Texto para Discussão

Série Economia

TD-E 04 / 2009
Modeling Labor Market Segmentation
Prof. Dr. Vladimir Pinheiro Ponczek

Universidade de São Paulo

Faculdade de Economia, Administração e Contabilidade

de Ribeirão Preto

Reitor da Universidade de São Paulo
Suely Vilela

Diretor da FEA-RP/USP
Rudinei Toneto Junior

Chefe do Departamento de Administração
André Lucirton Costa

Chefe do Departamento de Contabilidade
Adriana Maria Procópio de Araújo

Chefe do Departamento de Economia
Walter Belluzzo Junior

A série TEXTO PARA DISCUSSÃO tem como objetivo divulgar: i) resultados de trabalhos em desenvolvimento na FEA-RP/USP; ii) trabalhos de pesquisadores de outras instituições considerados de relevância dadas as linhas de pesquisa da instituição. A série foi subdividida em função das principais áreas de atuação da FEA-RP/USP: Economia, Administração e Contabilidade. Veja o site da CPq na Home Page da FEA-RP: www.fearp.usp.br. Informações: e-mail: cpq@fearp.usp.br

Modeling Labor Market Segmentation

Luis Araujo

Michigan State University

EESP-FGV

Vladimir Ponczek

EESP-FGV

April 30, 2009

Abstract

In this paper, we develop a model that captures stylized facts of informal labor markets. We show how justice interference on informal contracts leads to penalties in the equilibrium wage of informal workers. We also state that, in a repeated game situation, an equilibrium where the wage gaps between formal and informal contracts diminish with the worker skills exists and is unique. These claims are supported by two assumptions: (i) the existence of a technology that makes possible a firm to buy information about the worker productivity and past actions; (ii) unskilled workers have a more homogenous productivity than the skilled workers.

Keywords: Labor market, Informality, Wage Differentials.

JEL codes: J31, J33, J42.

1 Introduction

In many developing countries, the informal sector represents a large share of the labor market. For instance Maloney (2004) estimates that informal jobs encompass 30% to 70% of the labor market in the majority of Latin American countries. Informal jobs are broadly defined as employment relationships not subject to labor regulations. These regulations vary from country to country and include minimum wage, annual bonuses, vacations, advance notice, severance pay, seniority premium, among other mandate benefits.[1]

The extant literature presents two contrasting views about the nature of informal employment. The first view argues that there exists barriers to entry in the formal sector. As a result, even though firms and workers would prefer to participate in the formal sector, for some of them the informal sector is the only option (see e.g. Fields, 1975; Chandra and Khan, 1993; Loayza, 1994, 1997). A natural implication of this view is that wages in the formal sector are on average higher than wages in the informal sector. This is consistent with most empirical evidence. Indeed, the stylized fact is that informal jobs pay less than formal jobs even for equally productive workers (see e.g., Roberts, 1989; Pradhan and von Soest, 1995; Funkhouser, 1996, 1997; Magnac, 2001; Gong and Van Soest, 2002; Frank McInteyre, 2004; Badaoui et. al, 2007; Botelho and Ponczek, 2008).

The second view argues that firms and workers choose between formal and informal contracts, and that some of them actually prefer informal contracts in order to escape labor regulations (see e.g. Rosenzweig, 1988; Maloney, 1998, 1999; Tybout, 2000). The choice between a formal and an informal relation is thus explained by differences in workers and firms characteristics. For instance, workers may have distinct preferences over the fringe benefits provided by the formal sector, and firms may have distinct costs associated with maintaining a formal status. In what follows we put forward a model that builds on the second view and which reproduces the stylized fact that on average wages in the formal sector are higher than wages in the informal sector.

We motivate our model with the evidence that in most countries job regulations require the payment of all mandate benefits even for workers hired under informal contracts (see Heckman and Pagés, 2000). Moreover, the employer is usually liable to pay fines over unpaid benefits.[2] In fact, justice branches in many countries (e.g. Argentine, Brazil, Chile, Dominican Republic) have special courts specialized in labor disputes which generally rule

---

[1] Heckman and Pagés (2000, 2004) summarize job regulations in Latin American and Caribbean countries.

