NBER WORKING PAPER SERIES

NOMINAL WAGE RIGIDITIES IN MEXICO:
EVIDENCE FROM SOCIAL SECURITY RECORDS

Sara G. Castellanos
Rodrigo García-Verdú
David S. Kaplan

Working Paper 10383
http://www.nber.org/papers/w10383

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
March 2004

We are grateful to Oscar Budar, Armando Martínez and Mishelle Segui for excellent research assistance. Kaplan acknowledges the Inter-American Development Bank and the World Bank for financial support while assembling the data used in this paper. The views expressed herein are those of the author and not necessarily those of the National Bureau of Economic Research or those of Banco de México.

Nominal Wage Rigidities in Mexico: Evidence from Social Security Records
Sara G. Castellanos, Rodrigo García-Verdú, and David S. Kaplan
NBER Working Paper No. 10383
March 2004
JEL No. J31, J33

ABSTRACT

This paper analyses the existence and extent of downward nominal wage rigidities in the Mexican labor market using data from the administrative records of the Mexican Social Security Institute (IMSS). This longitudinal, firm-level dataset allows us to track workers employed with the same firm, observe their wage profiles and calculate the nominal-wage changes they experience over time. Based on the estimated density functions of nominal wage changes and other moments of the distribution, we are able to calculate several standard tests of nominal wage rigidity that have been proposed in the literature. Furthermore, we extend these tests to take into account the presence of minimum wage laws that may affect the distribution of nominal wage changes. The densities and tests calculated using these date are similar to those obtained using administrative data from other countries, and constitute a significant improvement over the measures of nominal wage rigidities obtained from household survey data. We find considerably more wage rigidity than previous estimates obtained for Mexico using data from the National Urban Employment Survey suggest. Furthermore, we find evidence that the extent of nominal wage rigidities has been falling over time. We also document the importance of minimum wages in the Mexican labor market, as evidenced by the large fraction of minimum wage earners and the widespread indexation of wage changes to the minimum wage increases.

Sara G. Castellanos
Dirección de Estudios Económicos
Banco de México
Avenida 5 de Mayo #18, 4o. Piso
Mexico City, D.F. 06059
MEXICO
sgcastel@banxico.org.mx

Rodrigo García-Verdú
Dirección de Estudios Económicos
Banco de México
Avenida 5 de Mayo # 18, 4o. Piso
Mexico City, D.F. 06059
MEXICO
rgarciav@banxico.org.mx

David S. Kaplan
Departamento de Economía and
Centro de Investigación Económica
Instituto Tecnológico Autónomo de México
Av Camino Santa Teresa #930
Mexico City, D.F. 10370
MEXICO
kaplan@itam.mx

1. Introduction

There is a growing consensus about the importance of labor regulations in determining the productivity of labor itself as well as total factor productivity. Thus, the effect of certain types of labor regulations may well extend beyond the traditional deadweight losses associated with taxation implied by static partial equilibrium models. This consensus is emerging at the crossroad of two strands of the literature.

According to the first strand, the existence of certain types of labor regulations may act as a barrier to the adoption of new technologies and best organizational practices, which can adversely affect total factor productivity (TFP) and thus per capita income. In particular, Parente and Prescott (1994, 1999, 2000) and Prescott (1998) have argued theoretically, and shown in a series of case studies, that regulations —including labor-market policies— can effectively block the adoption of more productive technologies and better organizational methods. Since differences in per capita income across countries are accounted for by differences in total factor productivity, these regulations or "barriers to riches" are at the center of the development theory they propose to explain relative per capita income levels.

The second strand of the literature is mainly empirical, and uses establishment- and firm-level data to decompose the growth in total factor productivity into different sources (see, for example, Foster, Haltiwanger and Krizan (2000 and 2002), Griliches and Regev (1995), Haltiwanger (2000), Oley and Pakes (1996)). According to these decompositions, growth in TFP can occur within existing firms (with firms increasing their factor productivity through the adoption of new technologies and better organizational practices), through resource reallocation across firms (with resources reallocated from less productive to more productive firms), or through the entry and exit of firms with different levels of total factor productivity (with less productive firms exiting the market and more productive firms entering the market).

The analysis of productivity growth occurring through the reallocation of resources across firms, industries and sectors or through the entry and exit of firms has received a great thrust from the availability of new longitudinal datasets at the firm or establishment level. These analyses reveal several important facts (see Davis, Haltiwanger and Schuh (1996), Davis and Haltiwanger (1999) and Haltiwanger (2000)). First, there is a lot more reallocation of resources across firms and industries at any point during the business cycle than the aggregate net statistics would suggest. Second, much of the growth in productivity occurs through reallocation between firms and industries and through the entry and exit of firms, rather than through productivity growth within existing firms. Thus, to the extent that rigidities or inefficiencies introduced by bankruptcy and labor laws or other regulations prevent the reallocation of labor and other resources to their most efficient uses, productivity growth may be seriously hindered.

A recent contribution that is at the intersection of these two strands of the literature is Lagos (2004), who builds a model where the level of aggregate TFP is an explicit function of the economic environment in general (including, for example, the firm-level technology and the distribution of shocks), and labor-market policies in particular. According to this model, labor-market policies affect the job creation and job destruction decisions and thus the productivity composition of active firms. Since the level of TFP is related to the average productivity of active firms, labor-market policies can increase or reduce the aggregate level of TFP in an economy.

While theory and evidence are increasingly pointing to the importance of a market that allows for unimpeded adjustments to labor, policies have lagged behind. From an economic policy standpoint, the implementation of a labor market reform to attain greater flexibility has been outstanding for the past two decades in Mexico and other Latin American countries (see Lustig and Edwards (1997) and Pagés and Heckman (2003)). The majority of the labor regulations in Latin America date back to the first half of the twentieth century, and have experienced only minor reforms since. While some countries in the region have adopted measures to increase the flexibility of their labor markets, these attempts have been halfhearted. The issue of labor reform has become even more pressing in light of the increase in international competition from China and other South East Asian countries, most of which have "at will" hiring and firing policies and thus very flexible labor markets. As the macroeconomic environment has become more stable and inflation gradually converges to the levels of developed countries, the typical clearing mechanism in the labor market —according to which unanticipated increases in inflation induced sharp decreases in real wages— is no longer available.

In this paper we focus on two particular types of labor regulations which may give rise to inefficiencies in the allocation of labor both within the firm and across firms, industries and sectors: nominal-wage rigidities and minimum wages. The existence and extent of downward nominal wage rigidities has given rise to one of the longest standing debates in macroeconomics. Many macroeconomic models postulate the existence of such rigidities, and their results crucially hinge on this assumption since the effects of monetary policy largely depend on their existence and magnitude. Despite this debate, there is surprisingly little empirical evidence on their existence and magnitude (for exceptions, see Castellanos (2003), Card and Hyslop (1997), Crawford and Wright (2001), Dwyer and Leong (2000), Farès and Hogan (2000), Faruqui (2000), Kahn (1997), Lebow, Saks and Wilson (2003), and Wilson (2002)). While most of the literature on downward nominal wage rigidities has focused on their implications for the conduct of monetary policy, it is possible, as will be argued below, that the effects of these rigidities extend to other areas of the economy. We also analyze the interaction of downward nominal wage rigidities and minimum wages, an issue which has not been analyzed before and which is potentially important in Latin American countries, where the fraction of minimum wage earners is high relative to more developed economies and the practice of indexing wage changes to the minimum wage increases is pervasive.

The issue of downward nominal wage rigidity in Mexico is particularly interesting for at least four reasons. First, the Mexican economy has undergone a remarkable process of economic liberalization during the past two decades, including a major shift in openness to trade and foreign investment. This fact should imply a greater need to reallocate labor across firms, industries and sectors increased relative to the period when the economy was closed. Second, the process of disinflation that the Mexican economy has undergone during the past two decades, and the resulting stabilization of nominal variables, may have increased the importance of nominal wage rigidities. Thus, while nominal wage rigidities may not have been relevant for firms during the period of high inflation when real wage declined even in the absence of nominal wage decreases, the current environment of low and stable inflation makes this feature potentially binding. Third, in contrast to many countries where downward nominal wage rigidity may be an artefact of a person's perception that a nominal-wage decrease is "unfair", in Mexico the law specifically forbids nominal wage cuts (see Federal Labor Law (LFT), Article 51). Thus, while for most countries it remains an open question why nominal wages do not adjust downwards to help clear the labor market during recessions (see Bewley (1999)), it is less of a puzzle in Mexico since this provision is part of the legal framework. Fourth, the nominal wage rigidities imbedded in the current legislation may interact with other regulations in the law such as minimum wages, mandated benefits and other restrictions such as firing costs, since a firm that complies with one regulation is very likely to comply with all other regulations. Furthermore, the firms that typically comply with the regulations tend to be the large industrial firms, many of which are among the most productive in the economy.

Another important issue in our paper is the analysis of the effects of minimum wages in the Mexican labor market. Minimum wages in Mexico might have different effects than in other countries due to the high fraction of minimum-wage earners and the common practice in the Mexican economy of indexing wages changes and other contracts — including administrative fees, fines, an even mortgage payments— to minimum wage increases. Our analysis confirms the importance of minimum wages in Mexico, as shown by the high fraction of minimum-wage earners and the indexation of wage changes to the minimum wage increases. Thus, the minimum wage is as a key variable in the Mexican economy through the influence that increases in the minimum wage exert on other price changes.

The main contribution of this paper is to bring together the measurement of downward nominal wage rigidity and the rigidities introduced by the existence of minimum wage laws in a unified and coherent framework. In particular, the present analysis provides evidence on the existence and extent of downward nominal wage rigidity in the Mexican economy using data from the administrative records of the Mexican Social Security Institute (IMSS). This dataset is similar to the establishment-level dataset used by Lebow, Saks and Wilson (2003) for the U.S., making the results more comparable between the two countries. In order to test for the existence and magnitude of DNWRs, this paper calculates several standard measures and tests proposed in the literature. Furthermore, it modifies the tests proposed by Kahn (1997) to account for the possible effect of a large fraction of minimum wage earners and widespread indexation of nominal wage changes to the minimum wage increases. By using data from the IMSS administrative records developed and used by Kaplan, Martínez and Robertson (2003a and 2003b) to analyze worker and job flows and employment displacement costs, we are able to obtain very accurate measures of nominal wages and nominal-wage changes. Thus, this paper greatly improves upon the previous evidence reported by Castellanos (2003) on nominal wage rigidity in Mexico using household survey data. To the best of our knowledge, this is the first time that tests on nominal wage rigidities have been obtained for a developing county using this type of data, and the first time that the standard tests of nominal wage rigidities have been modified to explicitly incorporate the effects of the minimum wages simultaneously.

The rest of the paper is organized as follows. The next section reviews in more detail the literature on nominal wage rigidity, while section 3 describes the data used in the paper. Section 4 describes an overview of the institutional and legal framework that regulates labor in Mexico. Section 5 presents some simple statistics. Section 6 describes the econometric models we estimate and presents our main results. Finally, Section 7 summarizes the main findings of the paper.

2. Downward Nominal Wage Rigidity (DNWR)

The empirical literature on Downward Nominal Wage Rigidity (DNWR), despite the obvious importance of the issue for the conduct of monetary policy, has received relatively little attention until recently. The first generation of studies were based on microeconomic data on wages from household survey, such as the Panel Study of Income Dynamics (PSID) or the Current Population Survey (CPS), and focused on establishing the existence and extent of DNWR (see Altonji and Devereux (1999), Card and Hyslop (1997), Castellanos (2003), Dweyer and Leong (2000), Kahn (1997) and McLaughlin (1994, 1999)).[1] More recently, this literature has shifted from using household survey panel data to using establishment- or firm-level panel data from administrative record, such as the data used in the calculation of the Bureau of Labor Statistics' Employment Cost Index (ECI) (see Lebow, Saks and Wilson (2003)). The advantage of the second generation of studies is that they are based on more accurate measures of wages since they are obtained from administrative records and not from self-reported household surveys. Even more accurate measures of wages and wage changes have been obtained using data for a small, non-random sample of firms that track both jobs and individuals (see Wilson (2002)). The current state of this literature can be summarized as follows: as the accuracy of the data on wages has progressively increased through the use of better datasets, more evidence on the existence of significant DNWR has been found.

