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

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

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Abstract

This paper analyzes the effects of labor regulation on employment for Bolivian registered manufacturing firms during 1988 to 2007. By estimating job flows we find that firms with high temporary worker rates (as a proxy of lower 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, by estimating demand functions we find that labor regulation changes (measured through the compulsory basic salary and the major labor costs derived from the new pension law) entailed costs in terms of permanent employment losses.

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 Bolivia 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 workers' rights have been applied in practice 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 (Muriel and Ferrufino, 2012).

Besides the importance of this issue for Bolivia, as far as we know there are no empirical studies that highlight the effects of labor norms on the labor market outcomes, aside from cross-country studies in which the country applies to one observation (see, e.g., Botero *et al.* 2004, Heckman and Pagés 2004, and Kaplan 2009).

In this respect, this research analyzes the effects of labor regulation on employment outcomes for the formal manufacturing firms through two approaches: job flows, and labor demand functions. 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.[1]

We set up two variables that permit to measure labor regulation at the firm level. The first variable is the rate of temporary workers over total permanent salaried workers. This indicator – controlled for other possible explanations – reveals firm's preferences for labor regulation enforcement; which is associated with selecting temporary workers, and paying a basic salary, over permanent workers providing all workers' rights besides the basic salary. The second variable considers labor regulation accounting costs as a tax (or taxes) proportional to the monthly basic salary. In addition, we use the Rigidity of Employment Index – constructed by the World Bank – noting that it is at the country level.

Job 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 that: 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 economic recession period of 1998-1999, and the highest net employment growth rate is observed in the economic expansion period of 2006-2007. Lastly, we find 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.

[1] Registered firms are those that are registered in the Bolivian Tax Service Institution, and hence considered formal.

Next we analyze empirically the links between job flows and labor regulation. The most striking results are that firms with high temporary workers rates have higher job reallocation rates as well as higher net employment growth; even controlling for other relevant variables. 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.

For the second approach we estimate employment-salary elasticities from labor demand functions, considering separately production and non-production workers. We find that an increase of 1 percent in labor costs decreases the demand for production workers by 0.49 percent, and the demand for non-production workers by 0.43 percent. These estimations permit to evaluate the impact of labor regulation changes on employment through micro-simulations. In particular, we analyze the mandatory basic salary increase during 2006-2009, and the new labor costs – proportional to the salary – derived from the new pension system since 2010. In the first simulation, we show that the costs in terms of job losses represent 5.7 percent for production workers and 4.8 percent for non-production workers. In the second simulation, employment demand decreased by 1.2 percent for production workers, and by 1.0 percent for non-production workers.

Lastly, by including the Rigidity of Employment Index in the demand functions, we find that labor protection rules have a negative impact on production workers demand, which is more relevant since 2006, as a consequence of the new norms.

The remainder of the paper proceeds as follows: Section II presents a brief overview of labor regulation in Bolivia. Section III describes 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 presents 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 stipulates two main types of labor contracts, indefinite and temporary, which differ significantly in rights and, hence, in labor costs.[2] Indefinite contracts allow workers to have all labor rights, including job security, bonuses, and social insurances. Fixed-term contracts undertake only the labor payment;[3] however, they cannot last more than one year, can be renewed only once, and must be of short-term work type (becoming indefinite otherwise).

Job security for workers with indefinite contracts has been modified over time. During 1985-2005 labor rules permitted dismissals but with compensations paid by firms: a

[2] A third type of contract is for specific tasks or services. Though, this is not a proper employer-employee relationship but rather employer-self-employed or employer-micro firm relationships.
[3] Since 2009 the government determined that these contracts are subject to all labor rights.

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 for voluntary retirements). Layoffs without any compensation were justified only under "bad workers 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. Furthermore, some firms hired workers using civil contracts, which were hired under the civil code, thus paying only a basic salary.

In May of 2006 the job security policy changed towards greater protection. Since then, dismissals and civil contracts has been prohibited, and layoffs has been justified only under the mentioned "bad workers behaviors". Nevertheless, if a bad behavior cannot be legally proved, a worker can accept to be fired, but receiving all the dismissal compensations described above.

In 2009 the Bolivian government established two additional job security rules. First, Job immovability was determined for both parents during the pregnancy period, until the child reaches one year of age.[4] 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 also a dense salary policy for workers with indefinite contracts. The monthly basic salary has to be at least equal to the national minimum salary,[5] and since 2007 this has a mandatory yearly lower bound increase. Besides the basic salary, this policy includes: i) Christmas, profit, and (non-compulsory) production yearly bonuses, each one usually equal to one monthly basic salary, ii) a *quinquennium* that corresponds to five monthly basic salaries paid every five years, iii) a monthly salary for Sundays for production workers, v) a monthly seniority bonus, vi) a monthly border area bonus, and vii) surcharges for overtime, work in days off, national holidays or at night.

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) 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 when the system passed from a *pay-as-you-go* system to a *fully-funded* system. In both cases contributions were proportional to the monthly basic salary paid twelve times per year. In the former system contributions were given by employees (8.8 percent on average), employers (4.5

[4] This rule used to benefit only mothers.
[5] This policy also applies to temporary workers.

percent) and government (1.5 percent) (von Gersdorff, 1997). In the later system firms had to pay only 1.71 for labor risk insurance, and employees 12.21 percent.

The second fundamental modification was made in 2010. The pension law became an hybrid of the two previous systems. Contributions were increased to thirteen times per year, including payments with the Christmas bonus, and other contributions were added for a new solidarity pension fund. These lasts contributions are paid by firms (3 percent), and by employees (0.5 percent), including a scale between 1 to 10 percent applied progressively to higher salaries.

