Informal Labor Contracts: An Analysis of the Brazilian Experience

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INFORMAL LABOR CONTRACTS: AN ANALYSIS OF THE BRAZILIAN EXPERIENCE

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Abstract: For representing an expressive source of labor absorption, the jobs with informal labor contract have been receiving a considerable attention among the specialists in the Brazilian labor market. This paper presents, concisely, some stylized facts about this labor market segment, as well as some of their most common interpretations. We argue that such interpretations are, in general, not very integrated and a model trying to make them compatible is developed. The model incorporates both segmentation and workers with heterogeneity in qualification. The results of the analysis are shown to be compatible with most of the observed facts.
INFORMAL LABOR CONTRACTS: AN ANALYSIS FROM BRAZILIAN EXPERIENCE

I. Introduction

One of the main Brazilian labor market characteristics is its low degree of formalization. Only about half of the occupied labor force has a formal labor contract. This fact is concomitant with a low open unemployment rate. Therefore, many authors have concluded that the main Brazilian labor market problem is not its incapacity to create jobs, but the low quality of the jobs created.

The Brazilian labor legislation enforces all employees to work under a formal labor contract. Therefore, the high proportion of employees without a formal labor contract is an indicator of a high degree of illegality in the labor market.

The employees with a formal labor contract get, in addition to their wages, a set of legal rights and benefits. On the other hand, the employees without a formal labor contract do not have these rights and get, on average, a lower wage. Thus, the jobs without formal contracts are, on average, worse in quality.

Many empirical studies on informal labor contracts have been made in Brazil, emphasizing aspects like duration on the job, wages differentials, cyclical pattern and trend, incidence for workers of different types, regional differences, etc. In addition, a series of hypotheses to explain the evidences have been formulated. However, these hypotheses are, in general, isolated from each other. A hypothesis is formulated to explain one characteristic of the informal labor contracts without taking account of its implications to the other characteristics.

This study aims at promoting a higher degree of compatibility among the different explanations about the distinctive aspects of informal labor contracts in Brazil. In particular, it tries to integrate the probability of a worker to be in this segment with pattern of wage differentials, stressing the question of the workers' skills. The main
theoretical challenge is to construct a model including two characteristics usually treated separately, that is, segmentation in labor market and heterogeneity of workers.

II. Empirical Evidences

Empirical studies about informal labor contracts in Brazil have described a set of characteristics of these jobs. We now list ten “stylized facts” about this segment of labor market.

1) The jobs offering an informal labor contract are an expressive source of labor force absorption. Table 1 presents the composition of the occupied labor force in 1990, and it is possible to check that the employees without a formal labor contract represent 22.4% of the labor force. In the same Table it is possible to see that self-employment jobs are another significative source of labor force absorption.

Table 1: The occupied labor force composition

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>PROPORTION (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employers</td>
<td>4.6</td>
</tr>
<tr>
<td>Self-employed</td>
<td>22.7</td>
</tr>
<tr>
<td>workers without payment</td>
<td>8.0</td>
</tr>
<tr>
<td>Employees:</td>
<td></td>
</tr>
<tr>
<td>with formal contract*</td>
<td>42.3</td>
</tr>
<tr>
<td>without formal contract</td>
<td>22.4</td>
</tr>
</tbody>
</table>

Source: IBGE
* Include public servers

2) Besides its high level, the proportion of employees with informal labor contract has not decreased over time. In 1980's it was relatively stable and it was higher than in 1985 and 1996 the open unemployment rate almost never higher than 5% [Corseuil, Reis and Urani (1996)]. However, since 1997 the unemployment rate has been increasing, it exceeded the 8% in 1998.

2. If all employees with informal labor contract are illegal workers the majority of the self-employed are illegal as well. In 1990 only 50.1% of the occupied labor force contributed for the obligatory social security system.
the end of the 1970’s. Recent information points to an increase in the beginning of the 1990’s. The self-employed proportion follows the same patterns.

3) There is some indication that the proportion of employees without a formal labor contract, as the self-employed proportion, follows an anti-cyclical pattern, that is, increases in times of recession. This pattern was moderate in the recession of the beginning of the 1980’s, but it was much stronger in the recession of the beginning of the 1990’s.

4) The proportion of employees without a formal labor contract is higher among the unskilled workers: It is higher among the less educated and among those in the extreme of the age distribution.

5) The employees with informal labor contracts are concentrated in small firms. IBGE’s data show that in 1990, 60,3% of the employees without a formal labor contract were working in firms with less than 6 employees. This proportion was only 10,8% for the employees with a formal labor contract. On the other hand, Cacciamali (1993) showed that in the São Paulo metropolitan area, 16% of the private sector employees had an informal labor contract, but this proportion increases to 57% for firms with less than 6 employees.

6) The proportion of employees without formal labor contract varies substantially across the Brazilian areas. In 1986, this proportion was 28% in the southeast area (the most developed one), 37,6% to in the north and central-west areas and 42,7% in the northeast area [Cacciamali (1989)].

7) The jobs without a formal labor contract are easier to find and have a shorter duration on average. Barros and Varandas (1987) present evidence that the average duration of the jobs without formal labor contract is less than half of the duration of the jobs with formal labor contract. Moreover, Sedlacek, Barros and Varandas (1990) estimated that around 50% of the employees without a formal labor contract, at a point in time, will get a job with a formal labor contract one year later.

