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Labor Market Reforms and Their Impact on Formal Labor Demand and Job Market Turnover: the case of Peru

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ABSTRACT*

This paper analyzes the effects of several aspects of labor legislation that were modified through successive waves of reform since 1991. Firing costs diminished sharply through the progressive elimination of job security regulations, the introduction of temporary contracts and changes in the severance payment structure. Simultaneously, non-wage labor costs increased. To assess the effect of these changes on the level of formal employment, we estimate labor demand functions. We use a pseudo panel data set for ten formal sectors observed bimonthly between 1987 and 1997 and panel data sets at the establishment level for three sub-periods. Both at the sector and establishment level, labor costs have a negative and significant effect on labor demand. The coefficient of our measure of firing costs, the expected severance payments, is negative and significant, and its magnitude decreases in the post reform period. After the reforms, the price and output elasticities are larger and there is evidence of a speedier labor demand adjustment. To assess the effect of regulations changes on turnover we use a series of repeated cross sections household surveys for Metropolitan Lima and calculate mean tenure using censored data. We find evidence that mean tenure fell since 1992. The fall is larger, and more statistically significant for formal salaried workers than for informal workers. Using censored and complete employment spells from the Peruvian Living Standards Measurement Surveys we compare employment duration data for the formal and informal sectors using empirical hazards and parametric estimations of hazard functions. After the reforms, there is an increase in the hazard function for formal wage earners relative to the hazard function of informal sector wage earners. We find higher hazards for informal, private, temporary and blue-collar workers.

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1. Introduction

After the expansionary phase of the "heterodox" experiment (1986-1987) of the García government, the Peruvian economy fell into a very deep recession. Output fell between 1988 and 1990 in the midst of a hyperinflationary process. The Fujimori government implemented a harsh macroeconomic stabilization program in August 1991, and a few months later a comprehensive set of structural reforms was launched. Peru experienced one of the fastest trade liberalization processes and one of the deepest labor market reforms in Latin America. These reforms were accompanied by a downsizing of the public sector, the start of a privatization process, the abolition of all state-owned monopolies and a tax reform. In addition, restrictions to capital account transactions were eliminated while the financial sector was deregulated.

The Peruvian Labor Code, developed during the import substitution period, had been termed one of the most restrictive, protectionists and cumbersome of Latin America (ILO, 1994). The Code was extremely complex and comprised a collection of overlapping decrees that had undergone many changes over time. The military government of 1969-1975 made firing extremely difficult by sanctioning job security after a probationary period. In 1985, the García government reduced the probationary period to just three months, during what was the period of most rigid labor market legislation. In 1991, labor market regulations were relaxed through a succession of reforms. Firing costs diminished sharply through the progressive elimination of job security regulations, the reduction in red tape for the use of temporary contracts and changes in the severance payment structure. In addition, firms in the formal sector faced high non-wage costs: payroll taxes, social security and health contributions, a tenure bonus, training fund contributions, family allowances, and a long 30-day vacation period. During the nineties overall non-wage costs increased slightly.

One of the first adjustment mechanisms to restrictive labor legislation is the use of informal contracts. In this sense, changes in firing costs expected by the firm and in non-wage labor costs have an impact on the distribution of employment between the formal and informal sector, but not necessarily on overall employment. If firing costs are perceived by firms as a tax imposed on layoffs, a reduction, like the one observed in Peru, given the fall in expected severance payments and the abolition of job security and the facilities given for the use of temporary contracts, will increase the equilibrium employment level. Moreover, reductions in expected firing costs may have an effect on the response pattern of firms to changes in product demand which may be reflected in larger employment-output elasticities. In this paper, we analyze the impact of changes in expected severance payments and labor costs estimating labor demand functions for the formal sector. We use data from establishment level surveys for formal firms in Metropolitan Lima. With these data we construct a pseudo-panel data set of 10 economic sectors observed bimonthly during the period 1987-1997, and three shorter panels of about 400 establishments for the periods 1987-1990, 1991-1994 and 1995-1997, dates dictated by sample changes.

Also, reductions in labor legislation-related firings costs typically accelerate the process of job creation and job destruction, therefore increasing turnover and reducing job duration, particularly in the formal sector. We examine changes in job duration and labor market turnover using data from a series of annual household surveys, with which we analyze changes in mean tenure in both the formal and informal sectors. In addition, using the Living Standards Measurement Survey, we

construct complete and incomplete employment spells with which we calculate empirical hazards for different sub-samples, and we estimate exponential hazard models.

The paper proceeds as follows. In Section Two we analyze the legal context regarding the probationary period, severance payments, non-wage costs and temporary contracts, all factors that affect firm and workers' behavior. We also describe changes in employment in Metropolitan Lima during the period of analysis, and how informality and temporary contracts have been mechanisms through which firms avoid paying mandated benefits and firing costs. In Section Three, we present results of labor demand estimations at both the sectoral and establishment levels. Finally, in Section Four, we analyze basic patterns of employment duration. In order to assess possible impacts of labor laws, we compare patterns of the self-employed with those of wage earners in the formal and informal sectors. We present a comparison of job duration among different groups of workers using empirical hazards and we show the results of exponential hazards functions.

2. Changes in the Regulatory Framework During the Nineties

Prior to the reforms, the Peruvian Labor Code was extremely complex and comprised a large collection of overlapping decrees. Formal workers enjoyed several employment stability provisions, payroll taxes and social security contributions were high and collective bargaining and other regulations gave unions great power. Since 1991, labor market regulations have been relaxed through a series of reforms. In this section we describe the changes in firing costs determined by the severance payment and job security regulations. We also describe changes in regulations and in use of temporary contracts and the evolution of non-wage labor costs.

2.1 Severance Payments and Job Security

The costs of firing in Peru comprised two main elements, mandated severance payments upon dismissal and the costs imposed by job security regulations. The military government of General Velasco introduced severance payments in 1970 as a fixed value equivalent to three wages upon dismissal without "just cause." This was conceived as a compensation for the hardship of dismissal and simultaneously as an unemployment insurance device. In addition to severance payments, Peruvian labor laws had very rigid employment protection clauses which increased firing costs dramatically. During the period 1971-1991, a worker who completed the probationary period, the length of which was changed several times, was granted absolute job security. That meant that if a firm dismissed a worker and could not prove "just cause" in labor courts, she could choose between being reinstated in her job or receiving the severance payment. This made the severance payment the lower bound of the firing cost, as workers had the incentive to ask to be reinstated in their jobs, and then settling out of court for a larger severance payment. This setting also implied high administrative and litigation costs. Just cause did not include economic reasons, and workers could be fired only due to serious misdemeanor or through complicated collective layoffs. From the employer's perspective, a worker was effectively "owner of his job."

In 1978, the length of the probationary period was increased to three years (see Table 1). The severance payment schedule was raised, and workers with less than three years in a firm received the equivalent of three wages if fired without notice, while workers with longer tenures received twelve wages upon dismissal. During the probationary period, the employer had to inform the worker in advance if he wanted to fire him to avoid the severance payment.

In June 1986, the probationary period was reduced again to just three months and a large portion of workers suddenly acquired total job security. An interesting feature here is that the change was announced in June 1985, about a year before the law was effectively sanctioned. Casual evidence for that year shows that employers did not increase layoffs massively among workers with less than three years of tenure who had not concluded their probationary period. Given that the economy was starting an expansionary period it is probable that business expectations regarding higher demand were on the rise, reducing the incentive of employers to fire workers who could potentially receive job security rights. Still, the announcement of the policy change, *ceteris paribus*, must have had a positive effect on turnover for these workers. The severance payment was set to the equivalent of three wages for those workers who had been employed between three months and one year, six wages for those with one to three years of tenure, and twelve wages for those with more than three years tenure (see García schedule in Graph 1 and Table 2).

Table 1
Probationary period and job security regulations

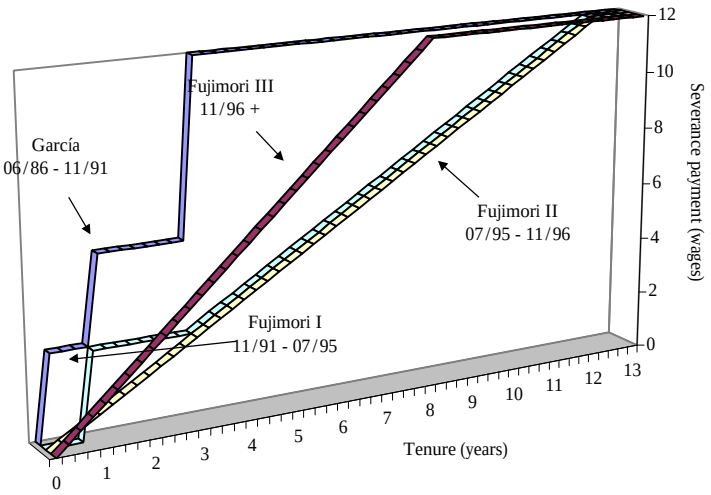
	Probationary period length	Job stability status	Temporary contracts availability
Before June 1986	3 years	Granted after 3 years	Low
June 1986 - October 1991	3 months	Granted after 3 months	Low
November 1991 - July 1995	3 months	In effect only for workers hired after November 1991	High
After July 1995	3 months	Abolished	High

The June 1986 changes in labor laws by the García administration made the 1986-1991 period the one with the highest degree of rigidity, as severance payments were high, the probationary period was short and job security rights were still in place. Rigid job protection pushed firms to look for ways to get around these regulations. One way was to lobby for the generation of the so-called Emergency Employment Program. Another way was to fire workers a few days before they completed the three-month period and then re-hire them. Another form of eluding these regulations was making workers sign an undated letter of resignation at the beginning of the contract period.

In 1991, the government introduced several changes aimed at reducing the extreme rigidity imposed by labor laws. The intention of the drafters of the Law Decree 726 of November 1991 was to abolish job security. However, the right to job security was written into the 1979 Constitution so, in principle, only through a two-year process could the Congress pass a law approving a constitutional change. The outcome was the creation of a dual regime in which workers with contracts signed before November 1991 maintained their job security rights, while new workers

would only have protection against unfair dismissal. In practice, this meant that these workers could be dismissed at will upon payment of a severance benefit. In addition, "just cause" clauses were extended to include issues related to workers' capabilities. In addition, the severance payment rule was modified in order to reduce firing costs. It was fixed at one wage for every year of tenure for workers with more than one year in the firm, with a minimum of three wages and a maximum of twelve, as shown in Graph 1 (Fujimori I schedule).

Graph 1
Severance payment regimes



In July 1995, with the second wave of labor reforms, the severance payment schedule was simplified to one month per year of work up to a maximum of 12 months (Fujimori II schedule in Graph 1). Given that the 1993 Constitution replaced the right to job security with the right to unfair dismissal, in the 1995 law job security rules were eliminated and the two-tier regime eliminated. These changes, the reduction in severance payments and the abolition of job security, implied a sharp reduction in firing costs, which may be interpreted as a lower level of the tax on dismissals perceived by firms. This has the effect of giving formal firms more flexibility to adapt to output changes. This may have the effect of increasing the employment level and also of increasing the output elasticity in labor demand estimations for formal firms. In addition, reductions in firing costs typically accelerate the process of job creation and job destruction, therefore increasing turnover. Finally, in November 1996 the severance payments rule was again modified. Instead of receiving one wage for each year in the firm, the employee received one and a half wages, introducing an important large increase in the firing costs of low tenured workers. The maximum cap of twelve wages remained unaltered (Fujimori III schedule in Graph 1).

Table 2
Severance payment legislation: Rules and examples

	Rule		Worker's tenure:		
	Tenure	Severance payment	2 years	10 years	20 years
June 1986 - November 1991	3 months - 1 year 1 - 3 years More than 3 years	= 3 wages = 6 wages = 12 wages	6 wages	12 wages	12 wages
November 1991 - July 1995	3 months - 1 year 1 - 3 years 3 - 12 years More than 12 years	= 0 wages = 3 wages = 1 wage per year = 12 wages	3 wages	10 wages	12 wages
July 1995 - November 1996	3 months - 12 years More than 12 years	= 1 wage per year = 12 wages	2 wages	10 wages	12 wages
November 1996 +	3 months - 12 years More than 8 years	= 1.5 wages per year = 12 wages	3 wages	12 wages	12 wages

Quantifying the severance payment

The severance payment rule has an effect on the amount of resources firms have to reserve to finance dismissals. Given that in Peru, as in many other Latin American countries, these payments are linked to tenure, these reserves will vary depending on the tenure structure of the workforce of the firm. In turn, the firm's tenure structure may be endogenous to the severance payment rule, as firms will try to avoid maintaining workers who will later be relatively more expensive to dismiss. This structure will also depend on technology and other characteristics of the firm and sector.[1]

We calculated the evolution of potential reserves for severance payment as a commodity contingent on a firing (F) or a hiring (H) state of the economy.[2] We may therefore think of a firm as choosing among probability distributions or "prospects" whose uncertain consequences are to be received with respective state-probabilities $\pi = (\pi_H, \pi_F)$. Specifically, expected severance payment is calculated by state and sector using the evolution of the tenure structure, an estimate of the firing probability for each tenure group, and the corresponding mandated severance payment. The following formula describes how it is calculated (time subscripts have been eliminated):

$$E(sp)_i = p_F\left[\sum_X l(X)_{i,F}.N_X.SP(X)\right] + p_H\left[\sum_X l(X)_{i,H}.N_X.SP(X)\right]$$

$E(sp)_i$ is the expected severance payment, which is a probability weighted average for the severance payments in each of the states, hiring and firing, and sector *i*. The first bracket corresponds to the severance payment for the firing state and the second for the hiring states which are weighted by p_H and p_F, the probabilities of being in a hiring (H) or in a firing (F) state of the economy respectively. The severance payment in each of the brackets for sector *i* is calculated by

1 For instance, the share of long tenure workers will generally be larger in the manufacturing sector, were firm and sector specific knowledge is more important than in trade.

