

## **Outsourcing and efficiency wages: the case of Brazil**

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July 2016

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### **Resumo**

Em 2015, o projeto de lei 4330/04, que promove uma nova regulamentação sobre as relações contratuais terceirizadas, gerou uma significativa discussão sobre os impactos deste modelo de contrato no país. Apesar disso, ainda são escassos os trabalhos que avaliam as consequências da terceirização. Neste trabalho buscamos contribuir com o debate, analisando os impactos da terceirização sobre salários e produtividade do trabalho. Construímos um modelo teórico pautado na ideia de assimetria de informação e evidenciamos que o não pagamento do salário-eficiência pode implicar em uma diminuição dos salários e da produtividade do trabalho. Testamos as implicações do modelo usando dados da RAIS e concluímos que: 1) os trabalhadores terceirizados sofrem uma penalização em seus salários de 7% a 10,5%, com características individuais controladas e 2) o não pagamento de salário-eficiência é o fator mais importante para explicar o *gap* observado.

**Palavras-chave:** Terceirização, salários, salário-eficiência, produtividade.

### **Abstract**

In 2015, bill of law 4330/04 advocating new regulations for outsourced contract relationships and the impacts of this type of hiring generated significant debate in Brazil. Nonetheless, there are still very few studies that evaluate the consequences of outsourcing. In this paper, we seek to contribute to the debate by analyzing the impacts of outsourcing on wages and labor productivity. We created a theoretical model based on the idea of information asymmetry and were able to show that not paying efficiency wages can imply lower wages and labor productivity. We tested the implications of the model using RAIS (Annual Report on Social Information) data and concluded that: 1) the wages of outsourced workers are reduced by 7% to 10.5%, with controlled individual characteristics, and 2) the non-payment of efficiency wages is the most important factor for explaining this gap.

**Key Words:** outsourcing, wages, efficiency wages, productivity.

JEL Classification: J31

Área de submissão: Economia do Trabalho

## **I – Introduction**

Recent decades have shown a tendency for change in the organizational structure of companies. They are becoming progressively more horizontal, meaning they are increasingly opting to reduce the number of processes conducted inside the company and to increase their demand for services in the market (RAJAN and WOLF, 2006).

One of the most relevant aspects of this process is the outsourcing of the labor force. Hiring workers and conducting activities internally has gradually been substituted by contracts with specialized companies that either execute the tasks or provide the workers to do so (ABRAHAM and TAYLOR, 1996).

In Brazil, the outsourcing phenomenon has a strong presence that will be substantially incremented once the procedure for any type of activity is regulated by bill of law 4330/2004. This is likely due to the lesser degree of uncertainty that is associated to outsourcing activities, both for workers and business owners.

According to Prado and Takaoka (2002), outsourcing permits company owners to significantly reduce their training and payroll costs. Consequently, once operation costs are consistently reduced, what is there to restrict the advancement of outsourcing?

The limiting factors of outsourcing are the same as those that constrain company size and market organization. Coase (1937) observed that economic theory did not have an explanation for the organization of individuals within firms, and suggested that business owners could not resort to the market without incurring costs. And if they did, they would have a number of transaction costs related to acquiring information, writing and supervising contracts, etc.

Hence, companies chose to go to the market insofar as their marginal benefits equaled the costs of their marginal transactions. All other activities in which costs were not compensated by benefits would be produced inside the company.

Williamson (1971, 2008) emphasizes that the theory of transaction costs is relevant to understanding the limits of outsourcing. He argues that because highly specific activities generate greater transaction costs (since not all training can be conducted by a personnel company, for example) they have less propensity for being outsourced.

Although Coase's contributions are relevant to understanding outsourcing, they require additional information. The author does not fully explain all the benefits of maintaining fragments of production inside the company as opposed to purchasing it on the market.

Grossman and Hart (1986) introduce the concept of incomplete contracts to the analysis. They suggest that it is frequently impossible (or very costly) to precisely state in a contract all future production possibilities. Thus, maintaining production inside the company would give entrepreneurs the important benefit of having control over their utilized assets (the possibility of exercising power over them), whether they are workers or capital.

Several authors use this theory of incomplete contracts to suggest different perspectives about why having control over assets is important. Most of them, however, concentrate on evaluating the importance of controlling financial assets or machinery, and very few have explored controlling workers (RAJAN and ZINGALES, 1998).

Dube and Kaplan (2007) stand out as providing the only explanation as to the importance of controlling workers. They argue that when entrepreneurs keep employees in the company, they can guarantee a legal set of rights that is different from when the activities are outsourced. It is especially important to retaining investments in human capital provided by workers.

When companies hire workers directly, they can appropriate this kind of investment by issuing patents or licenses for technology use. In the case of outsourced workers, however, the company's legal ability to assume the fruit of their investment in human capital is very restricted.

This explanation is, however, rather limited. On one hand, it focuses on the innovation process generated by workers, although the majority of those subject to outsourcing conduct work with very little

specificity or innovation. On the other hand, it does not relate to other important aspects of the outsourcing process – worker remuneration and productivity.

In this paper we set forth an alternative element to explain the importance of the company having control over its workers. We argue that the central element to understanding this concept is that outsourcing disengages the employers from a fundamental aspect of the employment relation, namely their ability to determine wages for each worker.

As stated by Ramos (2012), information asymmetry in the labor market can lead to situations where employers have flawed control over the efforts of their employees. There are different mechanisms by which employers can incentivize employees to align themselves with the interests of the company. Akerlof (1982), for example, argues that when a company treats its workers fairly it motivates the workers to act appropriately and to work hard at their jobs. Bowles (1985), on the other hand, builds a model where companies seek to make optimal investments in supervision technologies that obligate workers to apply maximum intensity to their work.

The most relevant contribution to such explanations is made by Stiglitz and Shapiro (1984). They argue that companies would be willing to pay workers more than the clearing market wage to stimulate productivity. This would increase the relative cost to the workers of losing their jobs, which would motivate them to exert greater efforts and thus increase the productivity of the company.

Consequently, being able to determine wages can be seen as an important control mechanism over workers. The more outsourcing removes this instrument from companies that effectively use labor, the more it can aggravate the disparity of incentives between the workers and the companies.

