Risk of Firm Closure and Wages in Brazil: Compensating Wage Differentials or Bargaining Concessions?

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August 22, 2008

Abstract

The economic theory proposes two hypotheses for the relationship between wages and risk of job loss due to firm (or plant) closure. The first hypothesis posits that workers at greater risk should be compensated by higher wages. This is known as the theory of compensating wage differentials. The second hypothesis states that workers at firms with a greater risk of closure would be willing to exchange higher wages for longer-term stability in the job. This is known as the theory of bargaining concessions. There is a paucity of empirical studies on this issue, and the results have been inconsistent. The aim of this paper is to provide evidence for the Brazilian manufacturing industry. To accomplish that, different risk measures, different databases, and different econometric methods are used. All the tests performed in this study confirm the theory of compensating wage differentials.

Keywords: Exit, Bankruptcy, Severance Payments, Insolvency, Wage Determination.
JEL Codes: C31, C33, J30, G10, G33, L25, L60.

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1 Introduction

The economic theory proposes two hypotheses concerning the relationship between wages and risk of layoff due to firm closure. The first hypothesis posits that workers at higher risk should be compensated by an increase in wages. The second hypothesis, however, states that workers holding a job at firms with higher risks of closure would accept exchanging higher wages for longer-term stability in the job.

The first hypothesis described above is known as the theory of compensating wage differentials. The idea that the risks taken by workers would be compensated by higher wages has been supported by the economic literature since the publication of The Wealth of Nations by Adam Smith [1].

The notion of bargaining concessions is more recent and was originally developed by Cappelli (1985) and Cappelli & Sterling (1988). In Cappelli (1985), the author closely follows wage negotiations in meat-packing and tire industries in the USA in 1981. The author notes that the negotiations conducted at one third of the firms implied wage concessions by workers. The author hypothesizes and presents the results that confirm the argument that wage concessions are originally made by workers at firms with greater risks of layoff or shutdown [2].

The sections in this paper will describe the available evidence of the relationship between wages and layoff risk due to firm closure. The methods for identification and estimation of this relationship will be introduced and discussed in light of the few available literature studies on the subject.

It is interesting to note that empirical studies do not take into account the reason why a firm (or plant) shuts down (due to closure or bankruptcy) and lays off its workers is not relevant, i.e., they only assume the risk of job loss for the worker.

This paper will also show that, due to the specificities of Brazilian labor laws, the hypothesis above becomes quite restrictive. The costs involving firm closure in Brazil (severance payments) are high because of contract termination clauses and benefits accumulated by workers throughout the employment period.

The risks and costs incurred by a worker laid off by firms in the process of shutting down may be significantly lower than those incurred by workers laid off by firms in the process of bankruptcy.

Given this difference in the "quality"of job destruction, some questions are raised: should one expect the same result for the relationship between wages and risk for "firms facing high likelihood of closure" and "firms facing high likelihood of bankruptcy"? Would the workers who hypothetically accept earning less in order to keep their jobs at a "firm at risk for closure" do the same at a "firm at risk for bankruptcy"? Would these workers be willing to bargain and to concede a share of their wages even under the hypothesis that the firm will take the severance pay and run by declaring bankruptcy?

The aim of this paper is to provide evidence for the Brazilian manufacturing industry. To do that, different risk measures, different databases, and different econometric methods are used so as to make the results more robust. All the tests performed in this study corroborate the theory of compensating wage differentials.

This paper is structured as follows. Section 2 introduces a survey into the empirical literature on this topic. Section 3 describes risk measures, taking into account the specificities of Brazilian labor laws in the study period. Section 4 presents the data, descriptive statistics, econometric specifications and the results. Section 5 concludes and shows the final remarks.

[1] See Rosen (1986), Ehrenberg (1985), and Viscusi (1978) for theoretical formalizations of Smith's insight.

[2] Blanchflower (1991) provides a model of bargaining concession

2 Survey of Empirical Evidence

There are few empirical studies on the relationship between wages and risk, and the obtained results are not consistent. The aim of this section is to provide a survey into the empirical literature on the topic.

Hamermesh (1988) used information of 114 workers who left their previous job between 1977 and 1981 because of plant closure, and 2,433 workers who were not displaced during this period. His data came from the Panel Study of Income Dynamics (PSID). His results show that shocks that increase the probability of displacement also reduce wage increase, which means that wages grow less rapidly in plants that will close soon.

Dunne & Roberts (1990) examine the empirical relationship between the probability for a plant to close down and the compensation paid to employees in the plant. They used a micro dataset on over 6,500 U.S. manufacturing plants for the 1974-1978 period (Annual Survey of Manufactures). They developed a two-equation empirical model of plant failure and wage determination. They found evidence of compensating differentials for the risk of displacement due to plant closure.

Blanchflower (1991) studied pay determination in Britain and the US in the 1970s and 1980s. The British Social Attitudes Surveys (BSA) and the U.S. General Social Surveys (GSS) are used in order to test the relationship between wages and unemployment likelihood (fear of redundancy). These surveys provide worker level information on perceptions of the chance of losing the job. The author found out that "‘fear of unemployment appears to depress pay substantially. Workers who expect to be made redundant earn 9% less in the UK, and 22% less in the U.S., *ceteris paribus*"’

Carneiro & Portugal (2006) provide a simultaneous equation model of firm closure and wage determination in order analyze how wages adjust to unfavorable shocks that rise the risk of displacement through firm closure, and to what extent a change in wage affects the likelihood of shutdown. The data used in their work were obtained from the Portuguese Survey, "‘Quadros de Pessoal"’, and include all workers that lost their jobs in Portugal during 1994, 1995 or 1996 due to firm closure. A control group, with no job losers, is used in order to compare workers' and firms' characteristics before the event. The results show that the fear of job loss generates bargaining concessions instead of compensating differentials.

Except for Blanchflower (1991), all other authors select closed-down and surviving firms (or firm-affiliated workers) at time t and compare the growth levels of wages (paid or received) by each group in previous periods. All of these papers imply the hypothesis that the reason why a firm (or plant), either one at risk of closure or one at risk of bankruptcy, closes down and lays off its employees is not relevant, i.e., only the risk of job loss is assumed.

If the amount of severance payment is negligible, there would not be a striking difference in the risk taken by a worker at a "firm at risk for closure" or at a "firm at risk for bankruptcy." On the other hand, in an economy where severance payments are sizable and strongly influence workers' incentives, the differences in the "quality" of job destruction should be taken into account. One of the aims of the present paper is to attempt to control such differences in the risk taken by workers.