2 This is following the expected utility rule of John Von Neumann and Oskar Morgenstern (see Hirshleifer and Riley (1992)).

multiplying a time-invariant sector specific and state contingent firing probability, $l_{,state}$(X); by the number of workers in a specific tenure group (N_X); and by the mandated severance payment that would have to be paid to employees in that group if they are fired, SP(X). X denotes the tenure group. To calculate this firing probability we used the average employment reduction by tenure group in each possible state (hiring and firing), and when employment grew, we assumed zero variation. Because of this, we obtained a constant probability across the whole period but different across sectors, tenure groups and states. Data on the structure of tenure groups and employment changes by sector comes directly from the Quarterly Survey of Wages and Salaries (QSWS)[3].

Graph 2 shows the evolution of E(sp) for the period 1986-1996 as a percentage of total wages. Note that we are fixing the sector-specific firing probability, so in this aggregate, changes may only be attributed to changes in the employment share of different sectors and changes in legislation. The first large fall in the index is at the end of 1991, and it reflects the reduction in the mandated severance payment schedule. Further changes are related to increases in the share of short tenure groups. Changes observed in 95:06 coincide with a further reduction in mandated severance payments, while the increase in 96:08 coincides with an increase in these payments. On average, reserves firms had to maintain for severance payment were reduced from 16% of the wage bill to around 8% after the reforms.[4]

Graph 2
Expected severance payments as a percentage of total wages, 1986-1996

Notes: Total expected severance payments have been divided by the total wagebill to eliminate wage and employment trends.
See footnote for an explanation of the adjustment.
Sample change
Legislative change

[3] The survey includes a sample of workers per firm , from which we calculate the firm tenure structure.Nx is calculated with this structure and total firm employment. The characteristics of the QSWS will be described in section 3.2.1.

[4] Graph 2 also shows an "adjusted" E(sp) for the period 1992-95. The increase in the calcualted E(sp) between 1992 and 1995 is related to an undersampling of newer firms. During those years the sample was not renewed, so only "deaths" were registered. As no new firms entered the sample, older firms, which tend to have older workers are over represented. This implies a tenure structure biased toward older workers, therefore increasing the E(sp). In the calculation of the employment series this problem was tackled through expansion factors that weighted the original data in order to take into account sample changes in the structure of firms by size.

2.2 Reducing Rigidities: Temporary Contracts

One possible way of bypassing the large adjustment costs imposed by employment protection policies is lobbying the government to introduce short-term or temporary contracts. Temporary contracts were introduced in 1970. Firms required prior authorization from the Ministry of Labor, and contracts were allowed under very specific circumstances. In practice, the high administrative costs this process implied heavily restricted their use. As shown in Table 3, between 1986 and 1990, around 20% of workers in formal firms were under temporary contracts. Most of them carried full social benefits but had no employment protection clauses (*contratos sujetos a modalidad)*, and important proportions of temporary workers were probationary period workers. During the short-lived populist boom of 1987, in the midst of a period of extreme job protection, firms were allowed to hire using short-term temporary contracts through an emergency employment program (*PROEM*, or *Programa Ocupacional de Emergencia*). These contracts, which could last up to a year, were used mainly by large formal firms.

In August 1991, with the first wave of labor reforms, red tape for the use of fixed-term contracts was significantly reduced and the reasons that could be used to justify hiring a worker under this type of contract were increased; at the same time The Ministry of Labor confined its role to record keeping and charging a fee for each contract. In general, in contexts of restrictive job protection regulations the output elasticity of temporary contracts is larger than for permanent contracts, given that they usually do not carry firing costs (Bentolila and Saint-Paul, 1992). In Peru, despite the reduction in firing costs for new workers under permanent contract in 1991, firms still preferred the now easier to use temporary contracts. The share of workers under these contracts increased from 20% in 1991 to 31% in 1992 and most of the formal private employment growth observed during the nineties was explained by temporary contracts. Moreover, even after the elimination of the two-tier system in 1995 with the elimination of job security for all workers, and an additional reduction in severance payments, temporary contracts continued growing, covering 44% of private formal wage employment in 1997.[5] This could be explained by the fact that firing costs for permanent workers, even if smaller than before, are still high or that firms may be reluctant to hire workers as permanent employees, fearing a setback of the flexibilization process. In fact, a change in the severance payments schedule in 1997 implied an increase in firing costs.[6] In our estimations we cannot distinguish permanent from temporary contracts; however, the lower administrative costs of using this type of contracts should imply a greater output elasticity after the reforms.

[5] By 1997, according to Household Survey data 316,000 private salaried workers in Lima had signed temporary contracts. According to the administrative records of the Ministry of Labor, 434,000 new contracts were signed that year. As a percentage of the total employment in Lima (i.e., including public workers and the informal sector, the share of workers under this type of contract reached 24%.

[6] . A surprisingly large output elasticity of temporary contracts was also observed in Spain when in 1986, as the economy picked up and restrictions for the use of temporary contracts had been lifted, almost all job creation was explained by this type of contracts. Between 1987 and 1990, the share of temporary contracts increased from 15% to 32%.

Table 3
Metropolitan Lima: Structure of total private formal salaried employment, 1986-1997
(Percentages)

	1986	1987	1989	1990	1991	1992	1993	1994	1995	1997
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Permanent	80.7	82.1	82.9	80.8	80.1	68.6	67.9	64.8	59.8	56.0
Temporary	19.3	17.9	17.1	19.2	19.9	31.4	32.1	35.2	40.2	44.0
Fixed term contract	19.3	17.7	14.3	19.2	19.6	30.0	29.8	33.3	39.4	39.9
Youth contracts	0.0	0.1	0.0	0.0	0.3	0.0	0.4	0.0	0.3	2.5
Probationary period	----	----	2.7	----	----	1.4	1.9	1.9	0.5	1.6

Source: *Encuesta de Hogares del MTPS 1986-1995, Encuesta Nacional de Hogares del INEI 1997.*

Note: Not all the surveys between 1986 and 1997 allow the separation between workers under fixed term contracts and those under probationary periods.

2.3 Non-Wage Costs

In Peru an important source of public finance is payroll taxation. This burden has been heavily criticized, mainly along the lines that these contributions increase labor costs, reduce competitiveness and have possible negative effects on employment. Peru has a complicated and unstable structure of non-wage labor costs:

- Public and private retirement plan payments. Between 1986 and 1993, the employer had to pay to the public pension agency, the *Instituto Peruano de Seguridad Social* (*IPSS)* a contribution of 6% of the employee's wage, while the employee had to pay 3%. Poor and corrupt management, increasing numbers of retirees and inflation led to a near collapse of the pay-as-you-go public system. In 1993, a private pension system was created, with individually held accounts managed by institutions called the *Administradoras de Fondos de Pensiones* (*AFP*s). Currently, both pension plans exist. In 1995, and after a few changes, the rate was set at a total of 11% in both systems and all the contribution had to be paid by the employee.[7]
- Health plan payments. The public health plan offered by *IPSS* is still the only option for workers. The total contribution rate has been fixed at 9% during the last years. However, its composition with respect to employers and employees has changed: Before 1995 the employer had to pay 6% while the employee had to pay 3%. Currently, the employer must pay the entire contribution fee.
- Accident insurance: The employer is required to pay accidents insurance for his blue-collar workers. The amount is calculated as a percentage of the employee's salary. This rate varies depending on the level of risk involved in the job and averages around 2%.
- Manufacturing training fund (*SENATI*): Paid by the employers of firms in manufacturing industries. Initially it was set at 1.5% of the worker's income. In 1995, it was reduced to 1.25%, in 1996 to 1% and in 1997 to 0.75%.

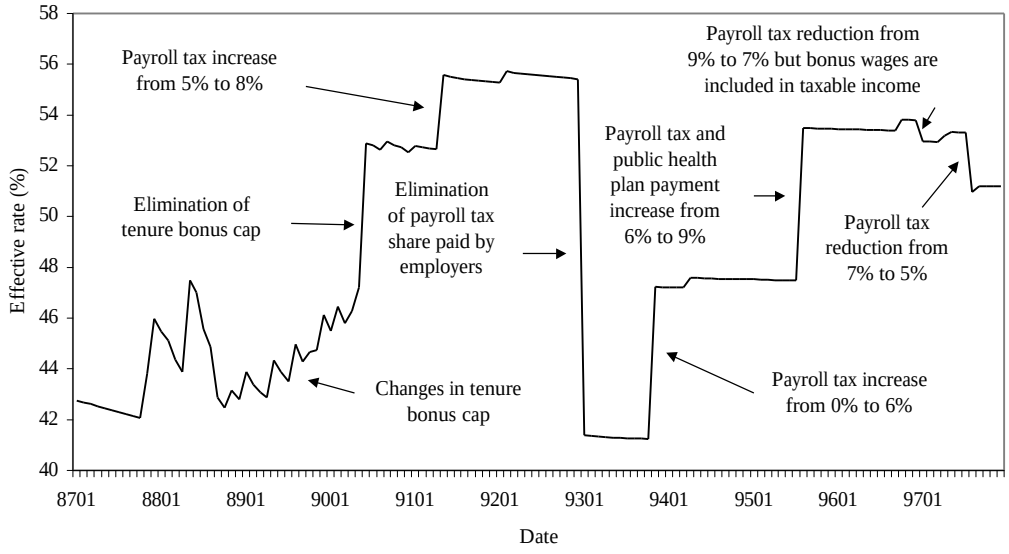
[7] See details in annex 1.

- What was originally created as a contribution to benefit workers' housing needs in the late 1970s, the National Housing Fund (*FONAVI*), rapidly resulted in a costly payroll tax, mainly due to inefficient and faulty management of collected funds.[8] Up to 1988, the *FONAVI* contribution paid by the employer was 4% of the employee's wage, while the employee's rate was 0.5%, and the maximum taxable wage was set on 8 *UIT*s (tax unit). In November of that year, the employer's contribution rate was increased to 5% and the employee's rate to 1%. In May of 1991 the employer's rate was set at 8% while the employee's rate remained unchanged, raising the total contribution to 9% and further widening the gap between the amount paid by the employer and the amount received by the employee. In January 1993 the employer's contribution responsibilities were abolished altogether, and the employee's rate was set at 9%. Even though the total contribution rate remained constant (at 9%), the maximum effective taxable wage was abolished, which might have increased the effective rate. Ten months later, due to harsh political pressures, the employee's contribution rate was diminished to 3% and the employer's rate was increased to 6%. In August of 1995 the employee's contribution was abolished and the employer's contribution rate was set at 9%. Finally, since January of 1997, the total contribution was reduced to 7% (paid completely by the employer), but the Christmas and holidays bonuses of a monthly salary were included in the taxable base.
- Tenure bonus- *CTS* (*Compensación por Tiempo de Servicios*). Additional wage paid by the employer to the employee for every tenure year of the worker. Prior to January 1991, the employer paid a maximum bonus of 10 minimum wages if the employee's wage was higher than that amount. Employers were allowed to keep tenure bonus money until an employee left the firm (his only obligation being to register it in the firm's balance sheet as a liability). The system failed due to employers' lack of compliance in actually keeping tenure bonuses for workers. Actually, when a worker was fired, the payment of this bonus worked as an additional firing cost. Since January 1991 the employer has to deposit all tenure bonus money in an authorized bank in May and November of each year.
- Christmas and National Holiday bonuses: In December 1989, it became obligatory for the employer to pay two additional wages to his employees (on July and December of each year). However, this was already a common practice before the law was established, especially in medium and large firms. In the public sector, these bonuses had been paid regularly to employees since the mid 1980s.

Graph 3 shows the evolution of the effective rate paid by a firm in the case of a blue-collar worker affiliated with a public pension plan. To calculate the non-wage costs effective rate it was necessary to estimate each of the non-wage costs listed above. The main difficulty in the estimation was to combine the effect of the different rates with the maximum and minimum taxable bases, so we calculated each of the non-wage costs separately and then summed them together. Most of the sources of change are related to cap changes in the tenure bonus and changes in the payroll tax rate. In addition, different rates were changed in such a way that the total employer contribution remained unaltered on several occasions. This is the variable used later in the labor demand estimations.

8 As a result of this, FONAVI became an important issue in political discussion, as opposition parties used it as justification to attack the government, while the latter constantly shifted the FONAVI rate back and forth between employers or employees and altered its total level, to satisfy political and financing needs. Throughout the document, when talking about the payroll tax, we refer to this contribution.

Graph 3
Evolution of non-wage costs paid by employers



Note: Non-wage costs paid by the employer include payroll tax, tenure bonus, public retirement plan payments and public health plan payments. Vacations and holiday bonus are included in the effective rate, although they were not modified during the period, and stand for 25% of non-wage costs paid by the employer (2 bonus wages and one month of paid vacations per year).