In this paper we will evaluate the economic consequences of outsourcing, while keeping in mind the changes it generates in the relationship between employers and workers. It is divided into four sections, besides this introduction. The second section reviews literature that addresses the impacts of outsourcing on wages and productivity. The third section presents our theoretical model that relates outsourcing to efficiency wages. The fourth section is an empirical analysis using Brazilian data. Finally, the conclusion is presented in the fifth section.

## **II – The Consequences of Outsourcing**

In this section we will outline a review of state of the art studies on outsourcing. We are interested in the effects that hiring modes can have both on wages and productivity. Because no article addresses both effects simultaneously, this chapter is divided into two parts, each with the state of the art of a specific subject.

### **2.1 Effects on Productivity**

Feenstra and Hanson (1998, 1999) created a database for each industrial sector in the United States using census information collected from 1972 to 1994. The authors defined outsourcing as the quantity of imported intermediate inputs for each industrial segment as a fraction of the total purchase of materials.

Although their work does not evaluate the impacts of outsourcing on productivity, it was fundamental in making subsequent estimations. Nevertheless, the data is seriously limited in that it refers only to imported intermediate inputs, thus addressing only the offshore phenomenon.

Consequently, phenomena such as the purchase of inputs that are initially made in the United States and later substituted by imports (outsourcing of raw materials), and activities conducted inside the firm that are later outsourced or substituted by finished inputs (outsourcing of labor) cannot be differentiated.

Raa and Wolff (2001) used a similar methodology to the one above to calculate estimates about the impact of outsourcing on the industrial productivity in the United States during the 80s and 90s. The authors argue that outsourcing was the determining factor that reignited growth productivity after the slowdown of the 70s.

The main result of their work is a decomposition of the variation in the total factor productivity (TFP) of each sector of American manufacturing. They observed that the determining factor for increases in TFP during the period being analyzed was a diminished need for input materials in the productive process. They concluded that the results are consistent with the explanation that outsourcing contributed to increasing productivity.

Nonetheless, they did find an unexpected result. The productivity of industrial services did not contribute to the increase in productivity. To the contrary, the result pointed out that the TFP variation for this sector was negative in the 1980s and was marginally positive in the 1990s. Thus, the results suggest that, despite the lower quantity of inputs used, the productivity incorporated into the purchase of factors either diminished or was very low during the period.

Amiti and Wei (2005) used outsourcing measurements similar to those in the works mentioned above. The authors created a panel for the various sectors of the United States between 1992 and 2000, and then added to the analysis by decomposing outsourced goods and services.

As a basis for their calculations of productivity effects, the authors used a linearized equation of a rather general function of production. Thus, variations of basic inputs were used as controls to estimate the equation. First, the authors used a grouped least squares estimator and concluded that both types of outsourcing positively affect TFP in ways that are statistically significant.

It should be noted that the results could be biased because of the presence of fixed effects in the industrial sectors. To avoid this problem, a re-estimation is done using the difference-GMM method developed by Arellano and Bond (1991). The variables were instrumented by all the available lagged values from each variable. The estimated coefficients are similar to those obtained in previous estimations.

Furthermore, the authors perform new regressions with additional controls for using extremely high-technology capital supply adopted by sectors that tend to outsource and to have an evolving TFP. In this manner they ensure the results are not driven by an omitted variable bias. Once again, the results do not undergo any significant alterations.

McCann (2010) builds a similar database for Ireland between 1991 and 2005. One of the particularities of this data source is that it permits the author to exclude materials imported from subsidiary companies from the sample.

The author argues that including intercompany trade in outsourcing calculations biases the analysis in that knowledge transfers can positively affect the estimates of outsourcing. This factor is not motivated by outsourcing itself, but rather by the specific characteristics of the transactions. Therefore, it is suggested that the removal of these transactions could lead to more consistent estimates of the impacts outsourcing has on productivity.

The calculations are done using the method developed by Arellano and Bond (1991). It was concluded that outsourcing only has a positive effect on the TFP of companies in the domestic market. However, the effect of outsourcing on larger companies that tend to export is insignificant, and in some cases negative. The authors attribute this only to the relative inefficiency of domestic companies in Ireland and to the significant impact that any improvement to the productive structure has on productivity indicators.

Gorzig and Stephan (2002) create a panel of German companies for the period between 1992 and 2000. Contrary to the previous studies, these authors have access to company level data. The gross operational surplus is used as a proxy for company performance and as a dependent variable for the empirical analysis. The outsourcing of variables is measured by the purchase of material inputs and the hiring of outside services or labor.

The covariance of the companies is analyzed to identify the determinants of their performance. The analysis found that, although the three types of outsourcing increase company productivity in the short term, outsourcing has a slightly negative effect on long-term returns. Thus, the authors conclude that an excessive amount of activities are outsourced, and that the managers underestimate the costs of outsourcing.

The only literature that relates production decentralization to company productivity using Brazilian data is Moreira's (2015). He composed a panel that included companies in 29 sectors over a period of 17

years. The data is obtained from the Annual Industrial Research (*Pesquisa Industrial Anual*) conducted by the Brazilian Institute of Geography and Statistics (IBGE).

The author uses the participation of service consumption as a proportion of the intermediate consumption of each sector as a proxy for decentralizing production. Thus, an equation is built that defines company productivity as a function of the proxy and of several control variables.

The author regresses this equation using grouped ordinary least squares. The coefficients estimated for the decentralization variable are positive and statistically significant. It is suggested that the previous estimation possibly incurred an endogeneity problem. The positive relation can occur because more productive companies opt to outsource their activities and not because decentralization generates productivity gains. Different than the others, this author does not employ a more advanced empirical technique to control the problem.

Moreover, the author performs an additional regression adding dummy variables that interact with the different sectors and services consumed as intermediate goods. The intention is to estimate the effects of decentralization on the productive process in the many sectors.

The results indicate that outsourcing positively impacts productivity only in sectors that are rich in natural resources. The results in terms of the impact of outsourcing on labor and knowledge intensive sectors are negative. Moreira (2015) suggests that outsourcing is more important to the production of goods that are differentiated by price. The process would be counter-productive for sectors that differentiate by product.

In evaluating the empirical literature on the impacts of outsourcing on productivity, Windrum, Reinstaller, and Bull (2008) suggest that there is an unexplained paradox. The relation between outsourcing and productivity is much less immediate than expected and, as suggested by most of the aforementioned literature, many estimates show that decentralizing production generates insignificant and sometimes negative impacts on company productivity. Nonetheless, firms are increasing their outsourced processes.