The detection of nominal wage rigidities usually begins by estimating the probability density functions of wage changes over consecutive periods (typically a year) using longitudinal data on individual workers or jobs. The existence of DNWR is then first established through analyzing the shape of the density functions as well as through estimating certain moments of the distributions. To the extent that wages exhibit DNWRs, the estimated densities should be asymmetric (right skewed), with few observations corresponding to negative wage changes and much of the density's mass

[1] A notable exception is Bewley (1999), who analyzes the causes of nominal wage rigidities through a series of extensive interviews with key labor market participants in the some labor markets in the Northeastern U.S.

piled up at zero, reflecting the fact that negative wage changes are legally or institutionally prohibited. The analysis is then formalized through the estimation of sample statistics and measures of DNWR, such as those proposed by Kahn (1997), Lebow, Stockton and Wascher (1995) and Lebow, Saks and Wilson (2003). In general, these measures try to compare the actual distribution of nominal wage changes with a hypothetical distribution of nominal wages under no rigidities (see below for a description of some of these tests).

The only evidence on downward nominal wage rigidities for the case of Mexico is by Castellanos (2003), who estimates a series of standard measures of DNWR using microdata from the National Urban Employment Survey (or ENEU for its acronym in Spanish) for the period 1994-2001. In particular, this study exploits the rotating panel structure of the ENEU data, which tracks workers over five consecutive quarters, in order to estimate distributions of wage changes. Since there is no way of knowing from the data whether an individual remains employed with the same firm over any two consecutive quarters, it is assumed that a worker who is employed in the same economic sector and has the same position and occupation over consecutive periods is employed with the same firm. The data on nominal wages come from self reported wages, and is thus likely to be measured with error. Both of these drawbacks when using household survey data imply that the extent of nominal wage rigidity is likely to be underestimated, since workers who are wrongly classified as job stayers will appear as having experienced a nominal wage change, and some of the measurement error in wages will be attributed to wage flexibility.

The results in Castellanos (2003) suggest that, according to the estimated densities of wage changes and from standard measures of DNWR, including those proposed by Kahn (1997), Lebow, Stockton and Wascher (1995), and Lebow, Saks and Wilson (2003), nominal wages in Mexico exhibit few rigidities when compared to other countries. Only for a small number of industries (large, formal firms) there is evidence of substantial nominal wage rigidities. Unfortunately, the estimations reported are not directly comparable to those obtained using data from administrative records for other countries (such as Lebow, Saks and Wilson (2003) for the U.S., or Dweyer and Leong (2000) for Australia), since there is no way of knowing with certainty if workers actually remained employed with the same firm, there is no uniform measure of wages such as wage per hour and there is much more measurement error in wages than with data from administrative records.

3. Data

The data used in this paper come from the administrative records of the Mexican Social Security Institute, or Instituto Mexicano del Seguro Social (IMSS). These administrative records constitute a unique database of all the private-sector firms affiliated with the IMSS and their employees. Although this type of longitudinal, establishment-level database has been used for academic purposes in other countries, such as in the U.S. and several European countries, this is one of the few database of its kind for a developing country.

It is important to stress that these data come from the actual records used by IMSS to administer the social security system; thus, they were not originally intended for use as a public database. In fact, this information only became amenable to statistical analysis after Kaplan, Martínez and Robertson (2000a and 2000b) gained access, cleaned and processed the administrative records. The number of employees ranges from roughly 5 million in the middle 1980s to roughly 12 million in recent years. It is also important to highlight that the database is not a representative sample of all firms in the country, but rather a census of all formal (i.e., legally established with the Mexican Social Security Institute) firms, their establishments and their employees.

The Social Security Law and its accompanying code establish that every private-sector employer has the legal obligation to affiliate each of their employees with the IMSS.[2]

[2] All definitions and regulations regarding the registration of employers and their employees to the IMSS are contained in the Social Security Law (Ley del Seguro Social, or LSS) and its accompanying code (Reglamento de la Ley del Seguro Social en material de afiliación, clasificación de empresas, recaudación y fiscalización).

Every affiliated firm is given an employer register number (*Registro Patronal*) for each county (municipio) in which the firm has an establishment or plant. If a firm has multiple establishments or plants within a county, it will have a single register for them as long as all establishments and plants are in the same sector of activity. Thus, firms can have multiple registers depending on the number of establishments they have in different municipalities, and can also have multiple registers within a municipality if the establishments or plants are dedicated to different activities. Once affiliated with the IMSS, each employees is assigned a unique social security number (*Número de Seguridad Social*), which has recently began to be replaced by a unique personal identification number (*Clave Única de Registro de Población*).

Wage in the IMSS data are reported in a standardized measure, called the base salary (*salario base de cotización,* or SBC). The SBC is a comprehensive measure of wage plus benefits, including payments made in cash, bonuses, premiums, room and board, commissions, benefits in kind and any other amount paid or benefit received. The SBC is also standardized in the sense that it is reported as a daily wage, even if the employees are paid on a weekly, fortnightly or monthly basis. Employers are also obliged to report the number of hours and number of days worked, and social security contributions are paid monthly and calculated based on the daily SBC and the number of days worked per month. We do not, however, have access to information on hours or days worked. Employers have the legal obligation to report to the IMSS, within the next five working days, if any of the following occurs: suspension, resumption, termination, or change of activities; change in name, registry or address; and any change in the SBC of any worker. In sum, the SBC is a comprehensive measure of wages plus benefits which is consistent over time and is required to be continually updated by firms when it suffers any change.

It is important to underscore that the SBC is capped below at the minimum wage in the corresponding geographic area of each establishment, and is currently capped at 25 times the minimum daily wage prevalent in Mexico City for all establishments. The cap was at 10 times the minimum wage prior to 1995. While a large fraction of the workers affiliated to the IMSS earn exactly the minimum wage (11.7% in 2002 according to official IMSS statistics), only a small share are capped above (2.3% in 2002). In order to insure that none of the results in this paper are not driven by this feature of the data, we repeated all estimations with and without the groups of workers whose base wage is capped below and above.

Regarding the accuracy of the SBC, it is important to note that employers have an incentive to underreport base wages in order to lower the social security contributions they pay. Employees, on the other hand, have no incentive to underreport wages since many of the benefits they receive are proportional the base wage their employees report to the IMSS. Thus, unless workers are appropriately compensated in cash by their employers for the decrease in benefits, they will not agree with a decrease in the wage reported to the IMSS.[3] Although there are incentives for employers to underreport wages, the IMSS has been accorded the legal status of autonomous fiscal authority. This implies that it can engage in coercive actions to collect contributions —including seizing firm's assets—, which greatly enhance its ability to enforce the law.

The administrative data from the IMSS records offer several advantages over existing household survey datasets such as the National Urban Employment Survey (ENEU), which make the calculations obtained using administrative data more reliable. First, with the administrative records it is known with certainty whether a worker remains employed with the same firm over time, since there are unique individual codes that identify establishments (*Registro Patronal*) and workers (*Número de Seguridad Social* or *Clave Única de Registro de Población*). In contrast, with household survey data one has to assume that a worker who is employed in the same economic sector, position and occupation over consecutive periods is employed with the same firm, although there is actually no information in the questionnaire that could help identify an individual firm.

[3] For example, in case of disability the insurance is based on a replacement rate of 100% of the base salary while the disability lasts, and 70% of the base salary if the disability is permanent. In case of illness, the health insurance is based on a replacement rate of 60% of the base salary while the illness lasts (up to 52 weeks). In case of maternity, the insurance is based on a replacement rate of 100% of the base salary for 42 days before and after giving birth. In the case of the retirement insurance, and old-age unemployment and old-age insurance (Cesantía en Edad Avanzada y Vejez), employer plus employee contributions are equal to 2% and 4.175% of the base salary, respectively. Since these contributions are deposited in an individual retirement account, there is a strong linkage between contributions and future benefits.

This method evidently does not precludes the possibility that workers may have switched jobs but remained in the same sector, position and occupation. If this is the case, one would classify a worker as a job stayer while in fact he would be a job mover. Second, as stressed above, the definition of base wages reported in the administrative data (*salario base de cotización*) is consistent over time and, given that they are the wages on which employers pay payroll taxes, they are less prone to be measured with error.[4] In contrast, the data on wages from household surveys are typically measured with error since they are based on self-reported wages.

On the other hand, the drawback of administrative records relative to household survey data is that they include a very limited set of information on individual and firm characteristics that could be used as covariates. Nevertheless, for the purposes of this paper, which is to analyze nominal wage rigidities for those workers who remain employed with the same firm over a period of time, the two advantages highlighted before far outweigh the drawback of having limited information on individual characteristics.

In this paper we use quarterly observations for the period 1985-2001. In particular, for each quarter we calculated the nominal wage changes over the previous year for all workers who remained employed with the same firm and then extracted a random sample of 500,000 workers on the following dates: March 31, June 30, September 30, and December 31. That is, we extract data from the last day of each quarter. The ability to know exactly to what date the wage observations refer to is of crucial importance for our ability to incorporate an analysis of minimum wages into the work. Minimum wages are often changed multiple times in a year (particularly in years with high inflation), and the dates of these changes can vary from year to year. Since we know the exact dates of the wage measurements, we know exactly which minimum-wage regime was applicable to each wage observation.

[4] In fact, the SBC is a standard measure of wage plus benefits which corresponds closely to the measure of total compensation from the Bureau of Labor Statistics' Employment Cost Survey used by Lebow, Saks and Wilson (2003). In this sense our results are comparable to theirs, except for the fact that the ECS follows jobs rather than persons.

4. Institutional Features of the Mexican Labor Market

The Mexican labor legislation is characterized, as in many other Latin American countries, by generous mandated benefits and a high level of job protection. At the same time, the labor market is characterized by a high degree of non-compliance with these labor laws and regulations, as reflected in the high share of workers that in fact do not receive some or any of the mandated benefits. In Mexico, the main labor laws mandate that employers should comply with several regulations, provisions and restrictions, including minimum wages, minimum age of employment, maximum length of the working day, overtime pay, social security contributions, severance payments, seniority premia, maternity leave, on-the-job training provisions and non-discrimination policies, among others. There is even a provision unique to Mexico that mandates employers to share profits with their employees (*reparto de utilidades*).

According to several measures of labor legislation flexibility (in hiring, in firing, and in working conditions), Mexico is one of the countries with the most rigid labor laws in the world (see Botero, Djankov, La Porta, Lopez-de-Silanes and Shliefer (2003)). In contrast, Mexico's main trading partners and closest foreign competitors, including the U.S., Canada and most South East Asian countries, have a highly flexible labor market, with few if any impediments to how labor is allocated within or between firms. This fact evidently places Mexico at a disadvantage relative to these countries. One reason why this fact could be ignored in the past is that real wages in Mexico displayed a remarkable degree of downward flexibility, which provided much of the correction needed to regain competitiveness. This adjustment in wages typically came through unexpected increases in inflation. At any rate, the adjustment mechanism afforded by real wage flexibility is no longer available in the current environment of low and stable inflation. Thus, flexibility in the labor market will have to come from some other source.