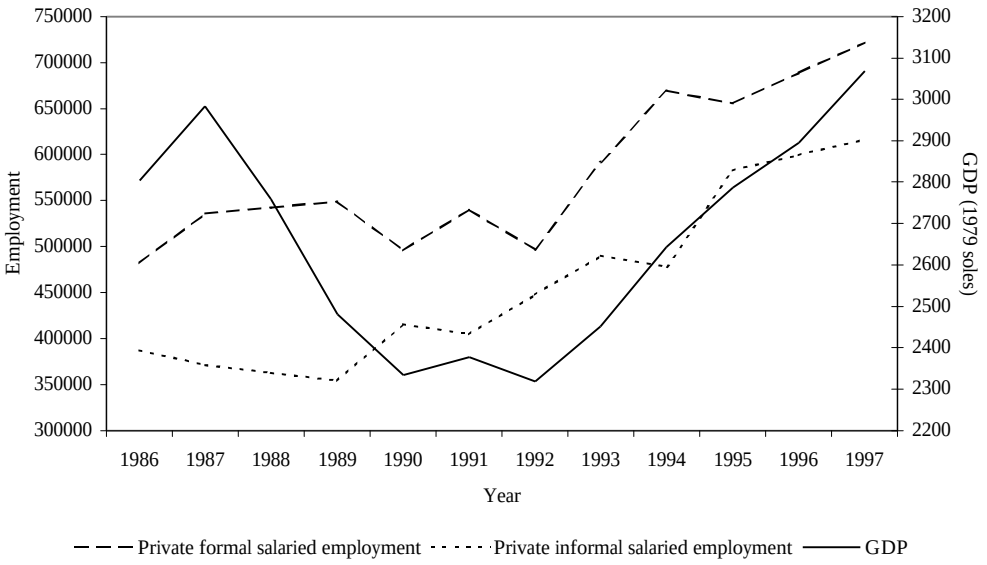
3. Evidence of the Effect of Labor Laws on Labor Demand

We can identify at least three main changes in labor legislation during the period 1986-1996 that had an effect on labor demand: changes in severance payments and job security, changes in non-wage costs, and changes in the use of temporary contracts. The difficulty lies in isolating these changes from the effect of the cycle over labor demand. In the Peruvian case in this particular period, even if it is very probable that the legislative changes had a large impact on the level and structure of demand, the economy underwent a very drastic process of structural adjustment (see Saavedra 1996a,b). The purpose of this section is to estimate labor demand functions and assess the effect of changes in two specific regulations in Peru: firing costs and non-wage costs. In 1991, absolute job security was eliminated for new hires and in 1995, after the constitutional change of 1993, job security was totally abolished. Severance payments rules were simplified and the severance profile was made less steep. This, together with the reduction in red tape for the use of temporary contracts, implied a drastic reduction in firing costs in two steps, one in 1991, and the second in 1995. On the other hand, non-wage costs were increased in 1987 and in 1990, first due to changes in caps and minimums in several contributions and later through the increase in FONAVI, a plain payroll tax, and in the pension contribution. We limit the analysis to labor demand for the formal sector, which is precisely the one affected by regulations. However, being formal (i.e., being in the universe of this study) is endogenous. One first consequence of high firing and non-wage costs in a low productivity economy is informality, so we start the analysis by looking at how informal and formal salaried employment adjusted between 1986 and 1996.

3.1 Informality, the First Way to Avoid Regulations

Firms and workers adjust to the labor market regulatory framework through multiple mechanisms. Job protection legislation and severance payments constitute firing costs that increase uncertainty about the actual costs of labor and renders labor a quasi-fixed factor. Given the regulatory framework that prevailed until 1991, Peruvian firms devised ways to reduce the costs of adjusting labor to their desired levels. The first adjustment mechanism was–and for many firms still is–the informal sector. Many firms, typically small ones, operate totally underground, fire and hire at will and do not pay any kind of socially mandated benefits. In most of cases, their productivity is too low to afford paying any kind of benefits. Both for the firm and for the worker, any kind of mandated benefit is a kind of luxury good. Many firms operate in the gray area, though, and in fact there is a continuum of firms with different productivity, and there is a cutoff point at which the firm decides that it has to operate formally. The decision to become formal entails a cost benefit analysis. Firms evaluate the costs and benefits of formality (mandated benefits compliance and larger volume of business, respectively) against costs and benefits of doing business informally (fines adjusted by the probability of being caught, and savings in mandated benefits and firing costs, respectively).

Graph 4
Metropolitan Lima: Private formal and informal salaried employment and GDP, 1986-1997



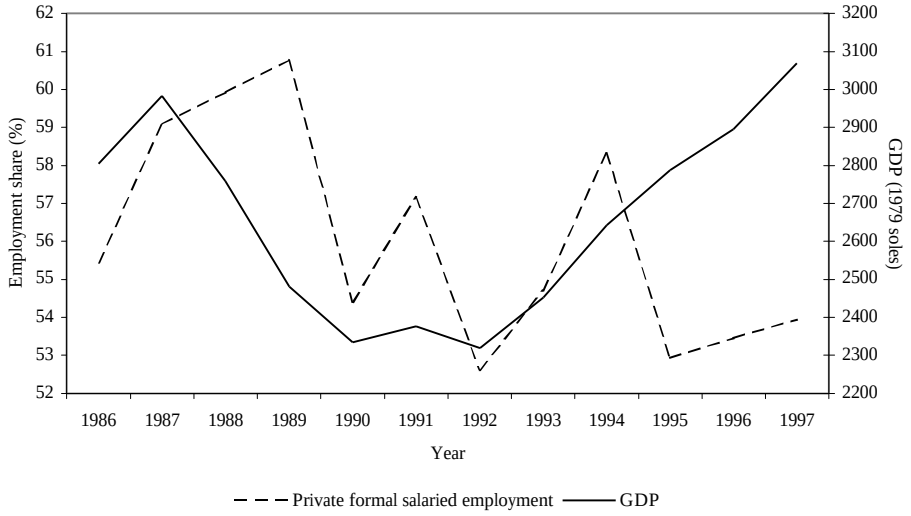
Source: *INEI, Encuesta de Hogares del MTPS 1986-1995, Encuesta Nacional de Hogares del INEI 1997.*

Given changes in the regulatory framework, the balance in this cost benefit analysis determines the evolution of formal and informal salaried employment. We used data from household surveys and defined formal salaried workers as those who show signs of working in a firm that complies with regulations.[9] As shown in Graph 4, salaried informal employment increased after 1987 throughout the period of analysis. However, employment among formal salaried workers was more responsive to the business cycle. It fell slightly between 1987 and 1992 and has increased rapidly since 1993. It could be argued that the rigidities in labor legislation in the eighties prevented

[9] Operationally, formal salaried workers were defined as those that had health insurance, had a retirement plan or belonged to an union. An application of this definition is found in Saavedra and Chong (1999).

formal employment from falling dramatically. Conversely, the more flexible environment of the nineties allowed for a quick employment expansion. Looking at the shares of formal and informal salaried employment in total private salaried employment (Graph 5), it is clear that the former fell sharply during the downturn, increasing as output bounced back during the nineties, after the launching of the reforms.

Graph 5
Metropolitan Lima: Share of private formal salaried employment in total private salaried employment and GDP, 1986-1997
(Percentage)



Source: *INEI, Encuesta de Hogares del MTPS 1986-1995, Encuesta Nacional de Hogares del INEI 1997.*

3.2 Labor Demand Estimations

Using household surveys, we only have annual data for ten years, so a formal analysis of the labor demand is not possible. Notwithstanding, it seems to be clear that, *ceteris paribus,* as the volume of business falls, as in 1988-1992, the costs of operating formally increase and outweigh the benefits, so more firms go underground, or more new firms decide to launch operations informally rather than formally. As of 1993, output rose again, and so did productivity; consequently, more firms should have found it profitable to operate formally. But to complicate matters, firms' decisions involve increasing or decreasing the share of their payroll that goes underground or not, and other developments affect this decision. Reductions in firing costs could have had a positive effect on formal labor demand, but at the same time, non-wage labor costs increased, with the opposite effect on this demand.

In what follows, and with the purpose of analyzing formally the effects of these changes, using the quarterly data sets described next, we first perform static estimations of the labor demand at the sector level and at the establishment level. We show the results of different specifications, in which we analyze elasticity of wages, payroll contributions–taxes, health, pension and other contributions, and expected severance payments.[10]

[10] In the case of the price of capital, it should be noted that in dollars, they probably increased mildly due to international inflation, but decreased since 1991 due to trade liberalization. The price of financial capital that affects both the price of capital goods and affects investment in general is more

The data

The main data source used to estimate static and dynamic labor demand functions for formal firms in Lima was the Quarterly Survey of Wages and Salaries (QSWS) conducted by the Ministry of Labor. The QSWS is a quarterly establishment survey that collects pooled data at both the firm and individual worker levels. This survey collects approximately 600 private firms of ten or more workers in Metropolitan Lima (composed of the province of Lima and the constitutional province of Callao) and 8,000 workers from the same firms. The survey is divided into two sections. Part A, provides firm-specific information which covers the gross wage bill divided into wage and non-wage costs, levels of employment, and presence of collective bargaining, each specified by category of employment (blue collar, white collar and executive) and SIIC code. In Part B, 5 to 25 workers (according to the size of firm) from each firm are surveyed at random, thus providing individual-level information on age, gender, tenure, salary breakdown and specific occupation, as well as employment category.

The survey has been conducted since 1957, though it has at several points undergone important modifications. One of the most significant changes occurred in 1986, at which time the method of sample selection changed from a univariate distribution to one stratified across ten categories of economic sector and four categories of firm size. The methodology used since 1986 ensures adequate representation of each cross section of firm sector and size–totalling 48 groups of firms among which a multivariate probability distribution is determined according to number of firms in each group, while minimizing total wage variance per group with standard optimal sampling methods.[11] Due to the significance of this modification, data prior to 1986 is inappropriate for analytical comparisons with that of later periods. Furthermore, only hard copy tabulations of data from this period have been preserved. Thus, the extent of survey information useful for analysis is confined to the period 1986-1997, which comprises ten years of bimonthly data (quarterly since 1996) representing a total of 68 distinct points in time.[12]

From 1986 to 1997 there were three different samplings of firms from the Ministry of Labor's *"Hoja de Resumen de Planillas"* (*HRP*) of 1986, 1990 and 1994. The HRP are summary payroll forms which all private formal firms are legally required to present annually. The degree of compliance is high among large firms, and the probability of compliance increases with size. The total number of sampled firms per period remains around 500, but they were not replaced if the firm died or did not report during that period. Therefore for the economic sector estimations, we pool the data of all the firms in each sector and use expansion factors to calculate sector level aggregates; we also use part B of the survey to calculate tenure structures by sector, used for constructing the

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difficult to calculate. On one side, the average interest rate increased, as the country passed from a financially repressed system with very low regulated interest rate, to a much-deregulated financial system. On the other hand, credit started to be available for firms than in the previous regime, in which were rationed and interest rates in the informal credit market were extremely high in real terms. We do not have stock of capital and will not be able to estimate capital-labor elasticity of substitution.

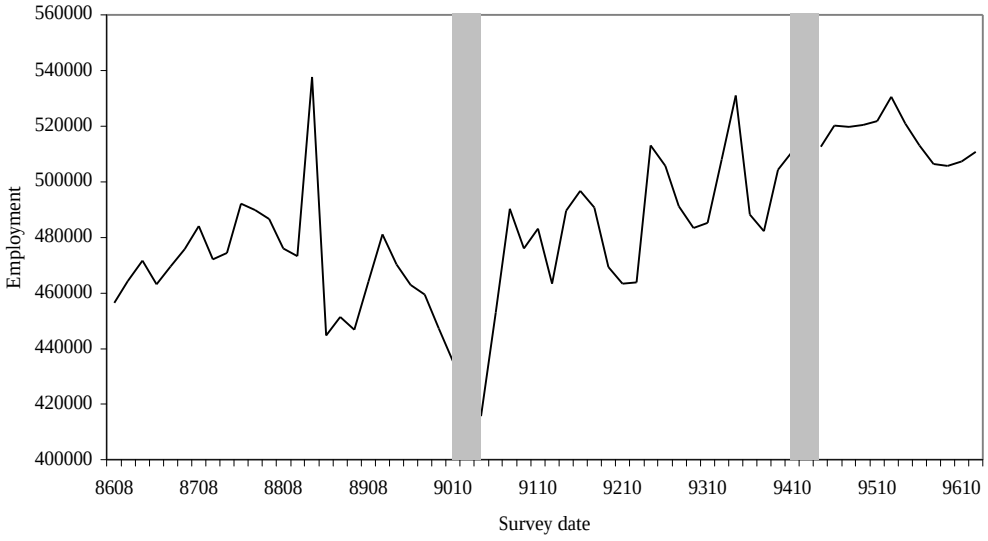
[11] Firms are divided into four size categories: 10-49 workers, 50-99, 100-499, and 500 or more. The economic sectors are agriculture, mining, manufacture of consumption goods, manufacture of intermediate and capital goods, utilities, construction, wholesale trade, retail trade, financial activities, insurance and real estate, transportation and communications, and services. Agricultural firms have been dropped from the sample.

[12] Data from all surveys prior to 1991 were stored only on eight-inch diskettes formatted with the antiquated XENIX system, which required the use of a Radio Shack TRS-16B computer and an eight-inch hard drive. Non of those machines in Peru were in operating conditions. The data was translated into readable a format by a software company based in Indianapolis and the information was processed in order to recover the shape of the original databases. Only a few internal documents form the Ministry of Labor prior to 1990 describing the data existed. Fortunately, the survey did not underwent any methodological changes during that period, according to several current and former employers of the *DNEFP* (*Direccion Nacional de Empleo y Formación Profesional*) that were interviewed.

expected severance payment variable. With these, we build a pseudo panel at the sector level with 56 time points per sector. Additionally, and to make the sector pseudo panel comparable to the establishment panel, we divide it in three sub-pseudo panels according to the sampling dates 1987-1990, 1991-1994 and 1995-1997.[13] Although they roughly coincide with three distinct periods in terms of labor legislation–recall that the two main laws were enacted in November 1991 and July 1995–there is variability within periods, particularly in regard to payroll contributions.

