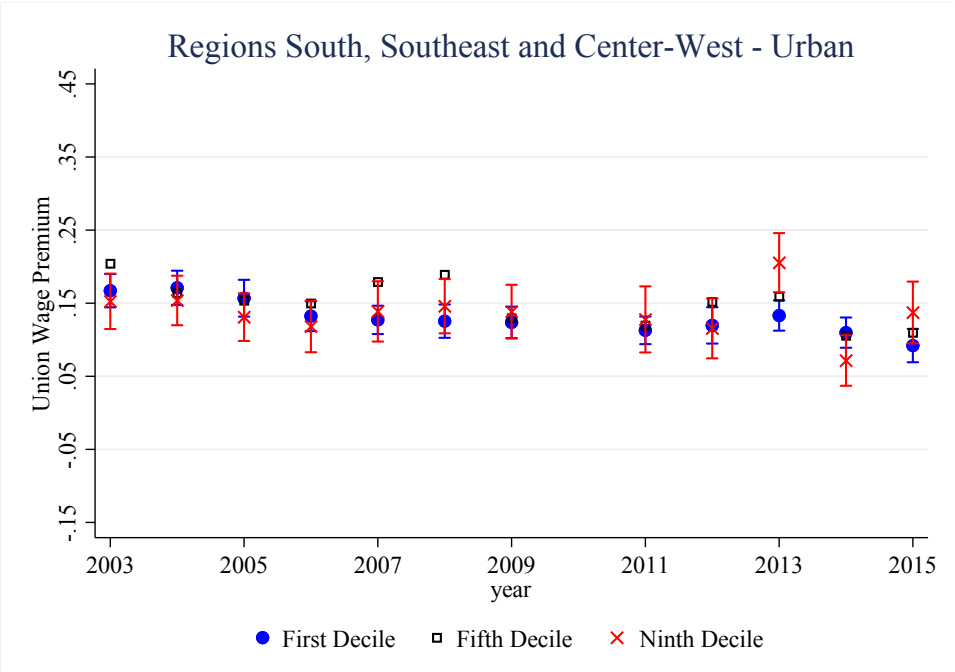
Source: Pesquisa Nacional por Amostra de Domicílios (PNAD), collected by the Brazilian Institute for Geography and Statistics (IBGE), 2003-2015.

Figure 8. The Labor Union Wage Premium: North and Northeastern Urban Brazil, 2003-2015.



Source: Pesquisa Nacional por Amostra de Domicílios (PNAD), collected by the Brazilian Institute for Geography and Statistics (IBGE), 2003-2015.

Figure 9. The Labor Union Wage Premium: South, Southeastern, and Center-Western Urban Brazil, 2003-2015.



Source: Pesquisa Nacional por Amostra de Domicílios (PNAD), collected by the Brazilian Institute for Geography and Statistics (IBGE), 2003-2015.

APPENDIX

Table A1. Descriptive Statistics

[COMPLETE]

Table A2. Quantile Regression Results: 10th Percentile

	2003	2004	2005	2006	2007	2008	2009	2011	2012	2013	2014	2015
Union member	0.167***	0.156***	0.143***	0.110***	0.101***	0.102***	0.091***	0.093***	0.075***	0.099***	0.095***	0.075***
	[0.011]	[0.012]	[0.009]	[0.010]	[0.010]	[0.011]	[0.007]	[0.008]	[0.007]	[0.009]	[0.009]	[0.009]
Age	0.029***	0.026***	0.030***	0.022***	0.017***	0.029***	0.010***	0.013***	0.018***	0.012***	0.015***	0.015***
	[0.006]	[0.005]	[0.004]	[0.004]	[0.005]	[0.006]	[0.003]	[0.004]	[0.003]	[0.004]	[0.004]	[0.003]
Age squared	-0.000***	-0.000***	-0.000***	-0.000***	-0.000**	-0.000***	-0.000	-0.000**	-0.000***	-0.000**	-0.000***	-0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Black	-0.076***	-0.067***	-0.070***	-0.051***	-0.053***	-0.042**	-0.050***	-0.040***	-0.041***	-0.061***	-0.039***	-0.042***
	[0.015]	[0.013]	[0.011]	[0.011]	[0.014]	[0.019]	[0.014]	[0.014]	[0.010]	[0.010]	[0.012]	[0.009]
Asian	0.240***	-0.035	0.215***	0.128	-0.005	-0.039	0.034	-0.131	0.010	0.006	0.025*	0.149**
	[0.020]	[0.204]	[0.020]	[0.216]	[0.106]	[0.178]	[0.071]	[0.171]	[0.129]	[0.012]	[0.015]	[0.062]
Mulatto	-0.064***	-0.056***	-0.044***	-0.042***	-0.038***	-0.033***	-0.029***	-0.037***	-0.036***	-0.036***	-0.044***	-0.040***
	[0.012]	[0.010]	[0.009]	[0.008]	[0.010]	[0.011]	[0.007]	[0.009]	[0.008]	[0.008]	[0.008]	[0.007]
Indigenous	0.019	-0.164	-0.338	-0.066	-0.116***	-0.147	-0.168***	0.007	0.070	0.068***	-0.007	-0.171
	[0.034]	[0.159]	[0.347]	[0.044]	[0.016]	[0.137]	[0.015]	[0.080]	[0.055]	[0.026]	[0.056]	[0.145]
Years of schooling	0.043***	0.044***	0.036***	0.036***	0.032***	0.032***	0.029***	0.027***	0.028***	0.026***	0.025***	0.025***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Urban	0.152***	0.108***	0.105***	0.091***	0.048***	0.096***	0.087***	0.110***	0.105***	0.087***	0.079***	0.045***
	[0.017]	[0.009]	[0.014]	[0.008]	[0.018]	[0.017]	[0.008]	[0.017]	[0.018]	[0.016]	[0.013]	[0.009]
Constant	0.587***	0.745***	0.835***	1.205***	1.431***	1.222***	1.731***	1.872***	1.934***	2.204***	2.221***	2.305***
	[0.112]	[0.094]	[0.110]	[0.100]	[0.109]	[0.122]	[0.064]	[0.081]	[0.059]	[0.087]	[0.083]	[0.067]
N	22,582	24,472	25,944	26,948	27,504	28,829	29,502	27,443	28,440	28,249	29,130	27,156

