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Market 1996-2011

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## Downward Wage Rigidities in the Mexican Labor Market 1996-2011\*

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**Abstract:** In this paper, we provide evidence on the existence and evolution of downward real and nominal wage rigidities in Mexico in the period 1996-2011, which was characterized by a reduction in the level and volatility of inflation. Our results suggest that, throughout the period, a larger fraction of private sector workers, who stayed in the same job from one year to another, were subject to downward real wage rigidities than to downward nominal wage rigidities. The relative importance of downward nominal wage rigidities seems to have increased slightly as inflation decreased, as found in studies for some other countries that achieved a lower and more stable inflation.

**Keywords:** downward wage rigidities, wage indexation.

**JEL Classification:** J30

**Resumen:** En este artículo, proporcionamos evidencia de la existencia y evolución de las rigideces salariales reales y nominales a la baja en México en el periodo 1996-2011, el cual estuvo caracterizado por una reducción en el nivel y volatilidad de la inflación. Nuestros resultados sugieren que, durante todo el periodo, una fracción más grande de trabajadores del sector privado, que permanecieron en el mismo trabajo de un año a otro, estuvieron sujetos a rigideces salariales reales a la baja que a rigideces salariales nominales a la baja. La importancia relativa de las rigideces salariales nominales a la baja parece haberse incrementado ligeramente conforme la inflación disminuyó, como se ha encontrado en estudios para algunos otros países que lograron una inflación más baja y estable.

**Palabras Clave:** rigideces salariales a la baja, indexación salarial.

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# 1 Introduction

In this paper, we provide evidence on the existence and evolution of downward real and nominal wage rigidities (DRWR and DNWR, respectively) in Mexico in the period 1996-2011. DNWR constrain nominal wage changes to be greater or equal to zero; whereas DRWR constrain nominal wage changes to be greater or equal to a reference point, which could possibly be different from zero. Such point is commonly referred to as the focal point for wage negotiations or the wage indexation point. The existence of either type of wage rigidities is typically associated with the labor market institutions in a given country. For instance, legal provisions against reducing nominal wages might exist, thus resulting in DNWR. On the other hand, the inclusion of indexation clauses, that explicitly tie wage changes to the inflation rate or any other focal point, in labor contracts would lead to DRWR. Gauging the relative importance of both types of wage rigidities, if they exist, is relevant because such rigidities could prevent the adjustment of the labor market to shocks, thus amplifying the effects of such shocks on real output.

Mexico is an interesting case to study both types of downward wage rigidities in the period 1996-2011 for several reasons. First, in this period fiscal and monetary policy were successful in stabilizing the Mexican economy after the 1994 crisis. In particular, Banco de Mexico, the Mexican central bank, adopted a strategy of rendering monetary policy implementation more transparent, keeping a restrictive bias and responding adequately to inflationary shocks (Ramos-Francia and Torres, 2005). This strategy allowed the Mexican central bank to gradually move towards an inflation targeting regime, which was officially adopted in 2001. In 2002, Banco de Mexico announced an annual permanent objective of 3 percent for inflation.<sup>1</sup> As a result of this strategy, annual inflation decreased from 27.7 percent in December of 1996 to 3.98 percent in December of 2003, and it remained at one-digit levels for the rest of the period. Second, the Mexican labor law, which dates from 1970 and remained virtually unchanged until 2012, constrains wage adjustment through several provisions, for instance, by penalizing employers for reducing wages. Third, the collective wage bargaining system in Mexico, which is argued to be relatively centralized (O'Connell, 1999), together with the importance of the minimum wage as a reference point for wage negotiations, could contribute to the existence of DRWR. In sum, the interaction of all these elements could potentially generate an environment in which DNWR might become more relevant over time,

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<sup>1</sup>According to the historical account on the website of Banco de Mexico, even though the adoption of inflation targeting was officially announced in the 2001 Monetary Program, the Mexican central bank began setting temporary annual inflation targets in 1996. See <http://www.banxico.org.mx/dyn/acerca-del-banco-de-mexico/historical-outline.html#esf>

but DRWR are still pervasive.