The authors affirm that there is no theoretical explanation for the phenomenon, and thus try to develop one. They suggest that companies tend to adopt a process of “total outsourcing” where an entire area and its responsibilities are transferred to third parties.

This process could generate a management split and would separate specific areas of the company. Having less contact between areas would diminish the organizational flexibility of the company and any innovation associated to it. Therefore, productivity gains would be observed in the short term with reduced payrolls, but organizational inflexibility would hurt productivity in the long term.

Although the explanation presented by the authors is coherent, it has several gaps. It does not explain the impact of outsourcing on different areas of the productive process, nor why certain types of companies usually show better results than others.

## **2.2 Effects on Wages**

There are a number of studies that have tried to estimate the effects of international outsourcing on the demand for labor in each country. In this case, outsourcing functions to commercialize production factors and generate equalization in the price of the factors (MANKIW, 2006). The expectation is to see a tendency toward falling wages in wealthier countries and rising wages in poorer countries.

Feenstra and Hanson (1998), for example, attempt to estimate the effects of outsourcing on worker wages in the United States using their previously discussed methodology. The authors performed a regression on wage variations not associated to production (skilled labor) as a function of the quantity of outsourced inputs and of controls for the sectoral composition of the inputs.

The authors found that between 1979 and 1990, outsourcing activities contributed to increasing the wages that were not associated to production. This suggests that outsourcing caused significantly greater demands for skilled labor in the United States, to the detriment of less qualified workers.

This type of study focuses solely on the effects of the international market through outsourcing. This perspective is very limited because the vast majority of outsourced processes are conducted locally

(WILLCOCKS and PLANT, 2003). Therefore, we must concentrate on the domestic effect of outsourcing on wages.

Munch and Skaksen (2009) attempted to separate the effects of domestic and international outsourcing. According to them domestic outsourcing must equally benefit the wages of both skilled and unskilled workers, since it fosters increased division of labor and positively impacts their productivity. International outsourcing, however, should benefit workers in those countries with greater relative abundance.

The authors created a panel for Danish workers in the period between 1993 and 2002. They use sectoral data and a methodology similar to Feenstra and Hanson's (1998) to build an equation that links workers' wages to individual characteristics and company characteristics, in addition to the quantity of outsourced inputs they used.

The equation is estimated using a fixed effect methodology. To address the potential problem of endogeneity similar to those found in the previously discussed articles that relate outsourcing with productivity, the authors instrument an outsourcing variable.

The estimates point out that international outsourcing negatively affects the wages of lesser-skilled workers and increases the wages of higher-skilled workers. Furthermore, domestic outsourcing positively affects the wages of lesser-skilled workers and does not affect the wages of more qualified workers. Thus, the estimates are in accordance with the authors' hypothesis.

What is little discussed in this study is that the authors are unable to use this method to capture the effect of decentralized production on outsourced workers. They are only able to estimate the effect of company outsourcing on the remaining workers.

Additionally, a large part of the explanation for their estimates is based on the effects of outsourcing on the division of labor in the company. However, as suggested by Abraham and Taylor (1996) and Willcocks and Lacity (2006), the main motivation for outsourcing does not seem to be the fragmentation of activities, but rather the reduction of costs for a specific process. This makes the explanation that says the division of labor is responsible for the obtained estimates implausible.

Berlinski (2008) seeks to evaluate the impact that switching to a different hiring modality has on outsourced workers. He creates a database for outsourced workers in the United Kingdom between 1995 and 2001.

The author performs a regression based on generalized least squares (GLS) using the Mincer equation that includes a dummy for outsourced workers and a set of exogenous controls that are related to the individual. It is estimated that outsourced workers earn approximately 17% less than non-outsourced workers and that the gap does not vary substantially according to professions.

An alternative estimate is also conducted. A propensity score-matching estimator based on a logistic regression attests to similar results: outsourced workers tend to earn 19% less than non-outsourced workers. The author does not outline any explanation for this phenomenon.

Dube and Kaplan (2010) also conduct an empirical study in an attempt to evaluate the effects of outsourcing on the wages earned by security guards and janitors in the United States. The outsourcing is measured by combining information about the profession being exercised by each worker and the sector in which they work using microdata from the Current Population Survey from 1983 to 2000.

The authors create a Mincer equation and estimate it based on ordinary least squares (OLS). They determined that the wages of outsourced janitors were penalized by approximately 5% and that of security guards by approximately 20%, when compared to non-outsourced workers exercising the same profession.

These results can be caused by a process of endogeneity: companies that tend to outsource workers also tend to pay lower wages. To control the problem, the authors performed a regression on an equation similar to the previous one, but where janitors and security guards are categorized with office workers working in the same company. By using this additional group as a reference, they were able to verify whether wage differences are due to company behavior or to worker characteristics. They observed that the penalties for outsourced workers were maintained: approximately 4% for janitors and 15% for security guards.

It was suggested that penalties for a type of workers could only be established within a competitive equilibrium if the productivity of the workers is different, or if one of the jobs has non-pecuniary benefits. Thus, Dube and Kaplan (2010) try to test each of the hypotheses.

First, they evaluated whether the non-observable differences in the productivity of the agents could explain the differences in wages. They create a two-period panel and observe the individuals in the same profession in each one. Then they estimate a new wage equation using a fixed effects model. It is supposed that the agents' non-observable skills do not vary over time. The penalties for outsourced workers are maintained, with approximately 7% for the janitors and 12% for the security guards.

Second, the authors test whether the outsourced occupations have particular non-pecuniary benefits. They test whether the outsourced workers receive greater health insurance benefits – a proxy for worker benefits – than the non-outsourced workers. There is evidence that the opposite occurs, meaning outsourced workers receive less benefits.

Thus, the authors conclude that outsourced workers receive less because of their contract model, and that the result is not compatible with a competitive labor market model. The penalties that occur must be associated to some kind of income that is not extracted by the worker, but, for example, obtained through labor unions.

In Brazil, the Unified Workers' Central – CUT (2014) sought to estimate the causal impact of outsourcing on wages. They concluded that outsourced workers earned approximately 24% less than non-outsourced. The employed methodology, however, is severely flawed. The authors only compare the average wage of individuals that exercise typically outsourced professions with other workers wages.

The study is not clear about which methodological options were adopted to determine the typically outsourced professions and does not control the different characteristics that can influence wages besides the contract model. As previously discussed, the less specific and productive activities tend to be more often outsourced, which most likely generates an uncontrolled selection bias in the estimate.