Graph 6 shows the evolution of employment of formal firms in Lima throughout the period. The gray bars show the periods in which the sample changed. Using the same data set, a sample of workers for each sector can be constructed for each period. From that sample, we analyzed some basic worker characteristics. The results confirm the trends observed using household survey data. In particular, it is found that in the nineties, the proportion of younger workers increases, there is a slight increase in the share of female employment, and average tenure falls.

Graph 6
Metropolitan Lima: Total employment in formal firms of more than 10 workers



Source: *Encuesta de Sueldos y Salarios del MTPS 1986-1996*

Sample change

Finally, from the February 1986-September 1997 survey data, three firm-level panels have been constructed, comprising all firms that remain in the sample set throughout the sub-periods. The three panels were constructed by dividing this period into three sub-periods, according to the sampling periods, and identifying firm level panels that remained in the survey throughout each sub-period. The first period is 1987-1990, and all firms were drawn from the 1985 Payroll Census of formal firms registered in the Ministry of Labor. The panel comprises 389 firms observed during 20 quarters. The second panel goes from 1991 through 1994, comprising 408 firms observed during 24 periods, drawn from the 1989 Payroll Census. These two panels are the largest due to the fact that firms were never re-sampled from the total population of registered firms during this period. In other words, the list of panel observations is altered only by the death of firms that were originally

[13] Additionally to this firm database, we had constructed time series of Gross Domestic Product (GDP) by economic sector.

sampled, and thus its size is determined solely by the mortality rate of those firms. In contrast, between 1995 and 1997, surveyed firms were re-sampled yearly from an updated sample set. Despite this greater variation in sampled observations, our third panel is only slightly smaller than its earlier counterpart (341 firms), largely because both the population (from payroll censuses) and sample populations of surveyed firms have been considerably enlarged in recent years.[14]

Econometric labor demand specifications

The objective is to specify a static labor demand function from which the impact of different regulations may be inferred. We are mainly interested in analyzing the effect of payroll contributions (taxes on wages and social security payments), and severance payments on the demand for labor. With this objective, we will specify a static labor demand function following Hamermesh (1993).

The equations to be estimated will be derived firstly from a profit-maximizing framework. The profit function will be of the form:

$$p = F(K, L) - E(w) - rK \qquad (1)$$

where K is capital, L is labor, w and r are the cost of labor and capital, respectively. $E(w)$, which is the expected cost of labor, is used in order to account for the expected costs the firm would incur in the event of layoffs. This is important because w in the firm's maximization problem is not fully represented by the observed salaries, making it necessary to add other factors to appropriately represent the relevant cost per worker (following the distinction made in Hamermesh, 1993).

The problem of the firm is to choose (K, L) such that maximizes profit:

$$Max\{F(K, L) - E(w)L - rK\} \qquad (2)$$

where:

$$E(w) = w + \mathrm{p} + E(\mathrm{sp}) \qquad (3)$$

Where w is the wage paid to the employee, p are all payroll contributions paid by the firm and E(sp) is a measure of the expected severance payments as described in Section II.

A wide variety of functional forms have been developed in the past decade, although the derived factor demand functions are still analyzed under the same optimizing behavior (Merrilees, 1982). The question remains as to which flexible production function will best suit our hypothesis testing. In this research we use one of the approaches proposed in Hamermesh (1986) and estimate a simple and flexible functional form without any imposition of the restrictions that factor demand be homogenous of degree zero in all factor prices

$$\ln \mathrm{L}_i = \mathrm{a} + \sum \mathrm{b}_j \ln \mathrm{E}(\mathrm{w}_j)_i + \mathrm{c} \ln \mathrm{Y}_i + \beta . \mathrm{Z}_i \qquad (4)$$

[14] We attempted the construction of a panel of all firms that appeared continuously in the survey data between 1990 and 1997. This panel spanning both sub-periods is by far the smallest and given the obvious biases it has we won't include it in our estimations. On account of the fact that in 1995 a new sample of firms was selected largely at random from an updated payroll census for the first time since 1991, very few firms from the 1991-1994 period are re-sampled in 1995 and reappear continuously in the 1995-1997 sample populations.

Where w_j corresponds to two measures of production factors, w and r ; i indicates the sector or establishment, and Z_i is a vector of other explanatory variables at the sector level. As mentioned by Hamermesh (1993), clearly (4) should be viewed as part of a complete system of factor-demand equations, but given that we do not have data on all factors it is not possible to estimate a complete system. Equation (4) will therefore provide all the necessary estimates, for:

$$\frac{\partial \ln L}{\partial \ln w_j} = \left[\frac{s_j}{s_L}\right] \cdot \frac{\partial \ln X_j}{\partial \ln w_L} \qquad (5)$$

Our initial objective is to see what is the effect of changes in labor regulations on labor demand in the formal sector of the economy. We analyze how labor cost elasticity changes as we add in payroll contributions and the expected severance payment in a marginal productivity condition. We do not attempt to estimate labor supply relationships under the plausible assumption that the labor supply to the formal sector, in an economy with a very large informal sector, tends to be nearly horizontal. We estimate two variants of (4) measuring the effects of the different components of labor costs on employment:

$$\ln L_i = a + b_1 \ln w_i + b_2 \ln E(sp)_i + c \ln Y_i + \beta . Z_i \qquad (6)$$

$$\ln L_i = a + b_1' \ln(w_i + p_i) + b_2 \ln E(sp)_i + c \ln Y_i + \beta . Z_i \qquad (6')$$

In equation (6) we just include the average wage of the sector or establishment and the expected severance payment as the two main labor costs. In equation (6') we add to the average wage the average non-wage costs (public and private pension contributions, health contributions, accident insurance, etc.–see section 2.3) mandated by law that the employer had to pay in addition to the wage. These contributions are added to the salary because they are monthly charges paid by the employer in contrast to the expected severance payment, which depends on the tenure structure of the employees.

Additionally, we estimate labor demand functions with sector-aggregated data and establishment level data with our three panels of the Peruvian firms (1987-90, 1991-94 and 1995-97).[15] Following a modified version of Bentolila and Saint Paul (1992), the econometric specification of labor demand is:

$$\begin{aligned} \ln L_{i,t} = {} & a + b_1 \ln[w_{i,t} + p_{i,t}] + b_2 \ln E(sp)_{i,t} + c \ln \hat{Y}_{t-L} + \\ & + d \ln \hat{L}_{i,t-L} + e \ln \hat{L}_{i,t-L} * \ln E(sp)_{i,t} + \delta t + \beta Z_{i,t} + \varepsilon_{i,t} \end{aligned} \qquad (7)$$

where wages (w) and payroll taxes (p) represent the labor costs, E(sp) represent the expected severance payments, $\hat{Y}$ is the quarterly output by economic sector as a proxy of firm output -

[15] As mentioned before, the periods roughly coincide with three different legislation regimes.

instrumentalized with the lag, $\hat{L}_{t-L}$ is the number of workers in the previous period instrumentalized with rolling regressions technique using one to four period lagged employment, and t is a time trend.

Lagged employment is also included to measure the speed of adjustment to changes in output. The coefficient of this variable can lie between zero and one; a large value is associated with a slower speed of adjustment and a small value implies that the adjustment is instantaneous.

Finally, following Burgess and Dolado (1989), we try to measure the adjustment costs of changes in employment by including the interaction between lagged employment and expected severance payment as the main firing costs. The coefficient of this interaction measures whether there are increasing marginal costs of changing employment and, therefore, a positive coefficient is expected.

Empirical results

Using quarterly data for ten economic sectors observed between 1987 and 1997 we estimated the constant output labor demand wage elasticity for equations 6 and 6'.[16] As observed in Table 4, all the components of $E(w)$ from equation 3 are significant and have the expected negative sign when included individually. The estimate of -0.19 for the labor demand wage elasticity (in the model in which labor costs included wages plus payroll contributions (b')) lies within the typical range for static labor demands using sector data (Hamermesh, 1993, 1986).[17]

Moreover, as hypothesized, the coefficient of the average wage paid by the employer (b_1) is smaller by 2 points than the coefficient of the average wage plus all the payroll costs paid by the firm (b_1'). Therefore, as we include payroll taxes, the employment response to changes in labor costs increases. Additionally, we carried out an encompassing test on the model fit to select which specification should be used. We used a non-nested procedure, a Cox test for non-nested hypothesis (Greene, 1997), and we were able to choose (6') where ln (w+p) is used as the correct set of regressors. The Cox test in which the null was that (6) contained the correct set of regressors was rejected with a p-value of 0.000 (Cox Statistic= 5.2729). On the other hand, when the null was that (6') contained the correct set of regressors, we could not reject it at any significance level (Cox Statistic = 3.5592).

The coefficient of the expected severance payment, on the other hand, also has the expected negative sign and is significant at the 99% level. This gives evidence that the reduction in firing costs has a positive effect on the employment level. Regarding the output elasticity, the coefficient for the whole period is around 0.05. This is a very small coefficient because in the models presented in Table 4 we are including fixed effects by sector absorbing most of its variation, which is mainly across sectors rather than within. Specifically, when running the regressions without fixed effects the output elasticity is 0.17 and significant at the 99% level. We included the log of Y_i lagged six months, because the correlation between the errors and the actual output level that results from measurement error also biases OLS output elasticity toward zero and output measurement error can also bias the

[16] This estimation is only done for the sector pseudo panel and not for the establishments panel because we can't generate a panel for the whole time period (1987-1997) given the structure of the survey (see data section 3.2.1).

[17] As a sensitivity test, we also carry out a CES estimation in which we include a proxy of the price of capital and the results where a elasticity of -0.13 for the wage and payroll cost variable and a positive elasticity for the price of capital, reflecting the positive cross-price elasticity of demand due to substitutability of labor for capital in production. Finally, the coefficient for the expected severance payment was -0.221.

estimates of own-price elasticities. Griliches and Hausman (1986) demonstrate that when panel data are available, lead or lag of a variable subject to measurement error may be appropriate instrumental variables.

Table 4
Constant Output Labor Demand Estimation
(1987 - 1997)

	Model 6 with fixed effects	Model 6' with fixed effects
Constant	13.528 ***	13.701 ***
	(0.572)	(0.620)
ln(w)	-0.174 *	
	(0.096)	
ln(w+p)		-0.191 *
		(0.098)
ln(E[sp])	-0.406 ***	-0.401 **
	(0.060)	(0.060)
ln(Y)	0.047 **	0.047 **
	(0.022)	(0.022)
Log likelihood	-183.22	-182.97
chi2(9)	1083.01 ***	1084.59 ***
N	504	504

Note: Standard errors in parenthesis.

Significance levels: * :p<=0.1, **: p<=0.05,

*** :p<=0.01.

Table 5 reports the results of equation 7, both at the sector and establishment level for the three sub periods determined by changes in the sample of firms: 1987-1990, 1991-1994, and 1995-1996. The first three columns are the results for the sectoral level panels and the last three columns show the results for the three establishment level panels. The variables used are the ones included in (6') plus the instrumentalized lagged employment[18] as a measure of adjustment costs, its interaction with the expected severance payment, and a time trend. For the estimations we apply generalized

[18] This variable is instrumentalized using the rolling regressions technique with one to four period lagged employment

least squares, and correct for serial correlation with a correlation coefficient specific for each panel when needed. For the sector panel we include and test for sector fixed effects.[19]

In four out of six cases wage elasticities are negative and significant. Unfortunately, there are two exceptions, first at the sector level for the first period in which the coefficient is positive and significant, and finally in the second sub-period on the establishment level data. It should be noted that variations in the measured price of labor may be the spurious result of shifts in the distribution of employment among sub-aggregates with different labor costs as mentioned by Hamermesh (1986). It is difficult, however, to determine the extent of these potential problems. Regarding the expected severance payment, we found that in the first sub-period, this variable had a negative and significant coefficient, -0.89 at the sector level and -0.31 at the establishment level. In the last sub-period, the coefficient reduces to -0.31 at the sector level and to -0.14 at the establishment level, losing its significance in both cases.[20] This result may be related to the fact that, after 1995, there was not enough time variability in firing costs within the sub-period in order to establish an effect on the employment level, or that the variance of within firm tenure structures had already fallen, reducing differences in expected severance payments across firms. In the establishment panel data set, the interaction of the expected severance payment with the lag of employment, a measure of the marginal cost of changing employment, has a small but significant and positive coefficient which decreases over time.

In the sector level estimations, the output elasticity increases from the first to the last sub-period, as shown in table 5. During the first sub-period it is 0.014 and not significant while in the last sub-period it is 0.09, significant at the 90% level.[21] This increase in the output elasticity may be related to the fact that labor reforms made it easier for firms to adjust to the desired employment levels given changes in output. Given a lower level of the tax on dismissals generated by the reduction in severance payments and the abolition of job security rights, and also given lower administrative costs of using temporary contracts, formal firms enjoyed more flexibility in adapting to output changes. As shown in Section II, available evidence suggests that most of the increase in formal employment during that period seems to have been concentrated in temporary contracts. Nevertheless, this fact might also introduce a bias in the estimates, as our data aggregates employment and wages for both permanent and temporary contracts and the true estimate for each of them might be different. This problem is dragged to the firm-level panel estimations also.[22] Output coefficients in this case are only significant for the first sub-period. It should be noted, however, that the output variable is defined at the sectoral level, so the coefficient cannot be interpreted as a firm level employment elasticity.

Lagged employment was included to measure if adjustment occurs instantaneously. As shown in Table 5, the effect of this variable is only significant in the establishment level panels with coefficients ranging between 0.62 and 0.94. The magnitudes of these coefficients are within the

[19] We didn't include fixed effects for the establishment estimations because both the expected severance payment and the GDP were available only at the sectoral and not at the establishment level.