The Bolivian workers' rights described briefly above have been ranked among the highest standards in the world;[6] however, they have covered only a small fraction of the labor force. For instance, according to the Household Survey of 2007, for urban workers over 14 years old: i) only 19.3 percent of them have secure jobs; ii) 28.3 percent receive Christmas bonus and 6.8 percent receive 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 Ferrufino, 2012).

III. Methodology

We analyze the links between employment and 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 job flows literature.

Gross job creation at time t is defined as the employment gains summed over all firms that expand or start up between t-1 and t, while job destruction at time t equals employment losses summed over all firms that contract or shut down between t-1 and t.[7] Usually job destruction is expressed as a positive number so that net employment changes are measured

[6] See, for example, the Employing Workers Indicators of the World Bank and the Labor Freedom Indexes of the Heritage Foundation.

[7] 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.

as the difference between job creation and destruction. These flows can be expressed as rates by dividing them by the total number of jobs as shown in Table 1.

Table 1: Job Flow Indicators

Indicators	At the Firm/Plant Level	At the Sector Level
Job creation rate (*CR*)	$\tau_{CR,jt} = \begin{cases} \dfrac{\Delta x_{Ejt}}{0.5(x_{Ejt} + x_{Ejt-1})} & if\ \Delta x_{Ejt} > 0 \\ 0 & otherwise \end{cases}$	$POS_t = \dfrac{\sum_{j+} \Delta x_{Ejt}}{0.5(x_{Et} + x_{Et-1})}$
Job destruction rate (*DR*)	$\tau_{DR,jt} = \begin{cases} \dfrac{\lvert\Delta x_{Ejt}\rvert}{0.5(x_{Ejt} + x_{Ejt-1})} & if\ \Delta x_{Ejt} < 0 \\ 0 & otherwise \end{cases}$	$NEG_t = \dfrac{\sum_{j-} \Delta x_{Ejt}}{0.5(x_{Et} + x_{Et-1})}$
Net employment growth (*NG*)	$\tau_{NGjt} = \tau_{CRjt} - \tau_{DRjt}$	$NET_t = POS_{CRt} - NEG_{DRt}$
Job reallocation rate (*RR*)	$\tau_{RRjt} = \tau_{CRjt} + \tau_{DRjt}$	$SUM_t = POS_{CRt} + NEG_{DRt}$
Excess job reallocation rate (*ER*)	$\tau_{ERjt} = \tau_{RRjt} - \lvert\tau_{NGjt}\rvert$	$EXC_t = SUM_t - \lvert NET_t\rvert$

Source: Haltiwanger, Scarpetta and Schweiger (2006).
Note: The symbol Δdenotes the first-difference operator: $\Delta x_{Ejt} = x_{Ejt} - x_{Ejt-1}$.

The sum of the job creation rate and the job destruction rate gives 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. In addition, 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.

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 (e.g., Micco and Pagés 2004, Haltiwanger *et al.* 2006, and Kaplan 2009). However, given that we are interested only in a single country we construct an indicator related with 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. In this regard, this indicator is used to classify firms by their labor contract preferences, which are associated with regulation enforcement of selecting temporary workers versus permanent workers.

In addition, we reinforce the employment and labor regulation correlation by estimating the following regression (see Haltiwanger *et al.* (2006) for a discussion of this approach at the country level):

$$(1) \qquad \tau_{(NG,RR)jt} = \alpha + \sum_r \alpha_r z_{rjt} + \sum_w \beta_w d_{wjt} + u_{jt}$$

where $\tau_{(NG,RR)jt}$ represents the job reallocation rate or the net employment growth rate of workers in firm j at time t; z_{rjt} is the labor regulation indicator r; d_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_{jt} is the idiosyncratic error independent and normally distributed.

We consider two labor regulation indicators in (1); the rate of temporary workers at the firm level, described above, and the Rigidity of Employment Index constructed by the World Bank at the country level. We notice that the hiring of temporary workers has been motivated not only to evade costs related to permanent contracts but also to conciliate firms' employment needs with their production characteristics, such as business cycles. In this respect, we adjust this rate by these characteristics to avoid any bias that can change the sign in the estimations.

III.2. Labor Demand

The impact of labor regulation costs on employment is analyzed through static labor demand functions where – besides the indicators described above – these costs are approximated as a tax (or taxes) proportional to the basic salary (e.g., Hamermesh 1993, Paes de Barros *et al.* 1999, and Heckman and Pagés 2004). Furthermore, 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 that, in turn, will allow them to hire more productive workers given the benefits linked to regulation.

The previous hypothesis is supported by the following facts. 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. This result means that, on average, workers subject to labor regulation are better-paid and probably more productive compared to those that are not subject to regulation.

The second 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.

[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).

The usual Cobb-Douglas and CES (Constant Elasticity of Substitution) production functions are discarded because they impose restrictions on the elasticities: 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 to 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 (see Hamermesh 1995).

The last issue is related to 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.[9]

Taking into account the previous assumptions, we assume that a representative firm j subject to labor regulation wants to minimize its costs given y units of production. The problem of the firm j in a given period can be written as:

$$(2) \qquad min\ w_{Sj}x_{Sj} + w_{Uj}x_{Uj} + w_{Kj}x_{Kj} + w_{Mj}x_{Mj}$$

$$such\ that\ f(q_{Sj}x_{Sj}, q_{Uj}x_{Uj}, x_{Kj}, x_{Mj}; z_r) = y_j$$

where x_{ij} is the quantity of factor i (= *S*, *U*, *K,* and *M*) in firm j, which are, respectively, non-production workers, production workers, physical capital, and intermediate consumption; w_{ij} is the return of factor i in firm j; $f(\cdot)$ is the production function assumed to be twice differentiable and concave; q_{ij} (i= *S*, *U*) is the quality of employment of type i in j, resuming skills in terms of education, experience, abilities, training, etc.; and z_r is the Rigidity of Employment Index specified in expression (1). Notice that 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 all labor regulation costs paid by the firm: basic salary, job security, bonuses, and social insurances. For simplicity we assume that these costs are proportional to the basic salary: $w_{ij} = (1 + \theta_{ij})\overline{w}_{ij}$, where $\theta_{ij} = \sum_c \theta_{ijc}$ and c refers to each specific regulation cost.