Labor legislation in Mexico is extremely detailed and complicated, since it is contained in several laws and in thousands of articles. It is also outdated. The Constitution dates back to 1917, and the main article related to labor (Article 123) has experienced only minor reforms since. The Federal Labor Law (LFT) was enacted in 1970, and has also experienced only minor reforms, mostly in the direction of increasing the mandated benefits for workers and reducing the flexibility with which labor can be employed. This law was written back when the economy in Mexico was mostly closed to external competition and foreign direct investment was limited, following the prescriptions of the import substitution model. In this context, it made sense, from a redistributive point of view, to have a labor legislation generous towards the employees since firms had rents to be shared. Of course, whether a generous labor legislation is the best way of extracting rents and redistributing them is highly disputable. Nevertheless, many of the rents that existed under a closed economy have disappeared since 1985, when the country began a trade liberalization process by joining the General Agreement of Trade and Tariffs (GATT). Today, Mexico has a mostly open economy, and has signed free trade agreements with the U.S., Canada, the European Union, and fourteen other countries. Thus, to the extent that Mexico competes with Asian countries to attract FDI, all of which have more flexible labor markets, the current labor laws and regulations have become a binding constraint for those firms and industries that compete on a global scale. The same is true of the United States, Mexico's largest trading partner and the final destination of over 85% of Mexican exports, which has an "at will" hiring and firing policy and one of the most flexible labor markets in the world.

It is important to underscore that some of the features of the labor market in Mexico may be the result of an explicit legal regulation, in contrast to other countries in which they may be the result of an implicit arrangement or of social convention. This is the case, for example, of the prohibition in the Mexican labor legislation to lower nominal wages (LFT, Article 51). In particular, a worker whose nominal wage or benefits have been reduced can take legal action against his or her employer and request for compensation as if he or she had been dismissed without just cause. Thus, while nominal wage rigidities are a well known —albeit little understood— fact in other labor markets, in Mexico one only has to look at the law to find its origin. One particularly detrimental aspect of the way in which the current labor regulations operate is the irreversibility of the rigidities induced (a sort of *ratchet effect*). This is, once an inefficiency or rigidity is introduced into the labor market through the law, there is little or no possibility of going back and renegotiating it, even if the firm faces the threat of bankruptcy. One example of this ratchet effect is the legal prohibition to reduce any wage or non-wage benefits. Thus, while gradual increments in wages and other non-wage benefits over any pair of consecutive years may not be binding for any particular firm or industry, the average differences between an extended period may become burdensome and may be impossible to revert.

Another important aspect of labor legislation is how it interacts with other laws and regulations, and particularly with the bankruptcy law (*Ley de Concursos Mercantiles*). Since past due wages, severance payments and seniority premiums are usually some of the biggest components of a firm's contingent liabilities, and labor has the highest priority claims in case of bankruptcy (LFT, Article 113), the current labor legislation may prevent inefficient firms from shutting down or may unnecessarily delay an inevitable bankruptcy procedure. As stressed by the literature on labor reallocation, these regulations may become an important barrier to the efficient entry and exit of firms, which is one of the main sources of productivity growth in the economy.

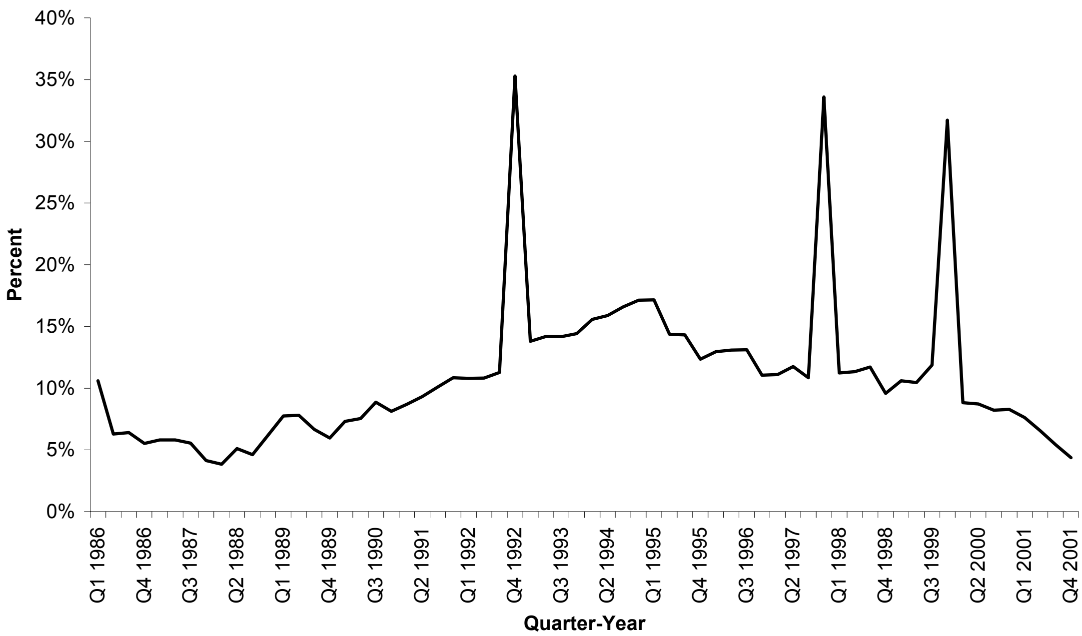
Another important institutional detail of the Mexican economy is the widespread use and incidence of minimum wages. In addition to being a minimum wage in the traditional sense (with which firms may or may not comply), many contracts use the minimum wage and minimum wage increases as an index. Many union contracts explicitly use the minimum wage as an indexing device for wages and many firms and workers implicitly use the minimum wage in their bargaining. In this sense, the minimum wage in Mexico is really more than a minimum wage: it is a benchmark commonly used to index contracts.

In summary, the current labor legislation and regulations in Mexico and the benefits they mandate makes it costly for firms to hire and fire employees and to modify the working conditions. Furthermore, these regulations introduce a high degree of uncertainty for potential firms or employers when making entry and hiring decisions. One of the results of these rigidities is that they prevent or limit firm from rapidly adjusting their factor demands to new economic shocks. As stressed above, the efficient reallocation of productive factors across firms and industries is one of the main sources of productivity growth in the economy.

5. Simple Statistics

We begin by presenting some simple statistics from our data. For each quarter in the years 1986- 2001 we restrict the sample to those workers who were employed in the same firm four quarters (one year) earlier. For these workers, we calculated the percent with exactly the same nominal salary they had four quarters earlier. We present a chart with these results below.

Figure 1: Percent of employees with no change in salary since the previous year



There are at least two striking features of this chart. One is that there are three quarters that look dramatically different from the rest. Specifically, the percent of workers with exactly the same nominal salary as four quarters earlier was extremely high in the fourth quarters of 1992, 1997, and 1999. While one might be tempted to dismiss these observations as measurement error, the explanation is quite simple and confirms the accuracy of the wage data. A new minimum wage was implemented on November 11, 1991 and was not changed until January 1, 1993. Therefore, when we compare a worker's wage on December 31, 1992 to the worker's salary on December 31, 1991, we know that the minimum wage had not changed during this period. We can explain the apparent anomalies in the fourth quarters of 1997 and 1999 similarly. This feature is the result of the high fraction of workers earning the minimum wage, as well as of the fact that many firms use the minimum wage as a reference when taking wage increase decisions. We will address this point later in this section.

The second noteworthy feature of the above graph is that the percent of workers with no change in the nominal salary after four quarters was increasing until about 1995 and has been decreasing since. We now contrast these trends with the trends of the percent of workers with nominal wage increases and with nominal wage decreases. We present these graphs below.

Figure 2: Percent of employees with a decrease in salary since the previous year

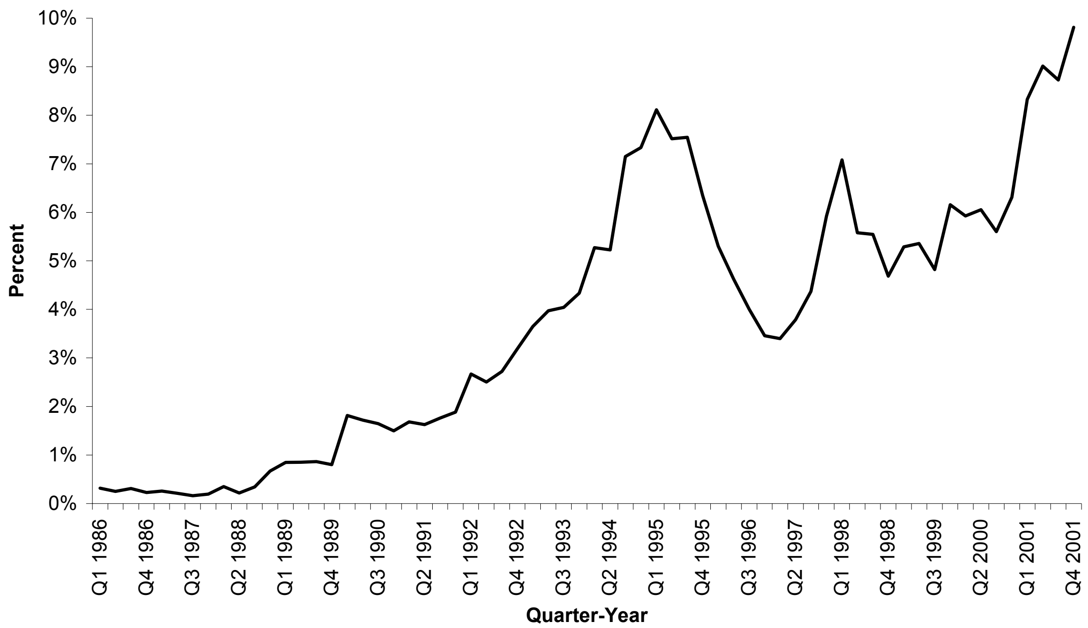
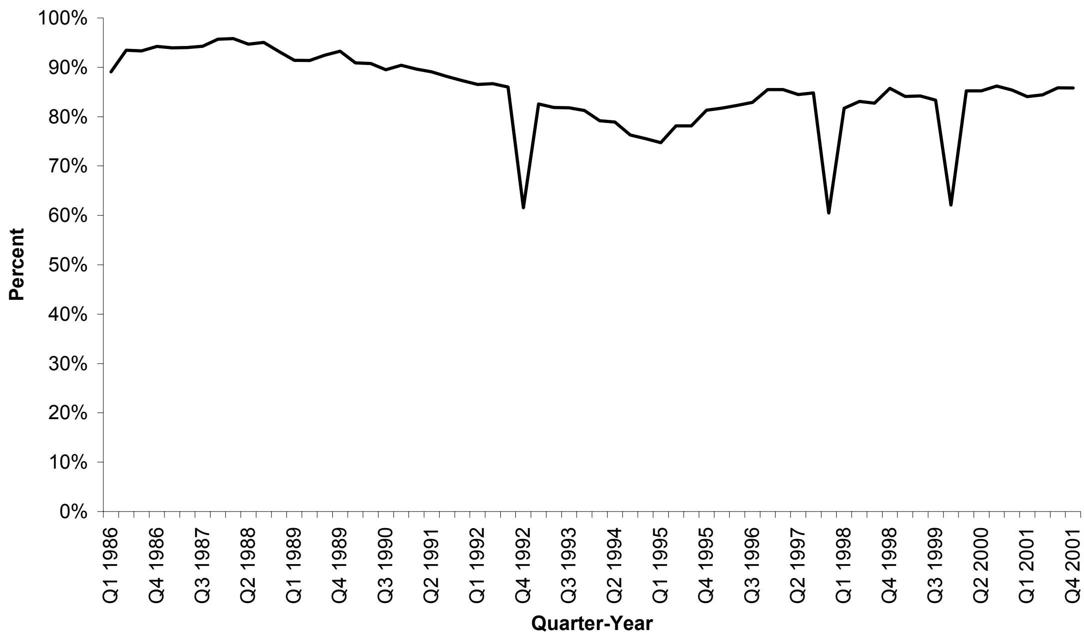


Figure 3: Percent of employees with an increase in salary since the previous year



We focus particularly on the trends since 1995. Note that the percent of workers receiving nominal-wage decreases has been increasing since 1995, as is the percent of workers receiving nominal-wage increases. One might interpret these trends as evidence that nominal wage rigidities have become less pronounced in recent years.