[20] We were not able to get evidence of statistically significant differences between these and other parameters when comparing different sub-periods, using Wald tests. The limitation of these tests is that we assume that they are independent random samples, which is not true given that large firms are always included in the samples.

[21] It is important to mention that the coefficient is small because these models include sector fixed effects, but despite this in the last sub-period the coefficient is significant. If we exclude the fix effects the coefficient is around 0.17.

[22] Finally, Annex 2 test for the implication that total labor demand should vary over the cycle due to employment composition changes (Bentolila and Saint Paul (1992)). When interacting the regressors with the cycle dummy to capture responses to the business cycles, the effects where not significant in practically all of our regressions, as shown in Table 12 of Annex 2.

range of the coefficients found by Abraham and Houseman (1994). Given that this is bimonthly data, a fall from 0.7 in the late eighties to 0.6 in the mid nineties would imply a reduction in the median adjustment, as, for example, from 6 to 4 quarters. The smaller coefficient in the last period could be suggesting an increase in the flexibility of the labor market, making it easier to reduce work force levels during periods of slack demand, as well as making employers more willing to hire during periods of rising demand. The speed of adjustment is, however, much lower than the one observed in the U.S. as reported by Abraham and Houseman (1994).[23]

Table 5
Labor demand estimation results for panels at the sector and establishment level

	Sector level[1]			Establishment level[2]		
	1987-90	1991-94	1995-97[3]	1987-90[3]	1991-94	1995-97
Constant	8.262 ***	15.395 ***	13.657 ***	0.470 ***	0.032	1.678 ***
	(1.570)	(2.217)	(3.688)	(0.166)	(0.085)	(0.507)
ln(w+p)	0.560 ***	-0.322 ***	-0.298 **	-0.030 ***	0.028 ***	-0.053 *
	(0.203)	(0.115)	(0.127)	(0.008)	(0.005)	(0.028)
ln(E[sp])	-0.892 **	-0.575	-0.315	-0.310 ***	-0.041 **	-0.140
	(0.363)	(0.422)	(0.632)	(0.034)	(0.017)	(0.101)
ln(Y)[4]	0.014	0.113	0.094 *	0.249 ***	0.008	0.085 **
	(0.067)	(0.101)	(0.053)	(0.008)	(0.007)	(0.033)
$ln(L_{t-4})$[4]	0.070	-0.194	0.077	0.736 ***	0.942 ***	0.616 ***
	(0.147)	(0.215)	(0.310)	(0.027)	(0.016)	(0.088)
$ln(L_{t-4})$ * ln(E[sp])	0.042	0.063	0.015	0.071 ***	0.006	0.040 *
	(0.027)	(0.045)	(0.060)	(0.006)	(0.004)	(0.021)
Log likelihood	210.55	139.45	199.31	2460.04	2484.48	-1389.821
chi2	12547.95 ***	4537.29 ***	3353.03 ***	230609.34 ***	186386.48 ***	2728.07 ***
N	189	189	117.000	4753	6491	1722

Note: Standard errors in parenthesis.

Significance levels: * p<=0.1, ** p<=0.05, *** p<=0.01.

1. With fixed effects.

2. A time trend was included. It was significant for periods 1987-90 and 1991-94, but not for 1995-97.

3. Corrected for serial correlation when tests for autocorrelation were significant with a correlation coefficient specific for each of the panels because of the presence of lagged dependent variables.

4. Instrumentalized with lagged values using rolling equations.

[23] These authors report an speed of adjustment for the U.S. manufacturing sector of 0.383. On the other hand , the speed of adjustment for West Germany , France and Belgium were similar to our results, 0.837, 0.935,0.823, respectively.

4. Effects on Duration and Turnover of Changes in Labor Legislation

In this section, we analyze basic patterns of employment duration in Peru. We address the question of how long do jobs last in Peru, if their lengths are different in the formal and informal sector and in different occupations and if there are significant changes related to changes in labor legislation. Reductions in labor legislation related firings costs, like the ones observed in Peru in the early nineties through the reduction in severance payments and the abolition of job security rights, typically accelerate the process of job creation and job destruction, therefore increasing turnover and reducing job duration, in particular in the formal sector. Moreover, with the Peruvian reforms the use of temporary contracts was facilitated. This has the effect of inducing firms to hire more in expansions as well as lay off more workers during downturns, which implies an increase in turnover. Using different data sets we find a reduction in employment duration that can't be explained only by cyclical movements of the economy. We compare job duration and employment exit patterns of the self-employed with those of wage earners in the formal and informal sectors using empirical hazards and we also try to analyze the effects of certain regulations on duration patterns and its changes over time.

We first present trends in job duration using the series of ten annual household surveys from the Ministry of Labor. The main shortcoming of this source is that it only provides us with data on incomplete (elapsed) tenures. As long as we are precise about what we are measuring, we can exploit the fact that it allows us to analyze some time series and cross section variations. Then we present empirical hazards and results of exponential hazard models using data from the Living Standards Measurement Survey data, which has the advantage of providing us with (unfortunately) a small sample of complete employment durations.

4.1 Analysis of Recent Trends Using Censored Data on Job Duration

We first analyze a repeated cross section data set, the Annual Household Survey of the Ministry of Labor for all the years between 1986 and 1997, with the exception of 1988. This survey collects information regarding job characteristics and elapsed tenure in the case of the employed and time in unemployment for those in that state. In the case of these surveys, the question is "How long have you been in your present job?" The data is recorded in years and months. The answer does not provide information on the length of a particular contract but only on a match between firm and employee. In the case of the self-employed, this relates to the time performing the same occupation. All elapsed tenures refer to the main job.[24]

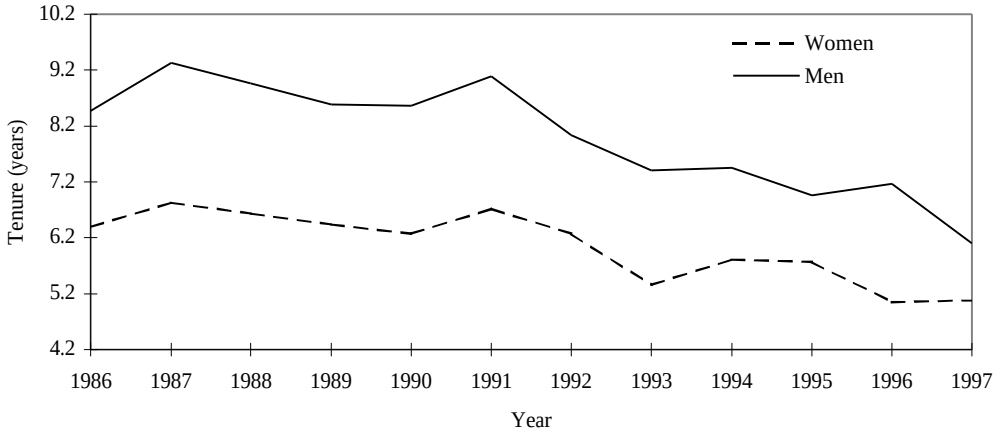
The data available from these surveys are reported as incomplete tenures. Following Lancaster (1990), we can assume that given a pdf of complete tenures for a sample of the stock of employed workers, there is a related pdf for elapsed tenures. Moreover, it is possible to assume that for workers with some labor market history, the pdf of remaining duration is the same as for the elapsed duration. Therefore, the expected value of completed durations is double the expected value of incomplete (elapsed) durations. This will be true as long as the stationarity of the process is assured (i.e., this may not be true for young workers starting their careers, women who enter and reenter the labor market or older workers approaching retirement (Burgess and Rees, 1997). Clearly,

[24] In all surveys and years, the proportion of workers who declare having a second job fluctuates between 12% and 15%.

this data allows the analysis of the distribution of tenures among those employed at the time of the survey, not the distributions of jobs.

Graphs 7, 8 and 9 show mean elapsed tenures for several categories of prime age workers (25 to 55 years). In general, it is clear that there is a downward trend in mean tenure. The trend is clear enough to dominate any possible cyclical fluctuations in tenure. During the sharp recession of 1988-1992, when an increase in mean tenure could be expected due to high separation rates and low hiring rates, mean tenure actually fell. Tenure rose only in 1991, when the Peruvian economy hit bottom.[25] In 1992-1993, right after the first changes in labor legislation, there was a sharp reduction in mean tenure. During the period 1994-1997, growth was fast and hiring and separation rates increased, as usually happens in a booming economy, resulting in a further reduction in mean tenure. However, the 1997 figure was much lower than in 1986-87, when the economy was also in an upswing. This gives an indication that the reduction in tenures may not only be a cyclical fluctuation but may also be showing a secular trend.

Graph 7
Metropolitan Lima: Incomplete (elapsed) tenure of male and female workers aged 25 to 55 years, 1986-1997

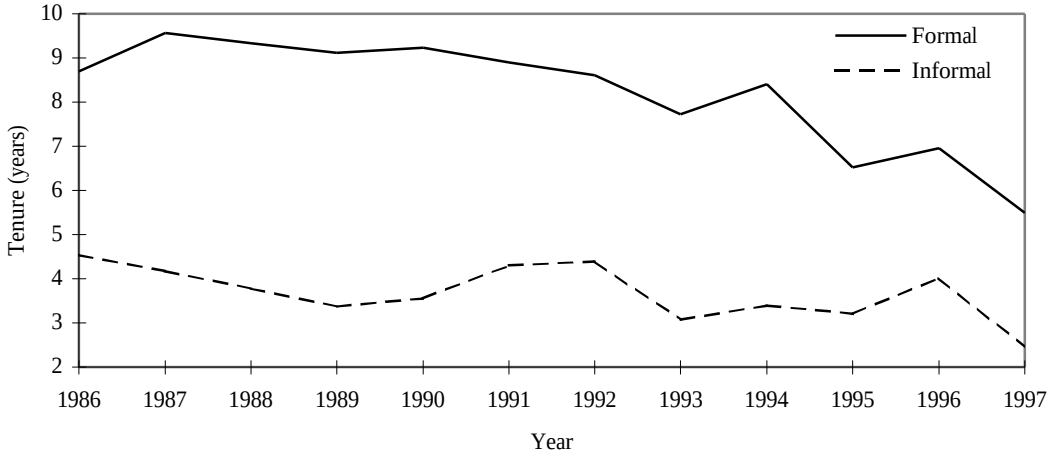


The downward trend is clearer among prime age males (Graph 7). Given that the mean value of complete tenures should be about twice that of lapsed tenures, in the mid nineties mean completed tenure was about 12 years,[26] down from 17 years in the mid eighties. There is also a reduction in mean tenure among females (not shown), but it is harder to assume a stationary process in this case. First, because of maternity women enter and reenter the labor market and second, during this period there is a fast increase in labor force participation among women (Saavedra, 1998). The differences in means between 1986 and 1991 and between 1991 and 1997 are statistically significant.

[25] Not reported tabulations show that there is no clear trend in mean tenure among young workers.

[26] Considering that the average schooling for males in Lima in this cohort is 8.5, and assuming retirement at 65, on average, each individual holds three jobs during her lifetime.

Graph 8
Metropolitan Lima: Incomplete (elapsed) tenure of formal and informal male salaried private workers aged 25 to 55 years, 1986-1997



Graph 8 shows the evolution of mean elapsed tenures for prime age male wage earners according to their formal or informal status. Several features are worth mentioning. Differences in mean elapsed tenures are large between formal and informal salaried workers. In fact, for formal salaried workers, mean tenure is between 9 and 6.8 years, while for informal workers, the mean fluctuates around three. This difference is statistically significant in every year during the period 1986-1997, as shown in Table 6.

Table 6
Tenure mean comparison test
H: (Informal worker tenure in period t - Formal worker tenure in period t) = 0

Year	t-test	Year	t-test
1986	-7.377	1992	-7.676
1987	-8.400	1993	-9.492
1989	-10.678	1994	-9.416
1990	-10.291	1995	-7.444
1991	-7.715	1997	-6.285

Note: In all years the p-value was 0.000.

The downward trend is more pronounced among formal workers,[27] particularly after 1991. Table 7 (Panel A.) shows tenure means comparisons within formal and informal workers pairing different years. Among informal workers there is a significant reduction in mean tenure in the period 1986-1993, and a smaller and less significant one in the period 1993-1997. In the case of formal workers the fall is much larger and more statistically significant in the post-reform period. From the results shown in panel B, it is clear that the differences in mean tenures between formal and

[27] Not reported tabulations for self-employed workers show a downward trend among formal self-employed workers, but not among informal self-employed.

informal sectors has fallen during the nineties. As discussed above, labor market reforms facilitated formal firms' adjustment to desired employment levels through temporary contracts, and by reducing severance payments and eliminating job security. In addition, unionization rates fell sharply, and union jobs have traditionally been much longer than non-union ones.