[2] For example, the Brazilian labor code stipulates a 50% fine; the Philippine code stipulates a fixed P100,000.00 penalty (around US$2,000.00) .

in favor of the plaintiff, particularly if the worker is informally hired. If one takes this fact into account, a possible implication is that wages under a formal contract may be higher than wages under an informal contract after all the workers' gains and employers' costs are internalized.

We also attempt at explaining a related feature of labor market in developing countries, which has been unveiled by recent empirical evidence. Precisely, there is a negative relationship between the wage gap (difference between the formal and the informal wage) and the productivity of the worker (as captured by his education and experience). Botelho and Ponczek (2008) documents this characteristic showing that for workers in the higher quintile of the wage distribution the differential inverts with informal contract paying more than the formal ones. Similar patterns are found for older and more educated workers.[3] Lehman and Pignatti (2007) study the Ukrainian labor market and show that the informal jobs in the upper tail of the wage distribution pay equal or more than the formal ones, but there is a wage premium in favor of formal jobs in lower parts of the wage distribution.

We claim that the negative relation between the wage gap and the productivity of the worker is explained by asymmetric information in the labor market. First, there is an adverse selection problem because firms incur a cost in observing the productivity of the worker. This problem is particularly severe when workers have higher skills because the variance of productivity increases with skills. Table 1 and 2 present some evidence on the standard deviation of wages (proxy for productivity) by education levels and age (proxy for skills) in Brazil. As expected, the wage distribution becomes more disperse as the workers become more educated and more experienced.[4] The presence of asymmetric information also leads to a moral hazard problem because firms incur a cost in observing the past actions of workers. In particular, the firm is interested in knowing whether the worker has a reputation of suing his past employers over unpaid benefits. We capture both costs by assuming that the only way a firm can obtain information about the productivity and the past actions of workers is through previous employers' references, which is a time consuming process.

We demonstrate that the firm only has an incentive to access the previous "record" of a worker if she is matched with a skilled worker. Intuitively, since unskilled workers have similar productivity, information about their past history is beneficial only to the extent

---

[3]Tanuri – Pianto and Pianto (2003), using Brazilian cross-sectional data, also show that the earnings gaps between formal and informal workers are wider at low income quantiles than at high ones.

[4]Essentially this is so because high skilled workers are more productivity, and the first and second moments of the wage distribution increase.

Table 1: Distribution of wages in Brazil by schooling and gender

	standard deviation of wages		
	Total	Men	Women
3 or less years of education	7.1	8.4	3.4
4 to 7 years of education	9.5	11.5	5.0
more than 8 years of education	20.2	24.1	15.3

source: PNAD 2006

Figure 1: Distribution of wages in Brazil by schooling and gender

Table 2: Dispersion of wages by age groups

	standard deviation of wages		
	Total	Men	Women
less than 30 years old	7.04	7.18	6.83
30 to 50 years old	13.58	14.16	12.77
50 to 65 years old	25.74	32.01	21.90

source: PNAD 2006

Figure 2: Dispersion of wages in Brazil by age groups

that it is useful in anticipating whether the worker will sue the firm over unpaid benefits. It turns out that, irrespective of the cost of accessing past histories (as long as it is positive), there is no equilibrium in which firms have an incentive to access the record the worker upon meeting an unskilled worker. As a result, the equilibrium wage of an unskilled worker in the informal sector is relatively low because it incorporates the employer's expectation that the worker will sue the firm at the end of the contracting period. In contrast, since skilled workers are heterogeneous, the firm has an incentive to incur the cost of observing their past history irrespective of their behavior. In the aggregate, this implies that firms can condition their choice of contract on the past behavior of skilled workers, which may discipline their behavior. As a result, the equilibrium wage of a skilled worker in the informal sector is relatively high because it incorporates the employer's expectation that the worker will not sue the firm at the end of the contracting period.

The paper proceeds as follows. In the next section, we present the model. In the following section we comment on the robustness of our results. The last section concludes.

2 Model

We start with the description of the environment and with a characterization of the unique equilibrium in an economy that lasts for one period. We then extend our environment to an infinite-horizon economy and characterize the ensuing set of equilibria.