There are few theoretical studies on the impact of outsourcing on wages. The only one that explains the penalization that was empirically observed by Berlinsky (2008) and Dube and Kaplan (2010) is conducted by Holmes and Snider (2011).

The authors build a model where the only product of the economy must be produced in two stages, one capital-intensive and one labor-intensive. The companies decide whether their production will be integrated or if they will outsource one of the stages in the process.

The labor market is unionized, which guarantees a “monopoly in labor supply.” The demand for labor from companies that decide to conduct an integrated production is less flexible than the demand from decentralized companies. Therefore, workers' wages diminish *pari passu* with the increasing intensity of the outsourcing process in the economy.

In this paper, our attempt is to develop a model that integrates the empirical insights of literature about the impact of decentralized production on productivity and wages, without resorting to the hypothesis of the powerful unionization of all the segments. We will also evaluate if the suggested model can be adapted to the reality of the Brazilian labor market.

### **III. Theoretical Model**

We suggest that information asymmetry can generate important impacts on the outsourcing process. Therefore, we will build a model that is similar to the one established by Stiglitz and Shapiro (1984).

#### **3.1 Basic Model**

Let us assume that our economy has  $n$  workers, only labor input, and only one final product  $a$ . The workers are identical and their preferences are denoted by

$$u = w - \varepsilon \quad (1)$$

where  $\varepsilon$  is a variable that indicates whether the worker is making an effort or not. We will assume that the effort is a binary variable. The  $w$  variable is the received wage. We then notice that our utility function is increasing in wages and decreasing in effort.

Unemployed workers have unemployment benefit  $\bar{w}$  guaranteed by the government. Additionally, the workers are not perfectly supervised. If the employer catches them in some form of cheating (not making an effort), they will be fired. This occurs with probability  $q$ .

The workers decide their behavior according to the theory of expected utility. If they are making an effort, they are not subject to any uncertainty and their utility will be:

$$u^e = w - \varepsilon \quad (2)$$

and if they are not making an effort,

$$u^n = \bar{w} * q + (1 - q) * w \quad (3)$$

which implies that workers will make an effort if, and only if,

$$u^e \geq u^n \Leftrightarrow w \geq \bar{w} + \frac{\varepsilon}{q} \quad (4)$$

The wage is positively associated to unemployment benefits, in that it raises the reservation wage, and is negatively associated to the probability of detection<sup>1</sup>.

Let us assume that there are  $m$  companies, all dedicated to the production of product  $a$  and all inserted in a competitive market. The profit of each one is understood as

$$\pi = (1 + \delta\varepsilon) * S(n) - (C + w) * n, \quad \delta > 0 \quad (5)$$

The prices of our economy are given and will be maintained as such until the end of the model. In this way we follow Laffont and Martimort (2002) and will model a function  $S(\cdot)$  to denote company revenue. We will assume that the function is increasing and concave.

Variable  $n$  denotes the quantity of workers hired by the company. Each worker will receive salary  $w$  and we will assume that the companies incur additional costs ( $C$ ) – associated to paying for training, human resource management, etc. – that varies linearly with the chosen quantity of work.

Additionally, we note that if the workers are making an effort, they push the company's production function upward by a  $\delta$  factor greater than zero. However, they only make an effort if the condition described in equation (4) is met. It is observed that the company has two distinct cost functions. If it pays wages that are only sufficient to attract labor,

$$w \geq \bar{w} \Leftrightarrow CP = C + \bar{w} \quad (6)$$

where  $CP$  is the company's unit cost.

If the company wants its workers to make an effort, it must pay an efficiency wage to individuals that is greater than in the previous situation. In this case, the company's total cost will be:

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<sup>1</sup> The model incorporates the essential characteristics of Stiglitz and Shapiro's work (1984), albeit only working in one period.



$$w \geq \bar{w} + \frac{\varepsilon}{q} \Rightarrow CP^e = C + \bar{w} + \frac{\varepsilon}{q} \quad (7)$$

where  $CP^e$  indicates the company's unit cost when it pays an efficiency wage.

The  $\theta$  productivity of the economy is given as

$$\theta = (1 + \varepsilon * \delta) * S'(n) \quad (8)$$

It is useful to define that the inverse function of what was derived from the company revenue function is

$$S'(n)^{-1} = \varphi(n) \quad (9)$$

It is observed that, because the revenue function is concave,  $\varphi(\cdot)$  is decreasing and convex.

Lets us assume that

$$\delta * CP < \frac{\varepsilon}{q} \quad (10)$$

and

$$(1 + \varepsilon * \delta) * S(n^e) - CP^e * n^e > S(n) - CP * n \quad (11)$$

where  $n^e$  is the quantity produced when a company pays an efficiency wage and  $n$  is the quantity produced when one is not paid.

The hypothesis specified in equation (10) guarantees that the costs associated to paying an efficiency wage are greater than the total cost when the company does not pay it, even when considering a shift in the production function.

Equation (11) indicates that the additional income generated by worker efforts more than compensates the higher costs generated by paying efficiency wages. Thus, the profit function is maximized when the company chooses this type of payment.

Companies in the economy maximize profits. Hence, they can do so in two different ways – by incentivizing or not the efforts of their workers.

The company's problem when it does not incentivize the efforts of its workers will be:

$$\max_n \pi = S(n) - (C + w) * n \quad (12)$$

$$s. a \quad w \geq \bar{w}$$

It is easy to note that at optimum the restriction will be active and therefore, the problem of the company will be solved by:

$$S'(n) = C + \bar{w} \Rightarrow n = \varphi(C + \bar{w}) \quad (13)$$

To incentivize the efforts of the workers, the company must increase paid remuneration so it can meet the requirements of equation (4). Let us say that in this case the company pays an efficiency wage to ensure that  $\varepsilon$  is equal to 1. Its problem will be:

$$\begin{aligned} \max_n \pi^e &= (1 + \delta) * S(n^e) - (C + w) * n^e \\ \text{s. a} \quad w &\geq \bar{w} + \frac{\varepsilon}{q} \end{aligned} \quad (14)$$

The restriction will once again be active and resolving the company's problem will imply

$$(1 + \delta) * S'(n^e) = C + \bar{w} + \frac{\varepsilon}{q} \Leftrightarrow n^e = \varphi \left( \frac{C + \bar{w} + \frac{\varepsilon}{q}}{1 + \delta} \right) \quad (15)$$

When a company pays an efficiency wage, it hires fewer workers since labor is more expensive. Yet even so, its revenues increase. This occurs because of worker efforts, which pushes the income curve upward, and because labor productivity is greater when fewer workers are employed in production.