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3. In 1996 the proportion of employees with a formal labor contract was only 39,9%. See Cacciamali (1989), Sedlacek (1989) and Amadeo et al. (1994).
4. See Amadeo et al. (1994).
5. See, for example, Fernandes (1995).
8) The wages of employees with formal labor contract are significantly higher; even when controlled for individual characteristics (like education, age and gender), region of residence and occupation.

9) The wage differential, between employees with and without a formal labor contract, increases for more educated groups. This happens because the increase in wage per additional year of study is higher for employees with formal labor contract. The pattern of this differential is less clear for age groups.

10) Finally, the earning distribution of the employees with an informal labor contract is, at least, as unequal as the one of employees with formal labor contract.

III. Explanations

III.1. Informal Labor Contract and Government Regulation

One of the main explanations for both the intensity and the evolution of the proportion of employees with informal labor contract and self-employed is the high cost associated with the government regulation.

It is costly to establish a formal labor contract (costs associated with tax, social security system contributions, minimum wage legislation, fine to fire workers, etc.) and so there is a gain for those who cheat the labor legislation. Nevertheless, there are also costs associated with cheating the law. In a simple way, the value of the fine times the probability of being caught cheating). Thus, the decision to hire workers with or without formal labor contract will depend on the firm cost-benefits analysis.

The problem would be that the government imposes to firms high costs of tax and control, has an inefficient inspection and offers to employees with formal labor contract a bad service, like the low values of benefits in the social security system. On the other

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6. Barros et al. (1993) and Fernandes (1995) showed that in Brazilian metropolitan areas a significant part of these differences remained when the heterogeneity of workers – in education, age and gender – was taken in consideration.


8. Fernandes (1995) estimated, for metropolitan areas, that these differentials increase 2.7% per additional year of study.

hand, the increase in proportion of employees with informal labor contract would happen because the government had increased these costs\textsuperscript{10}.

The costs to cheat the legislation tend to change according to enterprise size, because bigger enterprises are easier to inspect. Thus, this argument helps us to explain why informal labor contracts are more common in small enterprises.

The proposition that the costs associated with the labor legislation have a negative impact on the proportion of employees with formal labor contracts is very reasonable. The formal-informal contracts separation itself is a non-sense in the absence of labor legislation. However, this proposition does not explain the whole story. Firstly, there are no studies estimating the elasticity of the proportion of employees with a formal labor contract with respect to labor legislation costs. Therefore, there is no guarantee that a substantial reduction in labor legislation costs produces a substantial reduction in proportion of employees with informal labor contract.

It is also reasonable to admit that the labor legislation has different impacts across regions, otherwise it would be very difficult to explain, for example, why the proportion of employees with informal labor contract varies so much across the Brazilian regions and the labor legislation is formulated at the national level. Thus, the study of other Brazilian labor market characteristics is very important to better understand the informal labor contract phenomena in this country.

The explanation based only on high labor legislation costs does not shed light on differences in wage patterns between employees with and without a formal labor contract. It is important to emphasize that the labor legislation benefits would impose, in a competitive labor market, a wage gap in favor of employees without formal labor contract. However, as seen above, the wages of employees with formal labor contract are, on average, higher than the wages of the employees with informal labor contract, even when differences in observable characteristics are controlled for. This evidence has reinforced the hypothesis of a segmented labor market\textsuperscript{11}.

\textsuperscript{10} It has been stressed the crises in social security system, which increased the contribution rate on active workers and decreased the benefits for inactive, and also the new 1988 constitution has increased the right to workers and contribution on firms.

\textsuperscript{11} See, for example, Barros, Pontes and Varandas (1988) and Pero (1992).
III.2. Segmented Labor Market and Informal Labor Contract

The term segmented labor market characterizes the situation where homogeneous workers, in terms of productivity and preferences, have different utility levels when occupying different jobs. In this case, the market mechanism would fail to equalize the wages of these workers.

The Brazilian studies on labor market segmentation between employees with and without formal labor contract have concentrated on empirical evaluations of the wage differential as way to characterize the existence of segmentation. The causes to this segmentation are, however, not well understood.

The labor legislation appears again as an explanation, in particular the minimum wage law. The establishment of a minimum wage over the wage that would prevail under a competitive market would impose a rationing of jobs with a formal labor contract. Thus, those workers that haven't found a job with a formal labor contract could get a job with an informal labor contract, at a lower wage, while they continue their search. This is compatible with the fact that jobs with an informal labor contract are easier to find and of shorter duration. However, the relatively low value of the Brazilian minimum wage has raised doubts about this argument [Cacciamali and Fernandes (1993)].

Even if admitting that the minimum wage is an operant restriction, its impact would be mainly on unskilled workers, which could be an explanation for the higher incidence of this workers in jobs with informal labor contracts. But in this case, we would also expect that the wage differential, between employees with and without a formal labor contract, would be higher among the unskilled workers. This does not seem to be the case in Brazil, at least using education level\(^\text{12}\).

These evidences suggested to authors such as Barros et al. (1993) and Cacciamali and Fernandes (1993) that the labor legislation could be revealing instead of creating a market segmentation. Notice that, from a logical point of view, the existence of any mechanism that makes the firms with formal contracts to pay higher wage than the competitive can have the same effect as the minimum wage. Arguments such as the

\(^{12}\) With regard to age, Fernandes (1995) argue the minimum wage may be a very important restriction for young workers.
presence of strong unions or efficiency wage considerations could perform this function. However, as pointed out by Cacciamali and Fernandes (1993), such arguments are much more associated to the technological level and to the size of the enterprises than to the complying or not with the labor legislation. If the big firms are those that pay wages above the equilibrium, they are exactly the ones that face the largest costs of defrauding the law. Therefore, a segmentation between jobs offered by big and small enterprises would seem a segmentation between jobs with and without formal labor contract.