Previous studies, which focus mainly on developed countries, have used several methods to document the existence and extent of downward wage rigidities. The first one is graphical inspection of the histogram of nominal wage changes to detect asymmetries in their distribution (Card and Hyslop, 1997). For instance, if DNWR exist one would observe a "bunching" of wage change observations at zero, or at a positive value (e.g. expected or past inflation) if DRWR exist. Other studies have use regression-based methods to complement the graphical evidence and to measure whether the excess mass at zero or any other point is significant (Kahn, 1997; Castellanos et al., 2004; Castellanos, 2005). Finally, another set of studies use a particular type of censored regression model, which is estimated by maximum likelihood, to obtain the parameters of DNWR and DRWR, like the probability of being in a given wage regime and the focal point of wage negotiations (Altonji and Devereux, 2000; Bauer et al., 2007; Devicienti et al., 2007; Barwell and Schweitzer, 2007; Messina and Sanz-de-Galdeano, 2014). Despite the difference in the methods used, previous studies share some common features. All of them use micro data from firms, household surveys or administrative records and the key variable of interest is the annual change in log nominal wages. The majority of them focus on job stayers, i.e. workers who stayed in the same job from one year to another, to keep the job characteristics constant.

In this paper, we follow the studies that estimate the wage rigidities parameters by maximum likelihood. We use a modified version of the model by Altonji and Devereux (2000), which was extended by Goette et al. (2007a) to estimate the prevalence of both types of wage rigidities in the presence of measurement error in wage changes. This model distinguishes between the notional wage change, which is a latent variable capturing the wage change that would be implemented in the absence of any restrictions, and the actual wage change, which might be censored at zero if wages are subject to DNWR, or at a non-zero value, i.e. the wage indexation point, if wages are subject to DRWR. In the model, the observed wage change might differ from the actual one due to measurement error, and from the notional one due to both measurement error and downward wage rigidities. The model is estimated via maximum likelihood to yield estimates for the wage indexation point, whose value is not imposed a priori, and the fraction of workers belonging to each of three wage regimes: (i) flexible wages; (ii) wages subject to DNWR; and (iii) wages subject DRWR. In addition, the model also yields estimates for the fraction of reported wage changes that are subject to measurement error and for the actual incidence of wage rigidities, i.e. the probability that the wage change of a worker is constrained given that she belongs to the DNRW or DRWR regime.

We use data from the Mexican Urban Employment Survey (ENEU, 1996-2004) and the Mexican Survey of Occupation and Employment (ENOE, 2005-2011), two household surveys collected by the Mexican Institute of Statistics and Geography (INEGI). For estimation, we focus on a subsample of salaried workers in the private sector who stayed in the same job from one year to another, and we use the annual change in the nominal hourly wage as our variable of analysis. The panel structure of both surveys allows identifying such “job stayers”, albeit not perfectly. We classify workers as “job stayers” if they did not change industry and occupation from one year to another, as previous work by Castellanos (2005).

Our findings suggest that a much larger fraction of workers in our sample is subject to DRWR than to DNWR. This might be due to some institutional features of the labor market that remained relatively stable between 1996 and 2011. However, we also find that, as inflation decreased, the relative importance of DNWR increased slightly, as found by similar studies for other countries like Germany, Italy and the UK (Bauer et al., 2007; Devicienti et al., 2007; and Barwell and Schweitzer, 2007). Regarding the focal point for wage negotiations, we find that it decreased with inflation during the period. After 2003, shortly after the Mexican central bank officially adopted inflation targeting, we cannot reject that the focal point was statistically equal to the lagged values of inflation, the change in the minimum wage and the core inflation trend. However, for the whole period the focal point had the highest correlation with the lagged change in the minimum wage. Finally, between 2009 and 2011, the focal point was not statistically different from zero, which suggests that DNWR became particularly relevant during the latest recession.

Our paper contributes to the literature of wage rigidities by providing evidence for a developing country over a relatively long period, including the most recent years. So far this literature has mainly focused on the United States and Europe, with few exceptions: Messina and Sanz-de-Galdeano (2014) provide evidence for Brazil and Uruguay; for Mexico, the only previous studies that we are aware of are Castellanos (2005) and Castellanos et al. (2004), which provide evidence up to the year 2001. We use the same methodology as Messina and Sanz-de Galdeano (2014) to provide more recent evidence on wage rigidities in Mexico. This is relevant because inflation became lower and relatively more stable in Mexico after 2001. Thus, we add to previous studies for Mexico by jointly estimating the extent of nominal and real wage rigidities, by taking into account the possibility of measurement error in the estimation and by looking at year-to-year changes in the estimated parameters to explore their relation with the macroeconomic environment.