The representative firm is willing to incur 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

[9] Another issue is related to 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 follow Muriel (2004), who develops 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. This result is not described explicitly because it is not needed for the purpose at hand.

productivity. This behavior is modeled by introducing a relationship between both variables, following Oi (1990):[10]

$$(3) \qquad w_{ij} = g_i(q_{ij}, \tilde{w}_{ij}(\tilde{q}_{ij})), \; i = S, U$$

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

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 ($\tilde{w}_{ij}$), for a given quality ($\tilde{q}_{ij}$).[11] The representative firm then minimizes its costs with respect to the two types of employment, physical capital, intermediate consumption, and salaries. This problem gives a new condition for salaries

$$(4) \qquad g_{i,1}(q_{ij}, \tilde{w}_{ij}) = \frac{w_{ij}}{q_{ij}} = \frac{(1+\theta_{ij})\overline{w}_{ij}}{q_{ij}}, \; i = U, S$$

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 cost function is then described as:

$$(5) \qquad C = C\left(\frac{w_{Sj}}{q_{sj}}, \frac{w_{Uj}}{q_{Uj}}, w_{Mj}, w_{Kj}, y_j; z_r\right)$$

Consider now the *translog* production function structure, redefine $v_{ij}, v_{\kappa j} = \frac{w_{Uj}}{q_{Uj}}, \frac{w_{Sj}}{q_{Sj}}, w_{Mj}, w_{Kj}$, and apply logarithms to (5) to obtain

$$(5') \qquad lnC = \ln\gamma_o + \sum_i \gamma_i lnv_{ij} + \frac{1}{2}\sum_i\sum_\kappa \gamma_{i\kappa} lnv_{ij} lnv_{\kappa j} + \gamma_y lny_j$$
$$+ \sum_i \gamma_{iy} lnv_{ij} lny_j + \gamma_{yy}(lny_j)^2 + \gamma_r z_r \sum_i lnv_{ij}$$

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).[12]

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[10] 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).

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

[12] Notice that we assume a cross effect between z_r and v_{ij}.

Expression (5') is derived with respect to the returns of the factors of production to obtain the shares equations as regressions over time.

$$(6) \qquad \frac{\partial lnC}{\partial lnv_{ijt}} = \frac{x_{ijt} w_{ijt}}{C} = s_{ijt} = \gamma_i + \sum_{\kappa} \gamma_{i\kappa} lnv_{ijt} + \gamma_{iy} lny_{jt} + \gamma_{ir} z_{rt} + \nu_{ijt}\ ,\ i,\ \kappa = U, S, K, M$$

where $\frac{\partial C}{\partial w_{ijt}} = x_{ijt}$ by the Shepherd's Lemma, given the levels of labor quality and output, and ν is the idiosyncratic error independent and normally distributed.

The optimal relationship between salary and quality gives two additional equations to the system: expression (3) can be redefined as $g_{i,1}(q_{ijt}, \tilde{w}_{ijt}) / g(q_{ijt}, \tilde{w}_{ijt}) = q_{ijt}^{-1}$, $i = S, U$, which is integrated by q_{ijt} in order to obtain the following equation for empirical estimation:

$$(4') \qquad lnw_{ijt} = lnw_{oit} + lnq_{ijt} + \vartheta_{ijt}\ ,\ i = S, U$$

where w_{oit} is the labor cost of factor i at time t when $q_{ijt} = 1$, and ϑ_{ijt} is the idiosyncratic error independent and normally distributed. Given that employment in the representative firm is small compared with the entire workforce, w_{oit} is considered equal for each firm, and treated as a constant empirically.[13]

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

$$(7) \qquad \frac{\partial x_i}{\partial w_i} \frac{w_i}{x_i} = \eta_{ii} = \frac{\hat{\gamma}_{ii}}{s_i} + s_i - 1\ ,\ i = S, U$$

where $\hat{\gamma}_{ii}$ is the estimated value of γ_{ii}. 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 (4') to the system that we believe is consistent in a segmented labor market, were labor regulation coverage is very low, as it is the case here. In addition, as mentioned above, we avoid endogeneity problems, which will be analyzed in more detail below.

IV. Data

The data used corresponds to the Bolivian Annual Manufacturing Survey (BAMS) which is an unbalanced and broken panel of Bolivian manufacturing firms. The survey includes information of firms registered at the National Tax Service Institution (SIN). The survey was implemented for every year between 1988 and 2001 by the National Institute of Statistics

[13] This means that for firms j and j", $w_{oij}(1, \tilde{w}_i(\tilde{q}_i)) \approx w_{oij"}(1, \tilde{w}_i(\tilde{q}_i))$ given that $\sum_{j' \neq j} (x_{ij'} / \bar{x}) w_{j'}(q_{ij'}) \approx \sum_{j' \neq j"} (x_{ij'} / \bar{x}_i) w_{j'}(q_{ij'})$ in each period t (see footnote 10).