III.3. Informal Labor Contract and Urban Informal Sector

In Brazil the employees without a formal labor contract are sometimes considered as integrating what come to be known, in the literature on developing countries, as urban informal sector. Another group of workers frequently included in the informal sector is the self-employed workers one.

In the beginning of the 1970s the formal-informal dichotomy appeared to characterize the situation, experienced by several developing countries, of fast demographic growth in the urban centers. Such demographic expansion was not followed by the raising of the open unemployment rate, but it was followed by the growth of activities of low productivity, which were developed in small productive units, frequently without fixed place. To identify such activities and to treat them differently seemed to be a promising idea for many authors.

Ever since, many criteria have been used to characterize the informal sector. Such criteria refer to aspects as: existence of barriers to entry; scale of operation; capital-labor ratio; workers' qualification; compliance with the legislation; origin and property of the capital; relationship between employee-employer; etc. To select among these criteria the most fundamental to base the formal-informal dualism is still a controversial point in the literature13.

13 For a discussion about the definitions of informal sector see, for example, Thurnham, D. et al. (1990) and Thomas, J. J. (1995).
In practice, a large part of the empiric studies adopt as demarcation criterion the size of the firm\textsuperscript{14}. So, we could think that the firms are distributed according to their size - measured, for example, by the number of employees - where the smallest ones would not hire any employee and would form the group of the self-employed. Thus, the informal sector would hold three groups of occupations: the informal employees, the informal employers and the self-employed ones. Even if the existence of formal labor contracts is not considered as the important criterion of demarcation, the employees without formal contracts could appear as an approximated measure of the first group.

From a theoretical point of view, the existence of barriers to entry appears to be one of the main criterions that give rise to the formal-informal dualism. The jobs in the formal sector are assumed to pay more but are not available for everyone, while in the informal sector prevails free-entry. The studies, in this line followed Todaro (1969) and Harris and Todaro (1970).

Although Todaro (1969) recognizes the underemployment category, in the Harris-Todaro model the urban workers are either employed in the modern sector or they are unemployed. An extension of that model to include, explicitly, the urban informal sector was accomplished by Fields (1975), where two options exist for those that didn't find employment in the formal sector. They can be unemployed and at the same time look for, in full time, a formal employment or they can stay employed in the informal sector, which reduces their probability of getting a formal employment, but offers a wage $W_i$. In equilibrium, the two strategies generate the same expected return.

One of the mains criticisms to this model is that it considers the informal sector as a “waiting area". It is only an transitory alternative for those who didn't find an employment in the formal sector\textsuperscript{15}. Many empirical studies have been pointing to the fact that a reasonable proportion of the workers in the informal segment stay there for a reasonable time and don’t manifest a interest to move to the formal sector. Moreover, many of the activities in the informal sector would not be characterized as allowing free-

\textsuperscript{14} As there is a high correlation between the other informal sector typical characteristics with occupations in units of small size, such demarcation can be shown useful, even for those that don't consider the size of the firm as the fundamental criterion for the formal-informal dichotomy.

\textsuperscript{15} The informal sector was initially conceived to hold workers newly arrived in the city. However, it could be easily extended to hold all workers entering in the labor market, as well as those that, for any reason, have lost their employment in the formal sector.
Fields (1990) recognizes these points and suggests subdividing the informal sector into two sub-sectors, which he defines as easy-entry informal sector and upper-tier informal sector.

The existence of rationing of jobs would mean that many workers would not be capable to find a job. As an alternative to open unemployment, those workers could be willing to occupy a temporary job, receiving a lower wage. This could motivate the appearance of firms specialized in hiring temporary workers. Due to their lower wage, these firms might be technologically less advanced and they should present low costs associated with the labor turnover, which are characteristics usually associated to small enterprises. For the employers to be established in this segment, they should possess some capital and, therefore, their option should be one of more permanent character. Thus, the informal sector holds transitory employees and permanent employers. The self-employed would be in an intermediary situation.

Rauch (1991) explored the idea that the fixation of a wage above the competitive can generate both wage dualism and permanent employers in informal sector. In his model, the informal sector employees earn less than the formal sector ones and the informal sector employer with the largest revenue earns less than the formal sector employer with the lowest revenue, but some informal employers earn more than the formal sector employees do.

For our purposes, however, Fildes (1975) model can be useful, in case we admit that the employees without a formal labor contract can be considered as an approximate measure of the easy-entry informal sector. The “waiting area” hypothesis can be reasonable for the case of employees with informal labor contract, as the item 7 of the section II could suggest. On the other hand, Pero and Urani (1994) point that, in Brazil, around 2/3 of the employees without formal labor contract declared to be interested in moving for a job with formal labor contract. However, Fildes (1975) model would not help us to explain why the probabilities of being in the informal sector and the pattern of

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16. As the labor legislation tends to rise the costs associated with labor turnover, there is an incentive for these firms to cheat the legislation.

17. When this same question was asked for the self-employed, only 1/3 of them showed interest in moving for an employment that offers a formal labor contract.
wages differential vary among the educational groups, because it considers the workers as productively homogeneous\textsuperscript{18}.

IV. The Theoretical Approach

The analysis to be developed is based on the segmentation hypothesis. It is supposed that the jobs with higher wages are rationed. It is also assumed that the big firms are over-represented in the jobs offering higher wages. As the big firms have a higher cost to operate defrauding the legislation, a positive correlation would exist between rationed jobs and formal labor contracts.

