Labor Market Regimes and Mobility through a Markov Chain in Chile

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Abstract

In this paper we analyze the dynamics of labor markets in Chile. Our goal is to understand how flexibility in the labor market has changed over time, and in particular, to relate this change with the legislation framework. Using transition probabilities we analyze mobility in five periods, each of them associated with different labor regimes. Based on flows, we estimate transition probabilities across three relevant possible states: unemployment, employment, and out of the labor force.

Our finding shows that since 1974 employment became less secure. The probability for an employed person of becoming unemployed almost doubled since 1974 and remained thereafter, but reached its peak in the period 1999-2003. Also, the probability of remaining unemployed increased from 25.9% in the period 1962-73, to over 40% in the periods 1974-79 and 1980-89, but felt to 16.6% in the period 1991-98, to jump again to 40.6% after 1999.

We also found that the natural rate of unemployment more than doubled after the reforms in 1974 and remained high, until the period 1991-98. However, the natural rate of unemployment rose to almost 6% after 1999. We found no evidence of discouraged and added worker effects to explain the increase in the unemployment rate in the last period studied.

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1. Introduction

The study of the Chilean labor markets offers significant interest due to at least three reasons. First, Chile from being a highly regulated economy, become one of the most open unregulated economies in the world by implementing deep economics reforms in most institutions, including the pension system and the labor markets. Second, Chile has relatively good historical data, which allows economic and statistical analysis that is not possible in most LDCs. Third, the performance of the labor markets in Chile has been puzzling. The jump in the unemployment rate in the middle seventies, when the government carried out a first group of structural reforms, was not reversed despite to the rapid growth of the economy in the last part of that decade. On the other hand, in the

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eighties, after a much deeper crisis that lead the unemployment rate to over 25%, the recovery in the employment, the reduction in the unemployment and the growth in wages was much more rapid than expected.

Unfortunately, panel data, based on the follow-up of a sample of people (or any other unit of study) across time, is not available form a historical perspective, so only indirect approaches have been carried out.[2] Studying the labor markets dynamics is crucial not only to understand the development process and the perspective of the economy, but also to understand the meaning of some indicators captured through surveys in a particular period. For instance, two economies could be facing the same unemployment rate affecting one twelve of the labor force (8.6%), but each of them, present a complete different situation regarding the severity of the unemployment. Thus, economy 1 may have that unemployment rate because each person who belongs to the labor force is unemployed during one month per year, that is, one twelfth of the year. Economy 2, on the other hand, could have the same unemployment rate because one twelve of their labor force is permanently unemployed. The other eleven twelfth is permanently employed.

As it becomes apparent, in the first economy the unemployment situation is simple, there is little if any social problem with unemployment. In the second case, the situation is extremely painful for 8.6% of the labor force. Furthermore, each economy offers a very different likelihood of giving employment for the unemployed. Consequently, each economy requires different policy measures.

As clearly derived from this example, studying the dynamic properties of the economy is critical for policy proposals. In this paper we perform a dynamic analysis to analyze whether the increase in legal flexibility in the labor markets in Chile has affected real flexibility. To do so, we analyze mobility in different periods associated with different labor regulations: 1960 - 1973; 1974 - 1979; 1980 - 1990; 1991 - 1998, and 1999 - 2003. Within each period, labor laws and other institutional arrangements were fairly stable, but the end of each period marks the beginning of a new institutional framework, that is, a set of policies and laws directed at altering the performance of the labor market. For this purpose, the paper estimates transition probabilities across three possible states: unemployment, employment, and out of the labor force and we associate flexibility with the size of these transition probabilities.

The paper has three sections besides this one. In section 2 we describe the Chilean economy during the period 1960-2003. Section 3 presents the methodology to compute transition probabilities and the results. Section 5 concludes.

2. The Chilean Economy and the Labor Market

The great depression was probably the most important conditioning factor that determined the roles that the State and other sectors and entities would play in the economy over the next forty years. In particular, the strong State intervention the country began to experience, as in most Latin American countries, started in 1930. Prior to 1973, the Chilean labor law was

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[2] See, Haindl (1985); Cahmi, Engel and Micco (1987), Larrañaga and Paredes (1999), and Paredes (2003).

very protective. Only one union per firm was allowed and membership to a union was mandatory. Strikes had no limit and replacement was forbidden. Dismissal of workers was very difficult until 1966, when a law prohibited dismissals without a justified reason. As many other restrictions applied, as to be registered member of specific unions to work in some activities, the public sector, where wages could only increase in real terms, was a main generator of employment.[3] In the private sector wages were closely determined by the regulation, including minimum wages and adjustment clauses. The state intervention, including that on labor, reached its peak in the early seventies during the Allende administration. In 1970, when Allende took office, there were 75 State-owned enterprises; by 1973, there were more than 200, accounting for 39% of the GDP.