(INE), and stopped until 2008, when INE implemented it again, asking for the information of years 2006 and 2007 at the same time.[14]

In 2004, the INE applied the Amplified Survey of Economic Establishments (EAEE) that included firms from sectors of manufacturing, mining, education, health, and services. As this survey has information similar to those of the BAMS, for the manufacturing sector, we include also this information in our analysis.

The original data is classified by different International Standard Industrial Classification (ISIC) revisions, but we harmonize them with ISIC revision 3.1. By merging all surveys, we end up with information of firms from 1988-2001, 2004 and 2006-2007. Different plants that belong to one firm are classified as different firms because they have different identification numbers. In fact the identification numbers also varied between the samples of 1988-1994 and the samples of 1995-2001. We harmonize also the identification numbers by looking at the name of the firms and sometimes by looking at the addresses.[15]

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: author's calculations based on 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.

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.[16] 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

[14] In appendix we provide additional information of the sample selection methodology and the incomplete processing of the data by INE.
[15] For these reasons we say that INE did not complete the processing of the data.
[16] Unsalaried workers are owners, workers who are relatives of the owners, and others that do not receive any labor earnings.

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.[17]

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 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 it is 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: Employment by Size of Firm

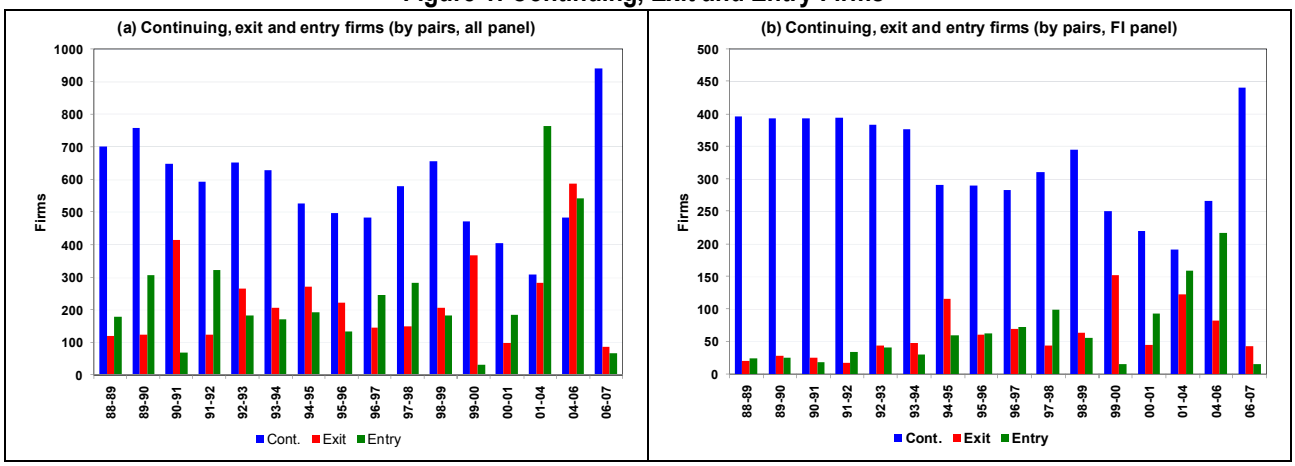
Year	Micro	Small	% of Total	Medium	Large	% of Total	Total
1988	4	3 087	10.65	7 269	18 650	89.35	29 010
1989	375	2 891	10.82	6 743	20 163	89.18	30 172
1990	729	3 277	12.69	6 636	20 931	87.31	31 573
1991	330	1 883	7.22	6 435	22 020	92.78	30 668
1992	533	2 608	9.05	6 668	24 893	90.95	34 702
1993	130	2 839	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: author's calculations based on 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).[18]

[17] This occurs because in 2004 the survey had other objectives, as it was an amplified survey of establishments.
[18] Since forced inclusion information is incomplete, we re-classified firms into this category. First, we re-classified as forced inclusion those firms that in 1988-2001 were classified as random in some years, but appeared in the database in consecutive years, but were classified as forced inclusion in most years. Second, the variable that classified firms as

Figure 1: Continuing, Exit and Entry Firms



Source: author's calculations based on BAMS.

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. Furthermore, 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. Thus, the different ISIC revisions used, the large exit of firms between 1999 and 2000, the large entry between 2001 and 2004 and the many continuing firms between 2006 and 2007, suggests that the forced inclusion sample is better for analyzing job flows.

In this regard, we consider the pair-wise panel for this segment of firms. In addition, we 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 are not considered. We 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 the construction of the variables used.

random or mandatory was not reported by INE in 2004, 2006 and 2007, which made us to classify 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.

Table 4: Firms' Variables

Quantity and Price Variables	
$x_i, i = E,U,S$	Total employment (*E*), salaried permanent workers and non-salaried workers (i.e. owners, and others that do not receive salaries), production workers (*U*), and non-production workers (*S*).
x_K	Stock of capital (net balances of buildings, technical facilities, machinery, equipment, vehicles, computer equipment, etc.). The variable is in Bolivian currency, and has been converted to real values by the GDP investment deflator.
y	Output measured by the gross value of production,[19] and transformed to real values by the implicit GVP price of the input-output matrix (constructed for 16 manufacturing subsectors and harmonized with the ISIC revision 3.1).
$q\ (=q_U=q_S)$	Employment quality, which is approximated by the ratio between firm labor productivity, and the corresponding manufacturing subsector labor productivity, and averaged over the years with information at the firm level.[20]
$w_i, i = E,U,S$	Total labor cost by unit of employment *i*, which is the sum of both the basic salary ($\overline{w}_i$) and regulation costs ($\theta_i \overline{w}_i$). The regulation costs include compensations, Christmas and other bonuses, contributions to social security, and others paid by firms.
w_K	Capital cost by unit, measured through the effective interest rate of the bank system estimated by the Central Bank of Bolivia.[21]
w_M	Intermediate consumption price, which is constructed as a weighted average of two prices: the implicit intermediate consumption prices, obtained from the input-output matrix, and the temporary workers' cost, approximated by the GDP consumption deflator. The weights are the corresponding costs over the composed intermediate consumption (i.e. intermediate consumption plus temporary workers' cost).
$w_M x_M$	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.
Other variables	
Temporary workers rate	Ratio between temporary workers over salaried permanent employees.[22]
Rigidity of employment	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).