3 Risk Measures, Labor Laws and Macroeconomic Instability

3.1 Labor Laws

The previous section showed that each of the empirical studies available in the literature implies the hypothesis that the reason why a firm (or plant) lays off its employees is not relevant, i.e., it is assumed that the worker only loses his/her job.

Depending on the labor law in effect and on the labor costs for firm closure, the risks and probable costs incurred by the worker when he/she is hired by a a firm at risk for closure are significantly lower than those incurred by a worker hired by a bankruptcy-prone firm.

In the Brazilian case, where layoff results in high costs (severance payments) for the employer[3], this means that not only the job and wage are at stake. A bankruptcy-prone firm may have to lay off its employees and might not have enough money to pay for employment contract termination and severance agreements.

Legally speaking, the rights or benefits of a worker at a debtless liquidated firm and from a bankrupt firm are just the same. The difference lies in how these benefits are paid. The worker of a debtless liquidated firm will get the severance payment at the time of layoff. On the other hand, the workers of a bankrupt firm must await the legal decisions on firm liquidation and the sharing of the bankrupt estate.

In these cases, there is no guarantee that the firm's bankrupt estate is sufficiently large to cover outstanding liabilities. Another aspect to be considered is that the bankrupt estate may include non-liquid assets (machinery and buildings), as well as technologically obsolete assets (e.g.: typewriters).

Given the specificities of the Brazilian labor laws, the present paper suggests that the desirable measure of risk of job loss should capture, at least partially, the "quality" (or should control the heterogeneity) of job destruction, i.e., make a distinction between the likelihood of layoff due to closure and that which arises from bankruptcy.

The financial literature provides a set of equity and financial indicators that add this desirable characteristic to the risk measure. Some of these indicators show the capacity of firms with regard to debt payment, leverage, and solvency. These indicators are used by financial and banking institutions to assess the granting of corporate credit and loans, and are also used by the firms when deciding on new investments or even on their exiting the market.

These financial and equity indicators have an additional role in the longitudinal (panel data) analysis of the relationship between wages and risk. A limitation of the available empirical studies concerns the fact that the identification of a firm at greater risk of layoff occurs, in most cases, at the time the firm exits the market.

This form of identification imposes a very strong restriction on the analysis between wages and risk, since a firm at lower risk is a surviving firm, whereas a firm at risk is a firm that exited the market. This type of risk measure can neither capture the heterogeneity of the financial quality of surviving firms, nor the variations in quality over time within the same firm. Financial recovery or a quick equity deterioration due to exogenous shocks may contribute to identifying the relationship between wages and risk in panel data.

A hypothesis raised herein is that workers assess the level of wage concession in bargaining or the level of wage compensation required by the risk according to the difficulty of the firm in fulfilling its future commitments.

A controversial issue in the financial literature concerns the most appropriate way to measure the probability of a firm going into bankruptcy. This controversy implies the discussion about which financial and equity indicators should be used, which weight each indicator should have on the forecast model and which statistical treatment is ideal.

[3]The high cost for the employer with regard to contract termination consists of a 50% penalty over the entire amount deposited in the severance pay indemnity fund (FGTS) of each employee. For characteristics and implications of the FGTS, refer to Gonzaga (2004) and Vodopivec (2006).

3.2 Risk Measurement by Financial Ratios

Financial ratios indicate the performance and financial situation of firms. These indicators have been used as regressors or components of bankruptcy likelihood models (Tamari (1966),Altman (1968),Gentry et al. (1987)). These indicators are also used to assess corporate ratings. Financial ratios are usually classified into five different categories: liquidity ratios, asset turnover ratios, financial leverage ratios, profitability ratios, and dividend policy ratios.

An argument that runs counter to the use of financial ratios to predict firm bankruptcy is that bankrupt firms show greater financial instability than surviving firms. Martikainen & Ankelo (1991) suggest that "'this instability apparently causes significant problems when predicting corporate failure using financial ratios"'.

It is not within the scope of this paper to infer on the quality and explanatory power of financial ratios in predicting corporate failure. The most important is that financial ratios indicate to the general public that some firms are financially unhealthier than others in a given time period - which does not necessarily mean that financially unhealthier firms will go into bankruptcy in subsequent periods.

The next sections show that this paper uses a panel of manufacturing firms obtained from the Annual Industrial Survey (PIA - Pesquisa Industrial Anual) microdata. This survey provides individual and in-depth information about the revenue and expenditure frameworks of each firm; however, equity information, such as asset and liability frameworks, is not provided.

As previously mentioned, there is a wide range of financial ratios and a limitation of this study is that most of these financial ratios are built from balance sheet information. Few financial ratios are built solely from revenue and expenditure information.

Some financial ratios, such as gross profit margin, are built only from sales and costs information[4], but the use of this measure can be a hindrance to the purpose of this study. If there is a large correlation between costs and sales revenues, there will also be a large correlation between gross profit margin and markup (proxy for the bargaining power of the firm in the product market). The problem is that a relationship between wages and gross profit margin would, under these circumstances, be testing the hypothesis of rent sharing.

The alternative used herein is the use of the interest coverage ratio (ICR), which is calculated as follows:

$$ICR = \frac{EBIT}{InterestPayments} \tag{1}$$

Where EBIT are the earnings before interest and taxes.

The ICR is a way to measure firm solvency, i.e., it indicates the capacity a firm has to pay the debt interests owed to third parties using its own financial resources. An ICR equal to 2 means that a firm can pay as much as twice the value of overdue interests. An acceptable ICR value depends on several factors, including the industrial sector in which the firm operates, competition within this sector, the type of firm (either publicly or privately owned). However, a rule of thumb suggests that an ICR of 1.5 represents the minimum value for the safety margin required for any firm in any sector.

3.3 Risk and Macroeconomic Instability

The ICR can also be regarded as a measure of firm leverage. These ICR properties are very desirable for the analysis of the financial health of Brazilian firms throughout the study period (1996-2002).

[4]Gross Profit Margin=(Revenue-Cost of Goods Sold)/Revenue

Within this time frame, the Brazilian economy experienced several bouts of uncertainty produced by foreign and domestic factors, such as the Asian crisis (1997), the Russian crisis (1998), the Brazilian exchange rate crisis (1999), the Brazilian electric power crisis (2001), the Argentine exchange rate crisis (2002) and the crisis stirred up by the uncertainty over the outcome of Brazil's presidential elections (2002).

In some of these episodes, the Brazilian central bank swiftly manipulated the basic Selic rate so as to contain inflation expectations and avoid capital flight. Figure 1 shows the behavior of the Selic rate between January 1996 and December 2002.