Consistent with these institutions, employment growth in the 1960's followed the path of the economy. While relatively low employment product elasticity before the 1970's existed, the unemployment rate remained relatively low due to the increasing schooling rate and a lower labor market participation, and due to the progressive involvement of the government as an employer. The main changes in institutions and performance appeared after 1973, due to the political and economic crisis that had almost paralyzed the country. Thus, in September 1973, in the throes of that crisis, a military regime overthrew Allende. The Military Junta limited civil rights, banned unions and political parties and initiated a process of structural adjustment and reforms.

Although in 1973 the economy was beset by many microeconomic distortions and macroeconomic disequilibria, the public sector deficit was the foremost problem. An increase in taxes and a drastic cut in Government expenditures were the first actions that helped reduce the fiscal deficit. Expenditures on civil servants' salaries were reduced by more than 30 percent in four years, as public sector employment was cut by a third (100,000 jobs). Furthermore, from the very outset of the new administration, the government required its agencies to reduce their headcount by 20 percent, discontinued all fund transfers to most public firms, did away with discriminatory rules favoring public institutions (basically the Civil Service) and increased prices of public services markedly. Simultaneously, the new government deregulated most of the previously controlled prices (out of 3,000 initially price-controlled commodities, only 30 were left by 1975), reduced import tariffs from 103% to 10% and implemented a tax reform.

Regarding labor, in 1973 and for the following six years, unions were banned and collective bargaining was replaced by a government wage setting plan. The crisis and the institutional and economic changes rocketed unemployment over 30%. Thus, whilst the law did not change, there was a de facto deregulation. In particular, the Ministry of Labor accepted "economic reasons" as a justified reason to dismiss workers. The consequence, between 1973 and 1978 layoffs increased substantially (González, 1996).

After the crisis though, and despite the important recovery of GDP since 1978, the growth of employment and wages was slow. Some reasons may be that the tariff reduction policy implemented between 1974 and 1979 failed to establish clear objectives in terms of product specialization and export orientation (see, Edwards and Edwards, 1987) and that the economy

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[3] See González (1996) for a detailed description of the law and their changes.

did not have the capacity to readjust its human resources to the new skill needs (Paredes and Riveros, 1996). However, another explanation for the poor performance in the labor markets in late 1970s and early 1980s lies in the rigidities in the market. As a matter of fact, this diagnosis produced a major change in individual rights in June 1978, through the enactment of the Law Decree 2.200. This ended the requirement to ask for permission to the Ministry of Labor in the case of collective (massive) firing something though that in practice was generally allowed. Since then, it was allowed firms to dismiss workers for economic needs and was not required to have a "just cause" anymore.

In 1979, the new labor code was approved and sweeping reforms were introduced. Among the most important was the elimination of national unions in favor of firm level ones. Unionization became voluntary and workers' right to strike was curtailed. Striking workers could now be replaced from the first day of a strike. All that had clear implications on collective bargaining because it had to take place at the firm level. In case of firing workers, a limit was set on the severance payment equivalent to 5 months. In addition, in 1980 all restrictions on sub contracting ended. Also, in the early 1980s the centralized pension system was replaced by a private one, what reduced the social contribution in about 50% (from 30% to 20%).

The international crisis of the early 1980s hit Chile in a context where the economy was in a weak production and balance of payments position. As a consequence of the early 1980's crisis, and without a structural change, the macroeconomic effect on the unemployment was huge. The unemployment rate increased from 10.5% in September of 1981 to 24.9% in September of 1983 and real wages declined by about 12%. The government reacted with a massive temporal emergency employment program.