### 3.2 Outsourcing Model

Now we will insert an additional company<sup>2</sup> into our model. As opposed to the others, this one does not produce final good  $a$ , but it does supply labor that enables other companies to do so. Let us assume that this company is more efficient in labor management, which translates into a reduction in  $C$  since the company is specialized in this work and can have economies of scale. To simplify the notation, we will assume that the company's labor management cost is zero.

We will follow Holmes and Snider (2011) in modeling outsourced labor supply. The company will pay the lowest wage possible to obtain labor ( $\bar{w}$ ), which they will pass on to the companies that produce the final good for price  $w^o$ , so that

$$w^o > \bar{w} \quad (16)$$

The company model that supplies outsourced labor described above translates the main insight of the model. The company that supplies intermediary inputs concentrates on lowering the costs of labor management and obtains its profits from the spread between the minimum costs it pays to attain labor and the price of transferring it to the other companies.

A fundamental implication for the model is that outsourcing creates an asymmetry of incentives. Companies that outsource labor does not accrue additional profits from the efforts generated by their workers, and therefore do not pay greater wages to guarantee those efforts.

Companies that produce final goods will only choose to use outsourced labor if

$$w^o < \bar{w} + C \quad (17)$$

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<sup>2</sup> The company acts as a monopoly. Baccara (2007) shows that this is the only efficient equilibrium when the technology used for production is not publically known. In order to maintain simplicity, we did not insert such considerations into our model, but the hypothesis is in line with the development of microeconomic theory on the decentralization of activities.

Supposing the previous condition is met, the company's problem when hiring outsourced labor can be described as

$$\max_{nt} \pi = S(nt) - w^o * nt \quad (18)$$

where  $nt$  is the amount of hired outsourced labor. The resolution would be given as:

$$S'(nt) = w^o \Rightarrow nt = \varphi(w^o) \quad (19)$$

If the  $w^o$  cost is sufficiently low, we can guarantee that

$$S(nt) - nt * w^o > (1 + \varepsilon * \delta) * S(n^e) - CP^e * n^e \quad (20)$$

so that the company opts to only hire outsourced labor.

Now we can summarize the consequences of outsourcing. Hiring  $nt$  labor is greater than in the previous period. Because the  $S'(\cdot)$  function is decreasing, we can guarantee that labor productivity in the economy goes down.

Additionally, the wage paid by the labor-supply company is lower than in the previous equilibrium. This occurs because it does not have any incentive for an efficiency wage, since labor productivity does not directly affect its profits.

Our model provides a unified framework to explain the main evidence obtained from literature. Companies seek outsourced labor with the main objective of lowering costs (ABRAHAM and TAYLOR, 1998), the wages earned by outsourced workers is lower than non-outsourced workers (DUBE and KAPLAN, 2010 and BERLINSKY, 2008), and company productivity can be reduced even if costs are also reduced (RAA and WOLFF, 2001).

In the next section we will examine whether the previsions of the model are in line with Brazilian outsourcing data.

## IV – Empirical Evaluation

In this section we will try to evaluate the economic consequences of outsourcing. First, we will present the equations to be estimated. Second, we will give a detailed description of the database and the chosen variables. Finally, we will present the obtained outcomes.

### 4.1 Econometric Model

Our estimation-base will be a variation of the traditional Mincerian equation regression with an added dummy variable to indicate whether the workers are outsourced (MINCER, 1974).

Formally,

$$\ln(w_i) = \alpha T_i + \beta X_i + u_i \quad (21)$$

Thus, we place the natural logarithm of the individual wage  $i$  ( $w_i$ ) as function of a variable that indicates whether the worker is outsourced ( $T_i$ ), and a vector of control variables ( $X_i$ ).  $\alpha$  is our coefficient of interest and represents the percentage impact of outsourced contracting on wages, once the other variables in the

equation are controlled. Furthermore,  $\beta$  is the coefficient vector of the control variables and  $u_i$  is the non-observable part of our estimate, which we assume to have a zero average.

The above equation is estimated using feasible generalized least squares (FGLS). This estimator is more appropriate for regressing the Mincerian equation than OLS because the variance of the dependent variable is usually an increasing wage function, meaning the equation would present heteroscedasticity (SCHAFFNER, 1999).

Some authors argue that the above estimate can be biased by the presence of human capital that is non-observable in research, but that is observable by employers (DUBE and KAPLAN, 2010). In seeking to control this type of bias, we will do an additional estimate.

We will consider a specification that is very similar to the first regression:

$$\ln(w_{it}) = \alpha T_{it} + \beta X_{it} + a_i + u_{it} \quad (22)$$

where  $a_i$  represents individual characteristics that are fixed in time and affect wages.

Now, the same individuals are followed over time and we assume they have characteristics that vary in time, our original regressors, and fixed effects. By differentiating the above equation in time, we find:

$$\Delta \ln(w_{it}) = \gamma \Delta T_{it} + \theta \Delta X_{it} + e_{it} \quad (23)$$

In this way we eliminate the fixed effects and can regress the new equation without the risk of generating biases. This methodology, however, produces some inconveniences. We cannot use fixed variables such as gender, ethnicity, or region of origin as regressors in the equation.

Moreover, our occupational status variable is largely fixed. Consequently, we can only analyze the impact on people that changed statuses between one period of time and another, which reduces our sample.

Next we will investigate whether the wage-efficiency influences the wage gap of outsourced workers – estimated in previous equations. Our model foresees that outsourced workers will work in larger companies (since they have economies of scale and lower labor management costs), but that their wages will not be raised as a way to guarantee their efforts.

To evaluate the previsions of the model, we will first estimate the size of the company as a function of the control vector stipulated in equation (21) and of the dummy variable that indicates outsourced workers:

$$E_i = \alpha T_i + \beta X_i + u_i \quad (24)$$

where  $E_i$  is the size of the company where individual  $i$  works.

Again, we are interested in  $\alpha$ , the marginal impact of outsourcing on the size of the company where the individuals are working.