Figure 1 clearly shows two different behaviors of the Selic rate before and after the depreciation of the Real and adoption of the floating exchange rate system (January 1999). Since the implementation of the Real Plan (plan for stabilization of inflation) in 1994, Brazil had a controlled exchange rate system that was abandoned in January 1999. On the graph, this period is characterized by higher interest rates and a more volatile behavior. After the depreciation of the Real and the adoption of the floating exchange rate system, both interest rates and volatility decreased. Even though interests were reduced in 1999, Brazil had one of the world's highest real interest rates throughout the period (See Table 1).

The financial crises, the change in the exchange rate system, and the monetary policy adopted by the Brazilian central bank strongly influenced firm businesses. This influence on industrial sales can be clearly seen in Figure 2. Again, it is possible to note two different behaviors. Before the change in the exchange rate system, industrial sales showed a moderate uptrend. After January 1999, this uptrend continued in more strong way, but industrial sales fell after 2001 due to the Brazilian electric power crisis. Industrial sales only increased again after the uncertainty over the 2002 presidential elections was over.

Finally, one should consider the role of macroeconomic stability and of the variation in monetary cost (interest rates) in firms' investment decisions, and in their entry into and exit from the market.

Table 2 shows the data on the level of restriction of some variables upon investment decisions of Brazilian firms. These data were obtained from World Bank Investment Climate Brazil 2003. This survey provides individual information about 1,640 Brazilian manufacturing firms assessed in 2003[5].

The results of interest are reported in the Mean column. The values for the levels of restriction are 0 (=no restriction), 1 (=low restriction), 2 (=moderate restriction), 3 (=severe restriction) and 4 (=extremely severe restriction). Of 21 variables analyzed, four had means that were higher than restriction level 3: tax rates (3.25), cost of financing (3.19), economic and regulatory policy uncertainty (3.12), and macroeconomic instability (3.07).

The information above suggests that the study period and the risk measure used in this paper can properly capture firm heterogeneity in terms of financial fragility and exposure to macroeconomic shocks. The several exogenous shocks experienced by firms in the analyzed period may have produced large variation in ICR indicators, thus contributing towards an easier identification of the relationship between wage and risk of displacement.

4 Methods and Results

4.1 Data

The present paper uses information from two databases: (1) RAIS (Annual Social Information Report); and (2) PIA (Annual Industrial Survey). The study assesses the 1996-2001 period, and all nominal

[5] Further details about this survey are provided in the data presentation of this paper.

variables used herein are calculated using the prices for 2001, deflated by the Brazilian consumer price index (INPC).

The sample used herein includes information about an unbalanced panel of 39,710 Brazilian manufacturing firms. The sample comprises only firms with over 30 employees. The number of firms appearing only one year in the panel is 9652; 5,804 firms appear two years; 4,935 firms appear three years; 3,891 firms appear four years; 3,513 firms appear five year; and 11,915 firms appear six years, thus totaling 39,710 different firms, and 140,684 observations.

The PIA information includes firm size (employment), sales revenues, exports, operating expenses, financial expenses (interests), profits and taxes.

The RAIS information includes the mean wage per firm, level of education, age and job tenure. The single identification of each Brazilian firm through the Federal Employer Identification Number (Cadastro Nacional da Pessoa Jurídica - CNPJ) allows linking the RAIS and PIA information.

A third database (World Bank Investment Climate, Brazil 2003) is used to provide PIA-RAIS estimates with robust results. This survey provides individual information about 1,640 Brazilian manufacturing firms surveyed in 2003, but financial and equity information is available for the year 2002 (some variables are available for 2000 and 2001).

An advantage of the World Bank Investment Climate database is that it provides financial and equity information about the firm and also information about workforce (wages and level of education of workers). A limitation of this survey is that it is available for a single year (2003) only.

4.2 Descriptive statistics

The descriptive statistics of the variables obtained from the link between the RAIS and PIA databases are shown in Table 3. The means and standard deviations are provided for each variable and separately for each sampled year. Variables with money values are expressed using prices for 2001, deflated by the INPC.

Note that in Table 3 the mean weekly wage showed a real increase in 1997 (194.05) compared to that of the previous year (191.32). However, in subsequent years, there was a considerable reduction in real wages, which averaged 181.08 in 2001.

Throughout the analyzed period, the mean level of education of workers remarkably increased, being equivalent to a rise in approximately 1 year in schooling between 1996 (6.35 years) and 2001 (7.37). Unlike wages and level of education, there was no statistically significant difference in mean age and job tenure.

With regard to firm characteristics, one should mention the reduction in the mean size of firms throughout the period (from 178.06 workers in 1996 to 154.64 workers in 2001) and the increase in mean export rates and in sales from 1999 onwards (year in which the exchange rate regime was shifted).

The ICR is reported in three distinct ways: (1) ICR/1000, where the ICR value is divided by 1,000; (2) ln(ICR), where the logarithm of ICR is obtained and observations of $ICR \leq 0$ are discarded; and (3) the Solvency dummy variable, where Solvency=1 if $ICR > 1.5$ and Solvency=0 if $ICR \leq 1.5$ (as previously stated, a rule of thumb suggests that an ICR of 1.5 is the minimum value for the safety margin required for any firm in any sector).

The ICR/1000 values ranged from 11 in 1997 to 48 in 2001. This means that in 1997 Brazilian manufacturing firms could pay on average 11,000 times the interests of their debts using their own resources.

By analyzing the standard deviations of the ICR/1000 variable and the values of the Solvency variable (mean of 0.48 for the period) it seems clear that the group of Brazilian manufacturing firms shows large heterogeneity in terms of finances and equity. By analyzing the standard deviations of the ln(ICR) variable it is possible to infer that heterogeneity is large even amongst financially healthier firms (firms with $ICR > 0$).

The descriptive statistics of the variables obtained from the World Bank Investment Climate, Brazil 2003 are described in Table 11. The mean wage and mean level of education in 2002 were larger than those obtained from the RAIS-PIA database for 2001. Nevertheless, it is not possible to clearly identify whether this is due to a real increase in wages and in the mean level of education of workers or whether it is related to differences in the firm characteristics of each sample.

Firm size and sales growth yielded quite different values across the samples. Mean employment according to the World Bank amounted to 77.18 workers in 2002 vis-à-vis 150 workers in the RAIS-PIA database[6]. Sales growth according to the World Bank survey amounted to 0.20 in 2002 comparatively to 0.07 in the RAIS-PIA database for 2001. Again, it is not possible to determine how much of such difference is due to accelerated sales growth in 2002 and how much is due to sampling differences.