## 2 Previous Studies

As mentioned before, the majority of existing studies focus on developed countries, i.e, the U.S. and Europe, and the heterogeneity in their findings is attributed to the differences in the institutional setting in each particular country. Previous studies for the U.S. focus primarily on the existence of nominal wage rigidities using a variety of methods (e.g. Kahn, 1997; Altonji and Devereux, 2000, Barattieri et al., 2014). Studies for European countries look at the relative importance of both nominal and real wage rigidities, which typically reflect different labor market institutions across countries.

For the U.S., an early study by Card and Hyslop (1997) finds a "spike" at zero in the distribution of nominal wage changes, which is negatively correlated with inflation. Later work by Kahn (1997) uses a regression to test for nominal wage rigidities and finds that 9.4 wage workers did not receive a wage cut due to DNWR, and that the pile-up of wage change observations at zero can be explained by the infrequency of small wage changes. Altonji and Devereux (2000) find evidence of substantial nominal wage rigidity: only 0.5 percent of salaried workers receive wage cuts in their data from a private corporation, whereas 11 percent had a wage freeze. The authors also find that those few negative wage changes are mostly associated with changes in job characteristics, like full time/part time status, and/or a switch in compensation involving incentives.

For Europe, Dickens et al. (2007) use individual workers' earnings data for 16 countries. They find a high incidence of wage freezes and a lack of nominal wage cuts, which they take as evidence of DNWR. A second asymmetry they find is a tendency for workers' wage changes to clump in the vicinity of the expected rate of inflation, which suggest the existence of DRWR. They find substantial variation across European countries in the extent of both types of rigidities, even after controlling for dataset characteristics. After examining the relationship between their measures of wage rigidity and some characteristics of labor markets in the countries of their sample, they find that only greater union density appears to have a robust positive relationship with the extent of DRWR. Bauer et al. (2007), Devicienti et al. (2007), and Barwell and Schweitzer (2007) apply a common maximum likelihood estimator, the one also used in this paper, to three European countries: Germany, Italy and the UK. They find that real rigidities are far more prevalent in these countries than nominal ones, but as inflation decreased over time, the latter have become relatively more important. For instance, Bauer et al. (2007) report that in Germany, the probability of being subject to DRWR decreased from 62 percent in 1975 to 33 percent in 2000, whereas the one for DNWR increased from 19 to 28 percent between those years. For Italy, Devicienti et al. (2007) report that the probability

of being subject to DRWR decreased from 58 percent in 1985-88 to 39 percent in 1997-99, whereas that of DNWR increased from 21 to 26 percent between those two periods.

Only a few studies provide evidence for developing countries: Messina and Sanz-de-Galdeano (2014) for Brazil and Uruguay, Castellanos (2005) and Castellanos et al. (2004) for Mexico. Messina and Sanz-de-Galdeano (2014) use employer-employee administrative data and the same econometric model as Bauer et al. (2007) to examine how wage rigidities change with rapid disinflation (starting mid-1990s) in Brazil and Uruguay. They find that in Uruguay, DRWR fall from 75 percent in 1996-99 to 7 percent by the 2000s, and DNWR become more prevalent (from 11 to 66%). In Brazil, DRWR are stable (around 43%), but the introduction of inflation targeting anchors wage negotiations to expected inflation.

For Mexico, the only previous studies that we are aware of are Castellanos (2005) and Castellanos et al. (2004), which use the regression-based method proposed by Kahn (1997) to provide evidence of DNWR up to the year 2001. Castellanos (2005) uses data from ENEU, whereas Castellanos et al. (2004) use individual IMSS administrative records. Both of these studies find evidence of DNWR for a sample of job stayers, and especially in large, formal sector firms. Castellanos et al. (2004) also provide some evidence of indexation to the minimum wage, by imposing this focal point in an OLS regression. The main differences between our paper and these two previous studies for Mexico are the use of more recent data and a different empirical model, following Messina and Sanz-de-Galdeano (2014), which allows us to jointly estimate the parameters of both nominal and real wage rigidities, together with the wage indexation point, and to control for measurement error. In addition, we look at year-to-year changes in the estimated parameters to explore their relation with the macroeconomic environment, whereas previous studies for Mexico consider a period of several years as a whole.