With the labor reforms, by mid 1980s the government also initiated a massive privatization program, which included traditionally state owned enterprises.[4] Also the government introduced new rules governing the stock exchange, the insurance industry and mutual funds. The new rules sought not only to provide the necessary transparency of transactions, but also to ensure adequate portfolio diversification. In fact, there is relative agreement that the first privatization stage presented problems mainly because of a lack of regulation (Harberger, 1985). Likewise, since 1984 a more coherent policy approach relied on the expansion of labor-intensive sectors. Fiscal management became even more conservative, shrinking the consolidated deficit to zero.[5]

In 1990 Chile underwent a new institutional change with the recovery of the democracy. However, the basic economic aspects initiated with the mid 1970's reforms were retained, especially the macroeconomic policy of the late 1980's. Three governments pertaining to the same party coalition successively took office in 1990, 1994 and 2000. A main characteristic of these governments is that they kept a basic consensus on the critical role of the private sector and of private property, the importance of non discriminatory policies and the use of

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[4]For instance, ENTEL (telecommunications), CTC (local telephony) and ENDESA (electricity generation and distribution). For a detailed analysis and description of the privatization process in Chile, see Hachette and Luders (1993).

[5] This, however, had a negative social impact which, apparently, was addressed by providing greater assistance to the extremely needy.

markets to achieve efficiency. These governments, though, attached a much more critical role to social policies and were concerned not only with poverty but also with income distribution.

Notwithstanding, in 1991 some changes in the labor law took place. Perhaps the most significant was the increase in the limit to severance payment that went from 5 to 11 months. This amendment in the labor law was considered a final adjustment that would validate most previous changes that took place under the military government. This fact, more than any other, explains the most impressive increase in foreign investment and the sustained growth of about 6 per cent and the rate of unemployment that remained close to its natural level until late 1998.[6] However, since 1988, without any structural change, there was a macroeconomic downturn in Chile due to two factors: the beginning of the Asian crisis and a truly political cyclical period. The second factor was reflected in an important relaxation of the fiscal discipline, an impressive increase in the minimum wages, and the initiation of a debate about new changes in the labor law, that were finally implemented in 2002. Since 1998 the unemployment rate jumped and, despite the increase in the GDP, the employment and the labor force growth freeze. Regarding this last effect, an important controversy emerged in Chile on the reasons behind both the persistence of the unemployment and on whether a "discouraged worker effect" explained the labor force stagnation.

In short, though we can identify several small changes in between (table 1), we identify five distinct periods between 1960 and 2003. The first goes between 1960 and 1973 and is characterized by progressive government intervention, not only as a regulator, but as a direct employer. The second period goes between 1974 and 1979. In this period no collective bargaining was allowed and though formally there were little changes, in practice this was a period of de facto deregulation. The third period starts in 1980 and ends in 1990. In that period the new labor law applied. The fourth period starts in 1990 with the recovery of democracy and with further reforms that suggest a more stable and permanent framework, until 1998, when a macroeconomic downturn, and increase in minimum wages and the debate of new labor rules initiated in 1998. The last period starts in 1999 and ends the fourth quarter in 2003.[7]

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[6]Paredes and Riveros (1996) analyze the level and the causes of unemployment, concluding that in 1990 most unemployed were in that situation "voluntarily."

[7] Whilst only in 2002 some new changes in the law were implemented, the debate about taxes and the government intervention make it interesting the separate analysis. See Bergoeing and Morandé (2002).

Table 1
Employment Protection Provisions in Chile

| Periods	Prior Notice Period	Economic reasons just cause for dismissal on the law? / in the courts?	Compensation for dismissal in case of just cause	Compensation for dismissal in case of unjust cause	To whom the changes apply?
1960 – 1966	1 month	Dismissals at will	Dismissals at will	Dismissals at will	Dismissals at will
1966-1973 Firms could not dismiss workers without a just cause.	1 month	Economic reasons were just cause on the law/ In practice labor courts considered most dismissals unjustified.	The law does not mandate any compensation in this case.	One month's pay per year of work at the firm plus foregone wages during trial. Trials could last at most 6 months. There is no maximum in the amount to be awarded	To all workers
1973-1978	1 month	Labor courts were much more pro-firms. Workers' claims were weaker.	Same than previous period	Same than previous period	To all workers
1978-1980 June 15, 78 Decree 2,200	1 month	Economic needs are considered just cause.	zero	1 month per year of work, without maximum limit.	Only to workers hired after June 1978
1981-1984 Law 18,018 (August,14, 1981)	1 month	Economic needs are considered just cause.	zero	1 month' wage per year of work *with a maximum of 150 days*	Only to workers hired after August 1981
1984-1990 Law 18,372 (Dec, 1984)	1 month	Economic needs are not considered just cause for dismissal any more	zero	1 month' wage per year of work *with a maximum of 150 days*	All workers
1990- today (Nov. 1990) Firms need to justify dismissals	1 month	Firms have to justify dismissals but economic needs are considered just cause for dismissal	Economic reasons: 1 month' wage per year of work with a maximum of 11 months' pay	1.2-1.5 months per year of work	All workers hired after August 1981