In this approach, the labor market could be imagined containing urns with white and red balls. A lottery, without replacement, is made and each worker can draw only a ball of each urn, in a certain period of time. A worker gets a job when he draws a white ball. A different wage is associated to each urn and the workers drive themselves, firstly, to the urns with higher wages. Thus, if a worker draws a white ball in the first urn that he drove himself to the game will be over for him. On the other hand, if he draws a red ball, he will go to the urn that offers a wage immediately inferior, continuing in that game until drawing a white ball. As a simplification, it is admitted that the urn with smaller wage has white balls only (market clearing), so that no unemployment will exist in the economy.

The access to certain urns is not free, certain skills are required. It is assumed that workers have different skills and that the worker who has a certain skill also has all the other skills that are less valued in the market.

The number of urns, the wage and the proportion of white and red balls in each urn are determined by the state of the techniques and the distribution of skills in the workers' population. For example, an increase in the proportion of workers with a determined skill would tend to reduce the wage in that market. On the other hand, a

\textsuperscript{18} In fact, Fildes considers the existence of two groups of workers according to the educational level. That is done, simply, considering that the qualified workers possess preference in obtaining a job in the formal section. Authors like Glues and Sanders (1985) also tried to reconcile the formal-informal dualism with two levels of qualification of the worker. But, in this case, the solution was the one considering that the qualified workers only seek jobs in the formal sector and the unqualified worker only seek job in the informal sector. Therefore, these conciliation procedures are insufficient.
reduction in the wage, for a fixed technological state, would tend to rise the job supply, but probably less than the number of workers with this skill increases. In the end we would have a smaller wage associated to this urn and a larger proportion of red balls.

A model with such ideas is developed in the next section, where it is assumed the existence of three urns. Two of them concern the labor market with formal contracts and one concerns the market without formal contracts.

V. The Model

There are N workers in the economy, who are divided in two sub-populations: \( N_1 \) and \( N_2 \). The sub-population \( N_1 \) possess skills A and B, while the sub-population \( N_2 \) possess skill A only. The workers in \( N_1 \) are considered qualified, while those in \( N_2 \) are considered unqualified. There are also two technologies to produce the only good of the economy:

1) \( Q = f_1(N_a, N_b, K) \)
2) \( Q = f_2(N_a, K) \)

where,

\( N_a = \) workers employed by skill A
\( N_b = \) workers employed by skill B
\( K = \) Capital

We can consider the technology 1 as modern and the technology 2 as traditional. The number of firms is considered fixed and equal to \( Z = X + Y \), where \( X \) is the number of firms with technology 1 and \( Y \) the number of firms with technology 2\(^{19} \).

\(^{19}\) A reduction of costs in firms with technology 1 would tend to increase the relative participation of those firms in the workers' recruiting due to the increase in their size and the increase in their number, in
We considered that the firms with technology 1 only hire workers with formal contract, while the firms with technology 2 only hire workers without formal contract. Thus, a typical firm with technology 1 has a function of production in the form:

$$3) Q = N_1^a \cdot N_2^\beta \cdot K_1^\gamma, \text{where } \alpha + \beta + \gamma < 1$$

The cost equation of the firm is:

$$4) C_T = tW_bN_b + tW_aN_a + aK_1$$

where,

- $W_b =$ net wage received by workers employed by their skill $B$ in a firm with technology 1
- $W_a =$ net wage received by workers employed by their skill $A$ in a firm with technology 1
- $N_b =$ number of workers employed by their skill $B$ in a firm with technology 1
- $N_a =$ number of workers employed by their skill $A$ in a firm with technology 1
- $K_1 =$ capital employed by a firm with technology 1
- $a =$ capital services price
- $t =$ one plus the aliquot of the payroll taxes

On the other hand, a typical firm that hires workers without formal contract has a production function in the form:

$$5) Q = N_3^\phi \cdot K_2^\psi, \text{where } \phi + \psi < 1$$

The cost equation is:

$$6) C_T = W^* \cdot N_3 + h(N) + aK_2$$

where,

comparison to the firms with technology 2. Maintaining fixed the number of firms, we are considering that
\( W^* = \) wage in the sector without formal labor contract
\( h(N) = \) costs of staying in the illegality, which is equal to the value of the fine multiplied by the probability of the firm to be fined. It is admitted that firms become more visible as the number of employed workers is larger, \( h'(N)>0 \) and \( h''(N)>0 \).
\( N_{a2} = \) number of workers employed by their skill A in a firm with technology 2
\( K_2 = \) capital employed by the firm with technology 2

As a simplification, we will specify the cost function of the firms with technology 2 as:

\[
6^1) CT = W^* N_{a2}^h + aK_2 , \text{ where } h > 1
\]

V.1. The Demand for Workers with Formal Contract

Considering the price of the product as equal to one, the profit equation of a typical firm with technology 2 will be:

\[
\pi = N_{a1}^a . N_{b}^b . K_1^r - tW_b N_b - tW_a N_a - aK_1
\]

The conditions of first order for profit maximization of the firm are:

\[
7) \hat{a} + (\alpha - 1) \hat{N}_{a1} + \beta \hat{N}_b + \gamma \hat{K}_1 - t - \hat{W}_b = 0
\]

\[
8) \hat{b} + \alpha \hat{N}_{a1} + (\beta - 1) \hat{N}_b + \gamma \hat{K}_1 - t - \hat{W}_a = 0
\]

\[
9) \hat{\gamma} + \alpha \hat{N}_{a1} + \beta \hat{N}_b + (\gamma - 1) \hat{K}_1 - \hat{a} = 0
\]

where, \( \hat{x} = \ln x \)

this effect occurs only due to the change in the size of the firms pre-existent.
The Jacobian of the system is \( |J| = \alpha + \beta + \gamma - 1 < 0 \) and the demands of the firm for inputs \( N_a, N_b \) and \( K \) are:

10) \( N^D_{a1} = N_{a1}(W_a, W_b, t, a) \)
11) \( N^D_b = N_b(W_a, W_b, t, a) \)
12) \( K^D_1 = K_1(W_a, W_b, t, a) \)

V.2. The Demand for Workers with Informal Contract

The profit equation of the firm is:

13) \( \pi = N^e_a K^e_2 - W^* N^h_a - aK_2 \)

The conditions of first order for profit maximization are:

14) \( \dot{\phi} + (\phi - h) N^e_a + \psi K_2 - W^* - h = 0 \)
15) \( \dot{\psi} + \phi N^e_a + (\psi - 1) K_2 - \dot{a} = 0 \)

The Jacobian of the system is \( |J| = h(1 - \psi) - \phi > 0 \) and the demands for inputs \( N_a \) and \( K \) are:

16) \( N^D_{a2} = N_{a2}(W^*, a, h) \)
17) \( K^D_2 = K_2(W^*, a, h) \)

V.3. The Job Search Process

Let \( P_B \) be the probability to get a job by the skill \( B \) and \( P_A \) the probability to get a job by the skill \( A \) in the sector with formal labor contracts. It is also assumed that the
sector without formal labor contracts operates in competitive equilibrium, so the probability to get a job in that sector is 1.

It was assumed that all workers in the sub-population \( N_1 \) search for a job by their skill B as a first option. In case of failure, they search for a job by their skill A in the sector with formal labor contract as a second option. In the same way, it was admitted that all workers that don't get a job with a formal labor contract search for one without it. Thus, no unemployment would exist in the economy.

The workers' expected income in the sub-population \( N_1 \) is \( W_bP_b + W_aP_a(1-P_b) + W^*(1-P_a)(1-P_b) \), and \( (1-P_b)(1-P_a)N_1 \) is the expected number of workers in that sub-population that won't find a job in the sector with formal labor contract.

Considering the workers in the sub-population \( N_2 \), it was assumed that all of them begin searching for a job in the sector with formal labor contract. In case of failure, they search for a job in the sector with informal contract. Thus, the workers' expected income in the sub-population \( N_2 \) is \( W_aP_a + W^*(1-P_a) \), and \( (1-P_a)N_2 \) is the expected number of workers in that sub-population that will be employed in the sector without formal labor contract

V.4. The Equilibrium of Market

The demand for workers with skill B is \( XN_{b1}^D \), while the demand for workers with skill A in the sector with formal contracts is \( XN_{a1}^D \). Finally, the demand for workers in the sector without formal contracts is \( YN_{a2}^D \).

It is assumed that the firms in the sector with formal contract operate according to efficiency wage hypothesis, so that they pay a wage above the competitive one. To reduce turnover costs and to avoid shirking, the firms are willing to impose a cost for those workers who loose their jobs. The wages related to the skill A (\( W_a \)), are fixed by a minimum wage legislation and the dismissal cost that the enterprises want to impose on its workers is already attended implicitly. Finally, the wages related to the skill B (\( W_b \)), are determined by the following restriction:
where "s" is a parameter larger than 1. This expression shows that the wage received by a worker employed by his skill B is larger than his expected wage when he is unemployed. In this sense, the correct term for the denominator would be $P_b W_b + (1-P_b)(P_a W_a + (1-P_a)W^*)$. The modification above was done to facilitate the resolution of the model.

Expression (18) put in operation the segmentation hypothesis with the advantage of not requiring a fixed $W_b$, as it is usual in models of formal-informal segmentation. The rationality for this expression is that the firms, for efficiency wage reason or by virtue of union power, pay wages above the one that would be fixed in a competitive market.

The probabilities of finding a job are:

\[
19) \frac{X N_{a1}^D}{rN} = P_b \\
20) \frac{X N_{a2}^D}{J_{a1}} = P_a \\
21) \frac{Y N_{a2}^D}{J_{a2}} = 1
\]

where,

\[18) \frac{W_b}{W_b^P_b \left[P_a W_a + (1-P_a)W^*\right]} = s\]

20. In this analysis it is implicit that $W_b > W_a > W^*$.

21. In our case, the hypothesis of fixed wage (with basis in the minimum wage legislation) was done for $W_a$. Thus, if we fixed $W_b$ we would also be fixing the differential of wages among qualified and unqualified workers in the market with formal labor contract.

22. For example, in Shapiro and Stiglitz (1984) workers choose the level of effort "e" between two alternatives: $e = 0$ and $e = k$ (k = constant positive). Therefore, in the demands for labor expression for the firms that offer formal contracts (section V.I) was admitted that $e = k$. However, if effort reduces the workers' utility and the expected income is not altered for those that, for reasons of shirking, are dismissed, all workers would choose $e = 0$. Thus, the parameter "s", in (18), gives the measure of the shirking cost that is sufficiently necessary for all workers, with skill B, to choose $e = k$.

