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Employment and Labor Regulation: Evidence from Manufacturing Firms in Bolivia, 1988-2007[♥]

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Abstract

This paper analyzes employment in Bolivian registered manufacturing firms during 1988 to 2007, establishing its relationship with labor regulation. Estimating job flows, we find that firms with high temporary worker rates (less labor regulation costs) are those with both higher job reallocation rates and higher net employment growth, and only they contributed to employment growth during the country economic downturn, 1998-1999. In addition, estimating demand functions, we find the following effects of recent changes in labor norms: i) the compulsory basic salary rise in 2006-2009 entailed costs in terms of job losses, 5.6 percent for production workers and 4.8 percent for non-production workers; iii) the major labor costs derived from the new pension law, enacted in 2010, decreased employment demand around 1 percent; and, iv) labor protection policies decreased production workers demand.

Keywords: job flows, labor demand, labor regulation, translog function, unbalanced panel

JEL Classification: D24, J01, J23, K31

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I. Introduction

The employment and labor regulation relationship is a key topic in labor economics in order to evaluate the importance of norms to explain labor market outcomes. This issue is especially relevant for the Bolivian case for two contrasted reasons. First because labor regulation has high standards that increased even further since 2006, which made the country rank among the highest in the world in this regard (see, e.g., the Employing Workers Indicators of the World Bank and the Labor Freedom Index of the Heritage Foundation). Second because worker' rights have, in practice, applied to only a fraction of the labor force. For instance, in 2007 only 9.9 percent of urban workers had jobs subject to labor regulation; considered to be those simultaneously having job security, health insurance coverage, retirement pension contributions and Christmas bonus (Muriel and Ferrufino, 2011).

Despite the relevance of potential labor regulation impact on employment in Bolivia, empirical studies are very scarce. As far as we know, for the manufacturing sector, only Jiménez and Landa (2004) estimated job flows as well as employment dynamics as a function of salaries and value-added, both covering the 1996-1999 period. In addition, there are no research to evaluate employment performance and its relationship with labor regulation, aside from cross-country studies in which Bolivia applies to one observation (e.g. Botero *et al.* 2004, Heckman and Pagés 2004, and Kaplan 2009).

In this regard, this research analyzes the links between employment and labor regulation using two approaches. The first approach consists of studying job flows over time, and evaluating changes that can be attributed to labor regulation among other relevant factors. The second approach is based on estimating labor demand functions, which allows to studying – through the estimated employment-salary elasticities – the effect of labor regulation costs on employment by using micro-simulations. In both cases the information used is an unbalanced and broken panel for 1988-2007 of Bolivian registered manufacturing firms, which has been constructed for this research.

Jobs flow indicators are developed following Davis *et al.* (1996), Haltiwanger and Schuh (1999), Haltiwanger and Vodopivec (2002), and Haltiwanger *et al.* (2006). Initially we explore the main stylized facts emerging from these variables alone, observing what follows. First, job flows have relatively low magnitudes compared with the experiences of other

countries (see Davis *et al.* 1996). Second, net employment increases at different average rates during the period of analysis, following the business cycles to some extent. In particular, more jobs were destroyed than created in the 1998-1999 period, with negative growth of net employment of 3 percent, which can be attributed to the economic recession that Bolivia experienced at that time. The highest net employment growth rate is observed in the 2006-2007 period, and it can be associated to the economic expansion that took place at that time. Lastly, we found that net employment growth is relatively more volatile for non-production workers than for production workers, but the destruction of jobs is more severe for production workers in periods of economic downturn.

Next we analyze the links between job flows and regulation. Typically, this study has been performed observing country labor regulations differences (see Rajan and Zingales 1988, Micco and Pagés 2004, and Haltiwanger *et al.* 2006). However, because we are interested only in a single country, we propose an indicator related with labor regulation, taking advantage of the Bolivian labor regulation characteristics: the rate of temporary workers over total permanent salaried workers. This indicator is positively related with less labor costs, and implies less enforcement of labor regulation. The results show that firms with high rates of temporary workers have higher job reallocation rates as well as higher net employment growth. In addition we find that firms with a high proportion of temporary workers were the only type of firms that contributed positively to the net creation of jobs during the period of economic downturn, 1998-1999.

Labor demand functions are specified from a translog (transcendental logarithmic) production function, where labor regulation costs are considered as a tax (or taxes) proportional to the monthly basic salary. In addition, we assume that firms subject to these costs can establish their salary level, which in turn will allow them to hire more productive workers, compared with those not covered by the labor regulation. This hypothesis allows avoiding potential endogeneity problems between employment and salaries at the firm level. However, we evaluate whether the registered Bolivian manufacturing firms support this theory empirically by applying the Hausman test, which confirms this premise. As far as we know, this approach has never been used to empirically analyze labor demand functions, which would imply a contribution to this empirical literature.

We initially estimate labor regulation costs. They are extremely significant if we take into account that, on average, they raise the basic salary by nearly 51 percent. For instance, it

implies that firms that only pay basic salaries in the manufacturing sector should increase their labor costs by 51 percent if they decide to be subject to labor regulation costs. However, entry firms may transfer part of these costs to workers.

The employment-salary elasticities estimated show that an increase of 1 percent in labor costs decreases demand for production workers by 0.49 percent, and demand for non-production workers by 0.43 percent. In addition, we find that labor protection rules have a negative impact on production workers demand, which would be more relevant since 2006 with the new norms.

Finally, we present two micro-simulations for evaluating regulation changes in recent years: the basic salary mandatory increase in 2006-2009, and the new labor costs derived from the new pension system since 2010. In the first micro-simulation, the exercise shows that this entailed costs in terms of job losses of 5.7 percent for production workers and 4.8 percent for non-production workers. In the second micro-simulation, employment demand decreased by 1.2 percent for production workers and by 1.0 percent for non-production workers.

The remainder of the paper proceeds as follows: Section II presents a brief overview of labor regulation in Bolivia. Section III describes in detail the methodology used in both approaches. Section IV provides a detailed description of the data focusing on the linkages of firms across time. Section V shows the job flow indicators and correlations with labor regulation. Section VI discusses the labor demand estimations and the impact of labor regulation costs on employment. Finally, Section VII shows the conclusions.

II. Labor Regulation in Bolivia: An Overview

Bolivian fundamental workers' rights were created in 1939 with the enactment of the General Labor Decree, which became law in 1942. This law – and posterior rules that regulated, complemented, and made some changes to the law – established job security, salary policy, social insurance, and trade union legitimacy, which we explain briefly in turn.

The General Labor Law (GLL) stipulates that an employer-employee relationship begins with a labor contract, which may be oral or written. There are three main types of labor contracts: indefinite, fixed-term and for specific tasks or services. The first mode of contracts allows workers to have all the labor rights, which are stability, bonuses, social

security, and so on. However, workers have a trial period of three months before these contracts become effective.

Fixed-term contracts undertake only the labor payment, which can be made each month, corresponding to a monthly basic salary, or divided into installments that are negotiated between employers and employees.¹ In addition, these contracts cannot last more than one year, can be renewed only once, and must be of short-term work type (becoming indefinite otherwise).

Specific tasks or services contracts also consider only the labor earnings. Nevertheless, they are not proper employer-employee relationships, but rather employer-self-employed or employer-micro firm relationships.

Workers with indefinite contracts have had protected jobs, but with modifications over time. Until 1965, the labor rules permitted dismissals but with compensations paid by firms: a severance payment of three monthly salaries if the employer did not announce the dismissal 90 days in advance, and a compensation of one monthly salary per year of work if the worker had more than five years working in the firm (the latter being applied even though for voluntary retirements). In addition, layoffs without any compensation were justified only under “bad worker behaviors”. That is to say, when workers intentionally damaged work instruments, revealed firm industrial secrets, were careless with industrial safety, had more than six days of absence without justification, did not comply with the labor contract, or stole from the company.²

In 1965, through the Law Decree 7072, the job security policy was changed prohibiting layoffs, except in exceptional cases approved by the Ministry of Labor. This rule was repealed in 1985, and some degree of flexibility, established before this change, was allowed again (see Supreme Decree 21060). In addition, during 1985 to 2005 some firms hired workers using civil contracts, which were hired under the civil code, thus avoiding some labor regulation costs.

In 2006, the job security policy changed again towards greater protection. Since then, dismissals and civil contracts has been prohibited, and layoffs has been justified only under

¹ Since 2009, however, the government determined (but has not yet regulated) that these contracts are subject to all labor rights.

² Most workers of the agriculture and public sectors have been excluded from these job security rules. However, unions in the public sector, principally in health, education and mining, became stronger over time, achieving special protected jobs rules.

the mentioned “bad worker behaviors”. However, if a bad behavior cannot be legally proved, a worker can accept to be fired, but with the right of receiving the dismissal compensations described above.

In 2009, the Bolivian government established two additional rules. First, Job immovability was determined for both parents during the pregnancy period, until the child reaches one year of age.³ Second, the compensation of one monthly salary per year of work was extended for employees with less than five years of work in the firm.

Bolivian labor regulation has a dense salary policy. Firms offer to candidates a monthly basic salary, which has to be at least equal to the national minimum salary. Until 2007, the increase of the monthly basic salary was negotiated between firms and employees; however, since 2007 the government establishes each year a lower bound for this increase according to the inflation rate.

Besides to the basic salary, workers receive the following payments:

- i) Christmas bonus, which corresponds to one monthly basic salary per year, or in proportion to the time worked when the months worked are less than one year;
- ii) one monthly basic salary per year (or proportional to it) when the firm has positive net profit in the year (This benefit should represent 25 percent or less of the net profit);
- iii) one non-compulsory production bonus, which corresponds to one monthly basic salary per year (or proportional to it), paid when annual production exceeds the target set at the beginning of each year by both firms and unions;
- iv) a *quinquennium*, which corresponds to five monthly basic salaries, paid every five years;
- v) a monthly Sunday salary for production workers, established as an incentive for punctuality and attendance, equal to the monthly basic salary divided by the business days in a month and multiplied by the Sundays of the month;
- vi) a monthly seniority bonus, which is a percentage of three minimum wages: 5 percent for workers who have worked in the firm between two and four years, 11 percent for between five and seven years worked, 18 percent for between eight and ten years

³ This rule used to benefit only mothers.

worked, 26 percent for between eleven and fourteen years worked, 34 percent for between fifteen and nineteen years worked, 42 percent for between twenty and twenty-four years worked, and 50 percent for those who have worked in the firm for twenty five years or more;

- vii) a monthly border area bonus, equal to 20 percent of the monthly basic salary paid to workers whose workplaces are located within 50 linear kilometers of an international border;
- viii) surcharges for overtime, work in days off, national holidays or at night, with certain differences by gender favoring women; and,
- ix) yearly paid holidays, which correspond to 15 working days for workers who have worked between one and five years in the firm, 20 days for workers between 5 to 10 years of work, and 30 days for workers with 10 years of work or more.

In terms of social security, the Bolivian regulation has established that firms must be commitment with their workers' health. In this regard, the most relevant rules are: i) health insurance payment, around 10 percent of the monthly basic salary; and ii) the salary payments and other compensations to mothers during downtimes due to pregnancy (forty-five days before and forty-five days after the birth of the child or more in case of illness) as well as due to breastfeeding.

Since 1956, the Bolivian social security has included the pension system, but with two fundamental modifications over time. The first change was made in 1996 (November 26th), when the system passed from a *pay-as-you-go* system to a *fully-funded* system (see Law 1732). The former system consisted of one basic pension fund plus 38 complementary funds, all of them managed by the public sector. Contributions to the basic pension system were made by employees, 2.5 percent of their corresponding monthly basic salaries, employers (4.5 percent) and government (1.5 percent that in practice covered only public sector workers). Contributions to the complementary pension funds were made by workers, being, on average, 6.3 percent of their monthly basic salaries, but ranging from 3.5 percent to 12 percent (see von Gersdorff, 1997).

In 1996 the pension system was merged into two pension funds that were managed by private institutions. The contributions were standardized to 10 percent of the monthly basic salary plus 0.5 percent for the pension system operator. In addition, each worker had to pay

1.71 percent for her/his common risk insurance (applied to non-labor accidents or illnesses causing disability or death), and firms had to pay 1.71 for labor risk insurance (labor accidents or illnesses causing disability or death).

The second fundamental modification was made in 2010 (see Law 065). The pension law passed the system to the public sector management, establishing a hybrid between both a *pay-as-you-go* system and a *fully-funded* system. Contributions were increased to thirteen times per year, including payments with the Christmas bonus. In addition, solidarity and compulsory contributions were determined for a solidarity pension fund, for workers whose contributions do not allow reaching a minimum retirement pension. These contributions are paid by firms, 3 percent of the basic salary plus Christmas bonus costs, and workers, 0.5 percent of the monthly basic salary and the Christmas bonus plus a scale between 1 to 10 percent applied progressively to the monthly basic salary and the Christmas bonus when they are high.