### **3 Data and Estimation Sample**

We use data from two household surveys, which are collected by the Mexican Institute of Statistics and Geography (Instituto Nacional de Estadística y Geografía, INEGI) with the purpose of generating labor market statistics. The first one is the Mexican Urban Employment Survey (Encuesta Nacional de Empleo Urbano, ENEU) which is a rotating panel of households in a subsample of Mexican cities. The ENEU data are available from 1987 to 2004, but we use only the data for the period 1996-2004 because they are more comparable across years. Nevertheless, the sample of cities changed over this period, as more cities



were added every few years. The second dataset is the Mexican Survey of Occupation and Employment (Encuesta Nacional de Ocupacion y Empleo, ENOE), which is a nationally representative household survey, available from 2005 to 2011. The ENOE survey has both urban and rural households, and as such it replaced and expanded the ENEU. It also has a very similar panel structure. In both surveys, each household is followed for a maximum of 5 quarters. We use both datasets to construct a sample that covers the period 1996-2011. To maximize comparability between the two, we focus on the 27 cities that were included in all the ENEU years and, as described below, we define the variables accordingly.

For the whole period, we focus on a subsample of salaried workers age 18 to 65 who are full-time (i.e. report at least 30 work hours per week) in the private sector. Thus, we drop self-employed, unpaid, commission and piece-rate workers. We do not include workers in government and other public institutions because wage-setting practices in the public sector might be different from those in private firms. In addition, given that the literature focuses on private-sector workers, we will be able to compare our results with previous studies. Also for comparability, we further restrict our sample to job stayers, i.e. those workers that remained in the same job between their first and fifth interview. The ENEU survey does not allow us to clearly identify whether a worker stayed in exactly the same job during a year. The ENOE one does, but such information is available only in selected quarters of the period of interest.<sup>2</sup> So, for the whole sample we classify a worker as a job stayer if she had the same 4-digit occupation and 4-digit industry in her first and fifth interview, as in previous work by Castellanos (2005). Using the additional information in the ENOE for the quarters in which it is available, we are able to verify that about 80 percent of the workers in our sample are correctly classified as job stayers. After applying these restrictions and dropping out observations with missing values in the variables we use in the analysis, we are left with 50,446 individual observations for the ENEU 1996-2004 and with 14,623 in the ENOE 2005-2011.

Our dependent variable of interest is the change in the log nominal wage per hour between the first and fifth interview, i.e. between a given quarter and the same one in the following year. Both surveys have information on nominal monthly earnings, the hours usually worked by each individual per week and the hours worked in the week previous to the survey. This

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<sup>2</sup>Starting in 2009, an extended questionnaire is applied to respondents only during the first quarter of each year. This questionnaire includes questions about the year in which the respondent first started working for her current employer and whether she has remained with that same employer ever since, with no interruptions. This information, together with the occupation variable could be combined to have a more accurate classification of job stayers. Before 2009, the extended questionnaire was applied in all of 2005 and in the second quarters of 2007 and 2008.

information can be provided by the worker herself or by another respondent of the household. Given that this feature could affect measurement error, we include a dummy for whether the worker herself answered the survey, as explained below. We construct the hourly wage as monthly earnings divided by usual weekly hours of work multiplied by 4.3, for our main results. However, using the hours worked during the previous week does not change our results significantly.

## 4 Econometric Model

We use a censored regression model with measurement error that Altonji and Devereux (2000) use to analyze DNWR in the U.S. This model was extended by Goette et al. (2007a) to include also DRWR. In this section we outline the basic features of the model, following closely the exposition in Goette et al. (2007b) and Messina and Sanz-de-Galdeano (2014).<sup>3</sup>

The model has a latent variable: the *notional* wage change for worker  $i$  at time  $t$ , which is the nominal wage change that would be implemented in the absence of any wage rigidities and measurement error. This notional wage change is not always observed, but can be described by the following equation:

$$\Delta w_{it}^n = X_{it-1}\alpha + \epsilon_{it} \quad (1)$$

where  $\Delta w_{it}^n$  is the notional wage change between  $t-1$  and  $t$  for individual  $i$ ,  $X_{it-1}$  are worker and job characteristics at  $t-1$  and  $\epsilon_{it} \sim N(0, \sigma_w^2)$  is an error term. For estimation, worker characteristics include age (and its square term), years of schooling (and its square term), and a female dummy. Job characteristics include a formal dummy, equal to 1 if the job is covered by social security benefits (IMSS), a dummy variable equal to 1 if the worker has a written job contract, and industry, firm size and occupation dummies. Descriptive statistics for these control variables are presented in Tables A1 and A2 in the appendix. To control for any other factors affecting all observations in a given year, we also include year dummies.