2.1 One-period economy

2.1.1 Environment

Consider a one-period economy with one good, a unit continuum of workers and a unit continuum of firms. Workers can be unskilled (u) and skilled (s). All unskilled workers have the same ability $a_w = 0$. Skilled workers instead have abilities $a_w \in \{1, 2\}$. Skills are observable but abilities are private information.[5] The measure of unskilled workers is $\mu \in (0, 1)$ and the fraction of skilled workers with ability $a_w = 1$ is $\pi \in (0, 1)$. The labor market is subjected to frictions. We capture these frictions by assuming that firms and workers meet randomly and in pairs, with one meeting per period. In a match with an unskilled worker, total production is equal to y_{00}. In a match with a skilled worker, total production is equal to $y_{a_w a_f}$, where a_w is the ability of the worker and $a_f \in \{1, 2\}$ is an action taken by the firm. The firm incurs a cost c_{a_f} if she chooses action a_f. We assume that $y_{a_w a_f}$ is strictly increasing in a_w and a_f, c_{a_f} is strictly increasing in a_f, and $a_w = \arg \max_{a_f \in \{1,2\}} \left(\theta y_{a_w a_f} - c_{a_f} \right)$, where $\theta \in (0, 1)$ is the bargaining power of firms (see below). An action is essential for production to occur in a meeting with a skilled worker, but the firm can always choose not to take any action (in this case we say that $a_f = 0$).

At the beginning of the economy, after matches are formed, each firm chooses between a formal (F) and an informal (I) contract. In a formal contract, the worker earns wage w and benefits $b(w)$, where benefits are set in accordance with the prevailing labor code. In an informal contract, there are no benefits and the worker only receives wages. We consider an environment where firms are heterogeneous in terms of the costs and benefits of being formal. For instance, a formal firm may have an easier access to the credit market and to subsidies offered by the government. However, she may face transaction costs associated with maintaining a formal status. We do not dwell here on the reasons underlying this heterogeneity. We simply denote the net cost (henceforth, cost) of being formal by $c \in \mathbb{R}$. This cost is privately observed by the firm and comes as a random draw from a cdf $G(c)$.

At the end of the period, all matches exogenously break down. However, before this

---

[5] For instance, we can think of skills as the level of education and of abilities as the quality of education.
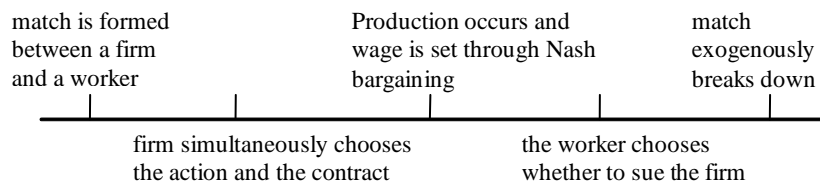
Figure 3: Sequence of Events

break occurs, each worker may choose to sue the firm if the firm did not pay the benefits required by the labor code. In this case, the worker wins the lawsuit. The firm then faces a penalty P and pays benefits $b(w)$, where w is the wage received by the worker. The worker can always sue a firm under a formal contract. However, there is a zero probability that he wins the lawsuit.

Workers and firms bargain over the wage. This bargaining occurs after the firm has made her decisions but before the worker's decision on whether to sue the firm. We solve the bargaining problem by applying the generalized Nash solution, where the bargaining power of the firm is equal to $\theta \in (0, 1)$. In the bargaining stage, firms and workers take as given the probability $\phi \in [0, 1]$ that the worker sues the firm under an informal contract. Finally, workers maximize the sum of wages and benefits, and firms maximize expected profits. The sequence of events is described in figure 3.

2.1.2 Equilibrium

The equilibrium concept we use is perfect Bayesian equilibrium, and we find the equilibrium by backward induction. Consider a generic match between a firm and a worker. First, consider the decision of the worker on whether to sue the firm. In a formal contract, because the firm pays the benefits required by the labor code, and there is a zero probability that the worker wins a lawsuit, the worker does not sue.[6] Consider instead an informal contract. Because the wage w is set before the worker's decision, the worker obtains w if he does not sue, and obtains $w + b(w)$ if he sues. It is thus a dominant strategy to sue. As a result, in any equilibrium, it must be the case that $\phi = 1$.