Lastly, the law established workers' unionization rights in order to protect collective interests through organized representations. Trade unions can negotiate better working conditions with their employers, determine collective agreements with them and/or be channels of conciliation and arbitrage between employees and employers. In addition, they have the right to strike if their demands are not adequately met.

The Bolivian workers' rights described briefly above have been ranked among the highest standards in the world;⁴ however, they have covered only a small fraction of the labor force. For instance, the Household Survey of 2007 shows that for urban workers with over 14 years of age:⁵ i) only 19.3 percent of them have secure jobs; ii) 28.3 percent receive Christmas bonus and 6.8 percent profit and/or production bonuses; iii) 19.3 percent are affiliated with the pension system; and iv) 24.3 percent have health insurance. Only 9.9 percent of urban workers have at the same time job security, health insurance coverage, retirement pension contributions and the Christmas bonus. In addition, these workers have, on average, more years of schooling, more experience and better economic conditions compared with the rest (see Muriel and Ferruffino, 2011).

⁴ See, for instance, the Employing Workers Indicators of the World Bank and the Labor Freedom Indexes of the Heritage Foundation.

⁵ We consider only urban areas because employment in rural areas is concentrated in household units, working in the agriculture sector.

III. Methodology

We analyze the links between employment and Bolivian labor regulation considering two approaches. The first method consists of constructing job flow indicators in order to have a comprehensive understanding of employment dynamics over time, and the role that labor rights play on these changes. The second approach consists of estimating static labor demand functions, which permits to analyze the impact of labor regulation, and its relevant changes, on employment. Each methodology is discussed in detail below.

III.1. Job Flow Indicators

Job flow indicators are constructed following Davis *et al.* (1996), Haltiwanger and Schuh (1999), Haltiwanger and Vodopivec (2002), and Haltiwanger *et al.* (2006). Table 1 shows these indicators, which are standard in the literature mentioned.

Table 1: Job Flow Indicators

Indicators	At the Firm/Plant Level	At the Sector Level
Job creation rate (<i>CR</i>)	$\tau_{CR,jt} = \begin{cases} \frac{\Delta x_{E,jt}}{0.5(x_{E,jt} + x_{E,jt-1})} & \text{if } \Delta x_{E,jt} > 0 \\ 0 & \text{otherwise} \end{cases}$	$POS_t = \frac{\sum_j^+ \Delta x_{E,jt}}{0.5(x_{E,t} + x_{E,t-1})}$
Job destruction rate (<i>DR</i>)	$\tau_{DR,jt} = \begin{cases} \frac{ \Delta x_{E,jt} }{0.5(x_{E,jt} + x_{E,jt-1})} & \text{if } \Delta x_{E,jt} < 0 \\ 0 & \text{otherwise} \end{cases}$	$NEG_t = \frac{\sum_j^- \Delta x_{E,jt}}{0.5(x_{E,t} + x_{E,t-1})}$
Net employment growth (<i>NG</i>)	$\tau_{NG,jt} = \tau_{CR,jt} - \tau_{DR,jt}$	$NET_t = POS_{CR,t} - NEG_{DR,t}$
Job reallocation rate (<i>RR</i>)	$\tau_{RR,jt} = \tau_{CR,jt} + \tau_{DR,jt}$	$SUM_t = POS_{CR,t} + NEG_{DR,t}$
Excess job reallocation rate (<i>ER</i>)	$\tau_{ER,jt} = \tau_{RR,jt} - \tau_{NG,jt} $	$EXC_t = SUM_t - NET_t $

Source: Haltiwanger, Scarpetta and Schweiger (2006).

The subindexes j and t refer, respectively, to firm and time, x_E represents employment, and the symbol Δ denotes the first-difference operator: $\Delta x_{E,jt} = x_{E,jt} - x_{E,jt-1}$.

Gross job creation at time t is defined in the literature as the employment gains summed over all firms or plants that expand or start up between $t-1$ and t , while job destruction at time t equals employment losses summed over all firms or plants that contract or shut down between $t-1$ and t .⁶ Usually job destruction is expressed as a positive number so that net employment changes are measured as the difference between job creation and destruction.

⁶ Ideally the unit of observation is a plant rather than a firm, but data at the plant level are not available for the Bolivian manufacturing case.

These flows can be expressed as rates by dividing them by the total number of jobs available in an economy or sector as shown in Table 1.

The sum of the job creation rate and the job destruction rate is the job reallocation rate, while the difference is the net employment growth rate. In other words, job creation and destruction figures decompose the net employment change into a component associated with growing firms and a component associated with shrinking firms. A measure of churning or reallocation of jobs, which is over and above the number of job reallocations necessary to accommodate a given net aggregate employment growth rate, is the excess job reallocation rate, and is defined as the job reallocation rate minus the absolute value of the net aggregate employment growth rate. This rate is interpreted as a measure of churning or reallocation of jobs within an economy or sector that detracts from the impact of net growth.

The literature points out that labor regulation may reduce job creation, job destruction, and job reallocation, which may lead to a negative effect on net employment growth. Typically, this analysis has been performed by using a difference-in-difference approach, studying cross-country differences in order to have labor regulation variability (Rajan and Zingales 1988, Micco and Pagés 2004, Haltiwanger *et al.* 2006, and Kaplan 2009).

However, because we are interested only in a single country, we construct an indicator related with different labor regulation enforcement at the firm level: the rate of temporary workers over total permanent salaried workers. As discussed above, temporary workers have had both fixed-term contracts and civil contracts, meaning lower labor regulations costs in terms of flexibility, non-coverage of social insurance, and non-payment of bonuses, among others. The hiring of these workers has been motivated by two main reasons: to avoid costs related to permanent workers, and to conciliate firms' employment needs with their business cycles.

The indicator described above is used to classify firms by their labor regulation enforcement in order to analyze differences, or similarities, between them in terms of job flows. In addition, we reinforce this analysis by estimating the following regression (see Haltiwanger *et al.* (2006) for a discussion of this approach at the country level):

$$(1) \quad z_{j,t} = \alpha + \sum_r \alpha_r reg_{rj,t} + \sum_w \beta_w d_{wj,t} + u_{j,t}$$

where $z_{j,t}$ represents the job reallocation rate as well as the net employment growth of workers in firm j at time t ; $reg_{r,jt}$ is the labor regulation indicator r ; d_w ($w=1, 2, \dots, W$) is the w^{th} relevant observed firm characteristic that affects job flows; the alphas and betas are the coefficients to be estimated and $u_{j,t}$ is the error term with the usual properties.

III.2. Labor Demand

The impact of labor regulation costs on employment can be approximated as a tax (or taxes) proportional to the basic salary, which, in turn, is estimated through labor demand functions (e.g., Hamermesh 1993, and Heckman and Pagés 2004). In addition, this approach is used to evaluate labor regulation changes in recent years through micro-simulations (e.g., Kesselman *et al.* 1977, Nissin 1984, Gruber 1997 and Peichl and Sieglochz 2010).

The specification of the labor demand function is based on several assumptions, which are discussed for the case of the Bolivian registered manufacturing sector. The first issue is regarding the endogeneity problem between employment and salaries. We consider that firms subject to labor regulation costs can establish their salary paid that, in turn, will allow them to hire more productive workers given the benefits linked to the regulation.

The previous hypothesis is supported by the facts that follow. As mentioned above, a very low proportion of the urban employed population is covered by labor regulation, and it is, on average, more qualified as compared to the rest of the workers. In addition, Muriel (2011) shows, through earnings regressions, that salaried workers with both pension system affiliation and Christmas bonus have higher labor earnings, even controlling for years of schooling, experience, economic sector, and firm size. These evidences mean that, on average, workers subject to labor regulation are better-paid and probably more productive compared to those not subject to regulation.

The second issue is related to the assumption of the goods market structure, which shapes (together with other variables) the labor demand function. In order to be consistent with imperfections in the labor market, we suppose that firms compete in prices, following the model developed by Muriel (2004), which is a Hotelling model with transportation costs. In

equilibrium, prices are equal to the price level that would prevail under perfect competition plus a percentage of these associated with transport.⁷

The third issue relates to the choice, among various options, of the best functional form of the production function. In this case, following Christensen *et al.* (1973),⁸ Berndt and Christensen (1973) and Binswanger (1974), the translog (transcendental logarithmic) production function is chosen because it has a generic technological specification that takes into account second-order effects.

In this regard, the usual Cobb-Douglas and CES (Constant Elasticity of Substitution) production functions are discarded because of the restrictions they impose on elasticities. For instance, the elasticity of substitution for all factors is one in the first case and constant in the second case. The generalized Leontief and the CES translog, which also account for second-order effects, are also discarded because of their limitations in empirical estimations. In the first case, the relationship between employment and salaries is derived from the estimated constant of the regression that can, in practice, represent other unobserved relevant factors related with labor demand. In the second case, the function does not easily allow calculations for multiple inputs and firm characteristics (other than inputs) given its non-linear specification.

The final issue is about the variable used empirically as production: value-added or gross product. In this case, the available data allow using the gross product, taking advantage of richer information.

The next subsection describes the model in detail, taking into account the assumptions discussed above for the case of the Bolivian registered manufacturing sector.

The model

We assume that a representative firm subject to labor regulation wants to minimize its costs given y units of production. The problem of the firm in period t can be written as:

⁷ We do not describe explicitly this assumption because it is not needed for the purpose at hand.

⁸ L.R. Christensen, D.W. Jorgenson and L.J. Lau (1970), "Conjugate Duality and the Transcendental Logarithmic Production Function"; see reference in Binswanger (1974).

$$(2) \quad \min w_S x_S + w_U x_U + w_K x_K + w_M x_M$$

$$\text{such that } f(q_S x_S, q_U x_U, x_K, x_M) = y$$

where x_i is the quantity of the factor i ($= S, U, K,$ and M), which are, respectively, non-production workers, production workers, physical capital, and intermediate consumption; w_i is the return of factor i ; $f(\cdot)$ is the production function assumed to be twice differentiable and concave; and q_i ($i= S, U$) is the quality of employment of type i , resuming skills in terms of education, experience, abilities, training, etc. We divide employment into production and non-production workers in order to capture specific employment-salary elasticities for these types of jobs.

The employment returns include labor regulation costs that are assumed to be proportional to the basic salary: $w_i = (1 + \theta_i) \bar{w}_i$, where $\theta_i = \sum_c \theta_{ic}$ and c refers to each specific regulation cost.

The representative firm is willing to take on higher labor costs derived from the labor regulation only if it can employ workers of a higher level of quality to obtain higher labor productivity. This behavior is modeled by introducing a relationship between both variables, following Oi (1990):⁹

$$(3) \quad w_i = g_i(q_i, \tilde{w}_i(\tilde{q}_i)), i= S, U$$

with $g_{i,1} > 0, g_{i,2} > 0, g_{i,11} > 0$

where $g_i(\cdot)$ is a twice differentiable function relating the salary with labor quality as well as with earnings in the rest of the labor market (\tilde{w}_i), for a given quality (\tilde{q}_i).¹⁰

⁹ This approach follows also efficiency salary models; however, we use quality as an exogenous variable and not effort as an endogenous variable (see Stiglitz 1976, Solow 1979, Yellen 1984, Akerlof and Yellen 1986).

¹⁰ One way of defining this variable is: $\tilde{w}_i(\tilde{q}_i) = \sum_{j \neq i} \frac{x_{i,j}}{\bar{x}_i} w_j(q_{i,j})$, where the subindex j corresponds to the representative firm, \bar{x}_i is the total employment of i (supposed equal to this labor force for simplicity), $x_{i,j}$ is the employment of i in the unit of production j (considering all units in the economy including self-employed workers units), and $w_j(q_{i,j})$ is the corresponding earnings of the unit of production j given that the quality of employment i is $q_{i,j}$.

The representative firm then minimizes its costs with respect to the two types of employment, physical capital, intermediate consumption, and salaries. The maximization problem can be written as:

$$(4) \quad \mathcal{L} = w_S x_S + w_U x_U + w_K x_K + w_M x_M - \lambda (f(q_S x_S, q_U x_U, x_K, x_M) - y)$$

and the first order conditions are

$$(5) \quad \frac{\partial \mathcal{L}}{\partial x_i} \Rightarrow w_i = \lambda \frac{\partial f}{\partial (q_i x_i)} q_i, \quad i = U, S$$

$$(6) \quad \frac{\partial \mathcal{L}}{\partial x_i} \Rightarrow w_i = \lambda \frac{\partial f}{\partial x_i}, \quad i = K, M$$

$$(7) \quad \frac{\partial \mathcal{L}}{\partial w_i} \Rightarrow x_i = \lambda \frac{\partial f}{\partial (q_i x_i)} x_i \frac{\partial q_i}{\partial w_i}, \quad i = U, S$$

Expressions (5) and (6) are the usual optimal solutions, where the marginal costs and benefits of each factor of production are equalized, and (7) is the new condition establishing that the marginal return of labor quality equals its incremental cost. Using (3) and (5) into (7), the following expression is obtained:

$$(8) \quad g_{i,1}(q_i, \tilde{w}_i) = \frac{w_i}{q_i} = \frac{(1 + \theta_i) \bar{w}_i}{q_i}, \quad i = U, S$$

which means that the incremental cost of the salary derived from an additional infinitesimal rise in quality is equal to the average of the salary per unit of quality (see Oi 1990).