Source: Montenegro and Pagés (1999)

3. Aggregate Flow and the Probability of Finding a Job

The diagnosis we can get form a dynamic analysis of the labor market is complementary to that provided by cross section surveys. Since Chile has historical data coming from cross section surveys, the only way to understand the dynamics of the labor market is using that information. Thus, we study the dynamics of Chilean unemployment from the perspective of a highly simplified stock-flow model of the labor markets. The data we use comes from the unemployment survey of the Universidad de Chile. The survey, which is conducted

quarterly since 1957, consists of repeated cross-sections of the population and provides data on stocks of employed, unemployed, and inactive workers.

The dynamics of labor markets economy can help us to understand, for instance, what is the probability of finding a job. This probability can be approached by the average duration of (interrupted) unemployment. Whilst this information is a biased estimation of expected duration, since declared unemployment is interrupted, it provides an idea that the probability of finding jobs may change dramatically over the years. Thus, the information about unemployment duration, something that has to do with the history on unemployment, tells something that the unemployment rate alone does not say. Thus, as apparent from figure 1, the length and the unemployment rate do not always move closely.

Figure 1
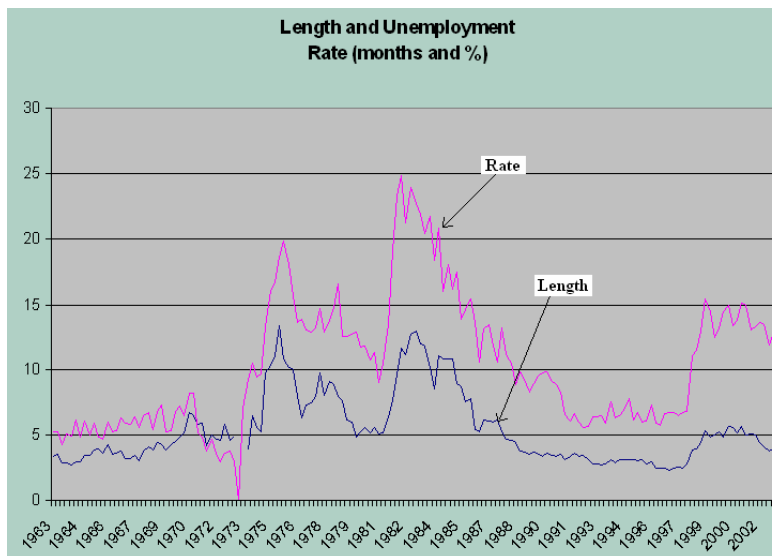
To understand the dynamics of the labor markets starting form cross section information, we estimate transitions among states, what requires imputing inter-temporal flows among states as the difference in stocks, information we do have. In particular, we are interested in the states of employment, unemployment and out of the labor force. We initially follow Haindl (1985), which combines identities and stock (capital letters) flow (small letters) relationships. Then, we use some of the inputs to compute transition probabilities and the Markov matrix.

3.1 The Stock-flow relationships

a) Identities.

(1) $D(t) = D1(t) + D2(t) + D3(t)$

where D(t) is the number of people unemployed in t, D1(t) is the number of people who is searching for jobs for the first time; D2(t) is people who has been unemployed for a quarter; and D3(t) is people unemployed for more than a quarter.

(2) $f(t) = f1(t) + f2(t)$

where f(t) is the net flow into the labor force; f1(t) people in the market for the first time; f2(t) people in the market that had participated before.

(3) $c(t) = c1(t) + c2(t) + c3(t)$

where c(t) is the flow of people hired in t; c1(t) is the flow of hired among those who are first time searchers; c2(t) is the flow of hired among those who had lost their jobs before a quarter; and c3(t) is the flow of hired among those who were searching for more than a quarter.

(4) $D(t) = F(t) - E(t)$

where F(t) is the labor force in t, and E(t) is the employment in t.

b) Stock-flow relationships.

(5) $F(t) = F(t-1) + f(t)$

(6) $E(t) = E(t-1) + c(t) - d(t)$

where d(t) is the flow of people out of the labor force, plus those who were fired in t.