---

[6] Precisely, the worker is indifferent between suing and not suing the firm. We can always break the indifference by assuming that the worker incurs an arbitrarily small disutility $\varepsilon > 0$ (e.g., transaction costs) if he sues the firm.

We now solve the bargaining problem. The bargaining problem under a formal contract consists of finding the wage w that solves

$$\max_{w} \left[y_{a_w a_f} - w - b\left(w\right) \right]^{\theta} \left[w + b\left(w\right) \right]^{1-\theta}.$$

The first order condition implies a wage w_F such that

$$w_F + b\left(w_F\right) = \left(1 - \theta\right) y_{a_w a_f}.$$

In an informal contract, the worker always sues the firm. The bargaining problem is thus

$$\max_{w} \left[y_{a_w a_f} - w - b\left(w\right) - P \right]^{\theta} \left[w + b\left(w\right) \right]^{1-\theta}.$$

Hence, the wage w_I is such that

$$w_I + b\left(w_I\right) = \left(1 - \theta\right) \left(y_{a_w a_f} - P \right).$$

Assume that the firm chooses action a_f. The profit of the firm under a formal contract is thus $\theta y_{a_w a_f} - c - c_{a_f}$, while her profit under an informal contract is $\theta \left(y_{a_w a_f} - P \right) - c_{a_f}$. The firm chooses a formal contract if and only if

$$\theta y_{a_w a_f} - c - c_{a_f} \geq \theta \left(y_{a_w a_f} - P \right) - c_{a_f},$$

that is,

$$c \leq \theta P.$$

We now turn to the firm's choice of action a_f. Consider a meeting with an unskilled worker. In this meeting, the firm knows that the worker has ability $a_w = 0$, she does not take any action ($a_f = 0$). Consider now a meeting with a skilled worker. In principle, we could allow the worker to make an announcement to the firm about his ability. However, the worker always has an incentive to announce that he has ability $a_w = 2$. This is so because $a_w = \arg\max_{a_f \in \{1,2\}} \left(\theta y_{a_w a_f} - c_{a_f} \right)$ and $y_{a_w a_f}$ is strictly increasing in a_f. In fact, the first condition implies that the firm chooses $a_f = 2$ whenever she believes that the worker has ability $a_w = 2$, while the second condition implies that the wage of the worker is strictly increasing in the firm's action. As a result, when making her choice of action, the firm must assume that the probability she is facing a worker with ability $a_w = 1$ ($a_w = 2$) is equal to the unconditional probability π ($1 - \pi$). Given this belief, the firm chooses $a_f = 1$ under an informal contract if and only if

$$\theta \left[\pi y_{11} + \left(1 - \pi\right) y_{21} - P \right] - c_1 \geq \theta \left[\pi y_{12} + \left(1 - \pi\right) y_{22} - P \right] - c_2.$$

In turn, the firm chooses $a_f = 1$ under a formal contract if and only if

$$\theta\left[\pi y_{11} + (1-\pi)\, y_{21}\right] - c - c_1 \geq \theta\left[\pi y_{12} + (1-\pi)\, y_{22}\right] - c - c_2.$$

Note that, irrespective of the choice of the contract, the firm chooses $a_f = 1$ if and only if

$$\pi \geq \frac{(\theta y_{22} - c_2) - (\theta y_{21} - c_1)}{\theta\, (y_{22} - y_{12}) - \theta\, (y_{21} - y_{11})}.$$

Proposition 1 summarizes our result

Proposition 1 *There exists a unique perfect Bayesian equilibrium. In this equilibrium, workers under an informal contract always sue the firm. A firm chooses $a_f = 0$ in a meeting with an unskilled worker. In a meeting with a skilled worker, a firm chooses $a_f = 1$ if and only if*

$$\pi \geq \frac{(\theta y_{22} - c_2) - (\theta y_{21} - c_1)}{\theta\, (y_{22} - y_{12}) - \theta\, (y_{21} - y_{11})}.$$

Finally, a firm chooses a formal contract if and only if $c \leq \theta P$.