Given that the data on wages are capped above and below, we next depict the fractions of workers with an increase, a decrease and no change in their nominal wage since the previous year in a single graph. The first one excludes those workers whose wage is more than 9 times the minimum wage (Figure 4). Recall that the wage cap was 10 times the minimum wage prior to 1995 and was subsequently raised to 25 times the minimum wage. The second graph excludes both those workers earning less than 2 times the minimum wage and those workers whose wage is capped above (Figure 5).

Figure 4: Percent of employees with an increase, decrease and no change in salary since the previous year, excluding workers whose wage is capped above

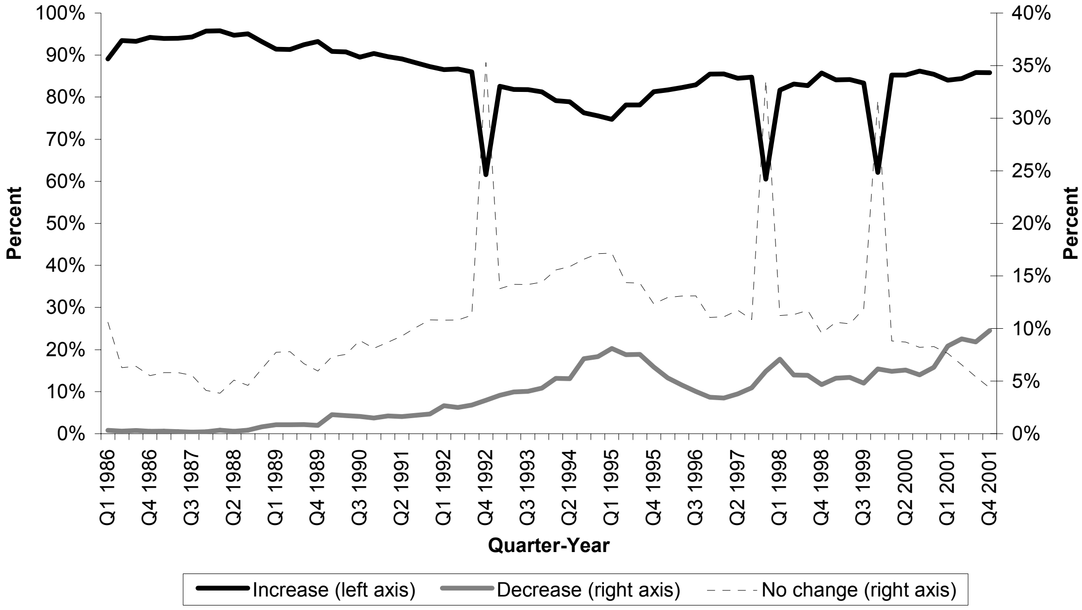
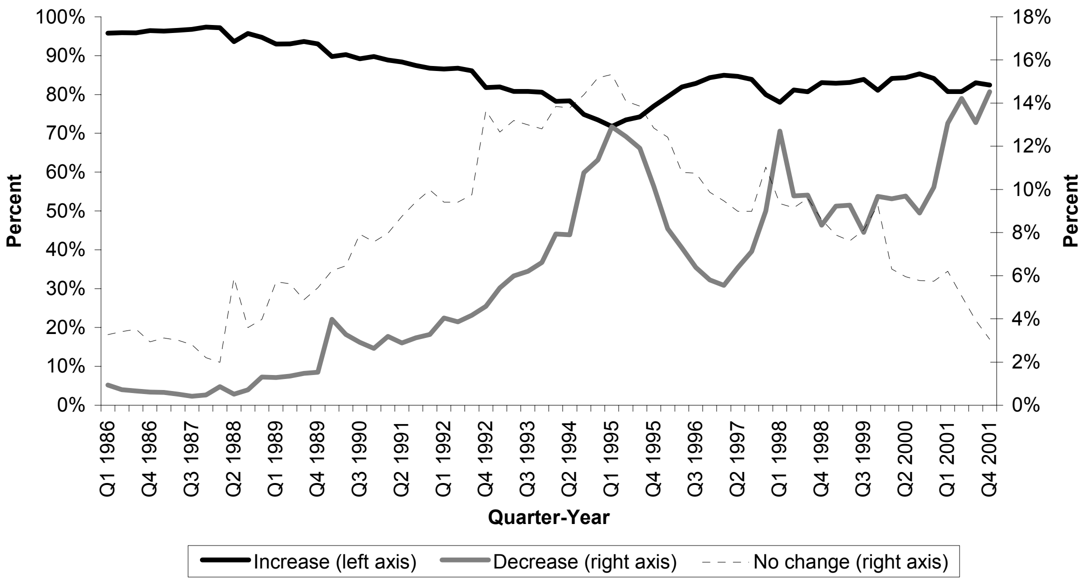


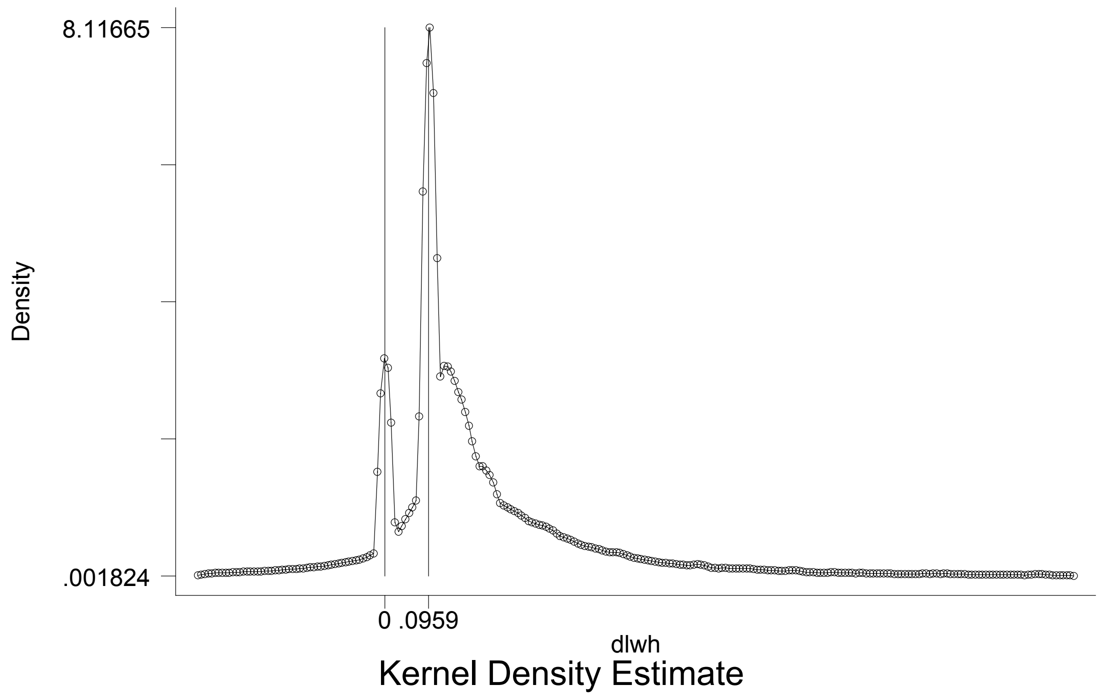
Figure 5: Percent of employees with an increase, decrease and no change in salary since the previous year, excluding workers whose wage is capped above and minimum-wage earners



As can be seen, the exclusion of those workers whose wages are capped above makes no difference in terms of the behavior over time of the different fractions. In contrast, excluding those workers whose wage is capped below at the minimum wage clearly eliminates the spikes during the last quarters of 1992, 1997 and 1999. Nevertheless, the trends before and after 1995 in the fractions of workers who experience a nominal wage decrease or a nominal wage increase are still clearly visible, while the increase in the fraction of workers experiencing a nominal wage decrease is more evident now. Thus, as will be argued below, the results of this paper are not affected by the inclusion or exclusion of workers whose wages are capped.

We now turn to looking at some kernel-density estimates of the probability density function of changes in the log wage (see Appendix A for the kernel densitiy estimates of each quarter). We present below a graph with a kernel density of the changes in the log wages between the third quarter (actually September 30) of 1999 and the fourth quarter of 2000.

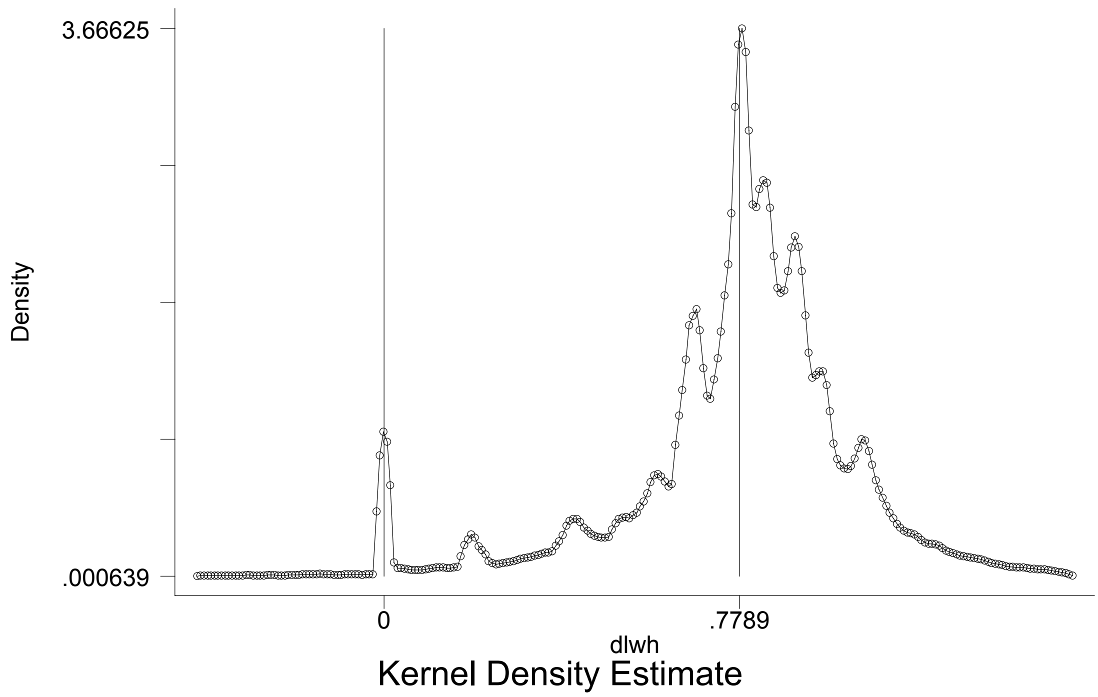
Figure 6: Log Wage Changes from 1999:3- 2000:3



One vertical line signals where a nominal change of zero is located on the horizontal axis. There definitely appears to be a spike in the density at this point. The other vertical line signals that the change in the log of the minimum wage from September 30, 1999 to September 30, 2000 was 0.0959. It seems clear that the density has a larger spike at this point. The densities of the changes in log wages for all quarters have this same feature.