[19] The variable 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.

[20] 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.

[21] This rate measures loans in US dollars (given that almost all loans were provided in this currency in Bolivia), and has been converted to Bolivian currency using the uncovered interest rate parity formula.

[22] 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 the relative labor cost (temporary workers' costs over salaried permanent labor costs) in order to extrapolate temporary workers data for 1988-1991. Given the endogeneity problem between the variables, the relative labor cost is measured in a previous period.

Continuation Table 4

Rigidity of employment	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).
Capital intensity	Capital per worker, 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).
Energy intensity	Ratio between the cost of fuels plus electricity (deflated by the intermediate consumption price), and real gross value of production (see Davis, Haltiwanger and Schuh, 1996).

Notes: i) 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; 2) other relevant firms' characteristics will be described in the empirical estimations.

Summary statistics of the variables are given in Table 5 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 5: Summary Statistics for 1988-2001, 2004, 2001-2007 (13,635 observations)

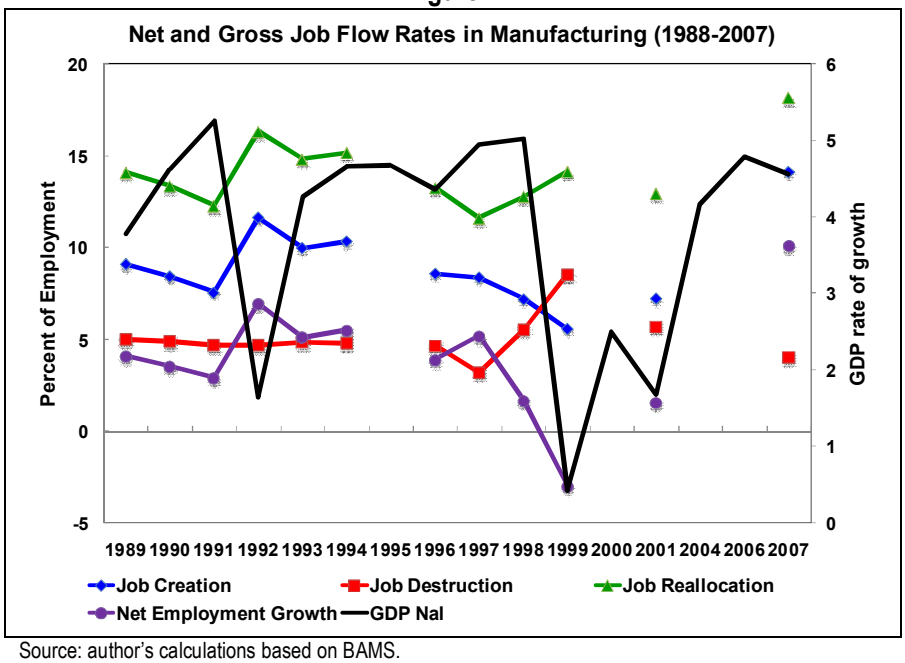
Variable	Mean	Standard Deviation	Pearson Coef. of Variation
Permanent workers (salaried and non-salaried)	45.361	112.083	2.471
Production workers	30.064	83.966	2.793
Non-production workers	14.457	40.556	2.805
Gross value of production (1990 Bs.)	6 807 277	38 000 000	5.582
Stock of capital (1990 Bs.)	4 341 906	57 900 000	13.335
Intermediate consumption (1990 Bs.)	3 846 502	18 500 000	4.810
Employment quality proxy (rate)	4.814	9.024	1.875
Salary_total employment (1990 Bs.)	6 905	7 487	1.084
Salary_production workers (1990 Bs.)	5 242	5 314	1.014
Salary_non-production workers (1990 Bs.)	9 299	15 678	1.686
Labor benefits payment rate	0.500	0.722	1.444
Share of production workers	0.103	0.097	0.937
Share of non-production workers	0.070	0.080	1.137
Share of stock of capital	0.160	0.149	0.935
Share of intermediate consumption	0.667	0.186	0.279
Temporary workers rate	0.210	1.102	5.241
Capital intensity(1)	9.90E-05	0.002	21.694
Energy intensity(1)	0.255	11.409	44.800
Proportion: D_main regions	0.812		
Proportion: D_export	0.139		

Note: (1) includes only 9,345 observations consistent with the job flows 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 stylized facts observed are: 1) job creation and destruction do not always respond in equal magnitudes over the cycle, 2) there is a relatively low magnitude of job flows, 3) there is a 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 analysis aimed at assessing the role of labor market regulation on employment.[23]

Figure 2



Source: author's calculations based on BAMS.

Figure 2 displays the cyclical behavior of manufacturing job flows by comparing the net and the gross job flow rates with the rate of growth of GDP. First, we can see that job destruction is countercyclical as the correlation between this measure and the net employment change is -0.82, while job creation is strongly pro-cyclical with a correlation coefficient of 0.95 with net employment growth. But most important, we can see that creation and destruction do not always move in opposite directions over the cycle. A particular interesting period is the recession of 1998 to 1999. The job creation rate fell by 13 percent in those years, while the destruction rate rose by 72 percent. In fact the correlation between job destruction and job creation is -0.59, indicating that the prevailing view of business cycle is not supported by the evidence of job flows in the Bolivian manufacturing sector.[24]

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

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[23] Jiménez and Landa (2004) have also estimated job flows for the Bolivian manufacturing sector, but covering only the 1996-1999 period.