Note that the choice of the contract by the firm does not depend on the production level. Hence, it does not depend on the skill and/or the ability of the worker. This implies that the distribution of workers in terms of skills is the same under formal and informal contracts. However, the choice of the contract depends on the decision of workers on whether to sue the firm. For instance, if workers would never sue under an informal contract, all firms with cost $c \in (0, \theta P)$ would prefer to choose an informal contract.

In what follows, we are interested in the difference between wages under formal contracts and wages under informal contracts. For this reason, in order to provide an explicit expression for wages, we assume that $b(w) = bw$. This implies that

$$w_F(a_w, a_f) = \frac{(1-\theta)\, y_{a_w a_f}}{1+b},$$

and

$$w_I(a_w, a_f) = \frac{(1-\theta)\left(y_{a_w a_f} - P\right)}{1+b}.$$

Not surprisingly, wages are increasing in skills and ability, as higher skills and ability are associated with a higher surplus. Moreover,

$$w_F(a_w, a_f) - w_I(a_w, a_f) = \frac{(1-\theta)\, P}{1+b} > 0.$$

Conditional on the skill and the ability of the worker (and on the action of the firm), the wage under a formal contract is higher than the wage under an informal contract. This occurs because the worker always sues the firm, which reduces the surplus of the match by a positive amount P.

8

2.2 Infinite horizon economy

We now assume that the economy has an infinite horizon and let the discount factor of workers and firms be given by $\delta \in (0,1)$. In every period, firms and workers randomly match, and events unfold as in the one-period economy. In an infinite horizon economy, we need to be precise about the informational linkage across matches, especially the information of the firm about the history of her current worker. Henceforth we allow the firm to pay a cost $c_h > 0$ in order to access the "record" of the worker. This record includes the ability of the worker and a summary of his behavior in all previous matches. The set of possible records is thus given by

$$H = \left\{ h = (a_w, A) : a_w \in \{0, 1, 2\} \text{ and } A \in \{\overline{S}, S\} \right\}.$$

The first entry of each vector corresponds to the ability of the worker, and the second entry is equal to $\overline{S}$ if the worker never sued a firm in the past, and is equal to S otherwise. In general, the benefit of observing the worker's record is twofold. First, the firm can condition her choice of action on the ability of the skilled worker. Second, the firm can condition her choice of contract on the past behavior of the worker. For instance, the firm may decide to choose a formal contract if she observes that the worker sued in the past, and an informal contract otherwise.

Consider a generic match between a firm and a worker. The history of the worker includes the past behavior of firms in all matches in which the worker participated, and the past behavior of the worker which cannot be accessed by observing his record. It also includes the record of the worker. In turn, the history of a firm includes her past behavior, the past behavior of workers in all matches in which the firm participated and the records of workers with whom the firm matched in the past and incurred the cost c_h. It also includes the record of the firm's current worker, as long as the firm incurs the cost c_h.

There is no loss in generality if we assume that workers only condition their behavior on their current record and on the current behavior of the firm. In turn, there is no loss in generality if we assume that firms only condition their behavior on their type (cost c) and on the record of her current worker, in case she incurred the cost c_h. The reason is that in an environment with a continuum of agents and random meetings, the private information of an agent is independent of the behavior of the agent's current and future partners. There is also no loss in generality if we assume that unskilled workers do not condition their current behavior on the firm's current action. This is so because the firm's current action has no impact on the current utility of the worker and is independent of the behavior of the worker's future partners. Finally, because our environment is stationary,

9

we further restrict our attention to stationary strategies. This reasoning implies that the strategy of an unskilled worker is fully described by a function $\sigma_u : \{\overline{S}, S\} \to \{\overline{S}, S\}$. In fact, an unskilled worker may only condition his strategy on his record, and he is only called upon to make a choice between suing and not suing the firm in case the firm chooses an informal contract. Lemma 1 partially characterizes the behavior of firms and unskilled workers in any perfect Bayesian equilibrium.