The maximization problem leads to the following cost function:

$$(9) \quad C = C\left(\frac{w_S}{q_S}, \frac{w_U}{q_U}, w_M, w_K, y\right)$$

Consider now the *translog* production function structure, redefine $v_i, v_\kappa = \frac{w_U}{q_U}, \frac{w_S}{q_S}, w_M, w_K,$

and apply logarithms to (9) to obtain

$$(9') \quad \ln C = \ln \gamma_o + \sum_i \gamma_i \ln v_i + \frac{1}{2} \sum_i \sum_\kappa \gamma_{i\kappa} \ln v_i \ln v_\kappa + \gamma_y \ln y + \sum_i \gamma_{iy} \ln v_i \ln y + \gamma_{yy} (\ln y)^2$$

where $\gamma_{i\kappa} = \gamma_{\kappa i}$ for all i, κ (Slutsky symmetry restriction); and $\sum_i \gamma_i = 1$, $\sum_i \gamma_{iy} = 0$, $\sum_i \gamma_{i\kappa} = 0$, $\sum_j \gamma_{i\kappa} = 0$ for all i, κ (linear homogeneity in prices).

Expression (9') is derived with respect to the returns of the factors of production to obtain the shares equations

$$(10) \quad \frac{\partial \ln C}{\partial \ln v_i} = \frac{\partial C}{\partial w_i} \frac{\partial w_i}{C} = \frac{x_i w_i}{C} = s_i = \gamma_i + \sum_{\kappa} \gamma_{i\kappa} \ln v_{i\kappa} + \gamma_{iy} \ln y, \quad i, \kappa = U, S, K, M$$

where $\frac{\partial C}{\partial w_i} = x_i$ by the Shepherd's Lemma, given the levels of labor quality and output.

Expression (10) is analyzed empirically over time, which implies a redefinition of the model as:

$$(10') \quad s_{i,t} = \gamma_i + \sum_{\kappa} \gamma_{i\kappa} \ln v_{i,t} + \gamma_{iy} \ln y_t + v_{i,t}, \quad i, j = U, S, K, M$$

where we added the subindex t to describe time; and v is the idiosyncratic error with the usual properties.

The optimal relationship between salary and quality gives two additional equations to the system: expression (8) can be redefined as $g_{i,1}(q_i, \tilde{w}_i) / g(q_i, \tilde{w}_i) = q_i^{-1}$, $i = S, U$, which is integrated by q_i in order to obtain the following equation for empirical estimation:

$$(8') \quad \ln w_{i,t} = \ln w_{o,i,t} + \ln q_{i,t} + \mathcal{G}_{i,t}, \quad i = S, U$$

where $w_{o,it}$ is the labor cost of factor i in period t when $q_{i,t} = 1$ for all t ; and \mathcal{G}_{it} is the idiosyncratic error with the usual properties. Given that employment in the representative firm is small compared with the entire workforce, $w_{o,it}$ is considered equal for each firm and treated as a constant empirically.¹¹

Lastly, the estimated coefficients are used to calculate the relevant elasticities. In particular, Binswanger (1974) determines the own-salary elasticity of labor demand as:

¹¹ This means that for firms j and j'' , $w_{o,i,j}(1, \tilde{w}_i(\tilde{q}_i)) \approx w_{o,i,j''}(1, \tilde{w}_i(\tilde{q}_i))$ given that $\sum_{j' \neq j} \frac{x_{i,j'}}{\bar{x}_i} w_{j'}(q_{i,j'}) \approx \sum_{j' \neq j''} \frac{x_{i,j'}}{\bar{x}_i} w_{j'}(q_{i,j'})$ in each period t (see footnote 10).

$$(11) \quad \frac{\partial x_i}{\partial w_i} \frac{w_i}{x_i} = \eta_{ii} = \frac{\hat{\gamma}_{ii}}{s_i} + s_i - 1, i = S, U$$

Unlike the usual system of equations for empirical estimations found in the literature (see Behar (2004) for a discussion), we contribute to it by adding a new equation (8') to the system that we believe is consistent in a segmented labor market, where labor regulation coverage is very low, as is the case here. In addition, as mentioned above, we avoid endogeneity problems, which will be analyzed in more detail below.

IV. Data

The information used corresponds to the Bolivian Annual Manufacturing Survey (BAMS) which is an unbalanced and broken panel of Bolivian manufacturing firms. We provide a detailed description of the data focusing on the linkages of firms across time given that – with the exception of Jiménez and Landa (2004) – there are no research that used these data to study employment.

The survey has data of firms that are registered at the National Tax Service Institution (SIN). The survey was collected for every year between 1988 and 2001 by the National Statistics Institute (INE), and stopped until 2008, when INE implemented it again, asking for the information of years 2006 and 2007.

The sample selection methodology, based on SIN records, consists of the stratification of firms that have more than 5 employees by both forced inclusion and random sample inclusion. The first stratification incorporates firms with 15-49 employees (medium-sized) and firms with more than 49 employees (large size). The second stratification includes firms with 5-14 employees (small size).

The selection procedure was year-by-year in the case of the random sample inclusion, where firms selected in a year were independent from those in another year. Nevertheless, the selection of firms under forced inclusion was not year-independent. According to the characteristics of the information, the INE made assumptions when there was no information for a firm in period t but the firm was in business in that period. The data of a firm in period $t-1$ were used for the assumptions. The identification criteria for the assumptions were the economic stratum, the ISIC number at 4-digit disaggregation, the employment category, and the location (department). For instance, the assumption of gross production value (y) of a firm was made according to the procedure that follows. First, the

variation of the gross production value $V(y)$ was computed according to: $V(y) = \frac{\sum y_{j,t}}{\sum y_{j,t-1}}$;

for firm j that had information in t and $t-1$. Second, the gross production value without information in period t was computed as: $y_{j,t} = y_{j,t-1} \times V(y)$. Once the gross production value was estimated, other relevant variables were calculated by using the technical coefficients generated by the information of the same firm from $t-1$.

The BAMS is based on the bookkeeping registries and balance sheets of the firms, and has national coverage, i.e. it includes the nine departments.¹² The survey was implemented approximately 8 months after the bookkeeping period concluded. The available information generally corresponds to the bookkeeping year of the firms (12 months), which begins on April 1st and ends on March 30th, or goes from January 1st to December 31st.

In 2004, the INE applied the Amplified Survey of Economic Establishments (EAEE) which also included firms from sectors of mining, education, health, and services. This survey has a representative sample for every economic sector (according to SIN firm records), and information similar to those of the BAMS, because the same questionnaire was applied with only some minor modifications. For instance, in 2004, managers, administrators and white-collar workers were considered to be one variable, but in the other years managers and administrators were one variable and white-collar workers were another. In any case, the data for 2004 came from a source similar to that of other years of the analysis. For this reason, we include it as part of the BAMS survey.¹³

The data are classified by ISIC revision 2 for 1988-1994, ISIC revision 3.1 for 1995-2001, CAEB 2005 for 2004, and ISIC revision 4 for 2006-2007 (all four-digit data). The data have been harmonized with ISIC revision 3.1. By merging all surveys, we end up with an unbalanced and broken panel, which comprises information of firms from 1988-2001, 2004 and 2006-2007.

Finally, it is worth mentioning that there are some observations (no more than 5) at the plant level. As INE did, these plants are treated as individual firms, because in most cases they are located in different departments. For instance, we have YPFB (the State oil company) that has refineries in Cochabamba, Santa Cruz and Chuquisaca. Each refinery has

¹² The Department of Pando, however, did not have any manufacturing firms registered in some years, and at most 3 in others.

¹³ Below is further discussion on the possible sources of noise due to this fact and how this is addressed.

a different identification number and therefore is treated as a different firm, although they all belong to YPFB.¹⁴ Firms with different plants that are located in the same department are also considered to be different units because their main product is different, and therefore they have different identification numbers.

Table 2 presents the sample of firms by year. They are classified in four groups according to the number of permanent (salaried and unsalaried) workers.¹⁵ The average number of firms per year is 824, with the highest number in 1990 (1,063 firms) and the minimum in 2000 (505 firms). In addition, firms are equally distributed: micro and small firms represent approximately 50 percent, the same proportion as medium-sized and large firms. However, in 2004 more micro and small firms were included due to sample reasons, representing almost 70 percent of the sample.

Table 2: Number of Firms in the Unbalanced Panel by Size

Year	Micro	Small	% of Total	Medium	Large	% of Total	Total
1988	1	403	49.09	279	140	50.91	823
1989	118	355	53.57	257	153	46.43	883
1990	263	394	61.81	253	153	38.19	1 063
1991	111	210	44.65	238	160	55.35	719
1992	187	305	53.77	249	174	46.23	915
1993	41	357	47.66	264	173	52.34	835
1994	66	310	47.06	246	177	52.94	799
1995	62	305	50.97	209	144	49.03	720
1996	8	266	43.42	190	167	56.58	631
1997	0	357	48.77	209	166	51.23	732
1998	3	438	51.10	230	192	48.90	863
1999	34	409	52.80	216	180	47.20	839
2000	58	183	47.72	128	136	52.28	505
2001	64	220	47.89	158	151	52.11	593
2004	380	351	69.75	189	128	30.25	1 048
2006	164	335	48.59	289	239	51.41	1 027
2007	164	328	48.71	281	237	51.29	1 010

Source: prepared by the authors based on Bolivian Annual Manufacturing Survey (BAMS)

Note: According to INE, micro firms are those with 0 to 4 workers, small-firms 5 to 14, medium-sized 15 to 49, and large 50 or more. Firm size determination includes permanent salaried and unsalaried workers, the latter being owners, workers who are family of the owners, and others.

We notice that there is a high increase in the number of medium-sized and large firms between 2004 and 2006; being 100 medium-sized firms more, and 111 large firms more, in

¹⁴ Another reason for treating the YPFB refineries as different firms is because in 1998 they were privatized as different firms.

¹⁵ Unsalariated workers are owners, workers who are relatives of the owners, and others that do not receive any labor earnings.

2006. This is a relevant issue in terms of employment, because it represents an increase of 57 percent of job for medium-sized firms, and of 60 percent for large firms, as may be observed in Table 3.

In terms of employment, the data account, on average, for 36,626 permanent (salaried and unsalaried) workers per year. The year with the highest number of workers is 2007 with 60,494, while the lowest number is of 2000 with 28,614. In addition, on average, 92 percent of employment is in medium-sized and large firms.

Table 3: Percentage of Employment by Size of Firm

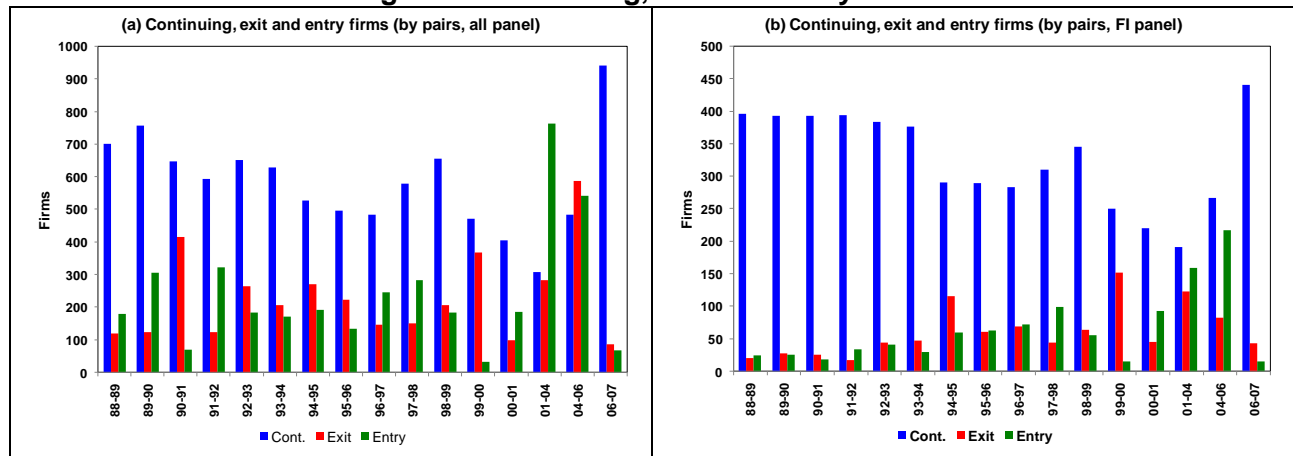
Year	Micro	Small	% of Total	Medium	Large	% of Total	Total
1988	4	3 087	10.65	7 269	18 650	89.35	29 010
1989	375	2 891	10.82	6 743	20 163	89.18	30 172
1990	729	3 277	12.69	6 636	20 931	87.31	31 573
1991	330	1 883	7.22	6 435	22 020	92.78	30 668
1992	533	2 608	9.05	6 668	24 893	90.95	34 702
1993	130	2 839	8.26	6 983	25 998	91.74	35 950
1994	223	2 508	7.46	6 316	27 548	92.54	36 595
1995	204	2 515	8.91	5 409	22 391	91.09	30 519
1996	28	2 311	7.16	5 080	25 232	92.84	32 651
1997	0	2 844	8.33	5 633	25 670	91.67	34 147
1998	8	3 422	8.49	6 086	30 889	91.51	40 405
1999	83	3 196	8.49	5 766	29 591	91.51	38 636
2000	173	1 546	6.01	3 627	23 268	93.99	28 614
2001	211	1 827	6.26	4 434	26 107	93.74	32 579
2004	963	2 916	10.18	4 882	29 331	89.82	38 092
2006	482	2 897	5.84	7 675	46 779	94.16	57 833
2007	478	2 890	5.57	7 535	49 591	94.43	60 494

Source: prepared by the authors based on Bolivian Annual Manufacturing Survey (BAMS)

Note: According to INE, micro firms are those with 0 to 4 workers, small-firms 5 to 14, medium-sized 15 to 49, and large 50 or more. Firm size determination includes permanent salaried and unsalaried workers, the latter being owners, workers who are family of the owners, and others.