(7) $D(t) = D(t-1) + f(t) + d(t) - c(t)$

(8) $D1(t) = D1(t-1) + f1(t) - c1(t)$

(9) $D2(t) = f2(t) + d(t) - c2(t)$

(10) $D3(t) = D3(t-1) + D2(t-1) - c3(t)$

The problem thus far is that the survey pertains only to unemployment. There is no data which describes flows into employment; therefore, the stocks of hires {c1(t), c2(t), c3(t), c(t)} are unobserved.

In order to solve the model, it is necessary to determine or assume how the economy employs individuals. We follow Haindl (1985) and assume that the stochastic process for employment is iid across individuals and has no memory. In any event, this amounts to finding the average probability with which an agent is hired, imposing no duration dependence on unemployment spells, and assuming there are no differences across individuals in the likelihood that they obtain a job offer. Essentially, the model closes by replacing actual flows into employment by their expected values. The probability of finding a job (within the quarter), if the person is unemployed at the beginning of the quarter, is given by pi(t), we can close the model as follows:

(11) $c1(t) = P(t)f1(t) + pi(t)D1(t-1)$

(12) $c2(t) = P(t)\{f2(t) + d(t)\}$

(13) $c3(t) = pi(t)\{D2(t-1) + D3(t-1)\}$

where pi(t) is given by (14).

(14) $pi(t) = 1 - D3(t)/\{D3(t-1) + D2(t-1)\}$

If people who enter into the labor force for the first time begin searching uniformly throughout the quarter, the average search time for them in that quarter is one month and a half, and the probability of getting a job during the period of three months p(t), comes from $\{1 - P(t)\}^2 = 1 - pi(t)$. Equation (14) closes Haindl's model and on the probability pi he develops his conclusions on unemployment duration.

Instead, we use this probability as an input to estimate the conditional probabilities of changing states in a three state model, employed, unemployed, and out of the labor force. In the following sub section we use this probability to solve the unknown flow parameters {c(t), c1(t), c2(t), c3(t), f(t), f1(t), f2(t), d(t)} in terms of the known stocks {F(t), F(t-1), E(t), E(t-1), D1(t), D1(t-1), D2(t), D2(t-1), D3(t), D3(t-1)}. Once the aggregate flow parameters have been obtained, we compute the flows across the three possible states, fij(t), the flow from individuals that were in state i at time (t-1) and who are in state j at time t.

3.2 Computation of Inter State Flows and Transition Probabilities

Once the model above is solved for aggregate flow parameters, it is possible to compute the expected flows across the different states. Let fij(t) denote the flow into state j at time t of those people who were in state i at time (t-1). These flows can be computed from the stocks of people in different states and the aggregate flows computed in the previous sections.

People who enter the labor force either go directly into employment or are unable to secure a job and become unemployed. Flow into employment is given by the fraction of first time searchers who are able to find a job within the period in which they enter the labor force. That is,

(15) $foe = P(t)f1(t)$

Flow into unemployment is the sum of first time searchers who do not obtain a job in their first period of search and of other labor force veterans, currently out of the labor force, who express a desire to work $x(t)$[8]:

(16) $fou = (1 - p)f1(t) + x(t)$

Workers in the labor force are re-shuffled between employment and unemployment. A fraction of workers who lose their job are able to find a new job within that same period. Flow into unemployment is, then composed of people who are either fired or quit their jobs:

(17) $feu = (1 - P(t))d(t)$

The unemployed who flow into employment (18) consist of the new hired who were unemployed for more than a quarter; a proportion of those first time searchers who were unable to secure a job initially, the fraction of fired individuals who become employed within their first period of unemployment, and a fraction of the net flow of workers previously out of the labor force (but only if net flow is positive).

(18) $fue = c3(t) + pi(t)D1(t - 1) + P(t)(1 - Pt))d(t) + P(t)\max\{f2(t), 0\}$

Finally, the flow out of the labor force comes either from unemployment or employment. These two flows are computed as residual flows; that is, the flow that generate the observed change in the stock of unemployed and employed workers. Therefore, flow out of the labor force from unemployment is given by:

(19) $fuo = fou + feu - fue - (D(t) - D(t - 1))$

while flow from employment to out of the labor force is given by

(20) $feo = foe + fue - feu - (E(t) - E(t - 1))$

From these flows, we can compute the average transition probabilities as in (21), where each element $p(ij)$ gives the (conditional) probability of going from state i to state j. For example, peu denotes the probability that an individual will be unemployed in period t, given that was employed in period t-1.