Lemma 1 *In any perfect Bayesian equilibrium, unskilled workers with a record S and firms simply maximize current payoffs.*

Proof. Consider the decision problem of an unskilled worker with a record S. Because this record is absorbing, the current behavior of the worker does not change his future record. Thus, the optimal decision of the worker is to maximize current payoff. Consider now the problem of a firm. Note that in every match workers cannot observe the firm's history. As a result, the current choice of the firm has no implications on her future profit and her optimal decision is to maximize current profit. ∎

A direct implication of Lemma 1 is that, in any perfect Bayesian equilibrium, unskilled workers sue the firm in every opportunity. Moreover, firms choose a formal contract if this contract provides a higher profit when workers never sue. This implies that firms with cost $c \leq 0$ always choose a formal contract. Finally, firms choose an informal contract if this contract provides a higher profit even when workers always sue. This implies that firms with cost $c \geq \theta P$ always choose an informal contract. Lemma 2 builds on this result and shows that in any perfect Bayesian equilibrium, a firm has no incentive to incur the cost c_h upon meeting an unskilled worker.

Lemma 2 *In any perfect Bayesian equilibrium, firms do not pay the cost c_h in meetings with unskilled workers.*

Proof. Assume that there is a perfect Bayesian equilibrium in which some firm incurs the cost c_h upon meeting an unskilled worker. The only benefit the firm obtains in accessing the record of an unskilled worker consists in observing whether this worker sued another firm in the past. Hence, it must be the case that she faces a positive probability of meeting unskilled workers with record S and unskilled workers with record $\overline{S}$. Moreover, it must be the case that a positive measure of unskilled workers condition their behavior on their record, otherwise the firm would not gain anything by observing their records. As reasoned above, in a perfect Bayesian equilibrium, a worker with the record S always sues the firm.

Thus, it must be the case that some workers with a record $\overline{S}$ do not sue the firm. Now, in a perfect Bayesian equilibrium, if a worker with the record $\overline{S}$ does not sue the firm, it is because it is optimal not to do so. This result, combined with the fact that all workers have a record $\overline{S}$ at the beginning of period 1 and the fact that strategies are stationary, implies that unskilled workers never sue the firm on the equilibrium path. This contradicts the argument that the firm faces a positive probability of meeting unskilled workers with record S, and thus proves that there is no perfect Bayesian equilibrium in which some firm incurs the cost c_h upon meeting an unskilled worker. ∎

A direct implication of Lemma 2 is that, in any perfect Bayesian equilibrium, an unskilled worker simply maximizes his current utility and sues the firm in every opportunity. Indeed, because no firm ever observes his record, the worker has no incentive to maintain the record $\overline{S}$. Proposition 2 proves that, as long as the cost c_h is not too high and the discount factor δ is not too small, there exists a perfect Bayesian equilibrium in which skilled workers never sue. This equilibrium achieves the highest surplus in the class of all perfect Bayesian equilibria.

Proposition 2 *Assume that $\delta \geq \frac{by_{22}}{by_{22}+[1-G(\theta P)]P}$ and $c_h \leq (1-\pi)\left[(y_{22}-c_2)-(y_{21}-c_1)\right]$. There exists a perfect Bayesian equilibrium in which unskilled worker always sue, irrespective of their record. In turn, skilled workers sue if they have a record $(.,S)$ and do not sue if they have a record $(.,\overline{S})$. In this equilibrium the strategy of firms is as follows. In meetings with skilled workers, firms pay the cost c_h and observe the record of the worker. The Firm then chooses action 1 (2) if and only if the worker has skills 1 (2), and (i) chooses a formal contract if $c \leq 0$, (ii) chooses a formal contract if $c \in (0,\theta P)$ and the worker has record $(.,S)$, (iii) chooses an informal contract if $c \in (0,\theta P)$ and the worker has record $(.,\overline{S})$, (iv) chooses an informal contract if $c \geq \theta P$. In a meeting with an unskilled worker, the firm does not pay the cost c_h and does not choose any action. Moreover, she chooses a formal contract if and only if $c \leq \theta P$. Finally, whenever a firm chooses an informal contract, the behavior of the worker as induced by the strategy profile, is taken into account in the bargaining process.*