In order to evaluate employment dynamics, Figure 1 analyzes the number of firms that exit, enter and continue by dividing the panel into two-year subpanels. In this pair-wise panel, continuing firms are defined as those that appear in two subsequent years ($t-1$ and t) regardless of whether they disappear or not in any other previous or subsequent year. Similarly, an entry firm is a firm that does not appear in period $t-1$, but does in period t , and an exit firm is one that appears in $t-1$, but not in t . In subpanel (a) we show the whole sample and in subpanel (b) the trimmed sample (only forced inclusion sample).

Figure 1: Continuing, Exit and Entry Firms



Source: prepared by the authors based on Bolivian Annual Manufacturing Survey (BAMS).

Since forced inclusion information is incomplete, we classify firms in this category considering the following. First, we include some firms that in 1988-2001 were classified as random in some years, but appeared in the database in consecutive years, and were classified as forced inclusion in most years. Second, the variable that classified firms as random or mandatory is not reported by INE in 2004, 2006 and 2007, which makes necessary a specific classification of firms as random or mandatory according to the number of permanent employees. Lastly, we create a dummy variable for inclusion (equal to 1 if it is forced and 0 otherwise) and averaged it by firm for the years with information, which allows reclassifying firms as belonging to the random sample if their average value is below 0.5 or to the forced inclusion sample if the average is above or equal to 0.5.

Figure 1 shows that the volatility induced by exit and entry firms is high in subpanel (a) compared to subpanel (b), being associated with the random sample inclusion in the first case. In addition, there is more stability in terms of continuing firms within specific sub-periods in subpanel (b), which can be related to the construction of the data. During the sub-period from 1988 to 1994 firms were classified according to ISIC revision 2 with identification numbers starting at 1. In the second sub-period, from 1994 to 1999, firms were classified by ISIC revision 3 with identification numbers starting in 100,000. The ISIC classification and identification numbers did not change in 2000 and 2001, but between 1999 and 2000 many firms were excluded, classified as exit firms in subpanel b). Also, Table 2 shows that there are around 300 firms less in year 2000, which can be attributed to sample reasons. We already observed that 2004 is a unique case: many firms are included

(entry) and excluded (exit) in this year. Lastly, between 2004 and 2006 there are many firms that are included (entry). Of course there are many continuing firms between 2006 and 2007, since the information for those years was collected in one survey made in 2008.

The above discussion suggests that forced inclusion samples are better for analyzing job flows. In this regard, we will consider the pair-wise panel for this segment of firms. In addition, we will take into account the sub-periods in which employment dynamics display stability, which means that job flows of 1994-1995, 1999-2000, 2001-2004, and 2004-2006 will not be considered. We will follow this strategy because we are not be able to corroborate that employment changes between those years are due to job creation and/or destruction or due to sample changes.

IV.1. Construction of Variables

The data required for the empirical analysis come mainly from BAMS, but we also use National Accounts Statistics and other relevant databases. Table 4 explains in detail the construction of the variables used.

Table 4: Firms' Quantity and Price Variables

Quantities	
x_E	Employment, which includes all salaried permanent workers (non-production and production workers) as well as unsalaried workers (i.e. owners, and others that do not receive salaries).
$x_i, i = U, S$	Non-production workers (U), and production workers (S).
x_K	Stock of capital, which is the sum of net balances of buildings, structures, technical facilities, machinery, equipment, vehicles, transport equipment, furniture, fixtures, tools, computer equipment, and others. The variable is in Bolivian currency, and has been converted to real values (1990 Bolivianos) by using the GDP investment deflator.
y	Output, measured by the gross value of production (GVP), which is the sum of (according to INE's definition) products, sub-products, commercial margin of products without transformation, revenues derived from own capital manufacturing, inventory changes of products in process, sales of electricity produced by the firms, and other operating incomes. Output in nominal terms has been transformed to real values (1990 Bolivianos) by using the implicit price between the nominal and real GVP constructed for 16 manufacturing subsectors according to the input-output matrix data and classification, and harmonized with the ISIC revision 3.1.

Table 4 (continued)

$q (=q_U = q_S)$	Employment quality by type of worker, which is approximated by the ratio between firm labor productivity, and the corresponding manufacturing subsector labor productivity (16 subsectors), and averaged over the years with information. Firm labor productivity corresponds to the nominal value of products and sub-products over (salaried and unsalaried) permanent employees. Labor productivity by subsector is equal to the nominal GVP derived from input-output matrix data over the corresponding employment. Employment for the 16 subsectors is obtained using the Population Census of both 1992 and 2001 to estimate the participation of each subsector in manufacturing employment, and applying these percentages to the data on total manufacturing employment constructed by Muriel and Jemio (2010) for 1992-2007 and extrapolating growth rates for 1988-1991.
Factor Prices	
$w_i, i = E, U, S$	Total labor cost by unit of employment (for salaried employment (E), non-production workers (U) and production workers (S)), which is the sum of both the basic salary (\bar{w}_i) and regulation costs ($\theta_i \bar{w}_i$). The regulation costs include compensations, Christmas and other bonuses, contributions to social security, and others paid by firms.
$\theta_i, i = E, U, S$	Rate of labor regulation costs (compensations, Christmas and other bonuses, contributions to social security, and others) over the basic salary (\bar{w}_i).
w_K	Capital cost by unit, measured through the effective interest rate of the bank system for loans in US dollars (given that almost all loans were provided in this currency in Bolivia), converted to Bolivian currency using the uncovered interest rate parity formula (see, e.g., Krugman and Obstfeld 2001). This interest rate includes fees and commissions and is estimated by the Central Bank of Bolivia.
w_M	Intermediate consumption price, which is constructed as a weighted average of two prices. The first price corresponds to intermediate consumption, obtained from the input-output matrix. We use nominal and real values of an intermediate consumption basket for 16 manufacturing subsectors to calculate the implicit price, which are added to the firm according to its corresponding classification. The second price corresponds to the temporary workers' cost that is approximated by the GDP consumption deflator. The weights are the corresponding costs of production over the composed intermediate consumption (i.e. intermediate consumption plus temporary workers' cost).
Note: Nominal factor prices are normalized by the GDP consumption deflator (by one plus the growth rate of the GDP consumption deflator in the case of the capital price) when these variables are included alone in the regressions.	
Costs and Cost Shares	
$w_i x_i, i = U, S, K$	The costs of the two kinds of employment and capital are calculated using the information on quantities and prices described above.
$w_M x_M$	Intermediate consumption costs are obtained by aggregating the nominal value of expenses on raw materials, auxiliary materials and packaging, basic services, and selected expenditures including the temporary workers' cost.
C	The total production cost is obtained from the sum of the four input costs.
$s_i, i = U, S, K, M$	Cost shares are derived from the division of input costs over total cost.

In addition, firm characteristics and labor regulation variables were constructed, which are described in detail in the following table.

Table 5: Firm Characteristics and Labor Regulation Variables

<i>Temporary workers rate</i>	Ratio between temporary workers over salaried permanent employees. Given that in 1988-1991 BAMS collected only data of temporary workers' costs, we estimate a random effect model between the temporary workers' rate and relative labor cost (temporary workers' costs over salaried permanent labor costs) in order to extrapolate temporary workers data for 1988-1991.
<i>Rigidity of employment</i>	Index that is part of the Doing Business Indicators of the World Bank, and averages three indicators: difficulty of hiring, rigidity of hours and difficulty of laying off. We collect data from 2004, 2005 and 2007, we use the same values of 2004-2005 for 1988-2001 (given that labor security rules did not change over the 1985-2005 period), and average the values of 2005-2007 for 2006 (given that the law changed in May of that year).
<i>Capital intensity</i>	This variable measures capital (x_K) per worker, and is calculated as: x_k / \tilde{x}_E , where \tilde{x}_E is average employment in a pair-wise period (see Davis, Haltiwanger and Schuh, 1996).
<i>Energy intensity</i>	This variable measures the ratio between the cost of purchased fuels plus purchased electricity (deflated by the intermediate consumption price), and real gross value of production (see Davis, Haltiwanger and Schuh, 1996).
<i>D_main regions</i>	Dummy for the most important departments/cities: La Paz, Santa Cruz and Cochabamba.
<i>D_export</i>	Dummy equal to 1 when export sales are positive.
<i>Dummies by size</i>	Dummies for micro firms (1 to 4 workers), small firms (5 to 14), medium-sized firms (15-49) and large firms (50 or more).

Summary statistics of the variables are given in Table 6 considering firms that have positive values of both permanent (salaried and unsalaried) workers, and gross value of production. Registered manufacturing firms have, on average, 45 workers, of which 30 are production workers and 14 are non-production workers. The share of the costs is concentrated in intermediate consumption, followed by employment (production and non-production workers) and capital.

**Table 6: Summary Statistics for 1988-2001, 2004, 2001-2007
(13,635 observations)**

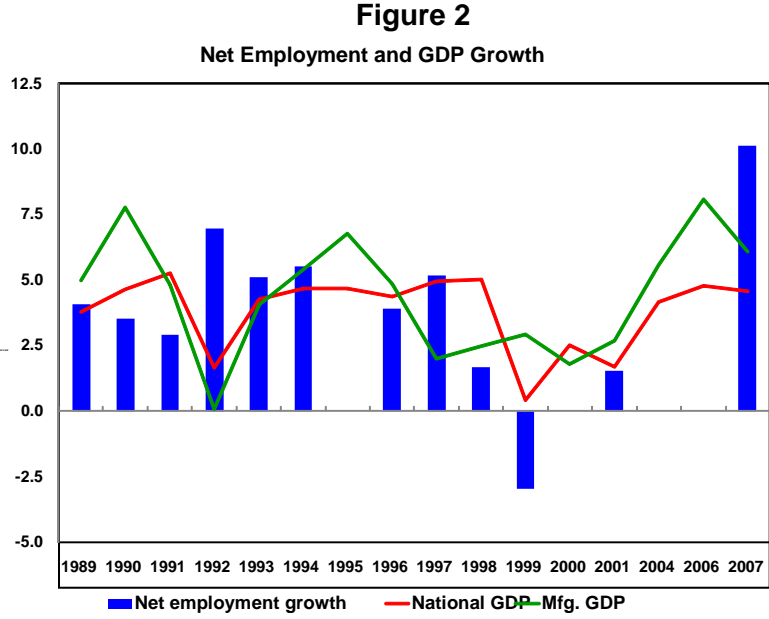
Variable	Mean	Standard Deviation	Pearson Coefficient of Variation
<i>Permanent workers (salaried and non-salaried)</i>	45.361	112.083	2.471
<i>Production workers</i>	30.064	83.966	2.793
<i>Non-production workers</i>	14.457	40.556	2.805
<i>Gross value of production (1990 Bs.)</i>	6 807 277	38 000 000	5.582
<i>Stock of capital (1990 Bs.)</i>	4 341 906	57 900 000	13.335
<i>Intermediate consumption (1990 Bs.)</i>	3 846 502	18 500 000	4.810
<i>Employment quality proxy (rate)</i>	4.814	9.024	1.875
<i>Salary_total employment (1990 Bs.)</i>	6 905	7 487	1.084
<i>Salary_production workers (1990 Bs.)</i>	5 242	5 314	1.014
<i>Salary_non-production workers (1990 Bs.)</i>	9 299	15 678	1.686
<i>Labor benefits payment rate</i>	0.500	0.722	1.444
<i>Share of production workers</i>	0.103	0.097	0.937
<i>Share of non-production workers</i>	0.070	0.080	1.137
<i>Share of stock of capital</i>	0.160	0.149	0.935
<i>Share of intermediate consumption</i>	0.667	0.186	0.279
<i>Temporary workers' rate</i>	0.210	1.102	5.241
<i>Capital intensity⁽¹⁾</i>	0.000	0.002	21.694
<i>Energy intensity⁽¹⁾</i>	0.255	11.409	44.800
<i>Proportion: D_main regions</i>	0.812		
<i>Proportion: D_export</i>	0.139		

Note: ⁽¹⁾ includes only 9,435 observations consistent with the job flow data.