Unlike the other variables, ICR/1000, ln(ICR) and Solvency are available for years 2000 to 2002, allowing for their comparison with the RAIS-PIA database for the same period. Note that the ICR/1000 variable yielded mean values of 831 in 2000 and 836 in 2001 in the World Bank survey. According to the RAIS-PIA database, these values were 45 and 48, respectively. The Solvency variable had a mean value of 0.78 in the World Bank survey and of 0.48 in the RAIS-PIA database. The analysis of means and standard deviations of these variables suggest that the World Bank database comprises more homogenous and financially healthier firms than those included in the RAIS-PIA database.

4.3 Cross-sectional analysis

This section describes the econometric models and the wage regression results for Brazilian firms. This section provides the results obtained from the cross-sectional analysis and two econometric methods are used: OLS estimates and instrumental variables estimates.

It is important to note that, different from matched RAIS-PIA panel (1996-2001), the World Bank Investment Climate is a cross-sectional data set (2002), so a secondary goal of this subsection is to check the robustness of cross-sectional empirical tests by using these different sources of data.

4.3.1 OLS estimates

This subsection presents the results obtained from OLS estimates for each sampled year. The econometric model is specified in the equation that follows:

$$lnw_j = \gamma_1 ln(ICR)_j + \beta_1' \mathbf{x}_j + \epsilon_j \tag{2}$$

Where lnw_j is the logarithm of the weekly wage paid by firm j, $ln(ICR)$ is the logarithm of the interest coverage ratio for firm j, $\mathbf{x}$ is a vector of variables related to the characteristics of firm j and ϵ_j is the random error.

This paper has shown so far that the economic theory posits two hypotheses for the relationship between wages and the likelihood of firm death: the theory of compensating wage differentials and the theory of bargaining concessions.

The ultimate goal of this model is to obtain estimates for coefficient γ_1 and then verify the sign and statistical significance of this coefficient. In the model described above the $ln(ICR)_j$ variable is supposed to capture the heterogeneity in financial health of firms, which can explain the different

[6] Recall that the RAIS-PIA database includes only firms with over 30 employees. This explains the difference in mean firm size.

probabilities of death for each firm. In this regard, a positive (negative) value for coefficient γ_1 is interpreted as bargaining concessions (compensating wage differentials).

The specification of the ICR variable in logarithmic form restricts the sample to a group of firms with $EBIT > 0$. This restriction rules out the set of firms in default situation, i.e., firms that cannot at least pay overdue interests and taxes with their own resources.

The intention of using $ln(ICR)_j$ is to make γ_1 capture the relationship between wages and the likelihood of firm exit. For this group of firms, it is assumed that the worker's risk is restricted only to job loss.

The estimates for the model specified above were obtained for years 1996 to 2001 (using RAIS-PIA data) and for 2002 (using the World Bank Survey data). The results for years 1996 to 2001 are reported in Table 4.

All coefficients γ_1 had negative and statistically significant signs. The values of γ_1 ranged from -0.014 in 1996 to -0.017 in 1998. All the other coefficients related to vector β_1' showed theoretically consistent and statistically significant signs. The value estimated for the year 2002 is shown in the first column of Table 12. Coefficient γ_1 had a negative sign that was quite similar to the values obtained for the previous years (-0.013).

A second specification of the ICR variable used herein is the binary Solvency variable. As mentioned in the previous section, this variable is equal to 1 if $ICR > 1.5$ and equal to 0 if $ICR \leq 1.5$. Note that 1.5 is regarded as the minimum value required as safety margin for any firm in any sector. Unlike $ln(ICR)_j$, the Solvency variable does not exclude any firm from the sample and its aim is to make a distinction between solvent and insolvent firms.

The specification with the Solvency variable is as follows:

$$lnw_j = \gamma_1^* S_j + \beta_1' \mathbf{x}_j + \epsilon_j \tag{3}$$

Where lnw_j is the logarithm of the mean weekly wage paid by firm j, S_j is the Solvency dummy variable for firm j, $\mathbf{x}$ is a vector of variables related to the characteristics of firm j and ϵ_j is the random error.

The intention of using S_j is to make this dummy capture the relationship between wages and the likelihood of firm bankruptcy. For this group of firms, it is assumed that the worker's risk is not limited only to job loss, but that it includes the possibility for the non-payment of severance benefits.

The estimates for the model specified in equation 3 were obtained for years 1996 to 2001 (using RAIS-PIA data) and for 2002 (using the World Bank Survey data), as in the previous specification. The results for 1996 to 2001 are shown in Table 5.

All coefficients γ_1^* had negative and statistically significant signs. The values of γ_1^* ranged from -0.04 in 1996 and 2000 to -0.06 in 1998 and 1999. All the other coefficients related to vector β_1' showed theoretically consistent and statistically significant signs. The value estimated for the year 2002 is shown in the second column of Table 12. Coefficient γ_1^* had a negative and statistically significant sign that was quite lower than the values obtained for the previous years (-0.18).

The theory of compensating wage differentials is corroborated for the Brazilian industry by all tests used in this section. This result is strongly robust, since it has been confirmed for the available years, for different specifications of the risk variable and for different databases. A limitation of the tests used concerns the hypothesis of exogeneity of the risk variable, which might be generating some bias in the sign of coefficients γ_1 and γ_1^*. The next section will deal with this issue.

4.3.2 2SLS and 2SPLS estimates

The previous section showed that the theory of compensating wage differentials was corroborated for the Brazilian industry. Also, it was verified that the hypothesis of exogeneity of the risk variable might be causing bias in the sign of coefficients γ_1 and γ_1^*, thus compromising the results obtained[7].

This section takes into account the endogeneity and simultaneity of the wage and risk variables when analyzing the relationship between them. The first empirical test involves the relationship between lnw_j and $ln(ICR)_j$, by using instrumental variables.

As both endogenous variables lnw_j and $ln(ICR)_j$ are continuous, two-stage least square (2SLS) estimators will be used for each sampled year. The vector of instrumental variables includes the lags of the $ln(ICR)_j$ variable, i.e., $ln(ICR)_{jt-1}$ and $ln(ICR)_{jt-2}$.

Table 6 shows the coefficients of the relationship between wages and risk for years 1998 to 2001. There are no 2SLS estimates for 1996 and 1997, since these periods do not have enough lags for instrumentalization and tests of overidentification for instrumental variables.

Table 7 shows the values for the coefficients of instruments in auxiliary regressions, the Shea partial R^2 values (Shea (1997)) and the Sargan statistics (Arellano & Bond (1991)). The coefficients of instruments have positive and statistically significant values, without any exception. The orthogonality of instruments with the errors is confirmed for all regressions according to the values obtained for the Sargan statistics. The explanatory power of the instruments over the endogenous variables is satisfactory, as pointed out by Shea partial R^2 values.