Proof. We have already described the behavior of unskilled workers and the choice of contract of firms with cost c such that $c \leq 0$ and $c \geq \theta P$. We also know that firms never incur the cost c_h in meetings with unskilled workers. Moreover, in meetings with unskilled workers, firms always choose $a_f = 0$ and firms with cost $c \in (0,\theta P)$ always choose a formal contract because they anticipate that these workers always sue. Consider now a meeting between a firm with cost $c \in (0,\theta P)$ and a skilled worker. If this firm anticipates that the

worker sues (which happens when the worker has a record S) she chooses a formal contract. Otherwise, she chooses an informal contract. Now, a firm is willing to access the record of a skilled worker if the benefit of doing of so matches the cost. Because in equilibrium all firms pay the cost c_h in matches with skilled workers, the only benefit a firm derives from also paying this cost comes from the observability of the ability of the worker. We obtain that a firm pays the cost if and only if

$$\pi \left(y_{11} - c_1 \right) + \left(1 - \pi \right) \left(y_{22} - c_2 \right) - c_h \geq \pi y_{11} + \left(1 - \pi \right) y_{21} - c_1,$$

that we can rewrite as

$$c_h \leq \left(1 - \pi \right) \left[\left(y_{22} - c_2 \right) - \left(y_{21} - c_1 \right) \right].$$

Finally, because $a_w = \arg \max_{a_f \in \{H,L\}} \left(\theta y_{a_w a_f} - c_{a_f} \right)$, the firm chooses $a_f = a_w$. Finally, we need to consider the behavior of skilled workers. Clearly, workers do not sue under a formal contract. In a match under an informal contract, workers with record $\left(a_w, \overline{S} \right)$ do not sue if and only if

$$\frac{\delta}{1 - \delta} y_{a_w a_w} \geq b y_{a_w a_w} + \frac{\delta}{1 - \delta} \left\{ G \left(\theta P \right) y_{a_w a_w} + \left[1 - G \left(\theta P \right) \right] \left(y_{a_w a_w} - P \right) \right\}.$$

We can rewrite this condition as

$$\delta \geq \frac{b y_{a_w a_w}}{b y_{a_w a_w} + \left[1 - G \left(\theta P \right) \right] P}.$$

Since $y_{22} > y_{11}$, a necessary and sufficient condition is that

$$\delta \geq \frac{b y_{22}}{b y_{22} + \left[1 - G \left(\theta P \right) \right] P}.$$

This concludes our proof. ∎

Proposition 2 implies that the difference in wages between a formal contract and an informal contract for an unskilled worker is

$$\Delta w_0 = \frac{\left(1 - \theta \right) P}{1 + b} > 0,$$

while the corresponding difference in wages for a skilled worker with ability $a_w \in \{1, 2\}$ is

$$\Delta w_{a_w} = -\frac{b \left(1 - \theta \right) y \left(a_w, a_w \right)}{1 + b} < 0.$$

In summary, the difference between wages under formal contracts and wages under informal contracts is decreasing in skills.

Finally, the average wage of a worker in the formal sector is higher than the average wage in the informal sector as long as the proportion of unskilled workers (μ) is high enough:

$$\mu > \frac{\pi y_{11} + (1 - \pi) y_{22}}{\frac{P}{b} + \pi y_{11} + (1 - \pi) y_{22}}.$$

3 Conclusion

In this paper, we build a model addressing aspects related to formal and informal labor markets in developing countries. In the model, firms decide to hire workers under formal or informal contracts based on its own characteristics. The existence of penalties for hiring informal workers may lead to wage gaps favoring formal contracts in a situation where firms do not have information about the worker's past history. A technology that disclosures information on the agents' past actions generates equilibrium where the informal worker does not sue the firm. Differences on the profitability of acquiring costly information for heterogeneous workers explain differences in the wage gaps. We assume that the productivity dispersion of skilled workers is higher than the unskilled. We also assume that the information on worker's productivity is bundled with his past actions. Therefore, firms will only benefit to acquire information on skilled workers. This guarantees the existence of an equilibrium where skilled workers never sue and, therefore, do not pay wage penalties under informal contracts. Informal unskilled workers are not screened and have incentive to sue. Thus, wage differentials for unskilled workers persist.

References

[1] El Badaoui, E., Strobl, E., and Walsh, F., 2008. Is There an Informal Employment Wage Penalty? Evidence from South Africa. Economic Development and Cultural Change 56(3): pp.683-710.