[24] The prevailing view of the business cycle literature predicts a correlation between creation and destruction of -1.0 and it is based upon the notion that most or all firms respond similarly to the cycle. In fact, this is how macroeconomists rationalize the use of representative agent's models.

Stylized fact 1: Job creation and destruction rates do not always respond in similar magnitudes over the cycle, in particular during the recessions.

Table 6 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 6: Annual Job Flow Rates in Bolivian Manufacturing, 1989-2007

Year	Job Creation	Job Destruction	Job Reallocation	Net Employ-ment 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

Source: author's calculations based on BAMS.

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 Reforms in Bolivia.[25]

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 labor reallocation measures the extent of simultaneous job creation and destruction. According to Table 6, this indicator increased to 11.1, 11.2 and 11.4 percent in the periods of 1997-1998, 1998-1999 and 2000-2001 respectively, being below 10 percent in the other sub-

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

periods. This shows that, in these periods that bound the period of economic downturn, a large fraction of employment opportunities changed locations.

The job reallocation rate in Bolivia has been on average below 15 percent, expect in the sub-period of 2006-2007. 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 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). Thus, according to the international evidence, the reallocation of job opportunities in Bolivia 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.[26] This allows us to state:

Stylized fact 2: The Bolivian 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 firms discarded jobs as a way to reduce costs. This allows us to state the third stylized fact.[27]

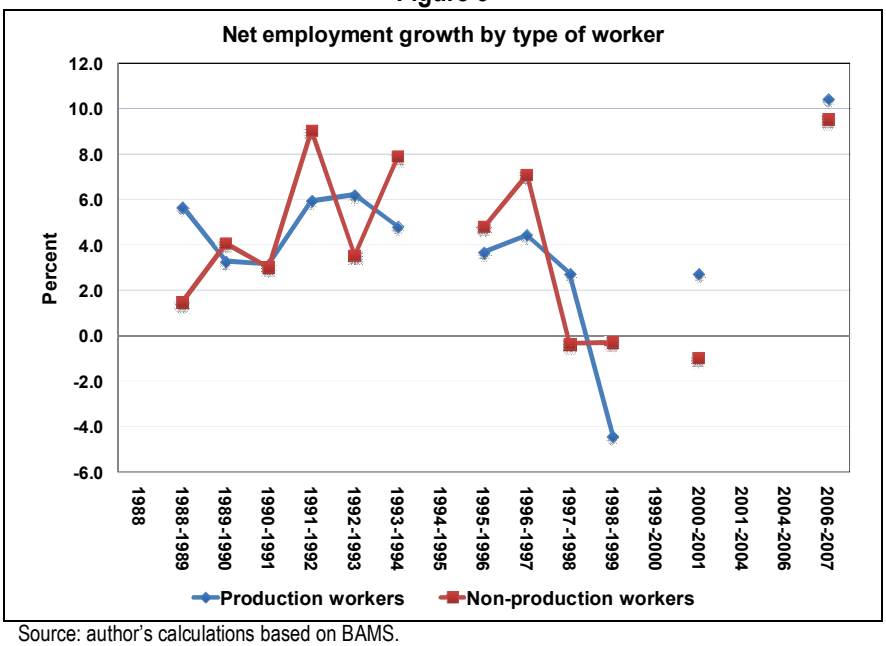
Stylized fact 3: The net shrinkage of manufacturing employment in 1998-1999 can be attributed to the economic slowdown that the Bolivian economy experienced.

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

[26] 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.
[27] Other authors that also state that this crisis had important economic effects are Jemio (2000), Mercado *et al.* (2005) and Chávez and Muriel (2004).

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.

Figure 3



Source: author's calculations based on BAMS.

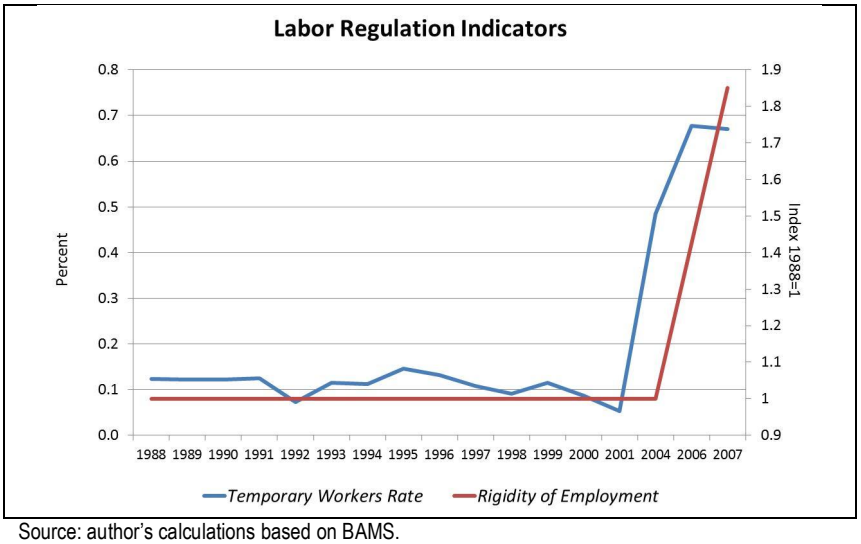
This result allows us to state the fourth stylized fact regarding job flows in Bolivia's manufacturing industry.