Once confirmed that the instruments used have satisfactory exogeneity and explanatory power of endogenous variable $ln(ICR)_j$, the interpretations of results in Table 6 demand less caution. All coefficients γ_1 in Table 6 have negative and statistically significant signs. The values of γ_1 ranged from -0.022 in 1999 and -0.025 in 1998. The 2SLS estimate for 2002 is shown in the third column of Table 12. Coefficient γ_1 had a negative and statistically significant sign (-0.017).

The second empirical test involves de model which the solvency variable, S_j, is used as proxy for risk. As the model consists of a continuous endogenous variable lnw_j and a binary endogenous variable, S_j, it is necessary to use 2SPLS (Two Stages Probit Least Square) estimators[8] for each sampled year. The vector of instrumental variables $\mathbf{w}_j$ includes the lag of the S_j variable, i.e., S_{jt-1}.

Table 8 shows the coefficients of the relationship between wages and risk for years 1997 to 2001, whereas Table 9 presents the results for the system's first stage. All coefficients γ_1^* have negative and statistically significant signs[9]. The values of γ_1^* ranged from -0.013 in 1998 to -0.018 in 2000. The value estimated for 2002 is shown in the last column of Table 12. Coefficient γ_1^* has a negative and statistically significant sign (-0.046).

Even after controlling for the endogeneity bias between wages and risk, the theory of compensating wage differentials is still corroborated for the Brazilian industry in all tests carried out in this section.

4.4 Longitudinal analysis

The previous sections showed that all estimates in the cross-sectional analysis corroborate the theory of compensating wage differentials for Brazilian firms. This section is going to deal with the longitudinal analysis of the sample, i.e., it will provide the results obtained from panel data estimates. Two approaches will be considered in this section: pooled regressions and fixed-effect regressions.

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[7] Durbin-Wu-Hausman (DWH) tests were used for OLS and IV models. The IV model turned out to be the most appropriate.

[8] See Amemiya (1978), Maddala (1983) and Keshk (2003)

[9] Standard errors are corrected according to Keshk (2003).

4.4.1 Pooled regressions

In this section, the annual observations of firms (1996-2001) are pooled as cross-sectional time series data[10]. The procedure implies the use of these data to reproduce the econometric methods previously applied in the cross-sectional analysis, i.e., OLS regressions[11]. The major aims of this section are to provide results that serve as baseline for the results to be developed with fixed-effect estimates and to provide the study with a robust analysis.

The first specification to be presented concerns the pooled OLS regression, as shown in the following equation:

$$lnw_{jt} = \gamma_1 ln(ICR)_{jt} + \beta_1'\mathbf{x}_{jt} + \lambda'\mathbf{t} + \epsilon_{jt} \tag{4}$$

Where $\mathbf{t}$ is a vector of dummies (or fixed effects) for each sampled year.

The result for coefficient γ_1 obtained from the pooled OLS regression is shown in the first column of Table 10. As with all previously reported results, the value of γ_1 is negative and statistically significant (-0.015).

The same procedure was used for the Solvency variable, as specified below:

$$lnw_{jt} = \gamma_1^* S_{jt} + \beta_1'\mathbf{x}_{jt} + \lambda'\mathbf{t} + \epsilon_{jt} \tag{5}$$

Where $\mathbf{t}$ is a vector of dummies (or fixed effects) for each sampled year.

The result for coefficient γ_1^* obtained from the pooled OLS regression is shown in the third column of Table 10. The value of γ_1^* is negative and statistically significant (-0.052).

4.4.2 Fixed-effect regressions

A source of bias in econometric estimates that had not been addressed yet in this paper concerns omitted variables. This section deals with this problem by using fixed-effect estimates[12]. The aim is to control for the unobserved and time-invariant heterogeneity of firms.

The econometric specification of the fixed-effect model using risk variable $ln(ICR)_{jt}$ is as follows:

$$lnw_{jt} = \gamma_1 ln(ICR)_{jt} + \beta_1'\mathbf{x}_{jt} + \lambda'\mathbf{t} + \alpha'\mathbf{j} + \epsilon_{jt} \tag{6}$$

Where $\mathbf{j}$ is a vector of fixed effects for the firms.

The result for coefficient γ_1 obtained from the fixed-effect regression is shown in the second column of Table 10. The value of γ_1 is negative and statistically significant (-0.005).

Again, the same procedure was used for the Solvency variable, as specified below:

$$lnw_{jt} = \gamma_1^* S_{jt} + \beta_1'\mathbf{x}_{jt} + \lambda'\mathbf{t} + \alpha'\mathbf{j} + \epsilon_{jt} \tag{7}$$

Where $\mathbf{j}$ is a vector of fixed effects for the firms.

The result for coefficient γ_1^* obtained from the fixed-effect regression is shown in the last column of Table 10. The value of γ_1^* is negative and statistically significant (-0.037).

Even after controlling for the bias of omitted variables in the relationship between wages and risk, the theory of compensating wage differentials is corroborated in all tests carried out in this section.

[10] The longitudinal analysis includes only information from the RAIS-PIA database.

[11] The standard errors of the coefficients obtained from pooled regressions are corrected for clusters, i.e., repeated observations of the same firm.

[12] (Hausman (1978))'s specification test (Hausman (1978)) was used for random effect models and fixed-effect models. The fixed-effect model turned out to be the most appropriate.

5 Final Remarks

The economic theory provides two hypotheses concerning the relationship between wages and risk of layoff due to firm closure: compensating wage differentials and bargaining concessions. Nevertheless, the empirical literature has not yielded consistent result.

This paper tests one hypothesis against the other in the Brazilian context, distinguishing between risk of job loss and risk of bankruptcy. Workers laid off due to firm closure lose their jobs, whereas workers laid off due to firm bankruptcy may have other types of losses relative to severance payments, in addition to job loss.

Two different risk measures are used to overcome this restriction. The first one, $ln(ICR)_j$, captures the relationship between wages and the likelihood of firm's exit. The second one, S_j, captures the relationship between wages and the likelihood of firm bankruptcy.

In addition to using two different measures of risk in view of the different impact of bankruptcy and closure on workers' income, this paper uses alternative databases and econometric methodologies to test the hypothesis of compensating wage differentials versus that of wage bargaining concessions.

The findings do not support the hypothesis of bargaining concessions while they are in favor of the hypothesis of compensating wage differentials. This holds both for risk of job loss and of bankruptcy.