Next we will perform Oaxaca-Blinder decomposition, developed simultaneously by Oaxaca (1973) and Blinder (1973). The decomposition takes the average difference between the wages of two distinct groups – outsourced and non-outsourced workers:

$$\alpha = \ln(w_i) - \ln(w_i)^t = (\beta X_i - \beta^t X_i^t) + u_i \quad (25)$$

where variables with the superscript  $t$  refer to outsourced workers.

The equation allows decomposing the average difference in wages initially observed in variations of individual endowments and of their impacts on wages.

In particular, we will report

$$\Delta \ln(w_i^t) = \beta^t X_i \quad (26)$$

and

$$\Delta \ln(w_i^t) = \beta X_i^t \quad (27)$$

Both equations above represent the variation that occurs in the wages of outsourced workers if: (1) they had the same factor endowments as non-outsourced workers, and (2) they received the same payment as the non-outsourced workers for each endowment. Our model foresees that the remuneration of our proxy for the efficiency wage must be lower for outsourced workers, which should largely explain the gap between the two groups.

## 4.2 Description of Variables

Our dependent variable is the natural logarithm of the average remuneration of each worker during the year of analysis. Our control vector is composed of the following variables: education, experience (level and squared), age, geographic region of residence, sector in which they work<sup>3</sup>, gender, ethnicity, and size of reported establishment.

The education variable, measured by the highest academic level reached, seeks to control the different productivity of individuals. Some authors suggest that this should be the most relevant factor used for explaining wage differences (BECKER, 1975).

By adding age and experience variables, this study tries to identify the presence of specific human capital that is acquired over time worked. A quadratic term was included to identify non-linear relations between experience and wages, seeing as the generated productivity gains are exhausted over time (ARROW, 1962). The variables are measured in months and identify the period in which the individual worked in the same company.

Variable dummies are added to control structural and regional tendencies in determining wages or patterns of discrimination against minorities. We use the northeast region as a reference and add dummies to the other regions. The ethnic binary variable takes on a one value if the individual is white and zero value for any other ethnicity.

We also used a binary variable to identify outsourced and non-outsourced workers, which is carefully explained in the next subsection.

Finally, we added to the regression the size of the establishment as an indicator of the propensity for an individual to receive an efficiency wage. It is supposed that it would be more costly to oversee an establishment with more employees. Therefore, this would increase the incentives for the company to offer higher wages (OI & IDSON, 1999). The size of the company is determined by the quantity of workers, according to the classification recommended by SEBRAE (2013) when using data from the Annual Social Information Report (RAIS)<sup>4</sup>.

Comparative analyses of outsourced and non-outsourced individuals suggest that another variable that significantly differentiates them is the rate of unionization (POCHMANN, 2012). This type of variable, however, is not provided by RAIS and so cannot be included in the study.

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<sup>3</sup> The sectors where we included dummies are: IT, electric, civil construction, administrative, security, food, maintenance, and residential.

<sup>4</sup> Our variable takes on four levels: micro-company (up to 9 employees), small company (between 10 and 49 employees), medium company (between 50 and 99 employees), and large company (over 100 employees).

### 4.3 Forming the Database

We used microdata from the Annual Social Information Report (RAIS) on 2013, obtainable at the Ministry of Labor and Employment (MTE). The microdata do not explicitly differentiate outsourced and non-outsourced workers.

Following Dube and Kaplan's (2010) approach, we sought to identify outsourced workers using other information. To do so, we separated workers functioning in activities that are commonly outsourced according to the Brazilian Classification of Occupations (CBO) code. We considered outsourced all workers that contributed to the productive process with a service and were not hired for the producing firm<sup>5</sup>.

Next, the worker activity sectors that we separated were analyzed according to the National Classification of Economic Activities (CNAE) code. We classified as outsourced the workers that are active in a sector that provided services to other companies or labor leasing. As a counterpoint, we classified as non-outsourced the individuals who work directly for the hiring company or are owners of the company where they work. The annex of this study contains a table that details this classification.

The case of private security agents is a worthwhile example. If they work in the "temporary labor leasing" sector, we assume that they provide services to other companies, and are therefore outsourced. If, on the other hand, they work in the "education" sector, we assume they are hired by the company where they effectively offer their services, and are therefore non-outsourced.

By using this methodology, we were able to synthesize a database for all the states in Brazil composed by all formalized Brazilian workers, and were able to differentiate them as outsourced or non-outsourced. Our sample contains over fifty-six million and a half observations.

The following table summarizes the quantity of workers from commonly outsourced segments in the database and decomposes the quantity and the fraction of outsourced workers in each one:

| Category           | Outsourced | Total      | Share |
|--------------------|------------|------------|-------|
| Administrative     | 37.138     | 415.467    | 8,9%  |
| IT and R&D         | 405.184    | 824.392    | 49,1% |
| Electricity Sector | 167.282    | 1.394.114  | 12,0% |
| Civil Construction | 564.420    | 5.910.633  | 9,5%  |
| Security           | 1.082.110  | 2.527.384  | 42,8% |
| Food Sector        | 331.870    | 1.623.284  | 20,4% |
| Maintenance        | 18.753     | 138.872    | 13,5% |
| Residencial Sector | 1.018.293  | 4.147.810  | 24,6% |
| Total              | 3.625.050  | 16.981.956 | 21,3% |

Table I: Descriptive statistics of the participation of outsourced workers relevant to the database

Although the RAIS microdata issued periodically by the Ministry of Labor and Employment (MTE) allows for a cross-section analysis, it is inadequate for performing our second econometric exercise, which requires an information panel.

We were able to obtain microdata that had not been public issued by RAIS and MTE that registers identification data for individuals. From that, we were able to create a panel and accompany individuals for two consecutive years<sup>6</sup>. The expanded base was for the study's second estimation.

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<sup>5</sup> This definition falls under very different types of workers. It's noteworthy that we considered consultants, such as accountants for example, as potentially outsourced workers.

<sup>6</sup> Because of data availability, we opted to do the first two estimates with 2013 data. The estimates in the panel were done using 2009-2010 data.