In the Shapiro and Stiglitz model, the efficiency wage appears as a worker discipline device. Though, the equation (18) could be thought to attend any other justify for the efficiency wage hypothesis (see Akerlof and Yellen, 1988), as well as for the monopoly power of the unions.
\[
r = \frac{N_1}{N}
\]
\[
J_{a1} = (1 - r)N + (1 - P_b) r N
\]
\[
J_{a2} = (1 - P_a)(1 - r)N + (1 - P_a)(1 - P_b) r N
\]

The system to be solved is:

19) \( \dot{X} + \dot{N}_{a1} - \dot{P}_b - r - \dot{N} = 0 \)

20) \( \dot{X} + \dot{N}_{a1} - \dot{P}_a - \dot{J}_{a1} = 0 \)

21) \( \dot{Y} + \dot{N}_{a2} - \dot{J}_{a2} = 0 \)

18) \( \dot{W}_b - \dot{s} - P_b \dot{W}_b - (1 - P_b)P_a \dot{W}_a - (1 - P_b)(1 - P_a)W^* = 0 \)

where the endogenous variables are: \( \dot{W}_b, \dot{W}^*, P_b \) and \( P_a \). It is possible to verify that the jacobian of the system is positive, \( |J| > 0 \), and, therefore, it has a unique solution.

VI. Comparative-Static Analyses

VI.1. The Impact of a Change in the Workers' Qualification

The first comparative-static analysis is the impact of an increase in the proportion of the population that have skill B. In this case, we can show that:

a) \( \frac{\partial \dot{W}_b}{\partial r} < 0 \);  
b) \( \frac{\partial \dot{W}^*}{\partial r} > 0 \);  
c) \( \frac{\partial P_b}{\partial r} < 0 \) and  
d) \( \frac{\partial P_a}{\partial r} > 0 \)
In summary, an increase of the workers' proportion with skill B reduces both $W_b$ and $P_b$ and it increases both $W^*$ and $P_a$.

VI.2. An Increase in Taxes

It is possible to show that:

$$a) \frac{\partial \hat{W}_b}{\partial a} < 0; \quad b) \frac{\partial \hat{W}^*}{\partial a} < 0; \quad c) \frac{\partial \hat{P}_b}{\partial a} \leq 0, \text{ or } > 0 \quad \text{and} \quad d) \frac{\partial \hat{P}_a}{\partial a} < 0$$

It is worth emphasizing that the reduction of $\hat{W}^*$ implies that an increase in taxes tends to increase the participation of employees without formal labor contracts.

VI.3. An Increase in the Minimum Wage

In this case we would have:

$$a) \frac{\partial \hat{W}_b}{\partial \hat{W}_a} \leq 0, \text{ or } > 0; \quad b) \frac{\partial \hat{W}^*}{\partial \hat{W}_a} < 0; \quad c) \frac{\partial \hat{P}_b}{\partial \hat{W}_a} \leq 0, \text{ or } > 0 \quad \text{and} \quad d) \frac{\partial \hat{P}_a}{\partial \hat{W}_a} < 0$$

Here, it would also exist a tendency of increasing the participation of employees without formal labor contracts.

VI.4. An Increase in the Price of the Capital Services

It is possible to show that:

$$a) \frac{\partial \hat{W}_b}{\partial \hat{a}} < 0; \quad b) \frac{\partial \hat{W}^*}{\partial \hat{a}} < 0; \quad c) \frac{\partial \hat{P}_b}{\partial \hat{a}} \leq 0, \text{ or } > 0 \quad \text{and} \quad d) \frac{\partial \hat{P}_a}{\partial \hat{a}} \leq 0, \text{ or } > 0$$

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Thus, an increase in the price of the capital services – which can represent a larger relative scarcity - tends to reduce all wages of the economy, except those controlled by legislation. In relation to the probabilities and, therefore, to the proportion of employees with informal labor contracts the results are ambiguous.

VI.5. An Increase in the Efficiency of the Government's Fiscalization

In this case we would have:

\[ a) \frac{\partial W}{\partial h} < 0; \quad b) \frac{\partial W^*}{\partial h} < 0; \quad c) \frac{\partial P}{\partial h} > 0 \text{ and } d) \frac{\partial P_e}{\partial h} > 0 \]

An increase in the efficiency of the government's fiscalization, or an increase in the penalties, tends to reduce the wages and to rise the probabilities of obtaining an employment with formal contract. So, there would be a tendency to reduce the employees' participation without formal labor contract.

VII. Interpreting the Results

The model assumes two types of firms: some small and traditional and others big and modern. The first ones operate under competitive rules while the last ones operate with rationed jobs and higher wages. This is compatible with the evidences that the employees in small enterprises receive, on average, wages that are lower than employees in big enterprises do.

Since the costs of defrauding the legislation rise with firm size, it was assumed that the big firms only establish formal labor contracts, while the small ones only establish informal labor contracts. This hypothesis is compatible with the fact that the informal labor contracts are over-represented among the small enterprises and with the evidence of a positive wage differential in favor of the employees with formal labor contracts.
In the analysis, the job without formal contract appears as an alternative for those that don't get a job with a formal contract. Such hypothesis can help us to explain why the jobs without formal contracts are easier to find and of shorter duration. The existence of competitiveness in the segment of the labor market that does not offer formal contracts, can be also considered as an explanation for the anti-cyclical behavior of the proportion of employees with informal contracts.

The explanation that the increase in the costs of establishing a formal labor contract increases the employees' participation with informal labor contract is also forecasted by the model.

The main theoretical contribution of this paper, however, is to combine segmentation in the labor market with workers' heterogeneity, as follows.

VII.1. Worker's Qualification and Informal Labor Contracts Incidence

According to the model, we could infer, at least, four results concerning the incidence of workers without formal labor contracts.