Notes: Robust Huber-White (Huber, 1967; White, 1980) standard errors, adjusted for within-community correlation/clustering (Wooldridge, 2010), in brackets under parameter estimates. The reference group for the ethnic groups is "White." Estimations also include state fixed effects (omitted here due to conserve space). *: statistically significant at 10 percent; **: statistically significant at 5 percent; ***: statistically significant at 1 percent.

Source: Pesquisa Nacional por Amostra de Domicílios (PNAD), collected by the Brazilian Institute for Geography and Statistics (IBGE), 2003-2015.

Table A3. Quantile Regression Results: 50th Percentile (Median)

	2003	2004	2005	2006	2007	2008	2009	2011	2012	2013	2014	2015
Union member	0.199***	0.169***	0.161***	0.157***	0.169***	0.159***	0.121***	0.123***	0.143***	0.154***	0.120***	0.107***
	[0.010]	[0.010]	[0.009]	[0.009]	[0.009]	[0.009]	[0.008]	[0.008]	[0.009]	[0.009]	[0.009]	[0.008]
Age	0.060***	0.057***	0.055***	0.048***	0.048***	0.043***	0.041***	0.046***	0.044***	0.049***	0.042***	0.047***
	[0.005]	[0.005]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]
Age squared	-0.001***	-0.001***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Black	-0.172***	-0.127***	-0.133***	-0.139***	-0.172***	-0.145***	-0.136***	-0.132***	-0.122***	-0.127***	-0.139***	-0.129***
	[0.016]	[0.017]	[0.013]	[0.014]	[0.013]	[0.013]	[0.012]	[0.010]	[0.013]	[0.011]	[0.012]	[0.011]
Asian	0.406***	0.426***	0.592***	0.457***	0.165	0.035	0.242**	0.047***	0.270**	0.127	0.326***	0.340***
	[0.046]	[0.083]	[0.040]	[0.144]	[0.117]	[0.062]	[0.120]	[0.012]	[0.131]	[0.133]	[0.091]	[0.097]
Mulatto	-0.116***	-0.121***	-0.106***	-0.121***	-0.115***	-0.105***	-0.106***	-0.102***	-0.107***	-0.097***	-0.102***	-0.106***
	[0.010]	[0.010]	[0.009]	[0.009]	[0.008]	[0.009]	[0.008]	[0.008]	[0.008]	[0.008]	[0.009]	[0.008]
Indigenous	0.091	-0.168*	-0.175***	-0.191**	-0.130	-0.163***	-0.150***	-0.142**	-0.073*	-0.102	-0.002	-0.133*
	[0.064]	[0.091]	[0.047]	[0.095]	[0.097]	[0.048]	[0.028]	[0.058]	[0.042]	[0.136]	[0.122]	[0.078]
Years of schooling	0.087***	0.082***	0.080***	0.076***	0.072***	0.069***	0.066***	0.057***	0.060***	0.057***	0.057***	0.056***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Urban	0.133***	0.089***	0.044***	0.039***	0.041***	0.039***	0.053***	0.081***	0.055***	0.049***	0.065***	0.060***
	[0.015]	[0.014]	[0.008]	[0.010]	[0.010]	[0.011]	[0.011]	[0.008]	[0.011]	[0.012]	[0.012]	[0.011]
Constant	0.221*	0.462***	0.596***	0.872***	1.027***	1.271***	1.335***	1.624***	1.745***	1.772***	1.944***	1.929***
	[0.113]	[0.104]	[0.080]	[0.084]	[0.095]	[0.081]	[0.083]	[0.079]	[0.082]	[0.076]	[0.085]	[0.076]
N	22,582	24,472	25,944	26,948	27,504	28,829	29,502	27,443	28,440	28,249	29,130	27,156