The simplest explanation many log-wage changes being exactly the change in the log of the minimum wage turns out to be the correct one—a substantial number of workers in the IMSS data earn exactly the minimum wage. If we look at other periods, however, this simple explanation is not complete. Below we present a kernel-density estimate of the distribution of log-wage changes from September 30, 1986 to September 30, 1987. We eliminate, however, all workers who earned less then two times the minimum wage in 1986. We also eliminated those who earned more than nine times the minimum wage.[5]

Figure 7: Log Wage Changes from 1986:3- 1987:3

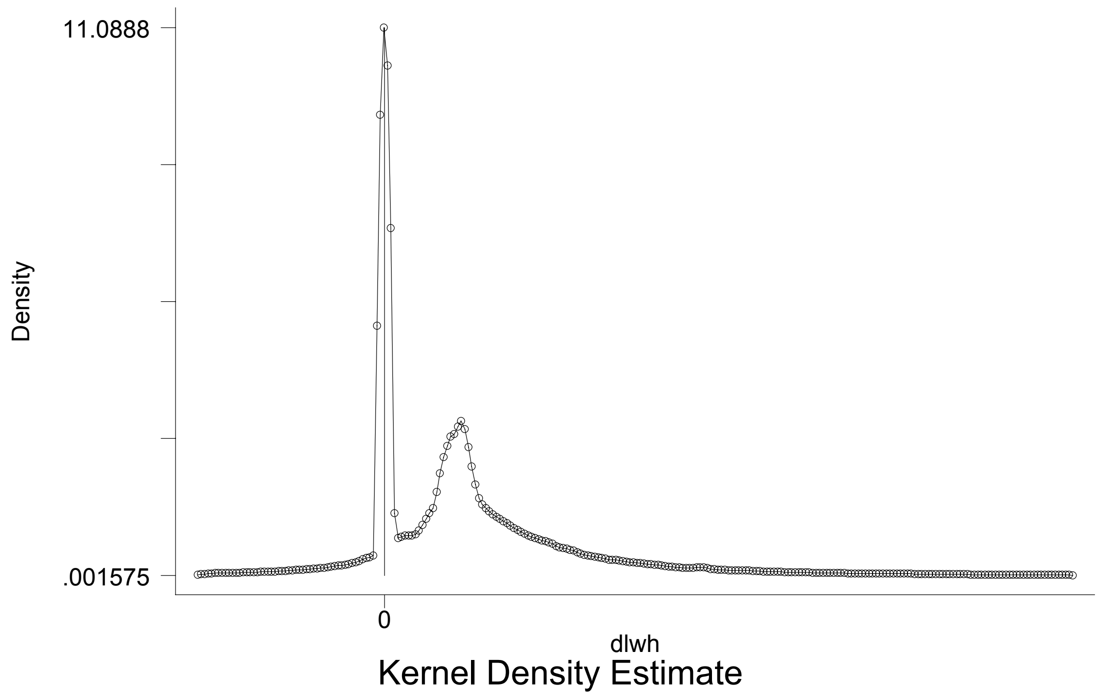


[5] In this period, wages were top coded at ten times the minimum wage.

The above figure is representative of the results we observe in the late 1980s. We find substantial evidence that wage changes are indexed to changes in the minimum wage, even for those earning substantially more than the minimum wage.[6] That is, the largest spike in the distribution of log wages is exactly the change in the log of the minimum wage. This effect has been called the "lighthouse effect" in earlier work. For the rest of the paper, however, we will focus on the distribution log wage changes for all wage earners. That is, we will treat wage rigidities that arise from workers earning the minimum wage as a phenomenon to be estimated and studied.

We conclude with one more kernel density estimate. It might be interesting to look at one of the three periods when the same minimum wage applied in both periods. Below we present the kernel density estimate of changes in the log wage between December 31, 1998 and December 31, 1999.

Figure 8: Log Wage Changes from 1998:4-1999:4



[6] Kernel-density estimates from all periods are available upon request.

In this case, the density looks smooth throughout with the exception of one large spike at zero. Thus, this spike in the density encompasses three phenomena: nominal-wage changes of zero are common, the high fraction of minimum-wage earners and the fact that nominal-wage changes proportional to the change in the minimum wage are common too. We interpret the above estimates as evidence of the indexation or *lighthouse effect* of minimum wages in the Mexican labor market.

6. Tests of DNWR

We now turn to some of the formal tests of Downward Nominal Wage Rigidity (DNWR) that have been proposed in the literature.

The Kahn Test (kahn)

This test, proposed by Kahn (1997), consists of two parameters that are estimated through a system of r seemingly unrelated equations (SURE). Each equation uses the fraction of wage changes located at the region between r and $r-1$ percentage points below the median as a dependent variable ($prop_t^r$). A constant (p^r) and a set of dummy variables indicating the histogram bar's position at ($dzero_t^r$) or below zero ($dneg_t^r$) are the equation's explanatory variables. The parameter n measures the proportion in which the bars containing negative wage changes are cut due to DNWR (if n=0 there is no DNWR and if it n<0 there is DNWR) and z measures the proportion in which the bar containing zero wage changes is increased due to long term contracts, menu costs, or other reasons for accumulating observations there (z>0). The size of r depends on the range where the r^{th} bars are more likely to lie above or below zero across time because this raises the test's power. Trials for r=15, 20 and 25 suggested that r=15 provides the soundest estimates. Thus, the form of the SURE is:

$$prop_t^1 = p_1 + np_1 dneg_t^1 + (z - n\sum_{j=2}^{15} p_i)dzero_t^1$$

$$prop_t^2 = p_2 + np_2 dneg_t^2 + (z - n\sum_{j=3}^{15} p_i)dzero_t^2$$

$$prop_t^3 = p_3 + np_3 dneg_t^3 + (z - n\sum_{j=4}^{15} p_i)dzero_t^3$$

:…

$$prop_t^{13} = p_{13} + np_{13} dneg_t^{13} + (z - n\sum_{j=14}^{15} p_i)dzero_t^{13}$$

$$prop_t^{14} = p_{14} + np_{14} dneg_t^{14} + (z - np_{15})dzero_t^{14}$$

$$prop_t^{15} = p_{15} + np_{15} dneg_t^{15} + (z)dzero_t^{15}$$

The Augmented Kahn Test (aug. kahn)

An augmented version of the Kahn test further distinguishes observations located at the bars within -1, 0 and 1 percentage points, adding robustness to noise around zero to the parameters (provided that there is enough variation in the dummy variables). This modifies the original test as follows:

$$prop_t^1 = p_1 + np_1 dneg_t^1 + (z - \theta n\sum_{j=2}^{15} p_j)dzero_t^1 - \delta n\sum_{j=1}^{15} p_j dneg1_t^1 - (1-\theta-\delta)n\sum_{j=3}^{15} p_j dpos1_t^1$$

$$prop_t^2 = p_2 + np_2 dneg_t^2 + (z - \theta n\sum_{j=3}^{15} p_j)dzero_t^2 - \delta n\sum_{j=2}^{15} p_j dneg1_t^2 - (1-\theta-\delta)n\sum_{j=4}^{15} p_j dpos1_t^2$$

$$prop_t^3 = p_3 + np_3 dneg_t^3 + (z - \theta n\sum_{j=4}^{15} p_j)dzero_t^3 - \delta n\sum_{j=3}^{15} p_j dneg1_t^3 - (1-\theta-\delta)n\sum_{j=5}^{15} p_j dpos1_t^3$$

…

$$prop_t^{13} = p_{13} + np_{13} dneg_t^{13} + (z - \theta n\sum_{j=14}^{15} p_j)dzero_t^{13} - \delta n\sum_{j=13}^{15} p_j dneg1_t^{13} - (1-\theta-\delta)np_m dpos1_t^{13}$$

$$prop_t^{14} = p_{14} + np_{14} dneg_t^{14} + (z - \theta np_{15})dzero_t^{14} - \delta n\sum_{j=14}^{15} p_j dneg1_t^{14}$$

$$prop_t^{15} = p_{15} + np_{15} dneg_t^{15} + (z)dzero_t^{15} - \delta np_{15} dneg1_t^{15}$$

where the $dneg1_t^r$ indicates that the r^{th} histogram bar is located at -1 percent and $dpos1_t^r$ that the r^{th} histogram bar is located at +1 percent. The new parameters are the fraction of observations included in the bar that contains zero (θ), in the bar that contains -1 percent (δ), and in the bar containing +1 percent (1-θ-δ). Notice that when θ=1 and δ=0 this system collapses to the previous one.

A Kahn Test that considers the effect of the minimum wage

As mentioned before, the distributions of annual nominal wage changes constructed with the IMSS data display another noticeable accumulation point. This point corresponds to the increase of the nominal minimum wage. A simple first approximation to analyze this pattern consists on adding to the simple Kahn test a couple of parameters that measure the proportion in which the bars containing wage changes that are lower than the minimum wage change are reduced ($\hat{n}$) and the proportion in which the bar containing the minimum wage change is increased due to indexation ($\hat{z}$). The first of them is associated to a dummy variable indicating the histogram bar's position below the minimum wage ($dmwlow_t^r$), while the second one to a dummy variable indicating the histogram bar's position at the minimum wage change (dmw_t^r). As a result, the SURE becomes:

$$prop_t^1 = p_1 + np_1 dneg_t^1 + (z - n\sum_{j=2}^{15} p_i)dzero_t^1 + \hat{n}p_1 dmwlow_t^1 + (\hat{z} - \hat{n}\sum_{j=2}^{15} p_i)dmw_t^1$$

$$prop_t^2 = p_2 + np_2 dneg_t^2 + (z - n\sum_{j=3}^{15} p_i)dzero_t^2 + \hat{n}p_2 dmwlow_t^2 + (\hat{z} - \hat{n}\sum_{j=3}^{15} p_i)dmw_t^2$$

$$prop_t^3 = p_3 + np_3 dneg_t^3 + (z - n\sum_{j=4}^{15} p_i)dzero_t^3 + \hat{n}p_3 dmwlow_t^3 + (\hat{z} - \hat{n}\sum_{j=2}^{15} p_i)dmw_t^3$$

$$\ldots$$

$$prop_t^{13} = p_{13} + np_{13} dneg_t^{13} + (z - n\sum_{j=14}^{15} p_i)dzero_t^{13} + \hat{n}p_{13} dmwlow_t^{13} + (\hat{z} - \hat{n}\sum_{j=14}^{15} p_j)dmw_t^{13}$$

$$prop_t^{14} = p_{14} + np_{14} dneg_t^{14} + (z - np_{15})dzero_t^{14} + \hat{n}p_{14} dmwlow_t^{14} + (\hat{z} - \hat{n}p_{15})dmw_t^{14}$$

$$prop_t^{15} = p_{15} + np_{15} dneg_t^{15} + (z)dzero_t^{15} + \hat{n}p_{15} dmwlow_t^{15} + (\hat{z})dmw_t^{15}$$

A menu cost interpretation suggests that the parameter $\hat{z}$ of this test should have a positive sign, as the original z has. But what sign should $\hat{n}$ have is less obvious.