First, it is possible to verify that the larger the workers' proportion with the skill B, the smaller will be the relative size of the segment with informal labor contracts. The probability of a random worker to be in the segment without formal labor contract is given for:

\[ P_{NI} = (1 - P_b)(1 - P_r)N + (1 - P_b)(1 - r)N = N(1 - P_b)(1 - rP_r) \]

Thus, \( \frac{dP_{NI}}{dr} = -N \left[ \left( 1 - rP_b \right) \frac{\partial P}{\partial r} + (1 - P_b)P \left( \frac{r \frac{\partial P}{\partial r} + 1}{P_b \frac{\partial P}{\partial r}} \right) \right] \), where

\[ \left( \frac{r \frac{\partial P}{\partial r} + 1}{P_b \frac{\partial P}{\partial r}} \right) > 0 \text{ and, therefore, } \frac{dP_{NI}}{dr} < 0 \]

Admitting that it is possible to generalize this proposition for the case of more than two skills, we can conclude that the larger the level of the workers' qualification, the
smaller will be the relative size of the sector with informal labor contract. The idea is that when the qualified workers' proportion rises, the wages of these workers tend to be reduced and, consequently, there is a rise in the demand for labor in this market. It is also true that the probability of a qualified worker to find a job based on his better skill tends to be reduced, but the point is that the number of employed workers in the modern firms tends to increase. As these firms have a smaller probability of moving themselves to the sector with informal labor contracts, the proportion of this segment will, invariably, be reduced.

This can help us to explain why proportion of employees without formal contract varies across areas. It would be expected that the areas with highest schooling levels are also those with the smallest proportion of employees without formal contract\(^{23}\). This result is, at least approximately, verified in Brazil. The south and southeast areas, which present the lowest incidence of workers without a formal contract are also those with the best educational performance; while the northeast area presents both the largest rates of employees without formal contract and the lowest schooling level\(^{24}\).

The second conclusion is that the larger the workers' proportion with skill B the larger will be the proportion of this attribute among the workers of the sector without formal labor contract. Defining \(\Omega\) as the ratio between workers with and without skill B, among the workers of the sector with informal labor contract:

\[
\Omega = \frac{(1-P_b)(1-P_o)rN}{(1-P_o)(1-r)N} = \frac{r-rP_b}{1-r}
\]

where,

\[
\frac{d\Omega}{dr} = \frac{(1-r)[(1-P_b)-r \frac{\partial P_b}{\partial r}]}{(1-r)^2} + r(1-P_b) > 0
\]

\(^{23}\) This could also be an argument to explain why the informal sector tends to be a characteristic of the developing countries, which present, in general, a lower average years of schooling.

\(^{24}\) Fernandes (1995) verified this proposition for the case of the Brazilian metropolitan areas. The coefficient of correlation between the proportion of employees without a formal labor contract and the average years of schooling years presented the expected sign, but very low (-0.22). This happened although one area (Belém) had one of the largest participations of employees with informal labor contract and one of the highest average of years of schooling. When this area is excluded from the analysis, the coefficient of correlation increases significantly, changing to -0.61. When the schooling indicator used was the number of workers without any instruction, the coefficients of correlation presented the expected sign and they become quite expressive: 0.54, when Belém is included and 0.92 when Belém is excluded.
Adopting the same generalization procedure of the previous case, the larger the educational level of an area the larger will be the workers' educational level operating in the sector with informal labor contract.

The idea is that when the proportion of qualified workers increases, the probability of these workers finding a job compatible with their more valued skill decreases. A larger contingent of people with a smaller probability of raffling a white ball in the first urn that they go increases the number of people qualified in the urns requiring more common skills. It is also true that the number of people going first to the urns that demand more common skills decreases, because part of them is now qualified. As the probability of raffling a white ball in a certain urn is the same for all workers (for those that are going to the first urn as well as for those that didn't raffle a white ball in the first urns that they went to), the proportion of qualified people in urns with lower wage tends to increase. This is independent of what happens with the proportion of white balls in the intermediary urns. Fernandes (1995) shows that a good adherence exists to this proposition for the Brazilian metropolitan areas.

The third conclusion is that those workers with skill B have a larger probability to be in the sector with formal labor contract. It is easy to verify that $P_e + (1 - P_e)P_s > P_s$. Thus, we expect that the larger the educational level the smaller is the probability of a worker to be in the sector without formal labor contract. The idea is that the most qualified workers, because driving themselves first for the highest urns, possess a smaller probability of drawing a ball in the inferior urns, which correspond to the sector without formal labor contract. This is in agreement with the available evidences.

Finally, the fourth conclusion is that the probability of a worker to be in the labor market without formal labor contract does not depend only on his skills. This probability depends also on the distribution of skills in the population.

It is easy to observe that an increase of the proportion of workers with skill B increases the probability of a worker that does not have this skill to be in the sector with formal labor contract, since $\frac{\partial P_s}{\partial \tau} > 0$. However, the effect of the increase in that portion
on the probability of workers with skill B to be in the sector with formal labor contract \[ P_{R_b}(N_i) \] is ambiguous\(^{25}\).

\[ P_{R_b}(N_i) = P_b + (1-P_b)P_a \text{ and,} \]

\[
\frac{dP_{R_b}(N_i)}{dr} = (1-P_b)\frac{\partial P_b}{\partial r} + (1-P_b)\frac{\partial P_a}{\partial r}
\]

where,

\[
\frac{\partial P_b}{\partial r} < 0 \quad \frac{\partial P_a}{\partial r} > 0
\]

The idea is that an increase of the proportion of qualified workers tends to reduce both the wages and the probability of these workers to get a job compatible with their worthy skills. If the probability of drawing a white ball in the intermediary urns was unaffected, the probability of a qualified worker to reach the inferior urns, those typical of the sector without formal labor contracts, would increase. However, these probabilities rise, providing an increase of the probability of getting a job with formal labor contract for the not qualified workers, and the result becomes ambiguous.