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Table 1: Real Interest Rate, World Ranking

Countries	Real Interest Rate, Yearly %
Indonesia	30.8%
Turkey	26.6%
Brazil	**23.7%**
South Africa	14.7%
Israel	14.5%
Argentina	13.6%
Hong Kong	12.0%
Mexico	8.8%
Chile	7.1%
China	6.7%
Thailand	5.8%
England	5.8%
USA	3.6%
Poland	3.6%
South Korea	3.2%
Singapore	2.6%
Australia	2.3%
India	2.1%
Germany	1.8%
Japan	1.7%
Italy	1.7%
Russia	1.6%
France	1.2%
Sweden	0.6%
Spain	-1.8%
Taiwan	-1.9%
Malaysia	-4.1%

Notes: (1) Source: Brazilian Stock Market; (2) Interest Rate in 17/May/1999.

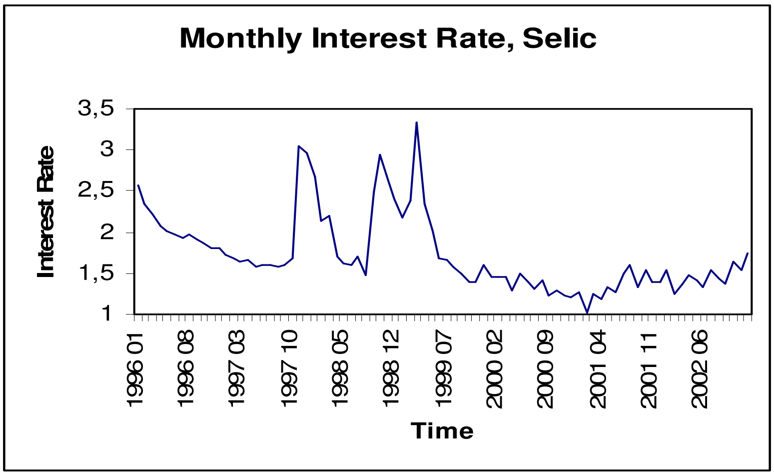

Figure 1: Brazilian Monthly Interest Rate, SELIC

Source: www.ipeadata.gov.br

Table 2: Descriptive Statistics, Investment Climate Constraints

Variables	Obs	Weight	Mean	St.Dv.
Telecommunications	1640	17350	0.57	0.96
Electricity	1641	17354	1.18	1.31
Transportation	1641	17354	1.22	1.24
Access to Land	1626	17166	1.15	1.37
Tax rates	**1641**	**17354**	**3.25**	**0.98**
Tax administration	1636	17256	2.76	1.23
Trade Regulations	1245	12501	1.66	1.52
Customs Regulations	1221	12294	1.74	1.54
Labor regulations	1637	17247	2.53	1.26
Skills and education of available workers	1641	17354	2.11	1.18
Business Licensing and Operating permits	1636	17306	1.73	1.41
Patents and Registered Trademarks (INPI)	1579	16539	1.08	1.32
Standards and Quality (INMETRO)	1580	16592	1.24	1.32
Access to Financing (e.g.. collateral)	1616	17174	2.46	1.43
Cost of Financing (e.g. interest rates)	**1623**	**17221**	**3.19**	**1.17**
Economic and regulatory policy uncertainty	**1639**	**17341**	**3.12**	**1.05**
Macroeconomic instability (inflation. exch rate)	**1637**	**17291**	**3.07**	**1.02**
Corruption	1634	17258	2.88	1.38
Crime. theft and disorder	1635	17317	2.49	1.45
Anti-competitive or informal practices	1634	17314	2.56	1.29
Legal system/conflict resolution	1626	17206	1.89	1.37

Notes: (1) Source: World Bank Investment Climate 2003; (2) Investment degree of constraint var=0=no constraint, var=1=low constraint, var=2=moderate constraint, var=3=severe constraint, var=4=very severe constraint.

Table 3: Descriptive Statistics, RAIS-PIA

	Mean (Standard Deviation)					
	1996	1997	1998	1999	2000	2001
Variables						
Weekly Wage	191.32	194.05	184.77	184.15	182.51	181.08
	(327.38)	(315.25)	(249.15)	(598.62)	(803.07)	(568.87)
Schooling (years)	6.35	6.66	6.79	7.00	7.17	7.37
	(1.91)	(1.89)	(1.88)	(1.89)	(1.89)	(1.90)
Age (years)	32.79	32.74	32.95	33.02	32.89	32.91
	(4.00)	(4.01)	(4.00)	(4.01)	(3.95)	(3.97)
Tenure (months)	45.14	45.40	46.98	47.80	46.18	45.07
	(24.32)	(24.72)	(25.31)	(26.31)	(26.85)	(26.93)
Firm Size (Employment)	178.06	178.54	157.52	156.87	163.53	154.64
	(650.76)	(648.59)	(579.47)	(574.51)	(586.07)	(569.36)
Exports/Sales ratio	0.04	0.04	0.04	0.05	0.05	0.05
	(0.15)	(0.15)	(0.15)	(0.16)	(0.16)	(0.17)
$\Delta Sales$	-	0.04	-0.04	0.05	0.11	0.07
		(0.43)	(0.44)	(0.47)	(0.45)	(0.45)
ICR/1000	33	11	38	28	45	48
	(2665)	(554)	(3507)	(2247)	(2905)	(3784)
Ln(ICR)	2.67	2.40	2.60	2.95	3.57	3.25
	(3.75)	(3.64)	(3.84)	(4.02)	(4.03)	(4.18)
Solvency	0.49	0.47	0.45	0.48	0.52	0.51
	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)
Observations	22674	21642	22904	23678	23967	25819

Notes: (1) Monetary values in R$; (2) At 2001 prices, deflated using INPC.

Table 4: Regressions: Cross Sectional Analysis OLS, RAIS-PIA

	Coefficient (Robust Standard Errors)					
	1996	1997	1998	1999	2000	2001
Regressors						
Schooling (years)	0.07	0.08	0.09	0.10	0.10	0.10
	(0.002)***	(0.003)***	(0.003)***	(0.003)***	(0.003)***	(0.002)***
Age (years)	0.14	0.06	0.13	0.15	0.15	0.12
	(0.01)***	(0.02)**	(0.02)***	(0.01)***	(0.01)***	(0.01)***
Tenure (months)	0.007	0.008	0.006	0.007	0.006	0.005
	(0.0005)***	(0.0006)***	(0.0005)***	(0.0005)***	(0.0005)***	(0.0005)***
Ln Employment	0.07	0.05	0.06	0.04	0.02	0.02
	(0.005)***	(0.006)***	(0.006)***	(0.006)***	(0.007)***	(0.006)***
Exports/Sales ratio	0.87	0.54	0.71	0.75	0.88	0.92
	(0.09)***	(0.10)***	(0.08)***	(0.08)***	(0.07)***	(0.07)***
Ln(ICR)	-0.014	-0.016	-0.017	-0.016	-0.014	-0.016
	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.001)***
Observations	15495	14709	15197	15885	16594	17810
F	165.84***	158.91***	175.78***	176.81***	172.44***	166.11***
R^2	0.57	0.56	0.59	0.59	0.58	0.57

Notes: (1) Dependent variable = lnw_j; (2) Significant at 99% (***), 95 % (**), and 90% (*); (3) All regressions include additional controls: Constant, Age^2, Tenure^2, Exports/Sales ratio^2, Dummies for location (27 States), Dummies for Sector (3-digit).