[2] Botelho, F. and Ponczek, V., 2008. Segmentation in the Brazilian Labor Market, Textos para discussão 165, Escola de Economia de São Paulo, Getulio Vargas Foundation (Brazil).

[3] Chandra, V. and Khan, M.A., 1993. Foreign Investment in the Presence of an Informal Sector. Economica 60, 79-103.

[4] Lehmann, H. and Pignatti, N., 2007. Informal Employment Relationships and Labor Market Segmentation in Transition Economies: Evidence from Ukraine, IZA Discussion Papers 3269, Institute for the Study of Labor (IZA).

[5] Fields, G. S. 1975. Rural-Urban Migration, Urban Unemployment and Underemployment, and Job-Search Activity in LDC's. Journal of Development Economics 2 (June): 165–87.

[6] Fields G. S., 1990. Labour Market Modeling and the Urban Informal Sector: Theory and Evidence. In David Turnham, Bernard Salomé, and Antoine Schwarz, eds., The Informal Sector Revisited, Paris: Development Centre of the Organization for Economic Co-Operation and Development.

[7] Fields G. S., 2007. Modeling Labor Market Policy in Developing Countries: A Selective Review of the Literature and Needs for the Future. World Bank Policy Research Working Paper 4362.

[8] Funkhouser, E., 1996. The urban informal sector in Central America: household survey evidence. World Development, v. 24, n. 11, pp.1737-51

[9] Funkhouser, E., 1997. Mobility and Labor Market Segmentation: The Urban Labor Market in El Salvador. Economic Development and Cultural Change 46, 123-153.

[10] Gong, X., and van Soest. A., 2002. Wage Differentials and Mobility in the Urban Labour Market: A Panel Data Analysis for Mexico. Labour Economics 9 (September): 513–29.

[11] Heckman, J. and Pages,C., 2004. Law and Employment: Lessons from Latin America and Caribbean, University of Chicago Press, Chicago.

[12] Heckman, J. and Pages,C., 2000. The Cost of Job Security Regulation: Evidence from Latin American Labor Markets, Economia: The Journal of Latin American and Carabbean Economic Association, Vol 1, No. 1, pp.109-154

[13] Loyaza, M.V., 1994. Labor Regulations and the Informal Economy. World Bank Policy Research Working Paper, No. 1335, Washington, D.C.

[14] Loyaza, M.V., 1997. The Economics of the Informal Sector: A Simple Model and Some Empirical Evidence from Latin America World Bank Policy Research Working Paper, No.1727, Washington, D.C.

[15] Magnac, T. (1991) Segmented or Competitive Labor Markets? Econometrica 59(1): pp. 165-87.

[16] Maloney, W., 1998. Are LDC Labor Markets Dualistic? Working paper (February), World Bank, Washington, DC.

[17] Maloney, W., 1999. Does Informality Imply Segmentation in Urban Labor Markets? Evidence from Sectoral Transitions in Mexico. World Bank Economic Review 13, 275–302.

[18] Maloney, W., 2004. Informality Revisited. World Development 32 (July): 1159–78.

[19] McIntyre, F. (2008) An Empirical Model of Shadow Markets and the Minimum Wage in Brazil. University of Michigan Business Economics Seminar.

[20] Pradhan, M., and van Soest, A., 1995. Formal and Informal Sector Employment in Urban Areas of Bolivia. Labour Economics 2 (September): 275–97.

[21] Roberts, B. 1989. The Other Working Class: Uncommitted Labor in Britain, Spain, and Mexico. In Cross-National Research in Sociology, ed. M. L. Kohn, 352–72. Newbury Park, CA: Sage.

[22] Rosenzweig, M., 1988. Labor Markets in Low Income Countries. In Hollis Chenery and T.N. Srinivasan, eds., Handbook of Development Economics, Volume 1. (Amsterdam: North Holland).

[23] Tannuri-Pianto, M. E. and Pianto, D. M. (2008) Informal Employment in Brazil ? A Choice at the Top and Segmentation at the Bottom: A Quantile Regression Approach." Serie de Textos para Discussao n 236 - Universidade de Brasilia.

[24] Tybout, J.. 2000. Manufacturing Firms in Developing Countries: How Well Do They Do, and Why? Journal of Economic Literature 38 (March): 11–44.