V. Job Flows and Labor Regulation

This section explores the main stylized facts emerging from the analysis of firms that belong to the forced inclusion sample. The inclusion criterion for this subsample of manufacturing firms in Bolivia is clear and uniform, and working only with these firms in the subsamples explained above makes sense. The stylized facts observed are: 1) the positive correlation of net employment growth with GDP growth, 2) the relatively low magnitude of job flows, 3) the significant impact of the 1999 crisis on employment, and 4) the volatility of net employment change between production and non-production workers. We review these stylized facts in turn below to motivate our multivariate analysis aimed at assessing the role of labor market regulation on job flows.

Figure 2 displays the cyclical behavior of manufacturing job flows by comparing the rate of growth of net employment with the rates of growth of national GDP and manufacturing GDP. It seems that net employment growth is more correlated with national GDP growth than with manufacturing GDP growth. For instance, observe that in 1997 manufacturing GDP grows by 2 percent, while national GDP increases by 4.95 percent and net employment also increases by 5.2 percent. Similarly, national GDP reaches the lowest rate of growth in 1999 (0.43 percent) and it is precisely the year in which net employment growth is negative (-3 percent).



Source: prepared by the authors based on Bolivian Annual Manufacturing Survey (BAMS)

Thus, the graphical correlations observed in Figure 2 leads us to the following stylized fact:

Stylized fact 1: Net employment growth in Bolivian manufacturing correlates more to national income (GDP) than to manufacturing income (manufacturing GDP).

Table 3 reports the rates of job creation, job destruction, job reallocation, net employment change, and excess labor reallocation for two-year periods and for the selected sub-periods (average). The first noticeable fact emerging from this yearly comparison is the moderate magnitude of job reallocation. Gross job flows (the sum of gross job creation and gross job destruction) ranged from 11.6 percent to 16.3 percent between 1989 and 2001. In the 2006-2007 period the job reallocation rate rose to 18.2 percent, which is explained, among other

reasons, by job creation due to the greater economic growth. Job creation has been higher than job destruction in all the two-year periods except 1998-1999, which is reflected in a negative rate of net employment of -3 percent.

Table 7: Annual Job Flow Rates in Bolivian Manufacturing, 1989-2007

Year	Job Creation	Job Destruction	Job Reallocation	Net Employment Growth	Excess Labor Reallocation
1988-1989	9.1	5.0	14.1	4.1	10.0
1989-1990	8.4	4.9	13.4	3.5	9.8
1990-1991	7.6	4.7	12.3	2.9	9.4
1991-1992	11.6	4.7	16.3	7.0	9.4
1992-1993	10.0	4.9	14.8	5.1	9.7
1993-1994	10.3	4.8	15.2	5.5	9.7
1995-1996	8.6	4.7	13.3	3.9	9.4
1996-1997	8.4	3.2	11.6	5.2	6.4
1997-1998	7.2	5.5	12.8	1.7	11.1
1998-1999	5.6	8.6	14.2	-3.0	11.2
2000-2001	7.2	5.7	12.9	1.5	11.4
2006-2007	14.2	4.0	18.2	10.1	8.1
Sub-periods (average)					
1989-1994	9.5	4.8	14.4	4.7	9.7
1996-1999	7.4	5.5	13.0	1.9	9.5
2000-2001	7.2	5.7	12.9	1.5	11.4
2006-2007	14.2	4.0	18.2	10.1	8.1

The rate of job destruction never fell below 3 percent of manufacturing employment, and it reached as high as 8.6 percent in 1998-1999. Job creation rates, on the other hand, averaged 9.5 percent in the 1989-1994 sub-period, which is certainly the period of greater economic stability due to the implementation of the First Generation of Economic Reforms in Bolivia.¹⁶

Recall that excess job reallocation equals total job reallocation minus the minimum amount required to accommodate the net change in manufacturing employment. In other words, excess reallocation measures the extent of simultaneous job creation and destruction. According to Table 7, this indicator increased to 14.2 percent, being below 10 percent in the other sub-periods. This shows that in the given period, a large fraction of employment opportunities changed locations.

¹⁶ See Barja (2000) for a detailed review of the reforms implemented in Bolivia between 1986 and 2001.

How does this moderate-scale job reallocation activity in Bolivia compare with the experiences of other countries? Davis *et al.* (1996) report net and gross job flow rates for selected developed and developing countries for periods before 1990. For instance, for the manufacturing industry in the United States, they find an average job reallocation rate of 19.4 percent for the 1972-1988 period. Morocco is the country with the highest rate (30.7 percent) while Norway is the country with the lowest rate (15.5 percent). According to the international evidence, the constant churning of job opportunities that characterizes Bolivian registered manufacturing employment represents the normal state of affairs for both developed and developing labor market economies. By these standards the Bolivian numbers are not particularly high, and in fact similar to the lower-end.¹⁷ This allows us to state:

Stylized fact 2: The Bolivian formal manufacturing sector is characterized by a relatively low magnitude of job flows.

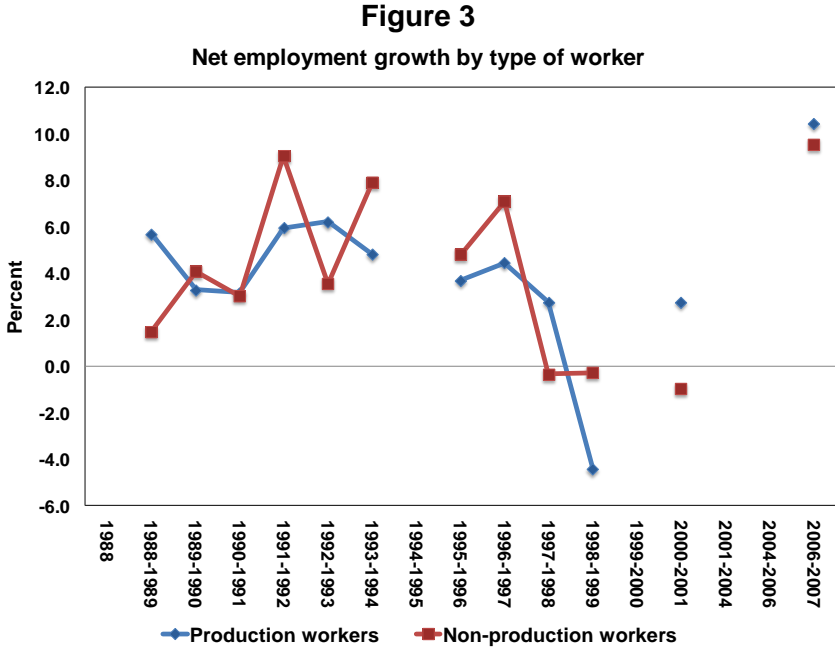
We already mentioned that the 1998-1999 period is the only one that displays a negative rate of net employment growth. This period is characterized by Calvo (2006) as Bolivia's Sudden Stop. This sudden drop in GDP growth had external causes that translated into a higher cost of and limited availability of credit, forcing indebted firms to slow down production, and to enter into default on their bank loans. Even though this international shock hit the service sectors hardest (including construction and commerce), it is possible to consider that it also affected the manufacturing sector, particularly those firms that were highly dollar-indebted. Clearly we cannot state causality of the crisis with net employment changes, but it is possible to suppose that a manner employed by firms to reduce costs was to eliminate jobs. This allows us to state the third stylized fact.¹⁸

Stylized fact 3: The net shrinkage of manufacturing employment in 1998-1999 could be attributed to the economic slowdown that the Bolivian economy experienced.

¹⁷ Jiménez and Landa (2004) found that manufacturing firms reallocated jobs at an annual average rate of 25 percent in the 1996-1999 period, with a net employment growth rate of 2.2 percent, which was attributed to a job creation rate of 20.2 percent and a job destruction rate of 18 percent. They conclude that the creation and destruction of jobs shows a high reallocation of workers, which is influenced also by some degree of labor flexibility, in particular among small establishments. Their results are clearly very large in comparison to our results. For the same period we find a job reallocation rate of only 13 percent, which can be due to the exclusion of the random sample of micro and small firms.

¹⁸ Other authors that also state that this crisis had important economic effects are Jemio (2000), Mercado *et al.* (2005) and Chávez and Muriel (2004).

Lastly, in Figure 3 we present the net employment growth rate for production and non-production workers of the manufacturing industry in Bolivia for the different sub-periods. Notice that the rate of growth of net employment for non-production workers is relatively more volatile than the rate of growth for production workers. However, when there is a fall in the rate of growth of net employment, the fall is more severe for production workers than for non-production workers. In particular, the decrease in net employment has been -4.4 percent for production workers in the 1998-1999 period, while it has been only -0.3 percent for non-production workers. However, net employment growth for non-production workers was negative and low for three consecutive periods, 1997-1998, 1998-1999 and 2000-2001, which coincide exactly with the period of economic downturn.



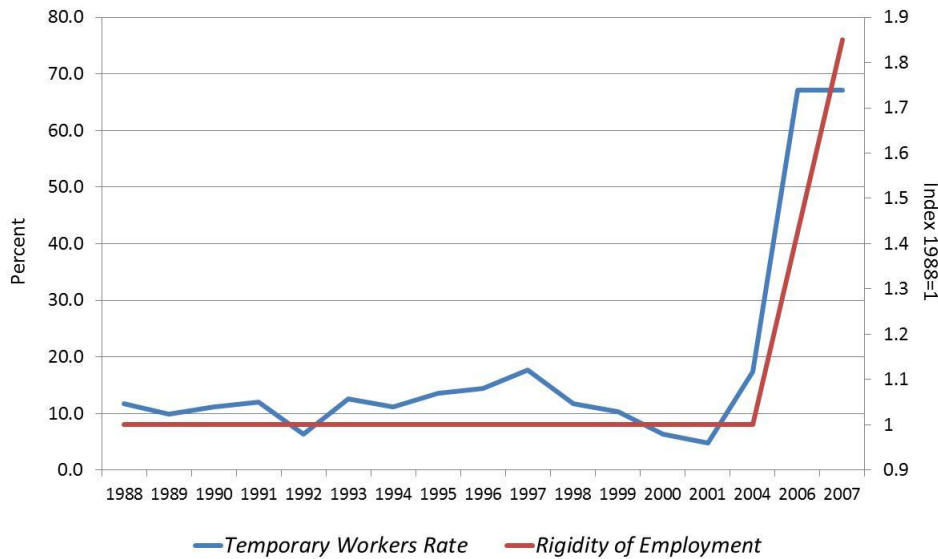
Source: prepared by the authors based on Bolivian Annual Manufacturing Survey (BAMS)

This result allows us to state the fourth stylized fact regarding job flows in Bolivia’s manufacturing industry.

Stylized fact 4: Net employment growth is relatively more volatile for non-production workers than for production workers, but the destruction of jobs is more severe for production workers in periods of economic downturn.

Next we explore the links between the regulatory environment in which firms operate and job flows, using the *temporary workers rate*. Figure 4 displays this variable averaged across firms in each year.

Figure 4
Regulation Measures

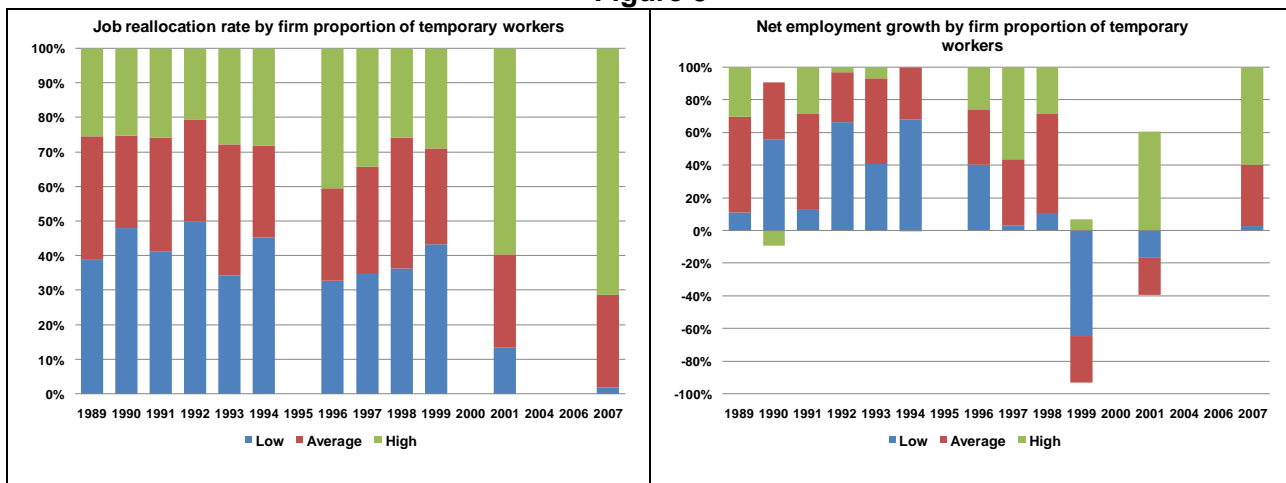


Source: prepared by the authors based on Bolivian Annual Manufacturing Survey (BAMS)

The rate of temporary workers increased from 6 percent in 1992 to 17 percent in 1997, and then decreased to 4 percent in 2001. The increase in temporary workers between 1996 and 1997 could be related to the implementation of the new Pension Law that changed the pay-as-you-go system to a fully-funded one. Notice that it is only since 2006 that temporary workers became important for firms, reaching a proportion of 67 percent, which would be a sign that regulation became even more stringent in these last years, with part of permanent vacancies being apparently changed by temporary ones. Labor regulation changes can be also appreciated with the *Rigidity of Employment Index* explicit in the Figure.