Table 5: Regressions: Cross Sectional Analysis OLS, RAIS-PIA

	Coefficient (Robust Standard Errors)					
	1996	1997	1998	1999	2000	2001
Regressors						
Schooling (years)	0.07	0.09	0.09	0.10	0.11	0.11
	(0.002)***	(0.002)***	(0.002)***	(0.002)***	(0.002)***	(0.002)***
Age (years)	0.15	0.05	0.14	0.16	0.16	0.14
	(0.01)***	(0.01)***	(0.01)***	(0.01)***	(0.01)***	(0.01)***
Tenure (months)	0.007	0.009	0.007	0.007	0.006	0.007
	(0.0005)***	(0.0005)***	(0.0004)***	(0.0004)***	(0.0004)***	(0.0004)***
Ln Employment	0.05	0.04	0.05	0.02	0.01	0.01
	(0.005)***	(0.006)***	(0.005)***	(0.006)***	(0.006)***	(0.006)***
Exports/Sales ratio	1.00	0.76	0.88	0.88	1.02	1.08
	(0.08)***	(0.10)***	(0.07)***	(0.07)***	(0.07)***	(0.07)***
Solvency	-0.04	-0.05	-0.06	-0.06	-0.04	-0.05
	(0.006)***	(0.006)***	(0.006)***	(0.006)***	(0.006)***	(0.006)***
Observations	22505	21501	22703	23543	23820	25622
F	188.76***	190.04***	227.03***	227.66***	226.91***	228.03***
R^2	0.53	0.52	0.55	0.55	0.54	0.55

Notes: (1) Dependent variable = lnw_j; (2) Significant at 99% (***), 95 % (**), and 90% (*); (3) All regressions include additional controls: Constant, Age^2, $Tenure^2$, Exports/Sales $ratio^2$, Dummies for location (27 States), Dummies for Sector (3-digit).

Table 6: Regressions: Cross Sectional Analysis 2SLS, RAIS-PIA

	Coefficient (Robust Standard Errors)			
	1998	1999	2000	2001
Regressors				
Schooling (years)	0.10	0.10	0.11	0.11
	(0.003)***	(0.003)***	(0.003)***	(0.003)***
Age (years)	0.15	0.17	0.17	0.12
	(0.01)***	(0.01)***	(0.01)***	(0.01)***
Tenure (months)	0.005	0.006	0.005	0.005
	(0.0007)***	(0.0007)***	(0.0006)***	(0.0005)***
Ln Employment	0.07	0.04	0.04	0.03
	(0.005)***	(0.005)***	(0.005)***	(0.005)***
Exports/Sales ratio	0.59	0.77	0.72	0.83
	(0.09)***	(0.09)***	(0.08)***	(0.08)***
Ln(ICR)	-0.025	-0.022	-0.023	-0.023
	(0.002)***	(0.002)***	(0.002)***	(0.002)***
Observations	8079	8179	8279	8988

Notes: (1) Dependent variable = lnw_j; (2) Significant at 99% (***), 95 % (**), and 90% (*); (3) All regressions include additional controls: Constant, Age^2, $Tenure^2$, Exports/Sales $ratio^2$, Dummies for location (27 States), Dummies for Sector (3-digit).

Table 7: Regressions: Auxiliary Regression 2SLS, RAIS-PIA

	Coefficient (Robust Standard Errors)			
	1998	1999	2000	2001
Regressors				
Ln(ICR)_{t-1}	0.42	0.41	0.37	0.44
	(0.01)***	(0.01)***	(0.01)***	(0.01)***
Ln(ICR)_{t-2}	0.22	0.25	0.26	0.24
	(0.01)***	(0.01)***	(0.01)***	(0.01)***
Shea Partial R^2	0.32	0.32	0.32	0.34
F	1909	1946	1950	2346
Sargan	0.21	0.96	0.08	1.29
χ^2	(0.64)	(0.32)	(0.76)	(0.25)
Observations	8079	8179	8279	8988

Notes: (1) Dependent variable = $Ln(ICR)_t$; (2) Significant at 99% (***), 95 % (**), and 90%.

Table 8: Regressions: Two Stages Probit Least Square Step 2, RAIS-PIA

	Coefficient (Corrected Standard Errors)				
	1997	1998	1999	2000	2001
Estimated Solvency_t	-0.017	-0.013	-0.014	-0.018	-0.015
	(0.006)***	(0.005)***	(0.005)***	(0.005)***	(0.005)***
Schooling (years)	0.09	0.10	0.11	0.11	0.12
	(0.002)***	(0.002)***	(0.002)***	(0.002)***	(0.002)***
Age (years)	0.04	0.14	0.17	0.16	0.15
	(0.007)***	(0.008)***	(0.009)***	(0.010)***	(0.010)***
Tenure (months)	0.008	0.006	0.006	0.005	0.007
	(0.0005)***	(0.0004)***	(0.0004)***	(0.0004)***	(0.0004)***
Ln Employment	0.04	0.05	0.03	0.02	0.02
	(0.004)***	(0.003)***	(0.003)***	(0.003)***	(0.003)***
Exports/Sales ratio	0.71	0.88	0.83	0.99	1.10
	(0.07)***	(0.07)***	(0.07)***	(0.07)***	(0.07)***
Observations	18221	19126	19468	19570	20726

Notes: (1) Dependent variable = lnw_j; (2) Significant at 99% (***), 95 % (**), and 90% (*).