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 link between the regulatory environment and job flows by using the *temporary workers rate* as our continuous measure of labor rules enforcement. Figure 4 displays this variable averaged across firms in each year. The rate of temporary workers increased from 7 percent in 1992 to 14 percent in 1995, and then decreased to 5 percent in 2001. The fall during the economic downturn of 1999-2001 can be associated with a higher flexibility to fire temporary workers compared to permanent ones.

During 2004-2007 the rate displays a large increase, reaching a proportion of 67 percent in 2007. We notice that this increase matches the evolution of the *rigidity of employment index*, suggesting that the changes of labor regulation rules towards more protection, modified firms' preferences (ceteris paribus) from using less permanent workers to using more temporary workers. This means in our terms less enforcement or labor rules.

Figure 4



Source: author's calculations based on BAMS.

Figure 5 shows firms classified as those that have low, average or high values of the *temporary workers rate* (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 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.

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 form the economic crisis of 1999 and they have been able to create more jobs than to eliminate jobs. This is also observed in the left Figure, where 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

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.[28] The results are shown in Table 7 where, besides labor regulation indicators, other relevant characteristics were also found to be significant as well as robust to alternative specifications.

The most striking results are presented in regressions one and four, where the coefficient of the *temporary workers rate* is positive and 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 for different estimation methodologies (e.g., fixed effects, feasible least squares, etc.).[29]

Furthermore, in the regressions three and six we adjust this rate for other production characteristics of firms that may explain it: sixteen dummies for manufacturing subsector, dummies for firm sizes, gross value of production (in logarithms), and the share of temporary workers cost. These variables are included to obtain the residuals from a regression for the *temporary workers rate* – which are orthogonal to these variables – that could be interpreted as an *adjusted temporary workers rate*. This rate is averaged by firm over the periods with information. The estimated coefficients of this adjusted rate preserve the sign and significance of the previous rate in the regressions.

The econometric results confirm the previous observation in which we found that firms with high temporary worker rates have higher job reallocation rates, showing that employment creation and destruction are lower when firm's preferences for labor regulation enforcement – in terms of hiring relatively more permanent workers – are greater, which is consistent with the literature (e.g., Haltiwanger *et al.* 2006, and Kaplan 2009). In addition, we show that the net impact of labor regulation has been negative on employment growth. In this regard, and considering also the observations made for Figure 5, we state the last stylized fact:

[28] See Wooldridge (2002), Baltagi and Songs (2006), Greene (2008) and Cameron and Trivedi (2009) for a discussion of (unbalanced) panel data estimation methodologies.
[29] These estimations are available by request to the authors.

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.

Table 7: Job Flows and Labor Regulation, 1988-01, 2004, 2006-07

Variables	Job Reallocation Rate with			Net Employment Growth with		
	Temporary Workers Rate	*Adjusted Temporary Workers Rate*	*Rigidity of Employ-ment Index*	*Temporary Workers Rate*	Adjusted *Temporary Workers Rate*	*Rigidity of Employ-ment Index*
$\ln w_{E(t-1)}$	-0.0246***	-0.0242***	-0.0242***	-0.0170***	-0.0167***	-0.0166***
	(0.0050)	(0.0050)	(0.0051)	(0.0061)	(0.0061)	(0.0061)
y *growth*	0.0229***	0.0234***	0.0232***	0.1725***	0.1726***	0.1728***
	(0.0078)	(0.0078)	(0.0078)	(0.0108)	(0.0108)	(0.0108)
GDP growth				1.8946***	2.0502***	1.9738***
				(0.3101)	(0.3870)	(0.3090)
Capital intensity	-0.5233***	-0.5753***	-0.5522***			
	(0.1750)	(0.1913)	(0.1779)			
Energy intensity	-0.0001***	-0.0001***	-0.0001***	0.0003***	0.0003***	0.0003***
	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
Dummy for main regions				0.0212**	0.0210**	0.0209**
				(0.0102)	(0.0102)	(0.0102)
Dummy for export$_{(\text{average } t,\ t-1)}$	0.0353***	0.0387***	0.0366***			
	(0.0115)	(0.0115)	(0.0115)			
Dummy for micro firm$_{(\text{average } t,\ t-1)}$	0.0591***	0.0610***	0.0606***	-0.0632***	-0.0618***	-0.0616***
	(0.0177)	(0.0178)	(0.0177)	(0.0201)	(0.0202)	(0.0201)
Dummy for forced inclusion	-0.0244***	-0.0250***	-0.0249***	0.0349***	0.0352***	0.0346***
	(0.0092)	(0.0093)	(0.0092)	(0.0084)	(0.0084)	(0.0084)
Temporary Workers Rate$_{(\text{average } t,\ t-1)}$	0.0141***			0.0172***		
	(0.0052)			(0.0057)		
Rigidity of employment index		-0.0109			-0.0054	
		(0.0121)			(0.0205)	
Adjusted Temporary Workers Rate			0.0098**			0.0139***
			(0.0041)			(0.0035)
Constant	0.4196***	0.4323***	0.4254***	0.0754	0.0795	0.0822
	(0.0422)	(0.0421)	(0.0421)	(0.0514)	(0.0542)	(0.0513)
Observations	9345	9345	9345	9345	9345	9345
R^2 overall model	0.1150	0.1117	0.1129	0.0982	0.0963	0.0972

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 three, and 1989-1991, 1993-1995, 1997-1998, 2000, and 2004 for the last three 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*.

We also analyze the *Rigidity of Employment Index* (regressions two and five), observing that the sign of the coefficients are consistent with the previous results; however, they are not statistically significant.