Figure 5 shows firms classified as those that have a low, average or high participation in the rate of temporary workers (i.e. they have been divided into three percentiles). Each firm is classified in one of the three categories by computing the mean of the regulation indicator across the years in which the firm appears. In this way we avoid having the same firm classified differently in different years.

Figure 5



Source: author's calculations based on BAMS.

The most striking result that we can extract from the two graphs in Figure 5 is that labor cost rationing is the best that firms can do if we consider the creation and destruction of jobs during periods of economic downturn. Observe that firms with a high proportion of temporary workers are the only type of firms that contributed positively to the net creation of jobs in the 1998-1999 period.

If we assume that more productive firms are also better-prepared to face an economic crisis, then according to our results, more productive firms should also be more “informal firms”.¹⁹ This is a controversial result, because it is more common to find a negative than a positive correlation between informality and productivity. Fajnzylber *et al.* (2007) show, in chapter 6 of their book, that within given sectors, and for given firm sizes and time in business, firms in Latin America with higher levels of labor productivity exhibit, in general, lower rates of tax and social security evasion. They show this by reporting the estimated effects on the rates of sales and employment underreporting of a hypothetical doubling in output per worker (controlling for firm size, time in business, location, and sector of activity). But they also admit that these effects are not significant for Panama, nor for sales underreporting in Bolivia and Colombia.

¹⁹ In a more general approach, it is reasonable to define the informal sector as encompassing all firms that, at least to some extent, choose to operate outside of the scope of existing regulations. Thus, medium-sized and large firms can be considered informal even if they are duly registered, provided that for instance they underreport their sales for tax purposes, do not register all their workers with the social security administration, or do not comply with some government regulations regarding mandatory operating licenses or permits, as well as product quality and safety regulations.

Certainly, the apparent negative correlation between productivity and “informality” is subject to different interpretations. On the one hand, more productive firms may arguably have more to lose from operating irregularly. On the other hand, however, it is also possible that productivity is affected by whether firms operate formally or informally, as well as by the general level of informality prevailing in their sector.

How can we rationalize our results? Lazear (2000) shows that average output per worker and average worker ability should rise when a firm switches from hourly wages to piece rates. The minimum level of ability does not change, but more able workers, who shunned the firm under hourly wages, are attracted by piece rates. As a result of incentive effects, average output per worker rises. Thus, average ability and output, as well as variance in output and range of ability, should rise when a firm switches from hourly wages to piece rates. We can hypothesize that this is exactly what it is happening in the case of temporary workers; they are paid piece rates rather than hourly wages, therefore as the share of temporary workers increases, productivity of the firm also rises.

Notice also that in 2001 the contribution to net employment growth by firms with low and average share of temporary workers is still negative. But the contribution of firms with a high share of temporary workers is positive and large. In fact it is larger than the negative contribution of the other type of firms, so we end up with a positive rate of net employment growth in that year. In other words, firms with a high share of temporary workers have been able to recover more rapidly from the economic crisis of 1999 and they have been able to create more jobs than to eliminate jobs. This is also observed in the first Figure, where it is seen that the contribution of firms with a high proportion of temporary workers to job reallocation was almost 60 percent in 2001 and above 70 percent in 2007.

V.1. Econometric Analysis

Finally, we estimate equation (1) presented in the methodology section. We employ a random effects model because we have an unbalanced panel with short periods by firm. The estimations also use cluster-robust standard errors by firm for the whole panel.²⁰ The results are shown in the following Table, where besides labor regulation indicators, other relevant characteristics were also found to be significant.

²⁰ See Wooldridge (2002), Baltagi and Song (2006), Greene (2008) and Cameron and Trivedi (2009) for a discussion of (unbalanced) panel data estimation methodologies.

Table 8: Job Flows and Labor Regulation, 1988-01, 2004, 2006-07

Variables	Job Reallocation Rate		Net Employment Growth	
	With Temporary Workers Rate	With Rigidity of Employment Index	With Temporary Workers Rate	With Rigidity of Employment Index
$\ln w_{E(t-1)}$	-0.0222 (0.0048)***	-0.0242 (0.0050)***	-0.0156 (0.0060)***	-0.0167 (0.0061)***
y growth	0.0237 (0.0078)***	0.0234 (0.0078)***	0.1737 (0.0108)***	0.1726 (0.0108)***
GDP growth			1.8675 (0.3109)***	2.0502 (0.3870)***
Capital intensity	-0.5100 (0.1803)***	-0.5753 (0.1913)***		
Energy intensity	-0.0001 (0.0)***	-0.0001 (0.0)***	0.0003 (0.0)***	0.0003 (0.0)***
$D_{main\ regions}$			0.0202 (0.010)**	0.0210 (0.0102)**
$D_{export}_{(average\ t,\ t-1)}$	0.0335 (0.0114)***	0.0387 (0.0115)***		
$D_{micro\ firm}_{(average\ t,\ t-1)}$	0.0560 (0.0174)***	0.0610 (0.0178)***	-0.0646 (0.020)***	-0.0618 (0.0202)***
$D_{forced\ inclusion}$	-0.0256 (0.0091)***	-0.0250 (0.0093)***	0.0339 (0.0083)***	0.0352 (0.0084)***
Temporary workers rate $_{(average\ t,\ t-1)}$	0.0257 (0.0088)***		0.0269 (0.0071)***	
Rigidity of employment index		-0.0109 (0.0121)		-0.0054 (0.0205)***
Constant	0.3971 (0.0402)***	0.4323 (0.0447)***	0.0630 (0.0510)	0.0795 (0.0542)
Observations	9345	9345	9345	9345
R^2 overall model	0.1153	0.1117	0.0996	0.0963

Notes: i) The methodology of estimations was random with cluster-robust standard errors by firm (2075). ii) In brackets are the standards errors. iii) *** means statistical significance at 1%, and ** at 5%. iv) Significant dummies by years were included in the regressions: 1995, 1997, 1998, 2000, 2004, and 2006 for the first two, and 1990-1993, 1994-1995, 1997-1998, 2000, and 2004 for the last two regressions. v) Sub-index “ $t-1$ ” means a period before, and “average $t, t-1$ ” is the arithmetic average of the variables between t and $t-1$.

The most striking results are presented in the first and third regressions, where the coefficient of the temporary workers rate is significant at 1 percent, being robust for many subsamples – considering only the forced inclusion sample or excluding the years in which employment dynamics displayed instability (1994-1995, 1999-2000, 2001-2004, and 2004-2006) – as well as estimation methodologies (e.g., fixed effects, feasible least squares, etc.).²¹ This confirms the previous observation in which we found that firms with high temporary worker rates have higher job reallocation rates, showing that employment creation and

²¹ These estimations are available by request to the authors.

destruction are lower when enforcement of regulations is greater, which is consistent with the literature (e.g., Haltiwanger *et al.* 2006, and Kaplan 2009). In addition, the third regression shows that the net impact of labor regulation has been negative on employment growth. In this regard, and considering also the observations made of Figure 5, we state the last stylized fact:

Stylized fact 5: Firms with high temporary worker rates (as an approximation of less enforcement of labor rules) have higher job reallocation rates as well as higher net employment growth.

We also analyzed the *Rigidity of Employment Index* (second and last regressions), observing that the sign of the coefficients are consistent with the previous results; however, they are not statistical robust.

Table 8 also shows additional relevant results. First we find that GVP growth by firm and national GDP growth, included to control for business cycles, have positive coefficients; in particular the last two columns confirm pro-cyclicality with employment growth. Second, the job reallocation rate is negatively related to capital intensity. It is common that as capital usage increases, the job destruction rate decreases. The fact that the job destruction rate falls sharply with capital intensity can be related to the prediction of the human capital theory of endogenous growth, once we recognize that human capital and physical capital tend to be complementary inputs in the production process. More capital-intensive firms usually operate with a more human-capital-intensive workforce; we expect them to exhibit lower job destruction and reallocation rates.

Third, the negative and significant relation between job reallocation and energy intensity probably reflects the sharp energy price increases that occurred over the sample period (compared with other input prices), which led to a systematic shift of resources away from more energy-intensive firms. The increase in energy prices occurred, because the main energy companies were capitalized during the period of implementation of the Second Generation Reforms.

Fourth, the coefficient of the variable *D_main regions* shows that employment growth is higher in the departments of La Paz, Santa Cruz and Cochabamba compared to the rest of the country; and the dummy *D_export* suggests higher employment volatility in firms that export. Lastly, as expected, we found that micro firms contribute negatively and significantly to the net employment growth rate, because, precisely, these firms have a

larger job destruction rate. Micro firms in Bolivia are always associated with familiar firms, with higher labor flexibility. This means that it is very easy for them to eliminate jobs in case of a fall in sales, for example.

VI. Labor Demand and Regulation

We estimate the equations using random individual effects from the unbalanced information of 1988-2007, and cluster-robust standard errors by firm.²² In addition, we include dummies for years, the *Rigidity of Employment* variable, and dummies for controlling zero values of shares,²³ when they are significant at 10 percent level and robust to alternative specifications.

Initially we analyze possible endogeneity problems. The model described above supposes implicitly that the quantity of workers does not explain their corresponding salaries at the firm level. We evaluate if the registered Bolivian manufacturing firms support this hypothesis empirically by applying the Hausman test for endogeneity (see, e.g., Wooldridge 2002). For each type of job we: i) estimate a salary regression with the exogenous variables as regressors; ii) calculate the residuals of this regression; and iii) include this residuals variable as a new regressor in the employment share equation.

For production workers, we find that the coefficient of the residuals is rejected even at 15 percent of significance, which means that there are no endogeneity problems. However, the coefficient of the residuals is rejected at 5 percent for non-production workers, but not at 10 percent (Table A.1 in Annex). These results suggest that firms have more power for establishing salaries for their production workers than for their non-production workers. This is consistent with the Bolivian labor force structure: production workers, usually with low levels of education, are abundant in the country, and mostly employed in precarious activities. In contrast, non-production workers have higher levels of education, are covered by the labor regulation in a higher percentage, and are scarce (see, e.g., Muriel and Jemio, 2010; Muriel and Ferrufino, 2011).

²² We select the random effects method for the following reasons: i) the apparent non-correlation between the individual effects and the regressors given the theoretical specifications of the functions; ii) the use of firm information, much of which is for very few time periods (one or two); and iii) the low variance of the shares over time by firm in most cases (see Wooldridge 2002, Baltagi and Song 2006, Greene 2008, and Cameron and Trivedi 2009, for a discussion of (unbalanced) panel data estimation methodologies). Furthermore, we did not use Seemingly Unrelated Regression models, which would be advisable for efficiency, because of the lack of software to process the system jointly.

²³ All firms have permanent workers, but not all of them contract either production workers or non-production workers.

We estimate the share equation for non-production workers with and without instrumental variables to evaluate the significance of the possible endogeneity problem. We use as instruments firm sizes: dummies for micro and large firms. According to the Wald test, we find that the coefficients estimated for salaries for the two methodologies (using and not using instruments) are not statistically different. Thus we maintain the hypothesis derived from the model of non-endogeneity (see Table A.2 in Annex).

Table 9 shows the results of the final estimations for labor variables (see Table A.2 in Annex for the estimation of capital and intermediate consumption equations).