The *actual* wage change for worker  $i$  at time  $t$  is  $\Delta w_{it}$ , which can be classified into one of the following three wage regimes: a regime with downward nominal rigidities (N), one with real wage rigidities (R), and the regime with flexible wages (F). As shown below, the actual wage change,  $\Delta w_{it}$ , will be zero if the observation belongs to the nominal regime and

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<sup>3</sup>For additional technical details, please refer to "Technical Appendix for Real and Nominal Wage Rigidities and the Rate of Inflation: Evidence from West German Micro Data" by Goette et al. (2007b) available at: <http://www.iza.org/files/EJ-WageRigidityFeature-TechApp.zip>. Messina and Sanz-de-Galdeano (2014) also provide a detailed technical note as part of the online appendix of their article.

the notional wage change is less than zero. So, if the nominal wage change that would be implemented in the absence of DNWR is a decrease, then the worker would actually receive a wage freeze. Conversely, if the observation belongs to the real regime and the notional wage change is less than  $r_{it}$ , the actual wage change received by the worker will be equal to  $r_{it}$ . The variable  $r_{it}$  is the focal point of wage negotiations or wage indexation point, which constrains from below the wage change observations that are subject to DRWR. Depending on the labor market institutions in a given country, the focal point could be equal to actual or expected inflation, or to the change in a reference wage, like the minimum wage. Note that the actual wage change will be equal to the notional one in any other case, e.g. if the observation belongs to the flexible regime. In addition, a given observation can belong to the nominal or real regime without being necessarily constrained if the notional wage change is strictly greater than zero or  $r_{it}$ .

$$\Delta w_{it} = \begin{cases} 0 & \text{if } \Delta w_{it}^n \leq 0 \wedge i \in N \\ r_{it} & \text{if } \Delta w_{it}^n \leq r_{it} \wedge i \in R \\ \Delta w_{it}^n & \text{otherwise} \end{cases} \quad (2)$$

An advantage of this model is that the focal point of wage negotiations ( $r_{it}$ ) is not imposed, but estimated jointly within the model with the following equation:

$$r_{it} = Z_{it}\gamma + v_{it}, v_{it} \sim N(0, \sigma_r^2) \quad (3)$$

Thus, in principle, the focal point of wage negotiations can be a function of worker and job characteristics too. In this paper, we only include year dummies in  $Z_{it}$  to be able to estimate an average focal point that varies over time.<sup>4</sup>

Each worker  $i$  has an index  $p_i^j$  that affects the probability of being in regime  $j$  ( $j = N, R, F$ ), but, as mentioned before, she can only be in one regime at time  $t$ . For instance,  $P(N) = \text{Prob}(p_i^N > p_i^R \text{ and } p_i^N > p_i^F)$ . Such index  $p_i^j$  may also be a function of worker's characteristics, but we include only year dummies in our main results.

Let  $\Delta w_{it}^o$  be the *observed* wage change. To account for measurement error, in the model the equation for the observed wage is as follows:

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<sup>4</sup>Accounting only for time variation in this variable is standard in similar studies. For instance, Messina y Sanz de Galdeano (2014) perform a separate estimation for each year in their data, leaving the focal point as a constant. Devicienti et al (2007) estimate the model grouping their data in 3-year periods and including only year dummies in the focal point for each of them.

$$\Delta w_{it}^o = \Delta w_{it} + \tilde{u}_{it}, \text{ where } \tilde{u}_i = \begin{cases} u_i & w/\text{probability } p_i^m \\ 0 & w/\text{probability } (1 - p_i^m) \end{cases} \text{ and } u_i \sim N(0, \sigma_m^2) \quad (4)$$

Thus,  $\Delta w_{it}^o$  potentially differs from  $\Delta w_{it}^n$  due to wage rigidities and measurement error.<sup>5</sup> The measurement error is specified as above to allow some wage changes to be accurately measured.