An augmented version of this test that distinguishes noise around the zero and the minimum wage change can be estimated through the addition to the system of the dummy variables $dneg1_t^r$, $dpos1_t^r$, $dmwlow1_t^r$, and $dmwhigh1_t^r$. The last two dummies indicate histogram bars located at -1 percent and +1 percent from the minimum wage change, respectively. The new SURE is:

$$prop_t^1 = p_1 + np_1 dneg_1 + (z - \theta n\sum_{j=2}^{15} p_j) dzero_1 - \delta n\sum_{j=1}^{15} p_j dneg1_1 - (1-\theta-\delta)n\sum_{j=3}^{15} p_j dpos1_1 +$$

$$+\hat{n}p_1 dmwlow_1 + (\hat{z} - \hat{\theta}\hat{n}\sum_{j=2}^{15} p_j) dmw_1 - \hat{\delta}\hat{n}\sum_{j=1}^{15} p_j dmwlow1_1 - (1-\hat{\theta}-\hat{\delta})\hat{n}\sum_{j=3}^{15} p_j dmwhigh_1$$

$$prop_t^2 = p_2 + np_2 dneg_2 + (z - \theta n\sum_{j=3}^{15} p_j) dzero_2 - \delta n\sum_{j=2}^{15} p_j dneg1_2 - (1-\theta-\delta)n\sum_{j=4}^{15} p_j dpos1_2 +$$

$$+\hat{n}p_2 dmwlow_2 + (\hat{z} - \hat{\theta}\hat{n}\sum_{j=3}^{15} p_j) dmw_2 - \hat{\delta}\hat{n}\sum_{j=2}^{15} p_j dmwlow1_2 - (1-\hat{\theta}-\hat{\delta})\hat{n}\sum_{j=4}^{15} p_j dmwhigh_2$$

$$prop_t^3 = p_3 + np_3 dneg_3 + (z - \theta n\sum_{j=4}^{15} p_j) dzero_3 - \delta n\sum_{j=3}^{15} p_j dneg1_3 - (1-\theta-\delta)n\sum_{j=5}^{15} p_j dpos1_3 +$$

$$+\hat{n}p_3 dmwlow_3 + (\hat{z} - \hat{\theta}\hat{n}\sum_{j=4}^{15} p_j) dmw_3 - \hat{\delta}\hat{n}\sum_{j=3}^{15} p_j dmwlow1_3 - (1-\hat{\theta}-\hat{\delta})\hat{n}\sum_{j=5}^{15} p_j dmwhigh_3$$

…

$$prop_t^{13} = p_{13} + np_{13} dneg_{13} + (z - \theta n\sum_{j=14}^{15} p_j) dzero_{13} - \delta n\sum_{j=13}^{15} p_j dneg1_{13} - (1-\theta-\delta)np_m dpos1_{13} +$$

$$+\hat{n}p_{13} dmwlow_{13} + (\hat{z} - \hat{\theta}\hat{n}\sum_{j=14}^{15} p_j) dmw_{13} - \hat{\delta}\hat{n}\sum_{j=13}^{15} p_j dmwlow1_{13} - (1-\hat{\theta}-\hat{\delta})np_m dmwhigh_{13}$$

$$prop_t^{14} = p_{14} + np_{14} dneg_{14} + (z - \theta np_{15}) dzero_{14} - \delta n\sum_{j=14}^{15} p_j dneg1_{14} +$$

$$+\hat{n}p_{14} dmwlow_{14} + (\hat{z} - \hat{\theta}\hat{n}p_{15}) dmw_{14} - \hat{\delta}\hat{n}\sum_{j=14}^{15} p_j dmwlow1_{14}$$

$$prop_t^{15} = p_{15} + np_{15} dneg_{15} + (z) dzero_{15} - \delta np_m dneg1_{15} + \hat{n}p_{15} dmwlow_{15} + (\hat{z}) dmw_{15} - \hat{\delta}\hat{n}p_{15} dmwlow1_{15}$$

On the other hand, we observed that during the periods of high inflation in 1986-1988 and 1995-1997 the bar of the zero wage change was more than 15 percentage points below the median wage change. In addition, several times during those episodes the nominal minimum wage increased at an annual rate higher than 15 percent. So in order that the model could capture both considerations and still preserve sufficient variation in the explanatory variables, instead of just including more 1 percent bars below the median into the sure, we made a twofold modification. We changed the reference point of the test from the 50th percentile to the 75th percentile and increased the size of the bars from 1 to 4 percentage points.

7. Results

The results of various specifications are presented below. We begin with two tables, both of which use data from the entire period 1986:1 – 2001:4. The first table uses the median of the wage-change distribution as the reference point with histogram-bar widths of one percent. The second table uses the 75th percentile of the wage-change distribution as the reference point with histogram-bar widths of 4 percent

All wage earners bar size 1% and reference point = 50% percentile, 1986:1-2001:4

	Kahn Test (15)	Kahn-MW Test (15)	Aug. Kahn Test (15)	Aug. Kahn-MW Test (15)
n	-0.621704	-1.907306	-0.59952	-4.149272
	-12.52097	*-9.901403*	*-10.86027*	*-5.635791*
z	0.115069	0.097394	0.114935	0.104938
	120.184	*61.47721*	*127.4483*	*59.29887*
delta			0.034325	0.120136
			1.362363	*2.452801*
theta			1.089534	1.121367
			18.20905	*11.19406*
n_hat		1.220935		0.960283
		7.752183		*4.967897*
z_hat		0.247846		0.251373
		70.05859		*76.92798*
delta_hat				-0.201102
				-2.321696
theta_hat				1.909663
				8.763821

t-tests are reported in italics.

All wage earners bar size 4% and reference point = 75% percentile, 1986:1-2001:4

	Kahn Test (15)	Kahn-MW Test (15)	Aug. Kahn Test (15)	Aug. Kahn-MW Test (15)
n	-0.351025	-0.602996	-0.225539	-0.566772
	-12.14983	*-24.78789*	*-3.652934*	*-18.1557*
z	0.082473	0.070989	0.071045	0.067879
	75.91015	*130.4101*	*87.96067*	*118.1004*
delta			-0.449272	-0.01023
			-2.086559	*-0.482407*
theta			2.751519	1.110676
			3.477566	*19.36639*
n_hat		0.193817		0.13009
		8.508608		*3.703433*
z_hat		0.250192		0.265253
		54.7696		*51.71593*
delta_hat				0.196728
				1.712647
theta_hat				2.184757
				4.807668

t-tests are reported in italics.

Qualitatively the results were similar across specifications. Histogram bars that encompass changes in the log wage of either zero or the change in the log of the minimum wage are both estimated to be higher than they would in the absence of menu costs or long term contracting. (This can be seen from the two "*z*" parameters). Histogram bars that encompass reductions in the nominal wage are estimated to be smaller as a result of nominal-wage rigidities. This result is consistent with studies from other countries. It is in this sense that we do find evidence of **downward** nominal-wage rigidities.

Histogram bars are estimated to be larger when they encompass changes in the log wage that are lower than the increase in log of the minimum wage (but above zero). One possible explanation is that workers who had been earning slightly more than the minimum wage receiving salary increases sufficient to reach the new minimum wage.

There is ample reason to suspect that wage rigidities might be waning over time. The early years of the sample were characterized by high inflation, making wage indexation a more pressing concern for workers. Furthermore, the fact that the economy was substantially less open to trade in the early years might lead one to suspect that the wage distribution would be less flexible. To address this point, we present tables where we divide our sample into two sub periods: 1986:1-1993:4 and to 1994:1-2001:4. We present these results below, using both the median and the 75th percentile as reference points.

All wage earners bar size 1% and reference point = 50% percentile, 1986:1-1993:4

	Kahn Test (15)	Kahn-MW Test (15)	Aug. Kahn Test (15)	Aug. Kahn-MW Test (15)
n	-0.61345	-3.803634	-0.675887	-22.83584
	-6.571289	*-7.40371*	*-5.93254*	*-1.198701*
z	0.123182	0.096047	0.122481	0.120509
	46.16382	*44.81215*	*46.74714*	*63.2843*
delta			0.083729	-2.611032
			1.327995	*-3.593271*
theta			0.930014	6.844068
			11.33185	*4.285309*
n_hat		1.378932		1.783492
		6.557021		*2.561708*
z_hat		0.25295		0.270816
		87.18583		*59.28765*
delta_hat				-0.70925
				-4.277296
theta_hat				2.590324
				7.628519

t-tests are reported in italics.

All wage earners bar size 1% and reference point = 50% percentile, 1994:1-2001:4

	Kahn Test (15)	Kahn-MW Test (15)	Aug. Kahn Test (15)	Aug. Kahn-MW Test (15)
n	-0.524213	-1.344846	-0.53489	-1.16683
	-13.50863	*-7.966568*	*-11.50597*	*-6.565205*
z	0.111933	0.09637	0.111565	0.094723
	128.5129	*59.25363*	*124.6211*	*50.24575*
delta			0.032276	-0.030042
			1.309195	*-0.719796*
theta			1.016303	1.170286
			26.78691	*17.04943*
n_hat		1.507361		1.146585
		5.715399		*6.19958*
z_hat		0.23406		0.241741
		32.82719		*44.42779*
delta_hat				-0.040481
				-1.50121
theta_hat				1.36865
				16.27897

t-tests are reported in italics.

All wage earners bar size 4% and reference point = 75% percentile, 1986:1-1993:4

	Kahn Test (15)	Kahn-MW Test (15)	Aug. Kahn Test (15)	Aug. Kahn-MW Test (15)
n	-0.519337	-0.744329	0.004611	-0.595871
	-15.5048	*-17.03895*	*0.050463*	*-10.09873*
z	0.070744	0.064836	0.062415	0.067647
	111.5483	*124.1244*	*152.7036*	*105.432*
delta			59.1036	-0.014701
			0.050831	*-0.437436*
theta			-199.567	1.292962
			-0.050471	*13.57473*
n_hat		0.123848		0.020828
		2.920243		*0.422106*
z_hat		0.255646		0.271409
		49.13524		*43.51707*
delta_hat				0.67948
				0.48165
theta_hat				12.50941
				0.452289

t-tests are reported in italics.

All wage earners bar size 4% and reference point = 75% percentile, 1994:1-2001:4

	Kahn Test (15)	Kahn-MW Test (15)	Aug. Kahn Test (15)	Aug. Kahn-MW Test (15)
n	0.119167	-0.365532	0.582731	
	1.053752	*-6.240649*	*2.631036*	
z	0.127767	0.08916	0.122383	
	36.28609	*17.49585*	*35.87185*	
delta			0.351269	
			4.816912	
theta			0.165363	
			0.908875	
n_hat		0.00504		
		0.19181		
z_hat		0.194918		
		20.74236		
delta_hat				
theta_hat				

t-tests are reported in italics.

When we break the sample period 1986:1-2001:4 into two sub-samples corresponding to 1986:1-1993:4 and to 1994:1-2001:4, we indeed find evidence that nominal-wage rigidities have become less important over time, as have the effects of minimum wages. We do not find evidence that "bunching" of log-wage changes has diminished (the z parameters do not appear weaker to be less important in the later period). We do find, however, that the positive effects on histogram bars encompassing positive changes in the log wage less than the change in the log minimum wage have attenuated over time. We also find that the negative effects on histogram bars encompassing reductions in the nominal wage have attenuated over time. It is in this sense that the distribution of changes of log wages appears to be more flexible in more recent years. Changes in log wages appear to be less affected both by minimum wages and by nominal-wage rigidities.

Reductions of the magnitudes of the "n" parameters after 1994 accord well with the fact that indexation was more prevalent during the years of the inflation stabilization plans than afterwards.[7] Substantial wage indexation as part of stabilization plans has been reported for other Latin American economies like Chile (Cortázar, 1997), Argentina (Pessino, 1997), and Brazil (Devereaux, 1994).[8] Less flexibility downwards in the former period than in the latter is reflected in less negative values for the corresponding n parameters. However, even with more liberalized trade, in the absence of any labor law changes to promote market flexibility this pattern presents a puzzle for future research.

8. Conclusions

We studied the distributions of changes in the log of wages for tax-registered employees in the private sector in Mexico. In particular, we focused on employees who do not change firms from one year to the next. We found it common that the nominal wage does not change from one year to the next. We also found it common that a change in the log wage is equal to the change in the log of the minimum wage. This latter finding is driven

[7] Aspe (1993) describes that in Mexico one of the main objectives of stabilization plan adopted during the late eighties and early nineties was to correct wage momentum. Agreements with the workers focused on moving away from short-term contracts with complete ex-post indexation toward longer contracts defined in terms of expected inflation (ex ante indexation). To this end, in December 1987 there was an immediate minimum wage rise of 15 percent during December of 1987 and a 20 percent rise in January 1988, followed by a monthly review according to anticipated inflation. The period for the review shifted from a monthly to a yearly basis within a few months.