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[8] We use the number of people out of the labor force that would be willing to work at least 20 hours per week.

(21) $p(ij) = fij(t)/Si(t-1)$

where Si(t-1) is the stock of individuals in state i at time (t-1).

Notice that transition probabilities are conditional probabilities. That is, they tell us the probability of ending up in a particular state, conditional on starting out in a particular state. Conditional probabilities inform us much more than non conditional ones. For instance, p(e,u) is the probability of becoming unemployed, given that the person was employed in the previous quarter. That is different than the probability of becoming unemployed computed from first time searchers only (pou), the probability of remaining unemployed (puu) and the probability of being observed in the unemployment state (puu+pou+peu).[9]

The results of the Markov matrix built from the different pij, are reported in table 2, and visually in figure 2.

Table 2
Average Transition Probabilities by period

	Peu	Peo	Pue	Puo	Poe	Pou	Pee	Puu	Poo
1962-1973	2,50%	1,02%	61,88%	20,22%	0,28%	2,04%	96,53%	25,91%	97,68%
1974-1979	4,79%	1,25%	39,33%	16,65%	0,34%	2,97%	93,97%	48,23%	96,69%
1980-1990	5,33%	1,56%	49,15%	15,13%	0,32%	3,28%	93,12%	40,98%	96,41%
1991-1998	3,86%	1,80%	77,73%	14,27%	0,50%	2,34%	94,33%	16,55%	97,16%
1999-2003	6,69%	2,12%	58,16%	3,81%	0,41%	1,43%	91,18%	40,62%	98,16%

The changes in different transition probabilities suggest what today is well known: employment became less secure since 1974, when Chile experienced the main change in their economic orientation and in particular, Courts ended in practice with employment rigidity. For instance, the probability for an employed person of becoming unemployed (Peu) almost doubled from 2.5% before 1974 to 4.79% in the 1974-1979 period. An exceptional period seems to be 1991 – 1998. Despite a more rigid labor law, the probabilities changed suggesting even larger labor mobility and in particular, a clear reduction of the probabilities of remaining unemployed. This situation can be explained in part by the increase in labor demand, which in turn followed a persistent increase in the GDP. However, at the same time, whilst this change in the labor law was in fact something that could make the labor market more rigid, it represented an improvement in the expectations of firms, since all the new government coalition parties had criticized the

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[9] We can compute several interesting elements, such as the probability of finding a job, conditional on staying in the labor force pue*= pue / (peu+poo). This probability nets out the flow from employment to out of the labor force, which includes mostly retired people. We can also define the probability of losing a job, conditional on staying in the labor force as, peu* = pue / (peu+puu), which tells the probability that a person becomes unemployed, but stays looking for a job.

changes in the Labor Code. Thus, with the return of democracy in 1990, many expected a return to the old Labor Code of the 1973, something which did not occurred.

In turn, there was an important reversal of these probabilities since 1999. Besides the international crisis that hit the Chilean economy, between 1998 and 2001 the minimum wage was increased over 30%, and new more rigid labor regulations were discussed and implemented. In this period, all the probabilities showing that the economy was providing less and more insecure employment, and hence, the probability to remain employed felt and the probability of remaining unemployed more than doubled it previous value.