Table 9: Employment and Salaries Equations, 1988-2001, 2004, 2006-2007

Variables	s_U	$\ln w_U$	s_S	$\ln w_S$
$\ln w_U$	0.0440 (0.0021)***		-0.0067 (0.0005)***	
$\ln w_S$	-0.0021 (0.0004)***		0.0414 (0.0017)***	
$\ln q$	-0.0036 (0.0008)***	0.0892 (0.0058)***	-0.1034 (0.0080)***	0.0826 (0.0064)***
$\ln w_K$	-0.1426 (0.0121)***		-0.0192 (0.0051)***	
$\ln w_M$	-0.0217 (0.0062)***		-0.0155 (0.0008)***	
$\ln y$	-0.0241 (0.0011)***		-0.2551 (0.0143)***	
<i>Rigidity of employment</i>	-0.0097 (0.0043)**			
<i>Constant</i>	0.0750 (0.0203)***	0.0079 (0.0213)	0.0527 (0.0159)***	0.0871 (0.0126)***
Observations	13635	13635	13635	13635
R^2 overall model	0.3405	0.9311	0.3643	0.9547

Notes: i) The methodology of estimations is random effects with cluster-robust standard errors by firm (3142); ii) In brackets are the standard errors, *** means statistical significance at 1%, and ** at 5%; iii) significant dummies by years are included in the regressions, 1989-1991 and 1994 for the s_U regression, 1996, 1998-2001 and 2007 for $\ln w_U$, 1989-1990, 1993, and 2004 for s_S , and 1997-2001 for $\ln w_S$; iv) in the first two regressions (last two regressions) a dummy is included when permanent employment is positive, but production workers (non-production workers) is reported as zero.

The coefficient of the *Rigidity of Employment Index* is statistically significant, and robust to alternative specifications, for production workers. This shows a negative impact of labor protection on employment demand, which should be more important since 2006, when the job security policy changed towards greater protection.

Table 10 presents the employment-salary elasticities calculated from equation (11) as well as from the econometric results described in Table 9. The estimations show that, *ceteris paribus*, an increase of 1 percent in labor costs will decrease demand for production workers by 0.49 percent, and demand for non-production workers by 0.43. In this regard, the impact of labor regulation costs are extremely significant if we take into account that, on average, they increase the basic salary by 50.76 percent for production workers and by 50.94 percent for non-production workers.²⁴ This means that firms that only pay basic salaries in the manufacturing sector should increase their labor costs by approximately 51 percent if they decide to be subject to the labor regulation costs. However, entry firms may transfer part of these costs to workers. Certainly, the high level of labor regulation costs is one reason that explains why there is a large number of micro-sized and informal firms in Bolivia who choose to stay at this scale due to the formal costs associated with their growth.

Table 10: Elasticities and Labor Regulation Impact, 1988-2001, 2004, 2006-2007

	Employment-salary Elasticity	Job Losses due to Labor Regulation	
		Due to the Basic Salary Policy ⁽²⁾	Due to the New Pension Law ⁽³⁾
Production Workers			
Average ⁽¹⁾	-0.4988	-5.65%	-1.21%
Minimum ⁽¹⁾	-0.5351	-6.06%	-1.30%
Maximum ⁽¹⁾	-0.4626	-5.23%	-1.12%
θ_U	50.76%	50.76%	54.15%
(%) increase in \bar{w}_U		≈11.32%	0.00%
Non-production Workers			
Average ⁽¹⁾	-0.4278	-4.82%	-1.03%
Minimum ⁽¹⁾	-0.4680	-5.27%	-1.13%
Maximum ⁽¹⁾	-0.3877	-4.37%	-0.93%
θ_S	50.94%	50.94%	54.15%
(%) increase in \bar{w}_S		≈11.27%	0.00%

Notes: ⁽¹⁾ elasticities are calculated using the expression $\eta_{ii} = \frac{\hat{\gamma}_{ii}}{s_i} + s_i - 1, i = U, S$, the average corresponds to the estimated coefficient $\hat{\gamma}_{ii}$, the maximum and minimum represent, respectively, the lower and upper bounds of the confidence interval (at 95 percent) of the values of $\hat{\gamma}_{ii}$; ⁽²⁾ elasticities are estimated considering that $\frac{\partial x_i}{\partial \bar{w}_i} \bar{w}_i = \eta_{ii}$; and ⁽³⁾ corresponds to $\frac{\partial x_i}{\partial \theta_{ic}} \frac{\theta_{ic}}{x_i} = \frac{\theta_{ic}}{1 + \theta_i} \eta_{ii}$.

²⁴ In this case the average rate of labor payments derived from the regulation consider only firms with positive workers for each category compared to Table 6.

In addition, Table 10 presents two micro-simulations for evaluating the regulations changes in the last years, which were previously described: the basic salary mandatory increase and the social costs increase as a result of the new pension system.

The first economic policy was implemented in order to maintain real salaries in relation to the Consumer Price Index (CPI), which increased principally because of the prices growth of food products. In 2006-2009 the basic salary had a mandatory growth of 29.36 percent. However, most manufacturing prices changed less than it, reaching, on average for the 16 subsectors,²⁵ a growth of 18.08 percent. This information allows estimating the difference between these prices at the firm level, which reaches 11 percent as shown in the Table 10.

One way to evaluate this policy is to consider the impact of this difference in prices (*ceteris paribus*), which would correspond to the labor cost increase in 2006-2009. Although this policy is desirable for maintaining living standards, the simulation shows that it entails costs in terms of job losses, 5.7 percent for production workers and 4.8 percent for non-production workers.

The second policy was conceived in order to capture more resources to the pension system, focused on favoring contributors that, for diverse reasons, do not reach a minimum retirement pension. One main problem of this rule is that it increases the rate of labor regulation costs (θ_i) by 3.4 percent per year, representing in practice a direct tax on employment paid by firms. Therefore this policy is not only distorting (i.e. generates efficiency problems) but also affects directly and negatively labor demand of firms subject to labor regulation.

We evaluate this second policy only through its direct impact on labor demand (*ceteris paribus*). This means varying the rate of θ_i in equation (11) to obtain the corresponding

elasticity: $\frac{\partial x_i}{\partial \theta_{ic}} \frac{\theta_{ic}}{x_i} = \frac{\theta_{ic}}{1 + \theta_i} \eta_{ii}$. The results show that this policy decreases employment demand

by 1.2 percent for production workers and by 1.0 percent for non-production workers.

Finally, it is worth noticing that the magnitude of the negative effects of both labor policies in terms of job losses are significant if we compare them with the net employment growth, described in Table 5, that reached, on average, 3.96 percent by year.

²⁵ We match the production price growth of the firm by the implicit price growth of the gross value of production of its corresponding subsector, according to the input-output matrix classification.

VII. Conclusions and Policy Recommendations

Bolivian governments strove to protect workers, creating rules that have been ranked among the highest standards in the world; however, with a very low coverage. In addition, this paper shows that employment subject to these labor rules have been restricted by them. We analyze this effect through job flows and labor demand estimations, using data for registered manufacturing firms through 1988 to 2007.

Jobs flow indicators show that net employment increased at a rate of 4.7 percent per year, on average, in the 1989-1994 period, and increased to 10.1 percent in the 2006-2007 period. In 1996-1999 and 2000-2001, the rate of net employment growth has been below 2 percent. The indicator presents negative growth in the 1998-1999 period, which can be attributed to the economic recession. In contrast, the positive and high net employment change observed in 2006-2007 could be attributed to the economic expansion. The job reallocation rate (job creation plus job destruction) averaged 14.6 percent per year, suggesting that the Bolivian formal manufacturing sector is characterized by a relative low magnitude of job flows. In addition, the data confirms that job creation is pro-cyclical, while job destruction is countercyclical.

Interesting results were obtained by comparing the job flow indicators and the proxy variable of labor regulation. The rate of temporary workers (equivalent to less enforcement of labor regulation) presents a positive relationship with the job reallocation rate, showing that firms with a higher proportion of temporary employees also have more degrees of freedom to contract and lay off permanent workers. In addition, the contribution of firms with a high level of temporary workers to the job reallocation rate has been increasing over time, in part due to the 1999 crisis, with these firms recovering quickly the following year, while other firms continued contributing negatively to the net employment change in the following years. In particular, firms with a high proportion of temporary workers were the only type of firms that contributed positively to the net creation of jobs during the period of economic downturn, 1998-1999. Lastly, firms with high levels of temporary worker rates also experienced higher net employment growth.

In the second approach, labor demand functions were constructed using a translog framework, including labor regulation costs as a tax (or taxes) proportional to the basic salary, and assuming imperfections in the labor market. The estimated employment-salary elasticities show that an increase of 1 percent in labor costs decreases production workers'

demand by 0.49 percent and non-production workers' demand by 0.43 percent. The impact of labor regulation costs becomes extremely significant if we take into account that, on average, it raises the basic salary by nearly 51 percent. For instance, it implies that firms that only pay basic salaries in the manufacturing sector would increase their labor costs by 51 percent if they decide to be subject to the labor regulation costs. Certainly the high level of labor regulation costs is one reason that explains why there are a large number of firms in Bolivia who choose to be informal (in terms of legality) due to the costs that it entails.

In addition, through the inclusion of an indicator that estimates the rigidity of employment, we find that labor protection has a negative impact on production workers demand. This effect would be more relevant since 2006 with the greater labor protection rules.

Lastly, we present two micro-simulations for evaluating regulation changes in recent years: the basic salary mandatory increase in 2006-2009, and the labor costs increase as a result of the new pension system since 2010. In the first case, the exercise shows that the salary increase entailed costs in terms of job losses of 5.7 percent for production workers and of 4.8 percent for non-production workers; and in the second case, employment demand decreased by 1.2 percent for production workers, and by 1.0 percent for non-production workers.

The high standard of Bolivian labor regulation associated with both low coverage, and negative effects on permanent employment, shows the need to think on alternative rules. Certainly, welfare benefits and costs of each possible policy should be evaluated carefully; however, we can suggest some policy recommendations: some degree of flexibility for permanent employment (subject to labor regulation), and a salary policy according to labor productivity.

We propose three alternatives that promote some degree of flexibility, but support job security. The first alternative is the *bank of hours*, which has been applied in Brazil since 1988 (see, e.g, Ministry of Foreign Affairs of Brazil, 2004). This policy consists of adjusting the working hours to production/sales needs of the firms, reducing the working hours during days of low business activity, and accumulating credits in hours for periods of high production/sales. The monthly basic salary does not change over time, and all conditions of credits and liabilities in working hours should be negotiated between employers and employees. In addition, the working hours could correspond to either part time or full time.

This policy will reduce in part the need to hire temporary workers in periods of high production/sales.

The second alternative is to properly regulate the compliance of the labor contracts. Currently this issue has many loopholes, and is excessive bureaucratic in solving any conflict, prejudicing both employees and employers.²⁶Certainly one of the main reasons for dismissing employees is their low performance or negligence at work, which should be clearly established in labor contracts. In this regard, a simple, clear and expeditious regulation will reduce the risk of contracting and maintaining permanently this kind of workers (with the consequent positive effects on permanent employment demand).

Lastly, we propose to generate specific rules for permanent employment in economic downturn periods, which would imply, among other policies, reducing working hours, and dismissing workers with a basic unemployment insurance supported also by the government.

In the case of *a salary policy according to labor productivity* we propose the following. First we believe that the premise behind Bolivian labor regulation must be changed; which is that “given that employers aim to exploit workers, employees must be protected”. For instance, new currents of thought believe that when workers feel happy at work (and certainly not exploited) are more productive. In addition, more productive workers that “feel exploited” will have more probability of quitting the job compared with less productive workers, because the former most likely will find a better job. In this regard, Bolivian government should promote the valuing employees, as key assets of firms, changing the vision of many labor rules.

Second, under a perspective of employees as key assets of firms, bonus should focus on productivity and production bonuses. In this regard, we propose to maintain the Christmas bonus, seniority and monthly border area bonus, and to merge the profit bonus, the non-compulsory production bonus, the *quinquennium*, and the monthly Sunday, in a bonus that reflects more properly productivity and performance.

Lastly, we recommend avoiding, as far as possible, mandatory increases in real labor costs. Tax theory shows that this kind of direct tax has adverse effects on labor demand, which has

²⁶ For instance, institutions may decide not to pay a given wage or a monthly salary without any punishment. In addition, workers may not comply the labor contract without any punishment. These situations are highly probable in Bolivia because any conflict resolution involves entering to a highly bureaucratic and costly judicial system.

been proven empirically in this paper. In particular, the new social cost associated with the new pension system should be financed by other kind of tax or taxes.