[8] For instance, Cortázar (1997) reports that in Chile, during the period of 1973-79, the military government replaced decentralized negotiations between entrepreneurs and workers with a policy of wage readjustments determined by government authorities. The rate of variation of nominal wages (around their medium-term trend) throughout those years was basically an exogenous variable determined by the central authorities. Equations estimated to test the hypothesis that the percentage of growth of nominal wages can be expressed as a fraction of the percentage wage readjustment decreed by the government during this period yields coefficient for this variable higher than 90 percent.

both by employees earning exactly the minimum wage as well as by the fact that wage contracts for those earning more than the minimum wage use the minimum wage as an index. We further estimate that wage changes are bunched in the region between the two benchmarks (zero and the increase in the log minimum wage), while reductions in the nominal salary are rare.

9. Bibliography

Akerlof, George A., William T. Dickens and George L. Perry (1996), "The Macroeconomics of Low Inflation," Brookings Papers on Economic Activity, 1:1996.

Altonji, Joseph and Paul Devereaux (1999), "The Extent and Consequences of Downward Nominal Wage Rigidity," Working Paper No. 7234, National Bureau of Economic Research, Cambridge, MA, July 1999.

Aspe, Pedro (1993), Economic Transformation the Mexican Way, The MIT Press, Cambridge, MA.

Bewley, Truman (1999), Why Wages Don't Fall During a Recession, Harvard University Press, Cambridge, MA.

Botero, Juan, Siemeon Djankov, Rafael La Porta, Florencio Lopez-de-Silanes and Andrei Shliefer (2003), "The Regulation of Labor," Working Paper No. 9756, National Bureau of Economic Research, Cambridge, MA, June 2003.

Castellanos, Sara G. (2003), "Downward Nominal Wage Rigidities and Employment: Microeconomic Evidence of Mexico," mimeo, Banco de México, June 2003.

Cortázar, René (1997), "Chile: The Evolution and Reform of the Labor Market," in Labor markets in Latinamerica. Combining Social Protection with Market Flexibility, Sebastián Edwards and Nora Claudia Lustig, editors, Brookings Institution Press, Washington, D.C.

Crawford, Allan and Geoff Wright (2001), "Downward Nominal-Wage Rigidity: Micro Evidence from Tobit Models," Working Paper 2001-7, Bank of Canada, May 2001.

Davis, Steven J. and John C. Haltiwanger (1999), "Gross Job Flows," in Handbook of Labor Economics, Vol. 3b, Orley Ashenfelter and David Card, editors, North Holland, Amsterdam.

Davis, Steven J., John C. Haltiwanger and Scott Schuh (1996), Job Creation and Destruction, The MIT Press, Cambridge, MA.

Davis, Steven J. and John C. Haltiwanger (1992), "Gross Job Creation, Gross Job Destruction, and Employment Reallocation," Quarterly Journal of Economics, Vol. 107, No. 3, pp. 819-863.

Devereaux, Michael B. (1994), "Wage Indexation, Adjustment, and Inflation," in Labor Markets in an Era of Adjustment, Susan Horton, Ravi Kanbur and Dipak Mazumdar, editors, Vol. 1, EDI Development Studies, The World Bank, Washington, D.C.

Dwyer, Jacqueline and Kenneth Leong (2000), "Nominal Wage Rigidity in Australia," Research Discussion Paper 2000-08, Economic Research Department, Reserve Bank of Australia, November 2000.

Edwards, Sebastian and Nora Claudia Lustig (1997), Labor Markets in Latin America. Combining Social Protection with Market Flexibility, Brooking Institution Press, Washington D.C.

Farès, Jean and Seamus Hogan (2000), "The Employment Costs of Downward Nominal-Wage Rigidity," Working Paper 2000-1, Bank of Canada, January 2000.

Faruqui, Umar Ahmed (2000), "Employment Effects of Nominal-Wage Rigidity: An Examination Using Wage-Settlements Data," Working Paper 2000-14, Bank of Canada, July 2000.

Foster, Lucia, John Haltiwanger and C.J. Krizan (2002), "The Link Between Aggregate and Micro Productivity Growth: Evidence from Retail Trade," Working Paper No. 9120, National Bureau of Economic Research, Cambridge, MA, August 2002.

Foster, Lucia, John Haltiwanger and C.J. Krizan (2000), "Aggregate Productivity Growth: Lessons from Microeconomic Evidence," mimeo, University of Maryland, June 2000.

Griliches, Zvi and Haim Regev (1995), "Productivity and Firm Turnover in Israeli Industry: 1979-1988," Journal of Econometrics, 65, pp. 175-203.

Haltiwanger, John (2000), "Aggregate Growth: What Have We Learned from Microeconomic Evidence?," mimeo, University of Maryland, June 2000.

Kahn, Shulamit (1997), "Evidence of Nominal Wage Stickiness from Microdata," American Economic Review, Vol. 87, Issue 5, pp. 993-1008.

Kaplan, David S., Gabriel Martínez and Raymond Robertson (2003b), "Worker- and job-flows in Mexico," mimeo, Inter-American Development Bank, Washington, D.C.

Kaplan, David S., Gabriel Martínez and Raymond Robertson (2003b), "Employment Displacement Costs in Developing Countries: Evidence from Mexico," mimeo, Inter-American Development Bank, Washington, D.C.

Lagos, Ricardo (2004), "A Model of TFP," mimeo, Federal Reserve Bank of Minneapolis and New York University, January 2004.

Lebow, David E., Raven E. Saks, and Beth Anne Wilson (2003) "Downward Nominal Wage Rigidity: Evidence from the Employment Cost Index," Advances in Macroeconomics, Vol. 3: No. 1, Article 2. http://www.bepress.com/bejm/advances/vol3/iss1/art2

McLaughlin, Kenneth J. (1994), "Rigid Wages?" Journal of Monetary Economics, 34, pp. 383-414.

McLaughlin, Kenneth J. (1999), “Are Nominal Wage Changes Skewed Away From Wage Cuts?” Federal Reserve Bank of St. Louis Review, Vol. 18, Issue 3, May-June 1999.

Olley, G. Steven and Ariel Pakes (1996), “The Dynamics of Productivity in the Telecommunications Equipment Industry,” Econometrica, 64(6), pp. 1263-1297.

Pagés, Carmen and James J. Heckman (2004), Law and Employment: Lessons from Latin America and the Caribbean, forthcoming, National Bureau of Economic Research and The University of Chicago Press, Chicago, IL.

Parente, Stephen L. and Edward C. Prescott (1994), “Barriers to Technology Adoption and Development,” Journal of Political Economy, No. 102, pp. 298-321.

Parente, Stephen L. and Edward C. Prescott (1999), “Monopoly Rights: A Barrier to Riches,” American Economic Review, No. 89, pp. 1216-1233.

Parente, Stephen L. and Edward C. Prescott (2000), Barriers to Riches, The MIT Press, Cambridge, MA.

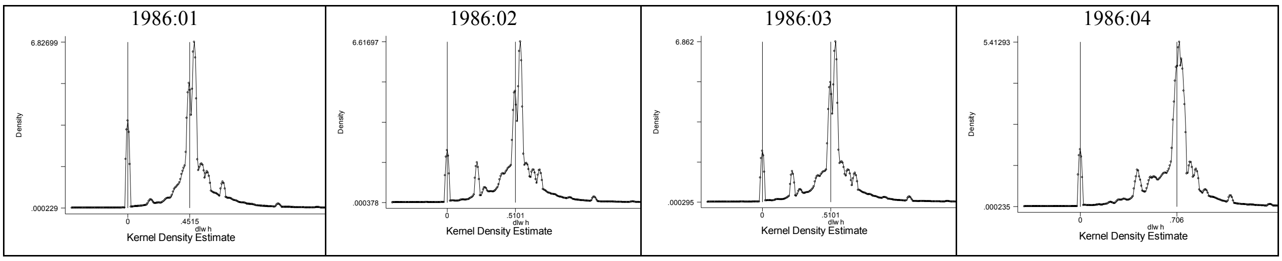
Pessino, Carola (1997), “Argentina: The Labor Market during the Economic Transition” in Labor markets in Latinamerica. Combining Social Protection with Market Flexibility, Sebastián Edwards and Nora Claudia Lustig, editors, Brookings Institution Press, Washington D.C.

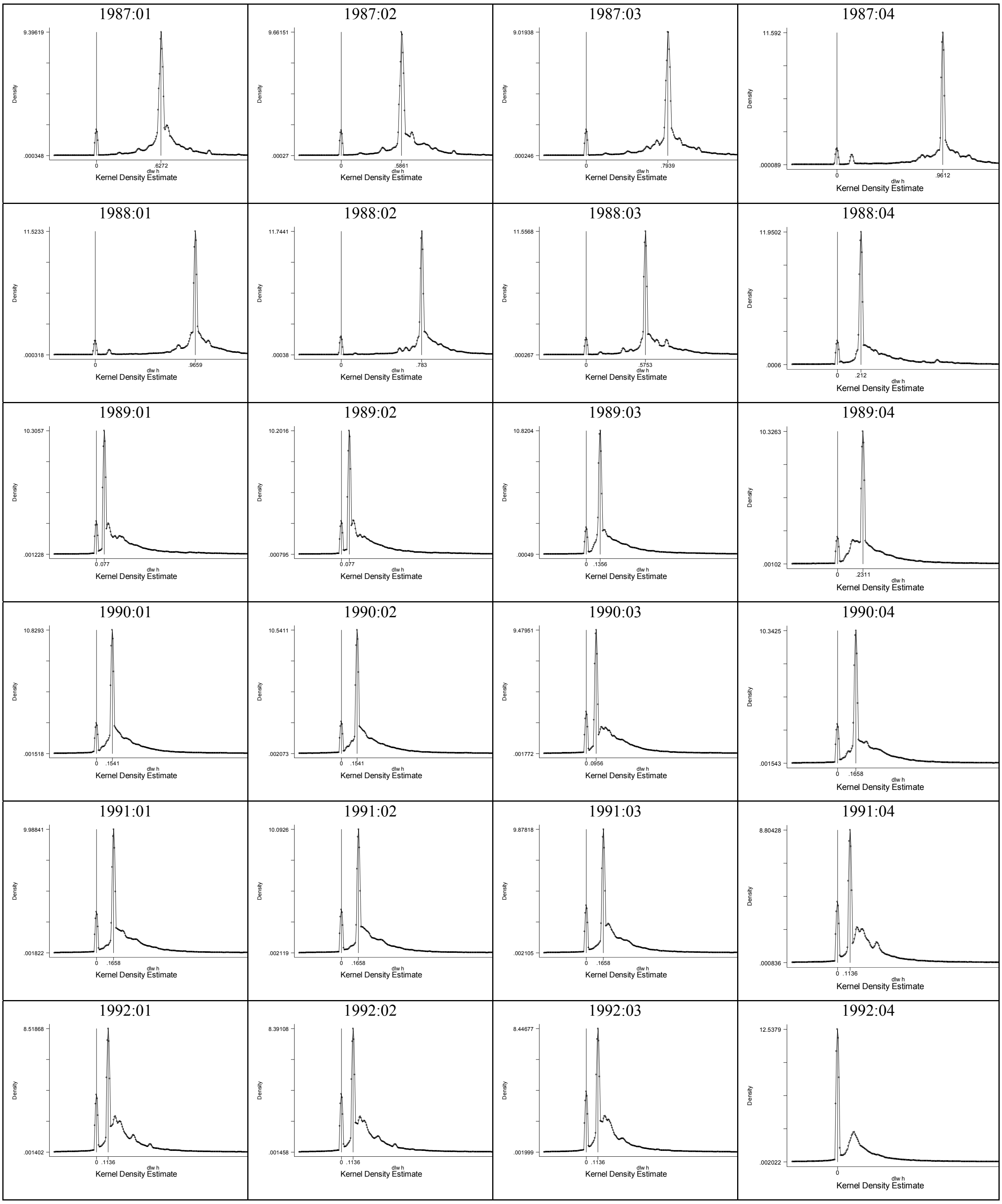
Prescott, Edward C. (1998), “Needed: A Theory of Total Factor Productivity,” International Economic Review, No. 39, pp. 525-552.