Table 9: Regressions: Two Stages Probit Least Square Step 1, RAIS-PIA

	Coefficient (Corrected Standard Errors)				
	1997	1998	1999	2000	2001
$Solvency_t$ (Endogenous)					
Estimated ln hourly Wage	-0.11	-0.21	-0.11	-0.08	-0.17
	(0.05)**	(0.04)***	(0.04)***	(0.04)**	(0.05)***
$Solvency_{t-1}$	1.26	1.27	1.23	1.27	1.29
	(0.02)***	(0.02)***	(0.02)***	(0.02)***	(0.02)***
$\Delta Sales$	0.64	0.70	0.66	0.65	0.60
	(0.03)***	(0.02)***	(0.02)***	(0.02)***	(0.02)***
Ln Employment	-0.01	-0.04	-0.06	-0.05	-0.05
	(0.01)	(0.01)***	(0.01)***	(0.01)***	(0.01)***
Exports/Sales ratio	-0.008	-0.121	0.52	0.48	0.58
	(0.22)	(0.23)	(0.21)**	(0.21)**	(0.21)**
Observations	18221	19126	19468	19570	20726

Notes: (1) Dependent variable = $Solvency_t$; (2) Significant at 99% (***), 95 % (**), and 90% (*).

Table 10: Regressions: Longitudinal Analysis Pooled and Fixed Effects, RAIS-PIA

	Coefficient (Standard Errors)			
	Pooled	Firms FE	Pooled	Firms FE
Regressors				
Schooling (years)	0.09	0.001	0.09	0.0026
	(0.001)***	(0.001)	(0.001)***	(0.001)**
Age (years)	0.12	0.03	0.12	0.04
	(0.01)***	(0.004)***	(0.009)***	(0.003)***
Tenure (months)	0.006	0.003	0.007	0.002
	(0.0003)***	(0.0003)***	(0.0003)***	(0.0002)***
Ln Employment	0.04	-0.35	0.03	-0.37
	(0.003)***	(0.003)***	(0.003)***	(0.002)***
Exports/Sales ratio	0.78	0.09	0.94	0.14
	(0.05)***	(0.03)***	(0.04)***	(0.03)***
Ln(ICR)	-0.015	-0.005		
	(0.0005)***	(0.0003)***		
Solvency			-0.052	-0.037
			(0.003)***	(0.002)***
Observations	95690	95690	139694	139694
F	203.38***	207.31***	322.71***	343.63***
R^2	0.57	0.91	0.54	0.89

Notes: (1) Dependent variable = lnw_{jt}; (2) Significant at 99% (***), 95 % (**), and 90%; (3) All regressions include additional controls: Constant, Age^2, $Tenure^2$, Exports/Sales $ratio^2$, Dummies for location (27 States), Dummies for Sector (3-digit), and Dummies for years.

Table 11: Descriptive Statistics, World Bank Investment Climate

	Obs	Weight	Mean	St.dv
Variables				
Weekly $\text{Wage}_{(2002)}$	1556	16475	188.30	802.36
Schooling $\text{(years)}_{(2002)}$	1636	17328	8.07	1.91
Firm Age $\text{(years)}_{(2002)}$	1642	17361	16.42	16.07
Firm Size $\text{(Employment)}_{(2002)}$	1636	17265	77.18	227.29
Export $\text{Firm}_{(2002)}$	1642	17361	0.20	0.40
$\Delta Sales_{(2002)}$	1508	15683	0.20	0.51
Trade $\text{Union}_{(2002)}$	1634	17296	0.57	0.43
$\text{ICR}/1000_{(2002)}$	1495	15335	875	2600
$\text{ICR}/1000_{(2001)}$	1460	14900	836	2160
$\text{ICR}/1000_{(2000)}$	1421	14439	831	2310
$\text{Ln(ICR)}_{(2002)}$	1273	12620	4.25	4.37
$\text{Ln(ICR)}_{(2001)}$	1254	12564	4.29	4.19
$\text{Ln(ICR)}_{(2000)}$	1226	12361	4.51	4.23
$\text{Solvency}_{(2002)}$	1642	17361	0.75	0.43
$\text{Solvency}_{(2001)}$	1642	17361	0.79	0.40
$\text{Solvency}_{(2000)}$	1642	17361	0.82	0.38

Notes: (1) Monetary values in R$ at 2001 prices, deflated using INPC; (2) Weights are used.

Table 12: Regressions: Cross Sectional Analysis, World Bank Investment Climate

Regressors	Coefficient OLS	OLS	2SLS	2SPLS
Schooling (years)$_{(2002)}$	0.03	0.04	0.09	0.05
	(0.01)**	(0.01)**	(0.01)***	(0.01)***
Firm Age (years)$_{(2002)}$	0.009	0.005	0.13	0.007
	(0.003)**	(0.003)**	(0.004)	(0.03)**
Ln Employment	0.001	0.009	0.020	0.023
	(0.026)	(0.023)	(0.027)	(0.022)
Export Firm$_{(2002)}$	0.28	0.30	0.18	0.25
	(0.06)***	(0.05)***	(0.06)***	(0.05)***
Trade Union$_{(2002)}$	0.01	0.003	0.07	0.05
	(0.05)	(0.04)	(0.05)	(0.05)
Ln(ICR)$_{(2002)}$	-0.013		-0.017	
	(0.005)***		(0.006)***	
Solvency$_{(2002)}$		-0.18		-0.046
		(0.04)***		(0.025)*
Observations	1247	1546	1036	1471
F	13.94***	19.26***	15.68***	23.88***
R^2	0.28	0.31	0.32	0.34

Notes: (1) Dependent variable = lnw_j; (2) Significant at 99% (***), 95 % (**), and 90% (*); (3) All regressions include additional controls: Constant, Firm Age^2, Dummies for location (27 States), Dummies for Sector (2-digit).

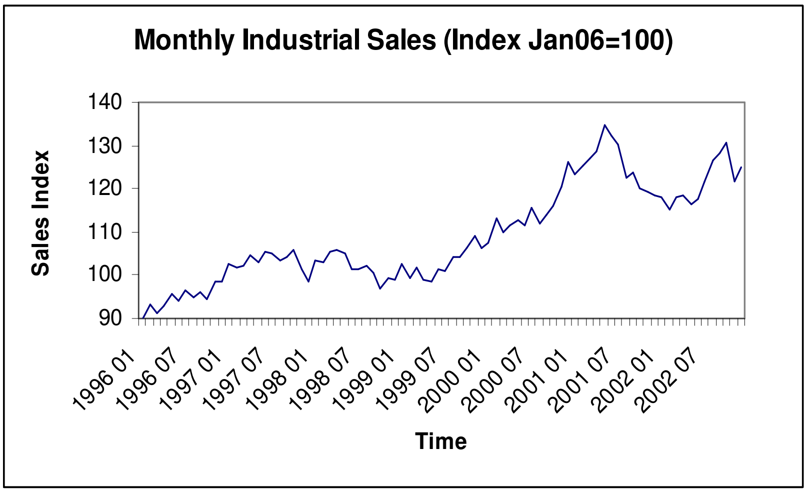

Figure 2: Brazilian Industrial Real Sales Index

Source: www.ipeadata.gov.br