#### 4.4 Results

In Table II, we present the regression results of our equation (21) using generalized least squares for three vectors with different controls<sup>7</sup>.

|                         | Model (1)   |                | Model (2)   |                | Model (3)   |                |
|-------------------------|-------------|----------------|-------------|----------------|-------------|----------------|
| Variable                | Coefficient | Standard Error | Coefficient | Standard Error | Coefficient | Standard Error |
| Outsourced              | -0,187***   | 0,0002         | -0,070***   | 0,00000        | -0,099***   | 0,00030        |
| Education               | -           | -              | 0,146***    | 0,00005        | 0,133***    | 0,00011        |
| Experience              | -           | -              | 0,0033***   | 0,00000        | 0,0033***   | 0,00000        |
| Experience <sup>2</sup> | -           | -              | -0,00004*** | 0,00000        | -0,00003*** | 0,00000        |
| Age                     | -           | -              | -0,0096***  | 0,00001        | 0,0097***   | 0,00001        |
| Company size            | -           | -              | -           | -              | 0,084***    | 0,00006        |
| Man                     | -           | -              | -           | -              | 0,2408***   | 0,00041        |
| White                   | -           | -              | -           | -              | 0,044***    | 0,00016        |
| Occupation dummies      | no          | -              | no          | -              | yes         | -              |
| Regional dummies        | no          | -              | no          | -              | yes         | -              |

Table II – Mincerian regression (21) results (FGLS)

Note: The statistical significance of the estimated coefficient is identified by the number of asterisks: \* is a significance of 10%, \*\* is a significance of 5%, \*\*\* is a significance of 1%.

The first model is a regression of our dependent variable that just functions as a dummy for outsourced workers. It gives us an average percentage difference in the wages between one group and another – approximately 20.5%<sup>8</sup>.

The second model adds controls that are more common in Mincerian equations. It can be observed that all the controls have their coefficient signs aligned with what the theory suggests and all of them are statistically significant at a 1% level. These variables help explain the gap in the wages of outsourced workers, which is reduced to 7.2% as the variables are controlled.

The third model considers estimates similar to the previous one, but with the addition of our variable indicating efficiency wage and dummy variables indicating gender, ethnicity, occupation sector, and region of work. Once again, all the variables present coefficients with the expected sign and statistical significance at the 1% level. However, in this model the added variables do not contribute to explaining the penalties imposed on outsourced workers. To the contrary, the gap increases again, reaching approximately 10.5%. A more detailed decomposition of the explanatory power of each variable will be showed further on.

In Table 2 we saw how the observable human capital contributed to explaining the wage gap found in the previous regressions. The regression of equation (22), shown in the table below, seeks to prove whether eliminating the model's fixed effects would contribute to an additional explanation of the phenomenon:

<sup>7</sup> The regional dummies are all significant at the 1% level and they all indicate positive variations in wages in terms of income.

<sup>8</sup> To register our results we used the following correction for the coefficients:  $R = (e^{\beta} - 1) * 100$ .

| $\Delta \ln(w)$          |             |                |
|--------------------------|-------------|----------------|
| Differentiated Variables | Coefficient | Standard Error |
| Outsourced               | -0,067***   | 0,0003         |
| Education                | 0,024***    | 0,0000         |
| Experience               | 0,003***    | 0,0000         |
| Experience <sup>2</sup>  | -0,00004*** | 0,0000         |
| Age                      | 0,0004***   | 0,0000         |
| Size of Company          | 0,030***    | 0,0000         |

Table III – Result of estimate (22) by first differences in the panel

Note: The statistical significance of the estimated coefficient is identified by the number of asterisks: \* is a significance of 10%, \*\* is a significance of 5%, \*\*\* is a significance of 1%.

When controlling the fixed effects of the estimate, the wage difference for outsourced workers fell by approximately 7%. Thus is it possible that the cross-sectional estimates were biased by the presence of unobservable human capital. Nonetheless, the larger part of the gap between the two groups continued without explanation.

In the next table we present the result of the estimate of our equation (24):

| Dependent Variable - Company Size |             |                |
|-----------------------------------|-------------|----------------|
| Variables                         | Coefficient | Standard Error |
| Outsourced                        | 0,539***    | 0,0006         |
| Education                         | 0,021***    | 0,00011        |
| Experience                        | 0,0026***   | 0,0000         |
| Experience <sup>2</sup>           | -0,0005***  | 0,0000         |
| Age                               | -0,005***   | 0,00001        |

Table IV – Result of regression of company size as a function of the individual characteristics of the workers

Note: The statistical significance of the estimated coefficient is identified by the number of asterisks: \* is a significance of 10%, \*\* is a significance of 5%, \*\*\* is a significance of 1%.

It can be observed that the outsourced workers tend to work in larger companies even when we controlled our estimate with the control vector described earlier. This result is in line with the premises of our model.

Table V shows the results of the estimates of equations (26) and (27). The first panel provides the percentage variation in the average wage of the outsourced workers, in case the average endowment for each one of the variables was equivalent to that of the non-outsourced workers. The second panel presents the average variation in the wages of outsourced workers that would occur if their endowments were remunerated in the same way as non-outsourced workers.



|                         | Endowment |                | Coefficient |                |
|-------------------------|-----------|----------------|-------------|----------------|
| Variables               | Variation | Standard Error | Variation   | Standard Error |
| Education               | 0,006***  | 0,0001         | -0,055***   | 0,0006         |
| Experience              | 0,056***  | 0,0002         | -0,027***   | 0,0003         |
| Experience <sup>2</sup> | -0,013*** | 0,0001         | 0,003***    | 0,00009        |
| Age                     | -0,037*** | 0,00003        | 0,021***    | 0,0009         |
| White                   | 0,0007*** | 0,00074        | -0,015***   | 0,0003         |
| Man                     | -0,008*** | 0,00008        | -0,004***   | 0,0004         |
| Company Size            | -0,013*** | 0,00001        | 0,233***    | 0,0009         |

Table V – Oaxaca-Blinder decomposition for outsourced and non-outsourced workers

Note: The statistical significance of the estimated coefficient is identified by the number of asterisks: \* is a significance of 10%, \*\* is a significance of 5%, \*\*\* is a significance of 1%.

We can observe that the differences between the shares with variables such as education and experience explain part of the wage gap between the two groups. This implies that the outsourced workers, for example, are on average less experienced and, if they had the same endowments as the non-outsourced workers, they would earn an average wage approximately 6% higher.

The estimate of greatest interest to testing our model is the coefficient of our efficiency wage variable. The estimate indicates that, if outsourced workers were remunerated in the same way according the size of the company, their average wages would be 26% greater. Thus, changes in this characteristic would imply that the outsourced workers would gain more than non-outsourced workers, even if their initial endowments were maintained.