To summarize, the table below shows all the possible cases that apply to a given wage change observation, according to the empirical model. Such observation can belong to any of the three regimes already defined above. If the observation is in either the nominal or real regime, it can either be constrained or unconstrained within that regime. And finally, each observation can be measured with or without error. Each cell in the table contributes with a term in the likelihood function. For instance, the part of the likelihood that corresponds to an observation that is in the nominal regime, constrained and measured without error (NC0) is  $L_{NC0} = P(N)P(\Delta w_{it}^n \leq 0|N)(1 - p_i^m)$ .<sup>6</sup>

	Wage Regime				
	Flexible	Real		Nominal	
		C	U	C	U
W/o error	F0	RC0	RU0	NC0	NU0
W/ error	F1	RC1	RU1	NC1	NU1

## 5 Descriptive Evidence

Figures 1 and 2 show histograms of annual nominal wage changes for our sample of salaried job stayers in the private sector in two different years. Figure 1 shows the distribution of such wage changes for 1996, a high-inflation year. The vertical lines show the different cutoffs that the literature has used to show the presence of DNWR and DRWR graphically. The first line corresponds to zero, and the distribution shows a spike at this value, which is visual evidence suggesting the presence of DNWR. About 5% of workers in our sample experience

<sup>5</sup>In the original model by Goette et al (2007b), the measurement error affects wage levels in each period. We introduce this slight modification, a measurement error in the observed wage change, to simplify the model.

<sup>6</sup>Note that this expression relies on the assumption that the error terms of the index variables and the notional wage change are independent. This is a strong assumption but it is standard in this framework. For a more thorough explanation of this and other details of the model, please refer to the technical note by Goette et al (2007b).

a wage freeze in 1996. In addition, the bar just below zero is far smaller than the one just above, which reinforces the idea that some negative wage changes might have been instead converted to wage freezes. Note also that overall more mass is observed to the right of zero than to the left. The other two vertical lines correspond to the annual inflation rate (27.7%) and the change in the minimum wage in that year (24.2%).<sup>7</sup> At those positive values, it is possible to observe some bunching of observations, suggestive of DRWR, but not as salient as the bunching at zero. The spikes at -1 and 1 are merely due to the fact that all wage changes that are either below -1 or above 1 are grouped together in those values. These extreme wage changes are most probably due to measurement error.

Figure 2 shows the histogram of wage changes for 2006, a low-inflation year. The spike at zero is still observed, and it is higher than the one in Figure 1. About 7.5 percent of workers receive a wage freeze in 2006, slightly more than in 1996. Once again, the bar just below zero is much lower than the one just above it, suggesting the presence of DNWR. The vertical lines corresponding to the annual inflation in December of 2006 (4.05%) and the change in the minimum wage (4.0%) overlap each other in this year and are fairly close to zero, due to the much lower levels of inflation observed in 2006 compared to 1996. Just by visual inspection of Figure 2, it is not easy to distinguish between the spike at zero and that, if there is one, at the inflation rate. As shown in our results, the model will also have difficulty distinguishing between the two in periods of low inflation.<sup>8</sup>

Figure 3 shows the evolution of the proportion of workers in our sample who receive a wage freeze during the period 1996-2006.<sup>9</sup> This fraction is just below 0.05 in 1995, when the annual inflation rate in December of that year was 51.97 percent. Inflation starts to decrease in 1996, due to the stabilization policies implemented by the Mexican government and central bank after the 1994 peso crisis. The proportion of wage freezes remains low and stable until 1999. After that, as inflation continues to decrease to one-digit levels, the proportion of wage freezes starts to increase steadily, reaching about 0.065 in 2004. This suggests that, as inflation decreased in Mexico, DNWR gained importance. In fact, after 2004, the fraction of wage freezes continues to increase but at a much lower rate, which also coincides with a stabilization of inflation at low levels. After 2009, the slope of the curve rises again, suggesting

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<sup>7</sup>In most years, the minimum wage is revised only once per year. In 1995 and 1996, the minimum wage was increased a few times each year, so we calculate the change in the average value of the minimum wage between those years.

<sup>8</sup>Put differently, the model requires a very large number of observations to be able to distinguish between DNWR and DRWR at low levels of inflation, as mentioned in Goette et al (2007a).

<sup>9</sup>To see the trend in the proportion of wage freezes more clearly, we apply a Hodrick-Prescott filter to this series.

the strengthening on DNWR during the latest recession, in which inflation increased, but not as substantially as in the Mexican crises of the 1980s and 1990s.