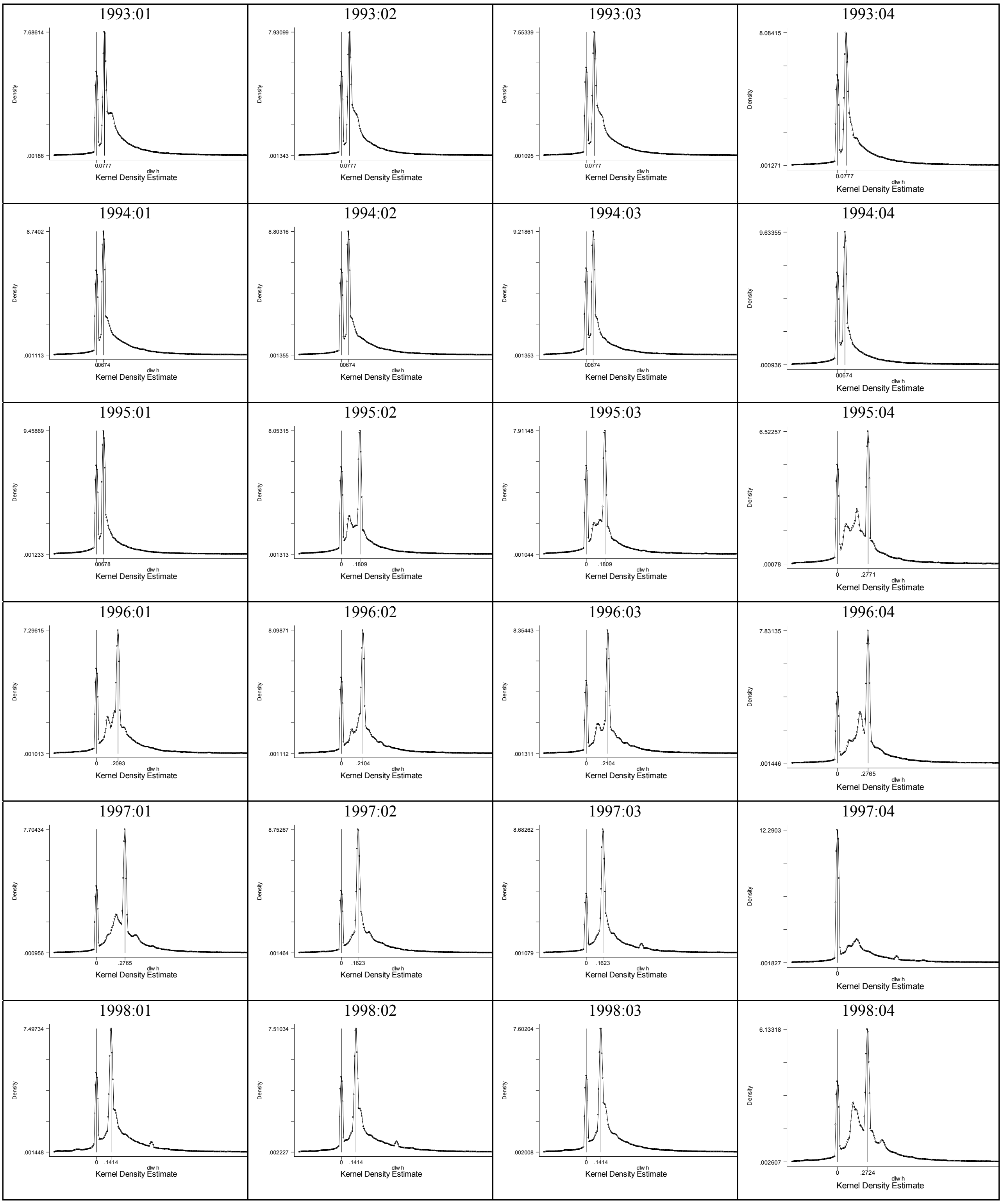
Wilson, Beth Anne (2002) " Wage Rigidity: a Look Inside the Firm", mimeo, Federal Reserve Board, February 2002.

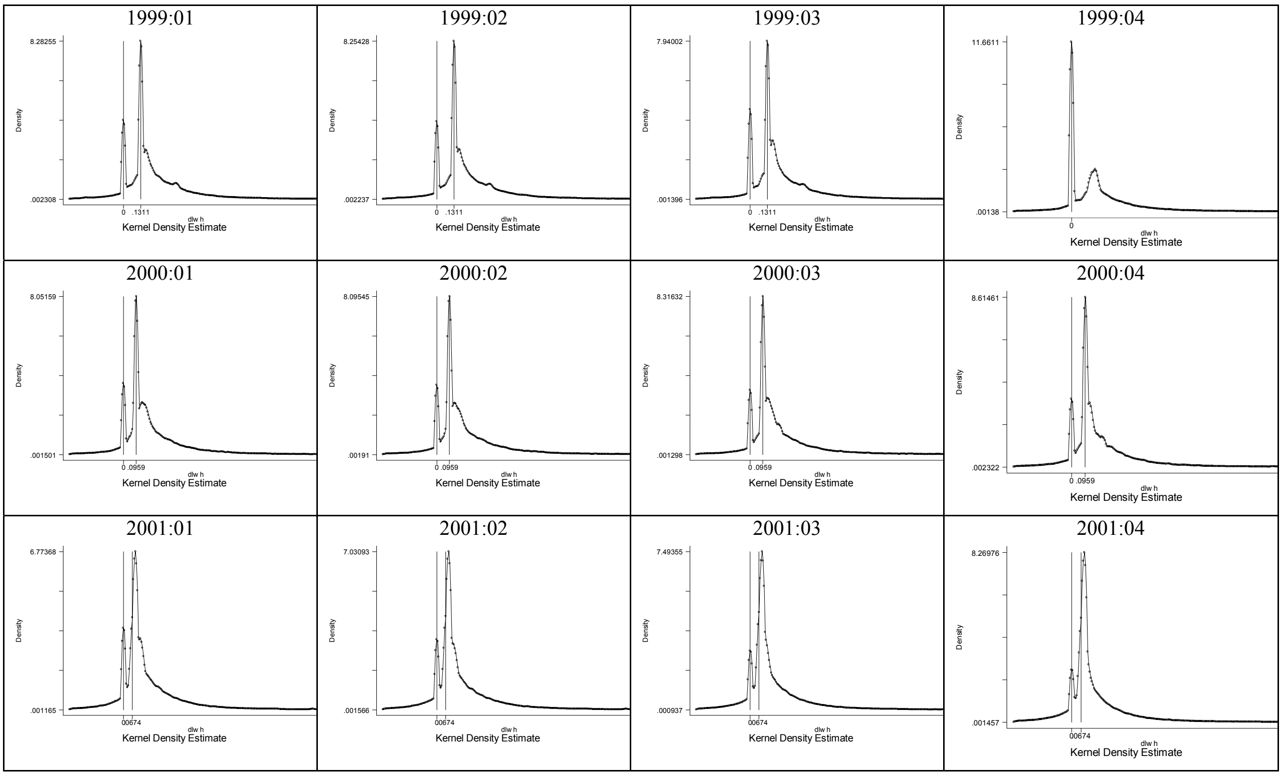
10. Appendix A

The following figures depict the kernel density estimates of the probability density functions of the change in the log nominal age for each quarter between March 31, 1986, and December 31, 2001. As before, the first vertical line signals where the nominal change of zero is located on the horizontal axis while the second vertical line signals the change in the log of the minimum wage from each quarter. Several features are apparent from these graphs. First, as mentioned above, in almost every case there are two large spikes in the density function, one at the zero change in the nominal wage and another one at the minimum wage change. The only three exceptions are the densities corresponding to December 31, 1992, December 31, 1997, and December 31, 1999. In these cases there is a large spike at the point corresponding to zero change in the nominal wage, but not to the point corresponding to the minimum wage increase. As explained above, these dates correspond to periods the where the same minimum wage from the year before was in effect. Another interesting feature of these graphs is that there are always observations to the left of the zero change in nominal wages, which implies that some of the workers are experiencing nominal wage decreases. Finally, it is interesting to observe the evolution of these densities over time, and how the distance between the zero and the minimum nominal wage increases grew closer up to the first quarter of 1995, then widened up until the fourth quarter of 1998 and has shrunk since then.




1987:01
1987:02
1987:03
1987:04
1988:01
1988:02
1988:03
1988:04
1989:01
1989:02
1989:03
1989:04
1990:01
1990:02
1990:03
1990:04
1991:01
1991:02
1991:03
1991:04
1992:01
1992:02
1992:03
1992:04
Kernel Density Estimate


1993:01
7.68614
.00186
0.0777
Density
dlw h
Kernel Density Estimate
1993:02
7.93099
.001343
0.0777
1993:03
7.55339
.001095
0.0777
1993:04
8.08415
.001271
0.0777
1994:01
8.7402
.001113
.00674
1994:02
8.80316
.001355
.00674
1994:03
9.21861
.001353
.00674
1994:04
9.63355
.000936
.00674
1995:01
9.45869
.001233
.00678
1995:02
8.05315
.001313
0
.1809
1995:03
7.91148
.001044
0
.1809
1995:04
6.52257
.00078
0
.2771
1996:01
7.29615
.001013
0
.2093
1996:02
8.09871
.001112
0
.2104
1996:03
8.35443
.001311
0
.2104
1996:04
7.83135
.001446
0
.2765
1997:01
7.70434
.000956
0
.2765
1997:02
8.75267
.001464
0
.1623
1997:03
8.68262
.001079
0
.1623
1997:04
12.2903
.001827
0
1998:01
7.49734
.001448
0
.1414
1998:02
7.51034
.002227
0
.1414
1998:03
7.60204
.002008
0
.1414
1998:04
6.13318
.002607
0
.2724


1999:01
1999:02
1999:03
1999:04
2000:01
2000:02
2000:03
2000:04
2001:01
2001:02
2001:03
2001:04
Density
dlw h
Kernel Density Estimate

11. Appendix B

Some International Evidence on DNWR: United States, Canada and Australia

Statistic / Country	United States (1)	United States (2)	United States (3)	Canada (4)	Australia (5)
n of kahn's test	-0.47	-0.47	-1.00		-0.92
z of kahn's test	4.43	9.98			
n of augmented kahn's test		-0.47			
z of augmented kahn's test		9.98			
% obs added at zero (θ		1.00			
% obs added at bar above zero (1-θ-δ)		0.00			
% obs added at bar below zero (δ)		0.00			
% Rigid wage observations	10.6	17.9	6.8	13.00	14.70
% Nominal cut observations	11.9	14.4	0.1	2.30	3.50

1 PSID wage earners only, Lebow Stockton and Wascher (1995)
2 ECI wage and salary earners 1991-1998, Lebow, Saks and Wilson (2003)
3 Firm 2's dataset of salary earners who stay in the job, Wilson (2002)
4 Human Resources Development Canada data of private sector settlements, Crawford and Seamus (1999)
5. Mercer Cullen Egan Dell surveys of remuneration, Dwyer and Leong (2000)

Some Evidence on DNWR in Mexico from the ENEU Dataset[1]

Statistic / Sample	**All wage earners**	**Wage earners who stay in the same job**	**Wage earners who stay in the same job at the formal sector**
n of kahn's test	-.089	-0.07	-0.11
z of kahn's test	2.91	3.74	3.58
n of augmented kahn's test	n.s.	.07	n.s.
z of augmented kahn's test	3.01	3.79	3.76
% obs added at zero (θ)			
% obs added at bar above zero (1-θ-δ)			
% obs added at bar below zero (δ)			
% Rigid wage observations	7.74	9.32	7.60
% Nominal cut observations	24.16	22.83	22.40

1. Source: Castellanos (2003).