VII.2. Labor Qualification and Wage Differentials

The model has at least two predictions with respect to wage differentials. The first is that the wage differential (formal/informal) is positive and larger for the sub-population possessing the skill B. The expected wage differential for the sub-population N1 is

\[
D_1 = \frac{W_pP_a + W_2(1-P_b)P_a}{P_aW^* + (1-P_b)P_aW^*},
\]

while the expected wage differential for the sub-population N2 is

\[
D_2 = \frac{W_2}{W^*}.
\]

It is easy to verify that \( D_1 > D_2 \).

---

\(^{25}\) We can show that:

\[
\frac{dP_{R_b}(N_i)}{dr} = (1-P_b)(1-P_b) \left[ \frac{P_b}{1-rP_b} \frac{\partial N_{p1}}{\partial W_b} + \frac{\partial N_{p2}}{\partial W^*} \frac{1}{r} \frac{\partial N_{p1}}{\partial W^*} \right] + \frac{\partial N_{p1}}{\partial W^*} \frac{(1-P_b)P_aW_b - W^*}{1-rP_b} \left[ \frac{P_b}{1-rP_b} \frac{\partial N_{p1}}{\partial W_b} + \frac{\partial N_{p1}}{\partial W_b} \right]
\]

where, the first term is positive and the second term is negative.
This would help us to explain why the wage differential, between the sectors with and without formal labor contract, is larger for the workers' groups with higher schooling levels. The idea is that the more qualified workers, as they begin to raffle in urns with higher wages, have a smaller chance of raffling a ball in the urns with smaller wages. As the urns with smaller wages correspond to the sector with informal labor contract, the wage differential between the sectors with and without formal labor contract tends to be larger for the most qualified workers.

The second result is that an increase in proportion of workers with skill B tends to reduce the wage differential (formal/informal) in the two groups of workers. Notice that it is possible to define $D_1$ as,

\[
D_1 = \nabla + D_2 \text{ where,}
\]

\[
\nabla = \frac{(W_b - W_a)P_b}{P_b W^* + (1 - P_b)P_a W^*}
\]

Therefore, it is possible to show that $\frac{d \nabla}{dr} < 0$ and $\frac{d D_1}{dr} < 0$ and, therefore, $\frac{d D_1}{dr} < 0$. In general, it is expected that an increase in the educational level reduce the wage differential between the sectors for all educational groups.

The idea is that an increase in the proportion of qualified workers tends to reduce the wage for the worthy skills and to elevate the wages of the less valued skills, especially in the sector without formal labor contract. Again, Fernandes (1995) finds some evidence, for the Brazilian metropolitan areas, that accords to these propositions.

VIII. Final Remarks

The analysis developed in this paper is compatible with a series of stylized facts that have been observed in Brazil for employees without formal labor contract. However, not all the evidence was contemplated, in particular the model does not have a clear
explanation for the relative high degree of earnings inequality which is verified for the employees with informal labor contract.

The model is compatible with the fact that the formal/informal wage differential is higher in the groups with highest level of formal education. This happens because average wages increase with years of study only for employees with a formal labor contract. In fact, this differential rises because the wage variation with years of study is larger for the employees with a formal labor contract. This occurs due to the simplified nature of the model, which considers only an urn to the segment without formal labor contract. However, it would be expected from this analysis that the earnings inequality should be smaller for the employees without formal labor contracts, a fact that does not comply with the evidence.

According to the Brazilian household survey data (PNAD-1989) for men between 18 and 45 years old and living in the Brazilian metropolitan areas, the GINI coefficient for the distribution of wages (standardized by the working hours) was 0,492 in the group with a formal labor contract and 0,504 in the group without a formal labor contract. Therefore, the higher inequality verified for the employees with informal labor contract is still a fact to be explained.

Finally, another evidence that could be difficult to reconcile with our analysis is the growth in proportion of employees without a formal labor contract that occurred in Brazil in the 1990’s, a period without a rise in taxes and social contributions and with a rise in the average schooling level of the workers. Here, a possible explanation could be skill-biased technological change, which has been used to explain the increase in U.S. earnings inequality. The relative wage for less qualified workers fell substantially in the United States during the 1980’s, in spite of the fall in their proportion in this period. This suggests the existence of shifts in the relative demand for labor favoring more-skilled and skill-biased technological change has been one of the main explanations for these shifts.

The idea is that the technological change (possibly associated with the robotic and the computer revolution) has made skilled workers more efficient in jobs that were formerly done by unskilled workers (e.g., these technological changes have complicated many tasks that had previously been routine). Thus, the skilled workers continue doing

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26. See, for example, Johnson (1997).
the tasks that they did previously and, at the same time, they now perform tasks that were previously done by unskilled workers. In other words, a skilled worker is now equivalent to one skilled worker plus one (or a fraction of) unskilled worker. This is equivalent to rise in the relative supply of unskilled workers, it can explain the fall in the relative wage of the unskilled workers. In our model, an increase in the proportion of unskilled workers will cause a reduction in the proportion of workers with a formal labor contract. However, this link needs to be more carefully examined.

Reference


Fernandes, R., 1995, Qualificação da mão-de-obra e mercado de trabalho não-regulamentado (Doctorate Thesis, Department of Economics, Universidade de São Paulo, São Paulo).