Figure 2
Transition Probabilities
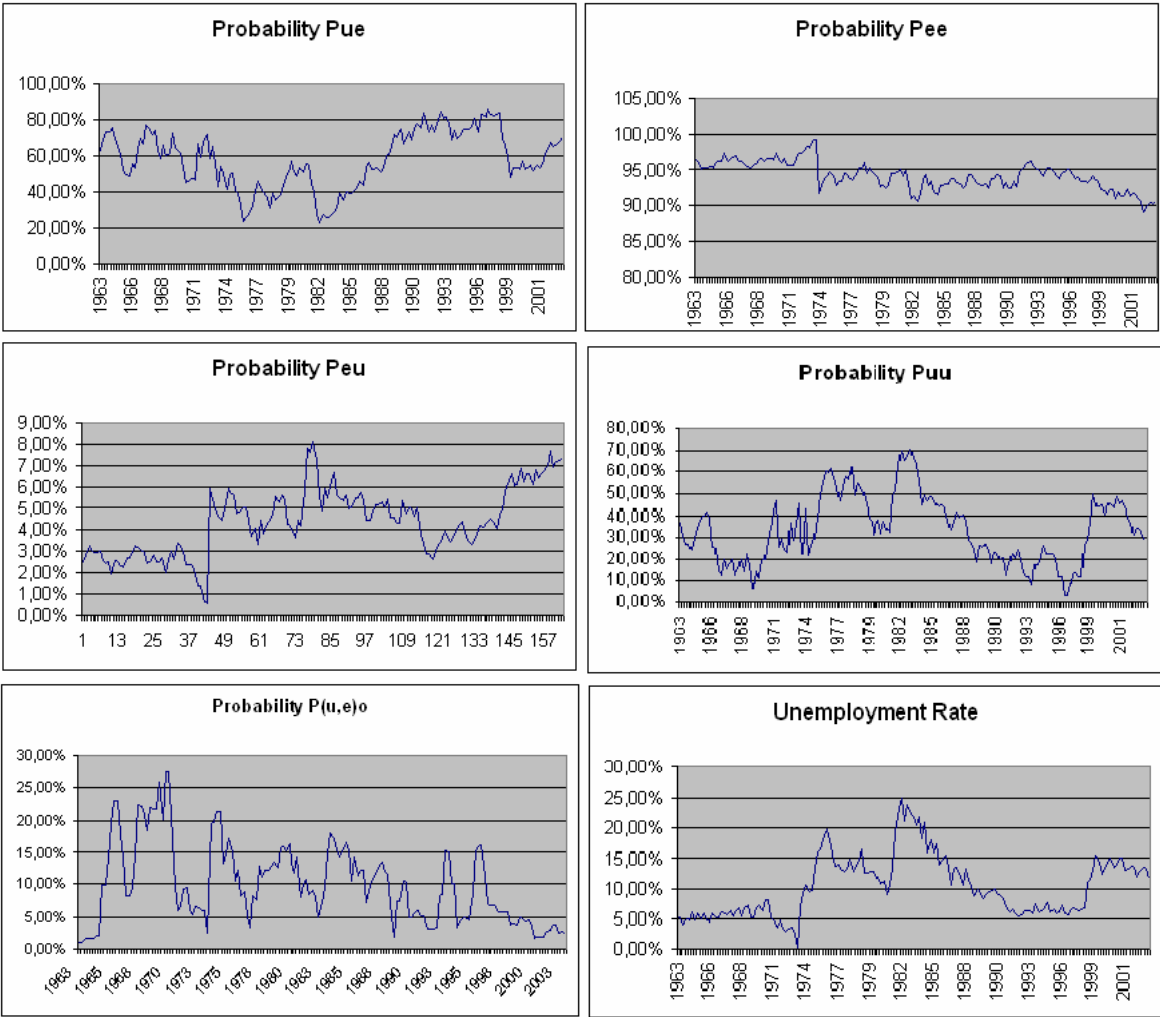
Due to the important jump in the open unemployment, a debate emerged. Two sources of data with somewhat different evolution of the main market labor indicators, the official information and that generated by the University of Chile, provided some of the basis of the debate. One of the hypotheses about the unemployment evolution had to do with the

"discouraged" versus the "added worker" effects on the labor force. The probability of leaving the work force, given one was unemployed the previous period (Puo), tells us about the discouraged worker effect, whilst Pou, and Poe, tell us about the added worker effect. Table 2 suggests that whilst these magnitudes remained quite stable in the different periods considered, except in the most recent one, after 1998. In that period the evidence shows that Puo felt form 14% to less than 4%, suggesting that the discourage worker effect didn't existed. The evidence also goes against the added worker effect, since Pou and Poe felt to their lowest levels.

3.3 Transition Probabilities and the Natural Rate and Length of Unemployment

From transition probabilities, we can study their effect on the steady state unemployment rate and on the expected length on unemployment. To do so, let's consider the three state Markov chain P in which an individual can find himself at anytime, that is, employed, unemployed, and out of the labor force. The transition matrix is:

$$P = \begin{vmatrix} pee & peu & peo \\ pue & puu & puo \\ poe & pou & poo \end{vmatrix}$$

Notice that pee + peu + peo = 1, since each individual must end up in some state, regardless of the state in which they begin. The Markov chain we study is irreducible, since it consists of only one class and all state communicates. If we assume that the transition probabilities are known, we can find the invariant distribution that defines the steady state probabilities. Let $\pi o, \pi e, \pi u$ denote the invariant distribution. It turns out that the invariant distribution in the unique non-negative solution to:

$$\pi j = \sum_{i=1}^{S} \pi i Pij$$

and

$$\sum_{i=1}^{S} \pi j = 1$$

with i, j = o, u, e and S=3.