Notes: Robust Huber-White (Huber, 1967; White, 1980) standard errors, adjusted for within-community correlation/clustering (Wooldridge, 2010), in brackets under parameter estimates. The reference group for the ethnic groups is "White." Estimations also include state fixed effects (omitted here due to conserve space). *: statistically significant at 10 percent; **: statistically significant at 5 percent; ***: statistically significant at 1 percent.
Source: Pesquisa Nacional por Amostra de Domicílios (PNAD), collected by the Brazilian Institute for Geography and Statistics (IBGE), 2003-2015.

Table A4. Quantile Regression Results: 90th Percentile

	2003	2004	2005	2006	2007	2008	2009	2011	2012	2013	2014	2015
Union member	0.147***	0.150***	0.119***	0.128***	0.154***	0.157***	0.150***	0.136***	0.119***	0.186***	0.093***	0.161***
	[0.022]	[0.018]	[0.018]	[0.019]	[0.019]	[0.016]	[0.019]	[0.021]	[0.023]	[0.022]	[0.021]	[0.020]
Age	0.068***	0.073***	0.060***	0.058***	0.041***	0.074***	0.061***	0.086***	0.062***	0.081***	0.081***	0.090***
	[0.011]	[0.009]	[0.010]	[0.010]	[0.009]	[0.008]	[0.008]	[0.010]	[0.011]	[0.011]	[0.011]	[0.011]
Age squared	-0.001***	-0.001***	-0.000***	-0.000***	-0.000*	-0.001***	-0.000***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Black	-0.230***	-0.180***	-0.230***	-0.261***	-0.268***	-0.270***	-0.190***	-0.295***	-0.229***	-0.268***	-0.286***	-0.240***
	[0.036]	[0.025]	[0.029]	[0.034]	[0.037]	[0.029]	[0.039]	[0.038]	[0.030]	[0.032]	[0.028]	[0.028]
Asian	0.649***	0.329***	0.231***	0.304	-0.031	0.067	0.416	0.252	0.367***	0.280***	0.366***	0.453***
	[0.037]	[0.044]	[0.029]	[0.362]	[0.028]	[0.148]	[0.283]	[0.324]	[0.026]	[0.042]	[0.027]	[0.138]
Mulatto	-0.203***	-0.198***	-0.179***	-0.162***	-0.205***	-0.238***	-0.180***	-0.247***	-0.221***	-0.244***	-0.242***	-0.247***
	[0.023]	[0.020]	[0.021]	[0.019]	[0.020]	[0.017]	[0.018]	[0.022]	[0.020]	[0.021]	[0.023]	[0.021]
Indigenous	0.130	0.016	-0.187***	-0.431***	0.124**	-0.194	-0.049	-0.262***	-0.128	0.008	-0.295***	-0.100
	[0.175]	[0.863]	[0.042]	[0.105]	[0.052]	[0.158]	[0.500]	[0.056]	[0.141]	[0.042]	[0.033]	[0.094]
Years of schooling	0.134***	0.130***	0.128***	0.128***	0.118***	0.114***	0.118***	0.103***	0.108***	0.101***	0.104***	0.105***
	[0.003]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]
Urban	0.198***	0.061**	0.074***	0.045	0.084***	0.030	0.063***	0.148***	0.082***	0.148***	0.068**	-0.013
	[0.030]	[0.031]	[0.024]	[0.028]	[0.028]	[0.029]	[0.017]	[0.032]	[0.024]	[0.028]	[0.029]	[0.030]
Constant	0.546**	0.787***	1.037***	1.035***	1.660***	1.088***	1.447***	1.307***	1.835***	1.619***	1.598***	1.588***
	[0.212]	[0.223]	[0.213]	[0.197]	[0.219]	[0.195]	[0.174]	[0.210]	[0.205]	[0.211]	[0.209]	[0.220]
N	22,582	24,472	25,944	26,948	27,504	28,829	29,502	27,443	28,440	28,249	29,130	27,156

Notes: Robust Huber-White (Huber, 1967; White, 1980) standard errors, adjusted for within-community correlation/clustering (Wooldridge, 2010), in brackets under parameter estimates. The reference group for the ethnic groups is "White." Estimations also include state fixed effects (omitted here due to conserve space). *: statistically significant at 10 percent; **: statistically significant at 5 percent; ***: statistically significant at 1 percent.
Source: Pesquisa Nacional por Amostra de Domicílios (PNAD), collected by the Brazilian Institute for Geography and Statistics (IBGE), 2003-2015.