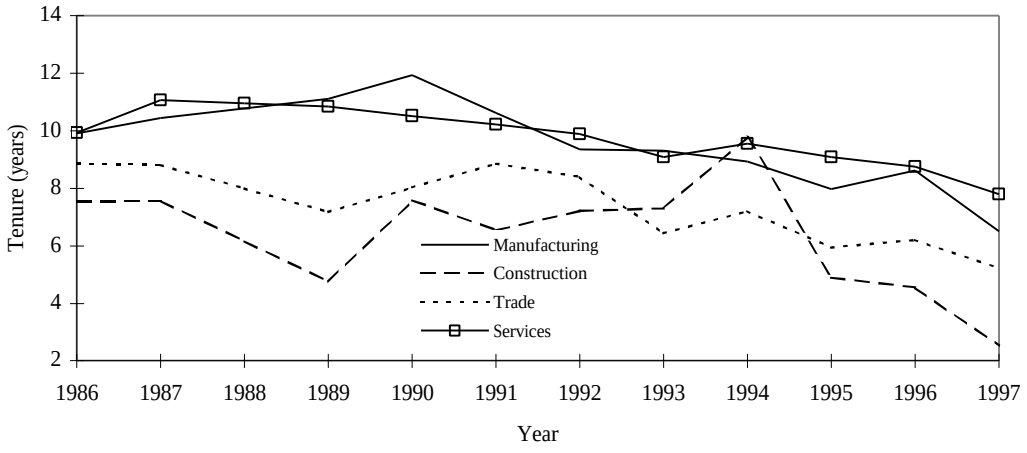
Table 7
Mean Tenure Differences and Differences in Difference

	1986-1993	1993-1997
A. Difference estimates		
Formal	-0.98	-2.23
	(0.55)	(0.57)
Informal	-1.45	-0.63
	(0.51)	(0.39)
B Difference in difference estimates		
Formal - Informal	0.48	-1.60
	(0.75)	(0.67)

Note: Differences of mean elapsed-tenure for currently employed wage earners in Metropolitan Lima. Standard errors in parenthesis

Graph 9 displays elapsed mean tenure calculations for prime age formal male salaried workers in selected sectors. In the manufacturing sector, there is a smooth upward trend between 1988 and 1990, as the economy fell into a recession. Afterwards, mean tenure falls as the economy picks up. We observe the same trend in services and to a lesser extent in trade. We also performed calculations controlling for age structure and the results were similar.

Graph 9
Metropolitan Lima: Incomplete (elapsed) tenure of male formal workers in selected economic sectors aged 25 to 55 years, 1986-1997



Several factors may lie behind the reduction in tenure among formal prime-age workers. Before the reforms, high firing costs induced long employment spells among formal workers, but they also induced a lower rate of job creation in the formal sector, increasing also the relative size of

the informal sector. The labor market reforms of 1991 facilitated an increase in hiring through temporary contracts and also reduced firing costs through a reduction in the severance payment and the elimination of job security for new workers. The reforms were followed by an economic expansion that begun in 1993 and increased employment, both formal and informal. The increase in net employment suggests that hiring was greater than layoffs. Layoffs in the private sector, also driven by trade liberalization and privatization, were larger among older workers.[28] On one hand, the relative cost of firing a high tenured worker fell tremendously with the reforms, in particular, with the 1995 changes, when job security was abolished for all workers. On the other side, the increase in demand for labor was greater for younger workers, who could more easily adapt to new technologies. Therefore, layoffs were biased towards older workers, while hiring was biased towards younger ones, with the effect of reducing mean tenures.

Table 10 shows mean job durations using elapsed tenure data from several sources. The first two columns are from the same data sets discussed in the previous paragraphs, the third comes from the firm level survey used in the labor demand analysis and the rest from the Living Standards Measurement Surveys (LSMS) described below. All data sources confirm a reduction in mean tenure for formal workers during the nineties.

Table 10
Mean job tenure: Comparing Different Data Sources

	Household survey[1]		Firm	LSMS[3]								
	Formal	All	level	Self-employed			Wage earner			All		
	workers		survey[2]	Informal	Formal	All	Informal	Formal	All	Informal	Formal	All
1985	-	-	-	8.27	8.58	8.29	3.92	7.53	6.66	7.33	7.58	7.43
1986	8.87	6.87	-	-	-	-	-	-	-	-	-	-
1987	8.97	7.28	-	-	-	-	-	-	-	-	-	-
1989	9.41	7.00	-	-	-	-	-	-	-	-	-	-
1990	9.70	6.97	-	-	-	-	-	-	-	-	-	-
1991	9.45	7.45	10.08	-	-	7.64	-	-	7.07	-	-	7.34
1992	8.98	6.83	10.26	-	-	-	-	-	-	-	-	-
1993	7.62	5.99	10.46	-	-	-	-	-	-	-	-	-
1994	8.23	6.39	10.34	7.20	8.70	7.30	4.26	7.08	6.30	6.55	7.21	6.81
1995	7.48	5.85	7.44	-	-	-	-	-	-	-	-	-
1996	6.11	5.74	6.93	-	-	-	-	-	-	-	-	-
1997	6.63	5.11	-	7.14	5.89	7.14	3.6	5.89	5.22	6.3	5.89	6.15

Source: *Encuesta de Hogares del MTPS 1986-1995, Encuesta Nacional de Hogares del INEI 1996-1997, Encuesta de Sueldos y Salarios del MTPS 1986-1996, Encuesta Nacional de Hogares sobre Niveles de Vida 1985, 1991, 1994 y 1997.*

1. Metropolitan Lima, currently employed workers.

2. Metropolitan Lima, currently employed workers in firms of 10 or more workers.

3. Urban Peru, currently employed workers.

[28] Saavedra (1998) shows that among workers older than 55, the employment/population ratio have not recovered with the employment growth observed in the nineties and that unemployment has risen for this group of workers.

4.2 The Duration of Employment Spells

The data used in this part of the analysis comes from the LSMS.[29] The employment modules of the LSMS contain information about job characteristics such as tenure in the current job, sector of activity, size of firm, if a contract was signed, union membership, type of employment (public/private/self-employed/wage earner), white or blue collar job, etc. This information is collected regarding the job held in the previous 7 days. In addition, individuals who are not working report whether they are looking for a job or not and number of weeks unemployed. The survey has another module that asks workers, either employed or unemployed, questions regarding their last job in the previous 12 months. If unemployed during the last 7 days, the survey asks for all the characteristics of the last job held during the previous year. If working during the last seven days, the survey inquires if this job is the one held during the last 7 days. If different from it, it asks for the characteristics of that job. Two types of job spells are calculated with each survey. We use each survey separately and calculate right-censored spells for the sampled stock of employed workers and complete spells for the unemployed and for those who changed jobs during the last year. The detail of the duration data is as follows:

- Right-censored spells for the stock of people who are currently working, using the question: "How long you have been working as (occupation)?" [The response is coded in weeks, months and years.[30]]
- For those who declare that they have indeed changed jobs during the last 12 months, we construct two spells, a right-censored spell of less than twelve months and a complete previous spell. This data has two obvious biases. First, we only have complete spells for those who changed jobs during the last 12 months, if the current spell lasts more than that, we have no information of the previous spell. For these movers, we do not have information on possible unemployment periods between the two jobs. Second, for some workers who report a change in job, the change is within a firm. In those cases, we will not count that as a job change. We will isolate those cases by comparing all the job characteristics of the previous and current spells (occupation, sector, size of establishment, public/private, etc).
- A complete job spell for those not currently employed, and who answer positively to the question, "Have you had a different job during the last 12 months?".[31]

The complete and incomplete employment spells that are constructed in our data sets are summarized in Chart 1. According to the employment duration data for the years 1985 and 1994 from the LSMS, 78% percent of the job spells of 1985 are incomplete spells, while for the 1994 sample, this figure is 86%.

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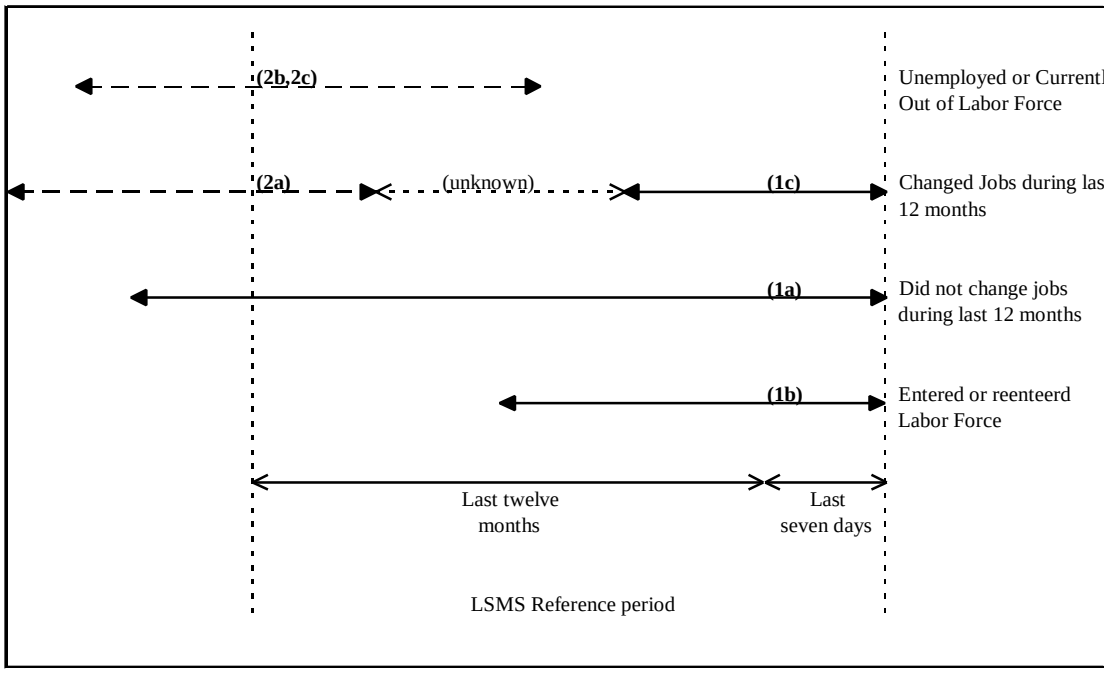
[29] The LSMSs are a series of household surveys developed since 1985 under the technical and financial support of the World Bank, and later implemented by *Instituto Cuanto.*

[30] The question, as written in the questionnaire, does not look very precise. However, two elements allow us to recognize them as job spells. First, personnel in charge of the fieldwork and of the interviewer's training process, maintain that they insisted that the duration reported as an answer to that question should be the length of time working in an specific occupation and in an specific firm. Second, the survey allows for a second check mechanism from a separate question: What was your main occupation during the last 12 months? Was this the same than your occupation during the last 7 days? In this case, the interviewer manual indicates that even a change in position within a firm should be considered a job change. If the respondent answers that the job was different, then he/she will answer for the characteristics of that previous job

[31] Note that we only have spells for those people - currently unemployed or out of the labor force- that had a job during the last 12 months, for those unemployed or inactive for more than that period, we do not have any information.

Chart 1

Employment Spells using the Peruvian LSMS



1. Right censored job spells: for the currently employed, either
   (1a) People who didn t change jobs during the last year.
   (1b) Newly employed entrants.
   (1c) People who changed jobs during the last year.
2. Complete job spells
   (2a) Currently employed that changed job during the last 12 months. This spell is the job held before the current one.
   (2b) Unemployed workers whose unemployment spell is smaller than 12 months and held a job during the last 12 months.
   (2c) Currently out of the labor force, that held a job during the last 12 months.

We analyze the basic differences in job duration patterns using the LSMS employment duration data for the years 1985 and 1994, including both complete and incomplete employment spells. These spells are to be thought of as independent realizations of a random variable T with survivor function $\bar{F}(t)$. Using the complete and incomplete employment spells from the LSMS data, we use the Kaplan Meier estimator for the survivor function. Following Lancaster (1985), for homogenous right-censored data the survivor function at t can be estimated by:

$$\hat{\bar{F}}(t) = \prod_{t(j)<t} (1 - \hat{\theta}_j), \quad t \geq 0 \qquad (14)$$

for $\hat{\theta}_j = n_j / r_j$, where n_j is the number of employment spells (possible only one) observed to end at time t and r_j is the risk set–spells that end at time t plus those censored at time t. θ_t is the probability of leaving the employment state (i.e., the hazard at time t). This estimator is a step function with steps at each observed (uncensored) exit time.

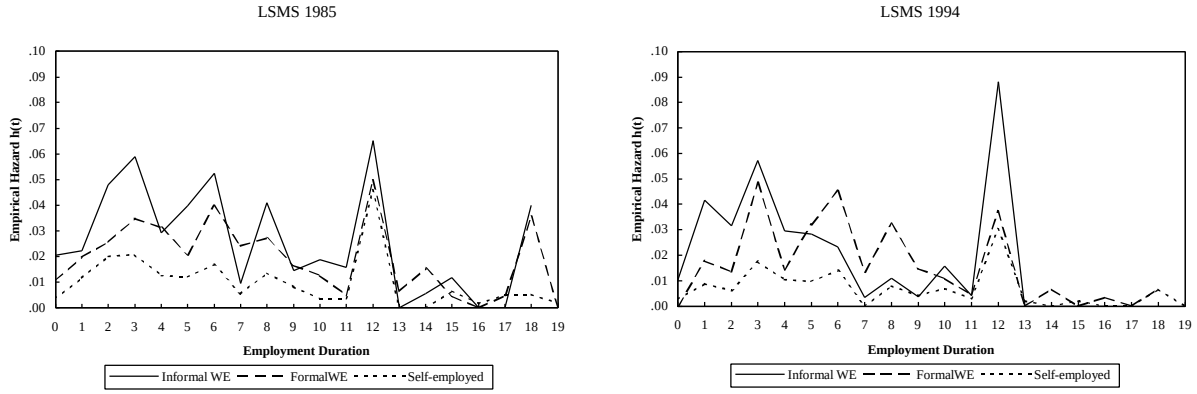
A shortcoming of this data set is that with the observational scheme of the survey complete spells are registered only for unemployed/out of labor force workers and for workers who changed jobs during the year prior to the survey. Therefore, complete employment spells tenures are available just for a specific type of individuals. However, as shown in Annex 3, there is a similarity between the hazard function calculated using only the complete spells and the hazard function estimated using only the incomplete (censored) spells as if they were completed, in spite of the possible biases of the censored data.