When we compare the many coefficients in our decomposition, we find evidence that the size of the company is the variable that carries the most weight when explaining the differences in wages. Therefore, our econometric analysis creates an empirical foundation for the main hypothesis of our model, namely that the efficiency wage must be the essential difference between outsourced and non-outsourced workers.

## V – Conclusion and Discussion

The discussions around the project to regulate outsourcing that began in the Federal Chamber in 2015, triggered debates on the economic consequences of outsourcing. Our attempt in this article has been to analyze these consequences from both a theoretical and empirical perspective.

The literature review on the subject (predominantly international) identifies that: the outsourcing process tends to reduce the workers' wages and is not always associated to productivity gains.

We developed a theoretical model based on the notion of information asymmetry in an attempt to explain the different economic consequences of outsourcing using a single framework. The model's main suggestion is that the process can create incentive mismatches between companies that hire and companies that supply outsourced labor, since the latter has no direct concern with worker productivity.

The model implies that outsourced workers earn lower wages because the companies that hire and manage them have no incentives for paying them an efficiency wage, and that labor productivity goes down when such workers are hired.

We used data from the Annual Report on Social Information (RAIS) to test the model's conclusions. First we used a Mincer equation to estimate the wage penalty placed on outsourced workers. Our estimates suggest that the penalty is between 7% and 10.5% and that the gap cannot be wholly explained by observable individual characteristics or non-observable fixed factors.

Additionally, we performed an Oaxaca-Blinder decomposition and showed that the main explanatory factor for the gap is the difference in remuneration given to workers in larger companies (our proxy variable

the payment of an efficiency wage). If the workers had been remunerated in the same manner as the non-outsourced workers according to the increasing size of the company where they work, their wages would be over 26% higher.

Therefore, this article was able to deliver a single theoretical framework that is aligned with the empirical facts suggested by Brazilian data and identified in international articles. Furthermore, this study offers a more careful perspective on the potential beneficial and detrimental effects of outsourcing and opens the door to new research topics, such as the heterogeneous impacts on workers with different human resource shares, for example.

## VI - References

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## VII – Annex –Database Formation

The Table below indicates the professions that are commonly considered outsourced and their associated sectors that suggest the occupational status of the worker<sup>9</sup>:

| Administrative Workers               |        |       | Professions                 | CBO                          | CNAE  |       |
|--------------------------------------|--------|-------|-----------------------------|------------------------------|-------|-------|
| Professions                          | CBO    | CNAE  | Barman                      | 513420                       | 56201 |       |
| Directors of several areas           | 1231   | 82113 | Food producer and assistant | 5135                         | 56201 |       |
|                                      | 1232   |       |                             | 5136                         |       |       |
|                                      | 1233   |       | Residencial sector          |                              |       |       |
|                                      | 1234   |       | Profissões                  | CBO                          | CNAE  |       |
|                                      | 1238   |       | Elevator operator           | 5141                         | 81214 |       |
| Lawyers                              | 2410   | 82113 | Cleaner                     | 5142                         | 81214 |       |
|                                      |        | 70204 |                             | 5143                         |       |       |
|                                      |        | 69117 |                             | 5172                         |       |       |
| Accountants                          | 3511   | 82113 | Security agent              | 5173                         | 80111 |       |
|                                      | 252210 | 69206 | Doorman                     | 5174                         | 81117 |       |
|                                      |        | 70204 |                             |                              | 81214 |       |
| IT and R&D                           |        |       |                             |                              | 80111 |       |
| Professions                          | CBO    | CNAE  | Eletricity Sector           |                              |       |       |
| Directors and workers of R&D and IT  | 1236   | 73114 | Professions                 | CBO                          | CNAE  |       |
|                                      | 1237   | 82113 |                             | 9511                         | 951   |       |
|                                      | 1425   | 631   |                             | 7313                         |       |       |
|                                      | 1426   | 620   |                             | 7321                         |       |       |
|                                      |        | 73203 |                             | 7311                         | 952   |       |
|                                      |        | 70204 |                             | 7156                         |       |       |
| Administrators and network analysts  | 2123   | 95118 | Eletricity Sector workers   | 7243                         | 63992 |       |
|                                      |        | 82202 |                             | 7301                         | 61096 |       |
|                                      |        | 82113 |                             | 8601                         |       |       |
|                                      | 2124   | 63119 |                             | 9501                         | 43215 |       |
|                                      |        | 620   |                             | 9502                         |       |       |
|                                      |        | 631   |                             | 9531                         |       |       |
| Programmers                          | 3171   | 95118 |                             | 9541                         | 33210 |       |
|                                      |        | 70204 |                             | Civil construction sector    |       |       |
|                                      |        | 620   |                             | Professions                  | CBO   | CNAE  |
|                                      |        | 631   |                             | Manual laborers and builders | 7151  | 71120 |
| Telemarketing workers                | 4223   | 82202 | 7152                        |                              |       |       |
|                                      | 4222   |       | 7153                        |                              |       |       |
|                                      | 420135 |       | 7154                        |                              |       |       |
| Maintenance                          |        |       | 7155                        |                              | 43991 |       |
| Professions                          | CBO    | CNAE  | 7157                        |                              |       |       |
| Maintenance technicians              | 3141   | 43223 | 7161                        |                              |       |       |
|                                      |        | 28691 | 7162                        |                              |       |       |
|                                      | 3144   | 33147 | 7163                        |                              |       |       |
|                                      |        | 7164  |                             |                              |       |       |
| Mechanics and maintenace specialists | 9151   | 33121 | 7165                        |                              |       | 43991 |
|                                      |        | 33147 | 7166                        |                              |       |       |
|                                      | 9153   | 61906 | 7170                        |                              |       |       |
|                                      |        | 43215 | 7201                        |                              |       |       |
| Food Sector                          |        |       | 7202                        |                              | 43215 |       |
| Professions                          | CBO    | CNAE  | 7211                        |                              |       |       |
| Cook                                 | 5132   | 56201 | 7212                        |                              |       |       |
| Server                               | 513425 | 81214 | 7241                        |                              |       |       |
|                                      | 513430 | 56201 | 7243                        |                              |       |       |

<sup>9</sup> Besides the classification stipulated in the table, all workers belonging to the following CNAE classifications were considered outsourced: 82997, 78205, 78108 e 78302.