The invariant distribution must sum to 1 ($\pi o + \pi e + \pi u = 1$) and the unique invariant distribution must also satisfy a set of equations that can be written as follows:

$$\begin{vmatrix} \pi e \\ \pi u \\ \pi o \end{vmatrix} = \begin{vmatrix} pee & pue & poe \\ peu & puu & pou \\ peo & puo & poo \end{vmatrix} \begin{vmatrix} \pi e \\ \pi u \\ \pi o \end{vmatrix}$$

In a simpler form, these equations state that the unique invariant distribution is also a vector of "stationary probabilities":

$$X = P'X$$

Where P' is the transpose of the transition matrix. The invariant distribution is akin to a vector of "steady state" probabilities in the sense that if we start the system out at the unique invariant distribution, this distribution will persist over all transitions of the system.

In order to obtain the steady state probabilities, we solve using the four equations above along with a set of restrictions of the transition probabilities of the type pii+pij+pik=1, with i,j,k all the states.

The invariant distribution for the three state Markov chain model of the labor market is given by:

$$(22) \quad \pi u = \frac{-peu(-1+poo)+peo\,pou}{1-pou\,puo+peu(1-poo+puo)+peo(1+pou-puu)+poo(-1+puu)-puu}$$

$$(23) \quad \pi e = \frac{-1+pou\,puo-poo(-1+puu)+puu}{-1+peu(-1+poo-puo)+pou\,puo-poo(-1+puu)+puu+peo(-1-pou+puu)}$$

$$(24) \quad \pi o = \frac{peu\,puo-peo(-1+puu)}{1-pou\,puo+peu(1-poo+puo)+peo(1+pou-puu)+poo(-1+puu)-puu}$$

Closely related with these values, an interesting question pertains to the duration of unemployment, we show in table 3 together with the invariant probabilities of the three states, we can interpret as equilibrium rates of unemployment, employment and out of the labor force. Assuming that the employment process of a particular individual begins in the employment state, the expected number of transitions until de process returns him to that state is equal to:

$$(25) \quad mee = \frac{1}{\pi e}$$

Table 3
Natural Rates of Unemployment,
(Employment, Out of Labor Force and expected duration)

	πu	πe	πo	*mee*
1962-1973	2,99%	56,03%	40,97%	1,78
1974-1979	7,05%	48,74%	44,22%	2,05
1980-1990	7,12%	51,18%	41,71%	1,95
1991-1998	3,76%	54,87%	41,37%	1,82
1999-2003	5,65%	39,93%	54,41%	2,50

From Table 3 we can notice that whilst the natural rate of unemployment more than doubled after the reforms in 1974, it remained high until 1990. Since 1991, it felt considerably, however it increased almost two points during the last sub period, when the minimum wage increased and the debate on the last reforms took place. The "natural rate of employment", in this last period felt to the lowest historical level, what explains the important increase in the number of periods to find a job.

4. Concluding Remarks
Our analysis of the dynamics of labor markets in Chile through a stock flow model allows us to understand some key aspects of this market, whose behavior has been in some periods puzzling. Mobility and flexibility dramatically increased after the early 1970s reforms and in particular, with the end of the requirement to fire workers. Employment became less secure, but simultaneously, the probability of finding a job increased so the net effect on workers welfare might well have been positive.

However, the law tells only part of the story. An exceptional positive period is 1991 – 1998. Despite a more rigid labor law, the transition probabilities changed suggesting even larger labor mobility and in particular, a clear reduction of the probabilities of remaining unemployed. Besides the reasons associated with the increase in the GDP, despite the change in the labor law that made firing more expensive, it represented an improvement in the expectations of firms, in terms that the new law would be consistent and more permanent because the legitimacy obtained through an ample consensus. As a matter of fact, there was an important reversal of these probabilities since 1999, even before new changes in the law took place. In this period and besides the international crisis that hit the Chilean economy, between 1998 and 2001 the minimum wage was increased over 30%, and new more rigid labor regulations started to be discussed, creating an uncertain environment. In this period, all the probabilities showing that the economy was providing less and more insecure employment, and hence, the probability to remain employed felt and the probability of remaining unemployed more than doubled it previous value.

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