In addition, the empirical analysis assumes a stationary economic environment. This assumption, which implies that the number of jobs created and destroyed is independent of time, allows us to use each survey as a photograph of the distribution of their hazards assuming they won't be affected by the passage of time. It is difficult to assume stationarity in the Peruvian case, though, given the structural reforms. However, if we analyze each survey separately (1985 and 1994), despite the huge macro shocks observed in the Peruvian economy, no clear pattern of steady increase in the rate of job creation has been observed in the years previous to the surveys. In fact, a typical variable that could be used to condition the hazard function to the different environments confronted by different cohorts at their entry to or exit from employment is the rate of unemployment. That variable has fluctuated around a steady mean of 8.5% since 1974. Still, it is difficult to assure that a stationarity assumption can hold in volatile economies like Peru, in particular in the case of employment spells when we would need the same data generation process for a relatively long time.

Monthly hazards for a sample of censored and complete spells allow us to investigate duration patterns at the early stages of a job. In most cases there are spikes at months 3, 6 and 12, which at least in part may be a heaping effect. In this sense, it will be important to compare changes through time and the comparison between categories. At the time of the fieldwork of the 1985 survey, the probationary period lasted three years, after which workers acquired total job security. However, the authorities had already announced its intention of giving workers job security rights after the third month.[32] In fact, the hazard function calculated with 1985 data for spells that started after 1983 and before June 1986 (left panel of Graph 11) shows a spike at the third month. It is possible that employers in the formal sector had already reacted to the announcement by dismissing workers right before reaching that tenure length. However, this spike is even larger among informal wage earners, who were not affected by regulations.

[32] The change was actually put in effect in June 1986.

Graph 10
Empirical hazards for wage earners and self-employed workers with less than three years of tenure
(Employment duration in months)

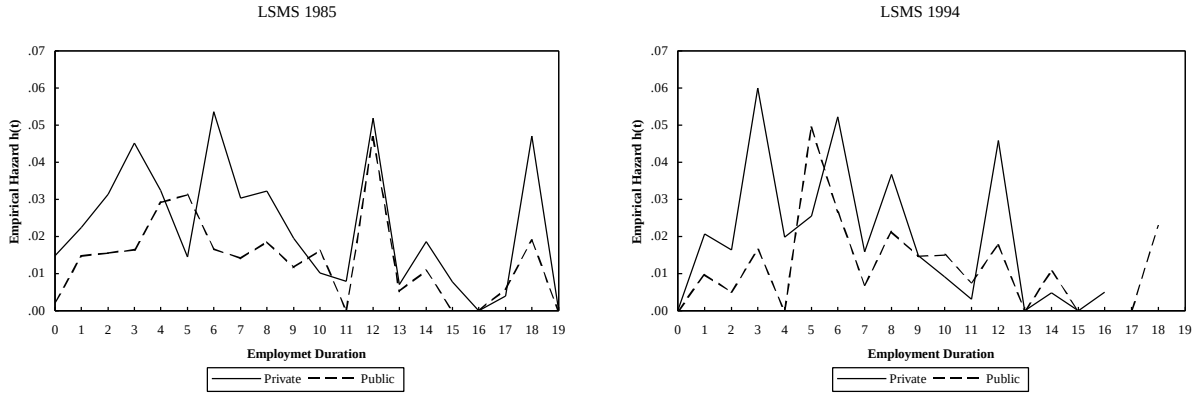


In 1994, labor legislation was more flexible, although only a few years had passed since the first wave of labor reforms in 1991. The probationary period was still three months, after which workers hired after 1991 only obtained the right to a severance payment upon unjust dismissal, not job security. Therefore, firing costs were obviously lower that those perceived by firms in 1985. As shown in the right panel of Graph 10, even if there is still a spike at the third month, the difference in the hazard functions for formal and informal workers is much smaller until the fourth month. Moreover, for tenures between 5 and 11 months the probability of leaving the state of employment is actually greater for formal workers than for informal ones. The hazard function for formal wage earners in 1994 is slightly above the one for 1985. These higher hazards for formal workers in the post reform year may be related to the lower firing costs. They could also be related to an increased inflow of employment, but as shown in Section II, inflows to informal employment were at least as large as those in the formal sector.

Note that in 1994 there still are large spikes in months 3 and 6. The spike in the third month may be explained by the fact that at that point workers acquired the right to a severance payment upon dismissal.[33] In addition, during this period employers still feared a possible reversal of the legislative change, so many of them were still reluctant to hire workers under permanent contracts. They relied heavily on temporary contracts for short-term periods, usually three or six months, which in some cases were continually renewed. There is a large spike at the twelfth month that may be related to the increase in the severance payment from zero to three monthly wages after completing a year in the firm, so right before finishing that year firms had their last chance to dismiss the worker at zero cost. Summarizing, there is an increase in the hazard function for formal wage earners between 1985 and 1994 and an increase in the hazard relative to that in the informal sector for workers with short durations.

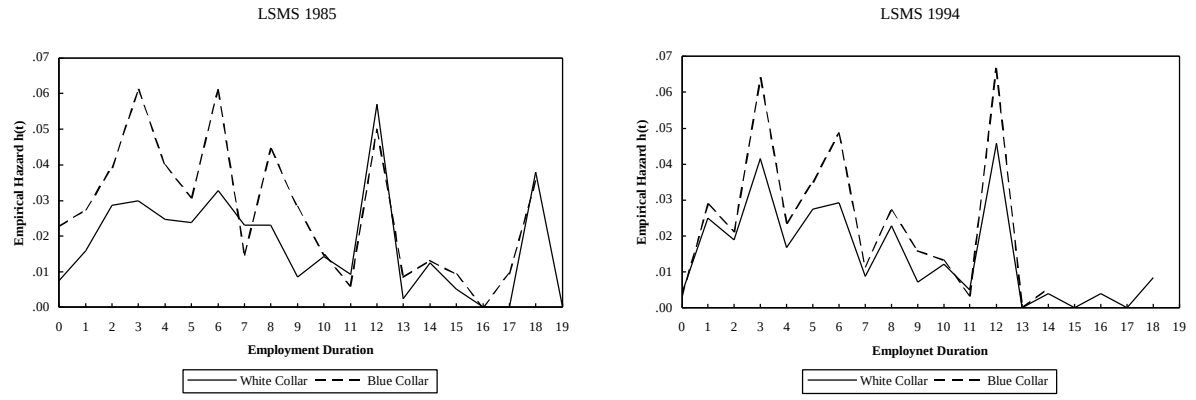
[33] The severance payment rule in 1994 stated that workers should get the equivalent to one monthly salary per year worked if they had more than one year in the firm -with a minimum of three wages and a maximum of 12. They acquired that right after the three month probationary period, but the severance payments between the third and 12 month was zero.

Graph 11
Empirical hazards for formal public and private workers with less than three years of tenure
(Employment duration in months)



An additional piece of evidence comes from the comparison between public and private formal wage earners. As shown in Graph 11, there is a large spike in the third and sixth month for private formal workers, which is not observed for public workers. This could be consistent with firms rehiring workers for two consecutive probationary periods. In general, the probability of exiting the employment state is much higher during the first months in the private sector, something that is not observed in the public sector.

Graph 13
Empirical hazards for wage earners (blue-collar and white-collar) with less than three years of tenure
(Employment duration in months)



An interesting change is observed when we compare hazards of blue-collar and white-collar workers. Clearly, during the first ten months of employment, hazards are higher for blue-collar workers, consistent with the common view that turnover is higher among those workers (see Graph 13). In 1985, spikes at the third, sixth and eighth months are very pronounced for blue-collar workers, and not observed among white collars. After 1991, however, the spikes are observed in both groups, and in general differences in the hazard functions are much smaller.

Parametric estimation of hazard functions

The sample of employment spells analyzed above are not drawings from a homogeneous population. In order to adjust for the heterogeneity of observations and analyze patterns for different groups of workers, we estimate exponential hazard models using complete and incomplete spells.

Table 9
Exponential hazard model: Self-employed and wage earners 'sample

	1985	1991	1994
Male	-0.462 ***	-0.212 **	-0.293 ***
	(0.064)	(0.103)	(0.092)
Age	-0.154 ***	-0.203 ***	-0.183 ***
	(0.012)	(0.019)	(0.017)
$Age^2 * 10^{-2}$	0.111 ***	0.176 ***	0.143 ***
	(0.014)	(0.024)	(0.020)
Married	-0.348 ***	-0.351 ***	-0.048
	(0.074)	(0.124)	(0.107)
Years of schooling	-0.005	-0.054 ***	-0.023 *
	(0.008)	(0.014)	(0.013)
Occupational training	0.073	0.480 ***	0.075
	(0.069)	(0.105)	(0.101)
Formal wage earner	-0.360 ***		-0.433 ***
	(0.094)		(0.138)
Self-employed	-0.979 ***		-0.976 ***
	(0.086)		(0.125)
Wage earner		0.704 ***	
		(0.114)	
N of observatons	6144	3570	4561
Log likelihood	-4461.59	-1788.78	-2656.25

Note: Standard errors in parenthesis.

Significance levels: * p<=0.1, ** p<=0.05, *** p<=0.01.

Table 9 shows the result of the estimation for three different years using employment spells of self-employed and salaried workers. Age shows the usual negative effect on the hazard, suggesting a lower turnover for older workers. The negative effect of age on the hazard is larger in 1991 and 1994, consistent with an increase in turnover among older workers. Education has a significant negative coefficient, suggesting lower hazards for the more educated, particularly after the reforms launched in 1991. Surprisingly, occupational training increases hazards in 1991. The results also confirm that the self-employed have lower hazards and much longer employment spells than formal

wage earners, and that they in turn have longer spells than informal wage earners, the category of control. The negative coefficient for formal salaried workers is larger after the reforms, suggesting a relative increase in turnover for this group. However, the standard error is also larger, so the change may not be statistically significant.

Table 10
Exponential hazard model: Wage earners sample

	1985	1991	1994
Male	-0.702 ***	-0.293 **	-0.517 ***
	(0.097)	(0.139)	(0.134)
Age	-0.175 ***	-0.222 ***	-0.176 ***
	(0.019)	(0.030)	(0.032)
$Age^2 * 10^{-2}$	0.146 ***	0.224 ***	0.123 ***
	(0.024)	(0.037)	(0.041)
Married	-0.355 ***	-0.463 ***	-0.010
	(0.096)	(0.164)	(0.139)
Years of schooling	0.050 ***	0.010	0.029
	(0.012)	(0.022)	(0.019)
Occupational training	-0.049	0.544 ***	-0.068
	(0.088)	(0.139)	(0.145)
Union	0.350 **	0.128	-0.303
	(0.137)	(0.197)	(0.272)
Social security	-1.180 ***	-1.212 ***	-1.219 ***
	(0.117)	(0.171)	(0.170)
Temporary contract	0.182 *		0.157
	(0.104)		(0.143)
Public worker	-0.362 **	-0.188	-0.484 **
	(0.157)	(0.274)	(0.221)
Blue collar worker	0.393 ***	0.269 *	0.288 **
	(0.103)	(0.156)	(0.146)
Union * Public worker	0.019	-0.107	0.535
	(0.200)	(0.338)	(0.376)
N of observations	3344	1945	2330
Log likelihood	-2557.92	-1039.92	-1481.19
chi2(df)	1171.71	517.49	592.49
Prob > chi2	0.00	0.00	0.00

Note: Standard errors in parenthesis.
Significance levels: * p<=0.1, ** p<=0.05, *** p<=0.01.

Table 10 presents an extended model that limits the sample to wage earners. The 1985 estimates show that having a temporary contract increases the hazard, suggesting higher turnover

among these workers. This effect disappears by 1994, although temporary contracts were intensively used, which may be related to a smaller difference in status within a firm between temporary and permanent positions.[34] Having social security coverage, a clear indication of formality, reduces the hazard rate, consistent with the higher empirical hazards found before for informal workers. Surprisingly, belonging to a private sector union increases the hazard; however, as the influence of unions vanishes over time, the estimate for this variable is not significant during the nineties. It is also found that married workers tend to have longer employment spells, and hazards are larger for blue-collar workers, as was suggested in the empirical hazard analysis. Limiting the sample only to private workers does not modify the result significantly.

5. Concluding Remarks

Peru is one of the countries that made the most progress in terms of labor market deregulation in Latin America as part of a package of structural reforms that took place in the nineties. One of the most important changes in labor legislation was the large reduction in firing costs, through the reduction in the steepness in the tenure related severance payment profile since 1991, the progressive abolition of job security, and the facilities given to the use of temporary contracts. To analyze the effect of changes in firing costs we constructed an expected severance payment indicator as a proxy of the monetary resources firms have to reserve in order to cover firing costs. We broke down the data into state-contingent components of firing and hiring states of the economy. Within each state, the severance payment was calculated by sector using the evolution of the tenure structure of workers, an estimate of the firing probability for each tenure group, and the corresponding mandated severance payment structure. These probabilities were allowed to vary only across sectors and were kept constant through time in order to reduce endogeneity. A series of non-wage costs was calculated by simulating the total labor costs paid by the firm as a proportion of the wage for different wage levels. This was necessary given that several mandated benefits and the payroll tax had absolute lower and upper bounds that were continuously changed. In many cases, most of the changes in the effective rate paid were due to changes in these limits.