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 three 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 a dummy for *main regions* (La Paz, Santa Cruz and Cochabamba) shows that employment growth is higher in these regions compared to the rest of the country; and the dummy for firms that export suggests higher employment volatility in these firms. 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 equation (5) using random effects from the unbalanced panel for the period 1988-2007, with cluster-robust standard errors by firm.[30] In addition, we include year dummies, the *Rigidity of Employment* variable, and dummies for controlling zero values of shares,[31] when they are significant at 10 percent level and robust to alternative specifications.

Initially we analyze possible endogeneity problems. The model described above assumes 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 these residuals as a new variable 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 for non-production workers the coefficient of the residuals is rejected at 5 percent, but not at 10

[30] 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 Songs 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.

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

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 relatively 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 proportion, and are scarce (see, e.g., Muriel and Jemio, 2010; Muriel and Ferrufino, 2012).

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 Appendix).

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 8: 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		-0.0067	
	(0.0021)***		(0.0005)***	
$\ln w_S$	-0.0021		0.0414	
	(0.0004)***		(0.0017)***	
$\ln q$	-0.0036	0.0892	-0.1034	0.0826
	(0.0008)***	(0.0058)***	(0.0080)***	(0.0064)***
$\ln w_K$	-0.1426		-0.0192	
	(0.0121)***		(0.0051)***	
$\ln w_M$	-0.0217		-0.0155	
	(0.0062)***		(0.0008)***	
$\ln y$	-0.0241		-0.2551	
	(0.0011)***		(0.0143)***	
Rigidity of Employment	-0.0097			
	(0.0043)**			
Constant	0.0750	0.0079	0.0527	0.0871
	(0.0203)***	(0.0213)	(0.0159)***	(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 percent. 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.[32] 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 9: 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 $\overline{w}_U$		≈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 $\overline{w}_S$		≈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 $\frac{\partial x_i}{\partial \overline{w}_i}\frac{\overline{w}_i}{x_i} = \eta_{ii}$; and (3) corresponds to $\frac{\partial x_i}{\partial \theta_{ic}}\frac{\theta_{ic}}{x_i} = \frac{\theta_{ic}}{1+\theta_i}\eta_{ii}$.

In addition, Table 10 presents two micro-simulations for evaluating the changes in regulation during 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.

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

The first economic policy was implemented in order to maintain real salaries in relation to the Consumer Price Index (CPI), which increased mainly 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 a growth of 18.08 percent, on average, for the 16 subsectors.[33] This information allows estimating the difference between these prices at the firm level, which reaches 11 percent as shown in 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 to collect more resources for 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 inefficiency) but also affects directly and negatively labor demand of firms subject to labor regulation.

We evaluate this second policy only through is 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.

VII. Conclusions and Policy Recommendations

This paper shows that Bolivian labor regulation have a negative impact on employment. We analyze this effect through job flows and labor demand estimations, using data for registered manufacturing firms between 1988 and 2007.

Initially we explore the main stylized facts emerging from job flows alone, observing that they have relatively low magnitudes compared with the experiences of other countries (see Davis *et al.* 1996). In addition, 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 economic recession period of 1998-1999, and the highest net employment growth rate is observed in the economic expansion period of 2006-2007. We also find that net employment growth is relatively more volatile for non-production

[33] 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.

workers than for production workers, but the destruction of jobs is more severe for production workers in periods of economic downturn.

Interesting results are obtained by comparing the job flow indicators and the proxy variable of labor regulation: the rate between temporary workers and permanent salaried workers. This rate has a positive relationship with both the job reallocation rate and net employment growth. This means that firms with higher proportion of temporary employees create more net permanent workers positions, despite having more degrees of freedom to lay off them, because this somehow eases labor costs for firms.

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 firms with low levels of temporary workers continued contributing negatively to the net employment growth rate in the following years.

The labor demand functions estimations permits to obtain employment-salary elasticities, which 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. 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 small and informal (in legal terms), paying only a basic salary.

Furthermore, 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 becomes 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 negative impact of labor regulation 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 want to discuss the following policy recommendations: i) some degree of flexibility for permanent employment (subject to labor regulation), and ii) a salary policy more linked to labor productivity.

For attaining flexibility for permanent employment, we propose three alternatives. 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. 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. Certainly 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 and applicable regulation will reduce the risk of contracting and maintaining permanently this kind of workers (with the consequent positive effects on permanent employment demand).

Third, 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.

For 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 of employees, as key assets for 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, they are distortionary as has 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.

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Appendix A: The Data

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.[34] 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.

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

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
$\hat{\vartheta}_{Ut}$ (coefficient for residuals of $\ln w_U$)	-0.0075	-0.0061		
	(0.0055)	(0.0050)		
$\hat{\vartheta}_{st}$ (coefficient for residuals of $\ln w_s$)			-0.0075	-0.0077
			(0.0042)*	(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	0.0015	-0.0132
	(0.0005)***	(0.0006)**	(0.0009)***
$\ln w_S$	0.0453	0.0024	-0.0130
	(0.0029)***	(0.0005)***	(0.0006)***
$\ln q$	-0.003	0.0029	
	(0.0007)***	(0.0015)*	
$\ln w_K$	-0.118	0.3506	-0.1458
	(0.0085)***	(0.0161)***	(0.0160)***
$\ln w_M$	-0.026	-0.0470	0.0707
	(0.0054)***	(0.0089)***	(0.0115)***
$\ln y$	-0.015	-0.0242	0.0564
	(0.0163)***	(0.0017)***	(0.0020)***
Constant	-0.006	1.3099	-0.4634
	(0.0005)	(0.0372)***	(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.