References

- Akerlof, A. G., and J. L. Yellen (1986), *Efficiency Salary Models of the Labor Market*, New York: Cambridge University Press.
- Autor, D., W. Kerr, and A. Kugler (2007), “Do Employment Protections Reduce Productivity? Evidence from U.S. States,” NBER Working Paper no. 12860, Cambridge, MA.
- Baltagi, B. H., and S. Heun Song (2006), “Unbalanced Panel Data: A survey,” *Statistical Papers* 47: 493-523.
- Barja, G. (2000), “Las Reformas Estructurales Bolivianas y su Impacto sobre las Inversiones,” in *Quince Años de Reformas Estructurales en Bolivia: Sus Impactos sobre Inversión, Crecimiento y Equidad*, L. C. Jemio and E. Antelo (eds), CEPAL-IISEC, La Paz, Bolivia.
- Behard, A. (2004), “Estimates of labour Demand Elasticities and Elasticities of Substitution Using Firm Level Manufacturing Data,” Centre for Social Science Research Working Paper No. 98, Rondebosch, South Africa.
- Berndt, E. R. and L. R. Christensen (1973), “The Translog Function and the Substitution of Equipment, Structures, and Labor in U.S. Manufacturing 1929–68,” *Journal of Econometrics* 1: 81–114.
- Bierens, H. J. (2007), “Multicollinearity,” unpublished manuscript, Pennsylvania State University, Pennsylvania.
- Binswanger, H. P. (1974), “The Measurement of Technical Change Biases with Many Factors of Production,” *American Economic Review* 64(6): 963-976.
- Biorn, E. (2004), “Regression Systems for Unbalanced Panel Data: A Stepwise Maximum Likelihood Procedure,” *Journal of Econometrics* 122: 281 – 291.
- Blackorby, C., and R. R. Russell (1989), “Will the Real Elasticity of Substitution Please Stand Up?: A comparison of the Allen/Uzawa and Morishima Elasticities”, *The American Economic Review* 79 (4): 882–888.

- Blomberg, J. (2007), *Essays on the Economics of the Aluminium Industry*, Department of Business Administration and Social Sciences, Luleå University of Technology, Sweden.
- Bolivia: Ministry of Development Economics, INE, BCB, CEP, CEPROBOL, UDAPE, UNCTAD, DFI (2005), *Flujos de Capital Extranjero Privado y Percepción del Clima de Inversión*, La Paz, Bolivia.
- Bölük, G., and A. Ali Koç (2010), “Electricity Demand of Manufacturing Sector in Turkey: A Translog Cost Approach”, *Energy Economics* 32: 609–615.
- Botero C. J., S. Djankov, R. La Porta, F. Lopez-de-Silanes, and A. Shleifer (2004), *The Regulation of Labor*, unpublished manuscript, Yale University, New Haven.
- CEDLA (2006) “Diagnóstico Nacional sobre la Situación Económica Laboral de Adolescentes y Jóvenes,” GTZ-CEDLA, La Paz - Bolivia.
- Calvo, S. (2006), “Applying the Growth Diagnostics Approach: The Case of Bolivia,” The World Bank, La Paz, Bolivia.
- Cameron, A. C., and P. K., Trivedi (2009), *Microeconometrics Using Stata*, Stata Press, College Station, Texas.
- Chávez, A. G. y B. Muriel H. (2004), “Los Efectos Económicos de la Erradicación Forzosa de la Hoja de Coca”, unpublished manuscript, La Paz, Bolivia.
- Davis, S. J., J. C. Haltiwanger, and S. Schuh (1996), *Job Creation and Destruction*, Cambridge, MA: The MIT Press.
- Evia, T. (2010), *Eficiencia Técnica del Sector Manufacturero en Bolivia: Una Aproximación de Frontera de Producción Estocástica*, Graduate Thesis in Economics, Catholic University of Bolivia, La Paz, Bolivia.
- Fajnzylber, P., G. Perry, W. Maloney, O. Arias, A. Mason, and J. Saavedra-Chanduvi (2007), *Informality: Exit and Exclusion, Building Effective and Legitimate Institutions*, Washington, DC: The World Bank.
- GEM – Global Entrepreneurship Monitor (2008), *Reporte Nacional Bolivia 2008*, Masters for Development, Catholic University of Bolivia, La Paz, Bolivia.
- Greene, W. H. (2008), *Econometric Analysis*, New Jersey: Upper Saddle River.

- Gruber, J. (1997), “The Incidence of Payroll Taxation: Evidence from Chile”, *Journal of Labor Economics* 15 (S3): S72-S101.
- Haltiwanger, J. C., and S. Schuh (1999), “Gross Job Flows Between Plants and Industries”, *New England Economic Review* (March/April): 41-64.
- Haltiwanger, J. C. and M. Vodopivec (2002), “Worker Flows, Job Flows and Firm Salary Policies: An Analysis of Slovenia”, Discussion Paper No. 569 (September), The Institute for the Study of Labor (IZA), Bonn, Germany.
- Haltiwanger, J. C., S. Scarpetta and H. Schweiger (2006), “Assessing Job Flows across Countries: The Role of Industry, Firm Size, and Regulations”, Discussion Paper No. 4070 (November), The Institute for the Study of Labor (IZA), Bonn, Germany.
- Hamermesh, D. (1986), “The Demand for Labor in the Long Run,” in *Handbook of Labor Economics* (Volume 1), Ashenfelter and R. Layard, ed., North-Holland: Elsevier.
- Hamermesh, D. S. (1993), *Labor demand*, Princeton, N.J., Princeton University Press.
- Heckman, J., and C. Pagés (2004), “Law and Employment: Lessons from Latin America and the Caribbean: An introduction,” in *Law and Employment: Lessons from Latin America and the Caribbean*, Heckman, J. and C. Pagés ed., Chicago: The University of Chicago Press.
- Hsieh, C. T., and P. Klenow (2009), “Misallocation and Manufacturing TFP in China and India,” *Quarterly Journal of Economics* CXXIV, (4): 1403-1448.
- Jemio, L. C. (2000), “Crunch de Crédito en el Sistema Financiero Boliviano,” unpublished manuscript, Corporación Andina de Fomento (CAF), La Paz, Bolivia.
- Kaplan D. S. (2009), “The Effects of Rigid Labor Regulations in Latin America,” Enterprise Surveys, Enterprise Note Series, The World Bank Group.
- Kaufmann, D., Kraay, A., and M. Mastruzzi (2010), “The Worldwide Governance Indicators: Methodology and Analytical Issues”, Draft Policy Research Working Paper.
- Kesselman, R. J., D. H. Williamson, and E. R. Berndt (1977), “Tax Credits for Employment Rather than Investment,” *The American Economic Review* 67(3): 339-349.
- Krugman P. R., and M. Obstfeld (2001), *Economía Internacional: Teoría y Política*, Fifth Edition, Madrid: Pearson Educación S.A.

- Landa, F., and W. Jiménez (2004), “Empleo y Productividad de la Pequeña y Mediana Empresa de la Manufactura en Bolivia 1995-1999”, Bolivian Poverty Assessment, World Bank.
- Layard, R., N. Stephen, and R. Jackman (1991), *Unemployment, Macroeconomic Performance and the Labor Market*, Oxford: Oxford University Press.
- Lazear, E. (2000), “Performance Pay and Productivity,” *The American Economic Review* 90 (5): 1346-1361.
- Machicado C. G. and J. Z. Birbuet (2009), “Misallocation and Manufacturing TFP in the Market Liberalization Period of Bolivia”, Development Research Working Paper 06/2009, Institute for Advanced Development Studies.
- Mercado, A., J. Leitón, and M. Chacón (2005). “El Crecimiento Económico en Bolivia 1952-2003,” Working Paper no. 01, Institute of Socio-Economic Research (IISEC), Catholic University of Bolivia, La Paz, Bolivia.
- Micco, A. and C. Pagés (2004), “Employment Protection and Gross Job Flows: A Difference-in-Difference Approach,” unpublished manuscript.
- Ministry of Foreign Affairs of Brazil (2004), ““Inversión en Brasil Paso a Paso”, Commercial Promotion Division, Brazil.
- Morales, R. (2008), “El Sector Informal en Bolivia, Reflexiones Teóricas y Realidad Estadística,” Superintendencia de Empresas, La Paz, Bolivia.
- Muriel, H. B. (2004), *Três ensaios sobre as predições de Heckscher-Ohlin: Questões teóricas e testes empíricos*, Ph.D. Thesis in Economics, Catholic University of Rio de Janeiro, Rio de Janeiro, Brazil.
- Muriel, H. B. (2005), “Female labor market conditions in urban Bolivia”, Working Paper no. 003, Master for Development, Catholic University of Bolivia, La Paz, Bolivia.
- Muriel, H. B. (2011), “Rethinking Earnings Determinants in the Urban Areas of Bolivia”, Development Research Working Paper no. 05, Institute for Advanced Development Studies, La Paz, Bolivia.
- Muriel, H. B., and R. Ferrufino G. (2011), “Regulación Laboral y Mercado de Trabajo: Principales Desafíos para Bolivia”, unpublished manuscript, Fundación Milenio, Denmark Embassy, La Paz, Bolivia.

- Muriel, H. B., and L. C. Jemio (2011), "Mercado Laboral y Reformas en Bolivia," in *Desafíos Laborales en América Latina Después de Dos Décadas de Reformas Estructurales*, Rodriguez J., and A. Berry ed., Lima: Instituto de Estudios Peruanos.
- Nissin, J. (1984), "The Price Responsiveness of the Demand for Labour by Skill: British Mechanical Engineering: 1963-1978", *The Economic Journal* 94 (376): 812-825.
- Oi, W. Y. (1990), "Employment Relations in Dual Labor Markets," *Journal of Labor Economics* 8(1): S124-S149.
- Peichl, A., and S. Sieglöcher (2010), "Incorporating Labor Demand Effects into the Microsimulation of Tax and Benefits Reforms", unpublished manuscript, The Institute for the Study of Labor (IZA), Bonn, Germany.
- Rajan, R., and L. Zingales (1998), "Financial Dependence and Growth," *American Economic Review* 88(3): 559-586.
- Schneider, F. (2002), "Size and Measurement of the Informal Economy in 110 Countries around the World," paper prepared for the Workshop of Australian National Tax Centre, ANU.
- Solow, R. (1979), "Another Possible Source of Salary Stickiness," *Journal of Macroeconomics* 1: 79-82.
- Stiglitz, J. (1976), "The Efficiency Salary Hypothesis, Surplus Labour, and the Distribution of Income in L.D.C.s," *Oxford Economic Papers* 28: 185-207.
- Vargas, M. (2011), "Ser o no ser Informal: Una Simulación Estructural para Bolivia," unpublished manuscript, ARU Foundation, La Paz, Bolivia.
- von Gersdorff, H. (1997), "The Bolivian Pension Reform: Innovative Solutions to Common Problems", unpublished manuscript, Financial Sector Development Department, The World Bank.
- Wooldridge, J. M. (2002), *Econometric Analysis of Cross Section and Panel Data*, Cambridge: MA MIT Press.
- World Bank (2009), *Doing Business 2010: Reforming Through Difficulties*, The International Bank for Reconstruction and Development-The World Bank, Washington DC, USA.

Yellen, J. L. (1984), "Efficiency Salary Models of Unemployment," *The American Economic Review* 74(2):200-205.

Annex

Table A.1: Labor Demand Equations with Salary Residuals as Regressors, 1988-2001, 2004, 2006-2007

Variables	S_U	S_U	S_S	S_S
\hat{g}_{Ut} (coefficient for residuals of $\ln w_U$)	-0.0075 (0.0055)	-0.0061 (0.0050)		
\hat{g}_{st} (coefficient for residuals of $\ln w_s$)			-0.0075 (0.0042)*	-0.0077 (0.0040)*
Controls for shares and salaries regressions	All exogenous variables and dummies	Only significant variables and dummies	All exogenous variables and dummies	Only significant variables and dummies
Observations	13635	13635	13635	13635

Notes: i) The methodology of estimations was random effects with cluster-robust standard errors by firm (3142); ii) in brackets are the standard errors; iii) * means statistical significance at 10%.

Table A.2: Remaining Equations, 1988-2001, 2004, 2006-07

Variables	S_S (IV)	S_K	S_M
$\ln w_U$	-0.006 (0.0005)***	0.0015 (0.0006)**	-0.0132 (0.0009)***
$\ln w_S$	0.0453 (0.0029)***	0.0024 (0.0005)***	-0.0130 (0.0006)***
$\ln q$	-0.003 (0.0007)***	0.0029 (0.0015)*	
$\ln w_K$	-0.118 (0.0085)***	0.3506 (0.0161)***	-0.1458 (0.0160)***
$\ln w_M$	-0.026 (0.0054)***	-0.0470 (0.0089)***	0.0707 (0.0115)***
$\ln y$	-0.015 (0.0163)***	-0.0242 (0.0017)***	0.0564 (0.0020)***
Constant	-0.006 (0.0005)	1.3099 (0.0372)***	-0.4634 (0.0462)***
Observations	13635	13635	13635
R^2 overall model	0.3238	0.0655	0.1325

Notes: i) The methodology of estimations is random effects with cluster-robust standard errors by firm (3142); ii) in brackets are the standard errors, *** means statistical significance at 1%, ** at 5%, and * at 10%; iii) significant dummies by years are included in the regressions, 1996, 1998-2001 and 2007 for S_S , 1990, 1992-1995 and 1997 for S_K , and 1991-1995, 1997, 1999 and 2001 for S_M ; iv) in the first regression instrumental variables (dummies for micro and large firms) are used for $\ln w_S$; and v) in the first regression dummy is included when permanent employment is positive but non-production workers is reported as zero.