To analyze the effects of changes in labor costs and firing on labor demand, we used a pseudo-panel data set of 10 economic sectors observed bimonthly during the period 1987-1997, and three shorter panels of about 400 establishments for the periods 1987-1990, 1991-1994 and 1995-1997. There are four main empirical findings. The wage plus payroll elasticity is -0.19 for the whole period of study when using the sectoral level panel. This price elasticity is larger when the payroll taxes are added as part of the labor costs than in an estimation in which only wages are included, and we were able to test that the latter was the model that should be used. In most of the sub-periods, both at the sector and establishment level, labor costs have a negative and significant effect on labor demand.

The second main finding is that the coefficient of our measure of firing costs, the expected severance payment, is negative and significant, showing that job security provisions have a negative effect on employment. We also found that its magnitude decreases after 1995. This result may be related to the fact that after that year, there was not enough time variability in firing costs within the

[34] Saavedra and Maruyama (1999) show that before the reforms temporary workers tend to be younger less experienced and less educated than permanenet ones. This differences diminished sharply arter the reforms. Also, there was a significant reduction in the earning premia of permanent workers.

sub-period in order to establish an effect on the employment level, or that the variance of within firm tenure structures had already fallen, reducing differences in expected severance payments across firms.

Third, output elasticity increases in the last sub-period. This may be related to the fact that labor legislation reforms made it easier for firms to adjust to the desired employment levels given changes in output. The reduction in severance payments and the abolition of job security rights may be interpreted as a lower level of the tax on dismissals. In addition, the lower administrative costs of using temporary contracts made it easier for formal firms to adapt to output changes. Finally, and in line with the previous result, we also find a speedier employment adjustment during the post reform period.

As discussed above, labor market reforms facilitated formal firms' adjustment to desired employment levels, through temporary contracts and by reducing severance payments and eliminating job security. This reduction in firing costs may have the effect of increasing turnover as firms will tend to increase hiring during expansions and firings during contractions. Using censored employment spells from different datasets that span the period 1985-1997, we find evidence that mean tenure fell after 1992, roughly coinciding with the beginning of labor market legislation changes, suggesting an increase in turnover in the Peruvian labor market. The reduction in mean tenure may also be related to the recovery initiated in 1993 when salaried employment was created both in the formal and informal sector. However, even if mean tenure among informal workers fell, among formal workers the fall is much larger and statistically significant in the post-labor reform period. The differences in mean tenures between the formal and informal sectors also fell significantly during the nineties.

The LSMS's for 1985 and 1994 allowed us to construct censored employment spells for currently employed workers and complete employment spells for the unemployed and for workers who changed jobs during the 12-month period before each survey. With this data we calculated empirical hazards for several groups of workers. We found spikes at three months of tenure, corresponding to the time at which the probationary period ended among formal workers. However, these spikes are also found in the informal sector. Spikes were also found at the sixth and twelfth months, probably related to renewal of short-term contracts, as a way to avoid job security, and to avoid discrete jumps in the severance payment. After the reforms, there is an increase in the hazard function for formal wage earners, and an increase with respect to the hazard function of informal sector wage earners. Large hazards in the third and sixth months are observed among private formal workers, and not among public ones, consistent with private firms using short term contracts in order to avoid job security. Hazards are always higher for blue-collar workers, but the difference between blue and white-collar workers diminishes after the reforms Finally, we performed parametric estimations of hazard estimations in order to control for demographic characteristics of workers. This confirmed the results of higher hazards for informal, younger, private and blue-collar workers. Education has a significant negative coefficient, suggesting lower hazards for the more educated, particularly after the reforms launched in 1991. There is evidence of a small relative increase in turnover for formal wage earners after the reforms. Having a temporary contract increases the hazard, suggesting higher turnover among these workers. This effect disappears by 1994, although temporary contracts were intensively used, which may be related to a smaller difference in status within a firm between temporary and permanent positions. Further work is needed with types of datasets as 1994 is close to the beginning of the labor market reforms.

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Annex 1: Non-wage costs

Table 11
Evolution of non-wage costs paid by employer and employee by item, 1987-1997

	1987	1988	1989	1990	1991	1992	1993		1994		1995		1996		1997	
							IPSS	AFP	IPSS	AFP	IPSS	AFP	IPSS	AFP	IPSS	AFP
NWC paid by employer																
Tenure bonus	8.33[1]	8.33	8.33	8.33[2]	8.33[3]	8.33	8.33		8.33		8.33		8.33		8.33	
National Housing Fund	4.00[4]	5.00[5]	5.00	5.00	8.00[6]	8.00	6.00[7]		6.00		9.00[8]		9.00		9.00[9]	
Holidays bonus	16.67	16.67	16.67[10]	16.67	16.67	16.67	16.67		16.67		16.67		16.67		16.67	
IPSS payments	6.00[11]	6.00[12]	6.00	6.00[13]	6.00	6.00	6.00	----	6.00[14]	----	----		----		----	
Public health plan	6.00	6.00[15]	6.00	6.00	6.00	6.00	6.00		6.00		9.00[16]		9.00		9.00	
Accident insurance	2.00	2.00	2.00	2.00	2.00	2.00	2.00		2.00		2.00		2.00		2.00	
Industrial Training Fund	1.50	1.50	1.50	1.50	1.50	1.50	1.50		1.50		1.25[17]		1.00		0.75	
Vacations	8.33	8.33	8.33	8.33	8.33	8.33	8.33		8.33		8.33		8.33		8.33	
TOTAL	52.83	53.83	53.83	53.83	56.83	56.83	54.83	48.83	54.83	48.83	54.58	54.58	54.33	54.33	54.08	54.08
NWC paid by employee																
National Housing Fund	0.50[4]	1.00[5]	1.00	1.00	1.00	1.00	3.00[18]		3.00		----[8]		----		----	
IPSS payments	3.00[11]	3.00[19]	3.00	3.00	3.00	3.00	3.00	----	3.00	----	11.00[16]	----	11.00	----	13.00[20]	----
AFP payments	----	----	----	----	----	----	----	1.00	----	1.00	----	8.00[16]	----	8.00	----	8.00
Solidarity payment	----	----	----	----	----	----	----	1.00	----	1.00	----[16]		----		----	
Accident/Burial expenses[21]	----	----	----	----	----	----	----	2.25	----	2.01	----	1.17	----	1.33	----	1.38
Percentual commission[21]	----	----	----	----	----	----	----	0.64	----	2.03	----	1.98	----	2.02	----	2.34
Public health plan	3.00	3.00[15]	3.00	3.00	3.00	3.00	3.00		3.00		----[16]		----		----	
TOTAL	6.50	7.00	7.00	7.00	7.00	7.00	9.00	19.89	9.00	21.04	11.00	11.15	11.00	11.35	13.00	11.72
TOTAL NWC	59.33	60.83	60.83	60.83	63.83	63.83	63.83	68.72	63.83	69.87	65.58	65.73	65.33	65.68	67.08	65.80

Source: *Análisis Laboral (1987-1997)*
Key: IPSS = Public retirement plan
AFP = Private retirement plan

Notes:

1. Last wage for every complete year of tenure. The maximum taxable wage equals ten Minimum Vital Wages.
2. Since June 1990, the maximum taxable wage is the last wage including Holidays bonus.
3. Since January 1991 the employer must deposit the tenure bonus in an authorized financial institution in May and November.
4. The maximum taxable wage is set at 8 tax units.
5. Changed in November 1988.
6. Changed in May 1991.
7. In January 1993 the employer's payment and the maximum taxable wage were abolished. In November 1993 it was set at 6%.
8. Changed in August 1995.
9. In January 1997 the employer's contribution was reduced to 7%, but the Holidays bonus was included in the taxable wage. In August 1997 the contribution was reduced to 5%.
10. Officially regulated since December 1989. However, this was already a usual practice long time before this date.
11. The minimum taxable wage equals one Minimum Vital Income, and the maximum to ten Minimum Legal Incomes.
12. Since January 1988, the maximum taxable wage was set on 20 Minimum Legal Incomes.
13. In August 1990 the Minimum Legal Income was replaced by the Minimum Vital Remuneration. In October 1990, the maximum taxable wage was eliminated.
14. Abolished in August 1995.
15. The maximum taxable wage, set on 10 Minimum Legal Incomes, was eliminated in January 1988.
16. Changed in August 1995.

17. The contribution decreases by 0.25% every year until 1997 (0.75%).
18. In January 1993, the employee's payment was set at 9% and the maximum taxable wage was abolished. In November 1993, it was set at 6%.
19. The maximum taxable wage for the employee was eliminated in January 1988.
20. In January 1997, the employee's contribution increases to 13%.
21. Market average.

Annex 2: Labor demand estimations

To test for cyclical variations of total labor demand due to employment composition changes (Bentolila and Saint Paul, 1992) we estimate the equation:

$$\ln L_{i,t} = X_{i,t}\Omega' + d \ln \hat{L}_{i,t-L} + e \ln \hat{L}_{i,t-L} \cdot \ln E(sp)_{i,t} + \delta t + \beta Z_{i,t} + cycle_t(X_{i,t}\Omega') + \varepsilon_{i,t}$$

where:

$$\Omega = (b_1, b_2, c, \delta)$$

$$X_{i,t} = (w + p, Y, E(sp))$$

where "cycle" is a dummy equal to zero in recessions and equal to one in expansions, and is interacted with all the regressors in the equation ($X_{i,t}$). This variable has a value of 1 when sectoral growth is 4% or more and zero otherwise. We used generalized least squares, and correct for serial correlation with a correlation coefficient specific for each of the panels. The results of the estimations are shown in the following table.

Table 12
Labor demand estimation results for panels at the sector and establishment level

	Sector level[1]			Establishment level[2]		
	1987-90	1991-94	1995-97	1987-90	1991-94	1995-97
Constant	8.189 ***	15.511 ***	14.900 ***	0.437 ***	0.027	1.554 ***
	(1.579)	(2.218)	(3.762)	(0.151)	(0.085)	(0.512)
ln(w+p)	0.574 ***	-0.316 ***	-0.353 ***	-0.031 ***	0.026 ***	-0.056 *
	(0.204)	(0.118)	(0.137)	(0.009)	(0.006)	(0.033)
ln(E[sp])	-0.907 **	-0.613	-0.443	-0.223 ***	-0.036 *	-0.125
	(0.363)	(0.424)	(0.634)	(0.032)	(0.018)	(0.104)
$\ln(Y)^3$	0.017	0.112	0.094 *	0.206 ***	0.008	0.083 **
	(0.067)	(0.102)	(0.054)	(0.009)	(0.008)	(0.035)
$\ln(L_{t-4})^3$	0.074	-0.206	-0.005	0.787 ***	0.943 ***	0.613 ***
	(0.148)	(0.215)	(0.313)	(0.024)	(0.016)	(0.088)
$\ln(L_{t-4})$ * ln(E[sp])	0.041	0.066	0.028	0.053 ***	0.006	0.041 *
	(0.027)	(0.045)	(0.060)	(0.005)	(0.004)	(0.021)
cycle dummy * ln(w+p)	-0.035	-0.022	0.018	0.040 ***	0.005	0.006
	(0.052)	(0.049)	(0.018)	(0.010)	(0.008)	(0.043)
cycle dummy * ln(E[sp])	0.046	0.030	-0.026	-0.009	-0.010	-0.023
	(0.063)	(0.066)	(0.024)	(0.013)	(0.011)	(0.059)
cycle dummy * ln(gdp)	0.017	0.020	-0.013	-0.078 ***	0.001	0.043
	(0.040)	(0.037)	(0.014)	(0.011)	(0.009)	(0.057)
Log likelihood	210.86	139.94	200.42	2757.98	2485.27	-1388.166
chi2	12589.99 ***	4561.53 ***	3474.32 ***	100574.42 ***	186433.25 ***	2736.63 ***
N	189	189	117	4754	6491	1722

Note: Standard errors in parenthesis.

Significance levels: * p<=0.1, ** p<=0.05, *** p<=0.01.

1. With fixed effects.

2. A time trend was included. It was significant for the period 1991-94, but not for 1987-90 and 1995-97.

3. Instrumentalized with lagged values using rolling equations.

Annex 3: Equality of empirical hazard functions

Graphical analysis

In order to verify the equality of the hazard functions for complete and incomplete spells we assume that incomplete spells are completed ones and then compute the empirical hazard rates (Kaplan-Meier) for both types of spells. These estimates are shown in the graph, Note that the empirical hazard for incomplete spells has the same shape and spikes as the complete ones. Hazard functions for complete spells are above those using incomplete data, a fact that is consistent with lower mean tenures calculated using the former data set. Still, the pattern followed by the hazard function looks similar.

Kolmogorov-Smirnov Test

We use the Kolmogorov-Smirnov (K-S) statistic to formally test the equality of the empirical hazards functions between complete and incomplete spells (defined as uncensored spells). The test evaluates the closeness of the distributions l^{is} and l^{cs} (for incomplete and complete spells hazards) by computing the least upper bound of all pointwise differences $|\ \hat{l}^{is}(x) - \hat{l}^{cs}(x)|$. We can write the K-S statistic D as:

$$D = \sup_x [|\ \hat{l}^{is}(x) - \hat{l}^{cs}(x)|]$$

The null hypothesis ($H_0 : l^{is} = l^{cs}$) is accepted if l^{is} is sufficiently close to l^{cs}, in other words if the value of D is sufficiently small or smaller than the critical value at a certain significance level. The results are shown in the next table. At the 95 percent significance level we can not reject the null hypothesis that the two empirical hazard functions are equally distributed.

Table 13
Kolmogorov-Smirnov *D* statistic

LSMS	*D* statistic	P Value	Critical value (95%)
1985	0.2143	0.228	0.22
1991	0.1721	0.661	0.23
1994	0.1884	0.470	0.23
1997	0.1779	0.553	0.22

Graph 14
Empirical hazard functions of complete spells (assuming completeness of incomplete spells)