In summary, Figures 1, 2 and 3 suggest the presence of both DNWR and DRWR in the Mexican labor market. These figures also suggest that DNWR gained importance as inflation decreased to one-digit levels in Mexico.

To continue describing our data before turning to our main estimation results, Table 1 shows the average annual changes in the nominal hourly wage, the nominal monthly earnings, and the hours usually worked per week and those worked the week previous to the survey. The annual change in the nominal hourly wage -measured as monthly earnings divided by either the usual or previous week work hours- averaged 14-15 percent during 1996-2004 and 4 percent during 2006-2011. The difference between those two averages is probably due to the decrease in inflation over the whole period. Table 1 also shows that most of the mean change in the nominal hourly wage is due to the mean annual change in monthly earnings and not to those in hours of work, which have a mean annual change close to zero, particularly in the ENOE period.

## 6 Estimation Results

Figures 4 and 5 show the histograms of the wage changes predicted by the model compared to those actually observed to get a sense of the fit. Figure 4 shows that in a high-inflation year (1996) the model performs very well, and it is able to match the mean and the standard deviation of observed wage changes almost exactly. Figure 5 shows that in a low-inflation year (2006) the model performs still fairly well, which is reassuring.<sup>10</sup>

Table 2 shows the estimated coefficients of the notional wage equation for the whole sample of stayers in 1996-2011. Age has a negative effect on the notional wage change and its square term is positive. Both age coefficients are statistically significant at 1 percent. In contrast, education and its square term are not significant at any conventional levels. Being female has a negative and statistically significant effect on the notional wage, suggesting that the annual wage change in absence of rigidities is lower for women compared to men. Having a job covered by IMSS and a written contract also have a negative and significant effect on the dependent variable.

At the bottom of Table 2, the estimate for the dummy indicating that the worker herself

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<sup>10</sup>To compare the observed and simulated histogram, and the means and standard deviations of both, is the standard way used by similar studies to give a sense of the performance of the model (as in for example, Messina and Sanz de Galdeano, 2014).

answered the survey has a negative and significant effect on the probability that her wage change is measured with error, as would be expected. This dummy also has a negative effect on the variance of the measurement error, which is not statistically significant.

Using these estimates, we obtain the parameters of DNWR and DRWR shown in Table 3. We report all parameters year by year to see their evolution over time. Columns 1 to 3 show the probabilities of being in each of the wage regimes. Column 1 shows that between 10 and 17 percent of salaried job stayers in the private sector are subject to DNWR, whereas between 82 and 90 percent of them are subject to DRWR. Thus, real rigidities are much more important during the whole period than nominal ones. However, the probability of being in the nominal regime increases slightly over time, consistent with the descriptive evidence in Figures 1 to 3 and the decrease in inflation during the period. Note that the estimated probability of being in the nominal regime is also larger than the spike at zero shown in Figures 1 and 2. This is because the model accounts for measurement error that might make nominal wages appear more flexible, by misclassifying small changes around zero as actual changes instead of freezes. Column 3 shows that the probability of being in the flexible regime is very small and almost constant throughout the period.

Column 4 shows the estimated focal point for wage negotiations, which decreases steadily from 13 percent in 1996 to 1-2 percent in 2009-2011. This decline is probably explained by the decrease in inflation during this period. Later, we show in a graph how the focal point relates to past inflation and the change in the minimum wage.

Recall that a given observation can be in the nominal or real regime without necessarily being constrained. Columns 5 and 6 show the joint probabilities of being in the nominal and real regime, respectively, and being constrained, and columns 7 and 8 show the conditional probabilities of being constrained given that the observation belongs to a given wage regime. Overall, columns 5 to 8 show that most of the observations in a given regime are constrained in any given year. Finally, according to the estimates of the model (not shown), about 56 percent of wage changes are measured with error.

To see more clearly how these parameters have evolved over time and their potential correlation with the inflation rate, in Figure 6 we report the probabilities of being in the nominal and real regimes (columns 1 and 2 in Table 3) together with the annual inflation rate. All variables are normalized to 100 in 1996. The shaded areas are recession periods, which we identify using the simple rule of two consecutive quarters of decline in real Mexican GDP. Note that, even though we identify these recession periods using quarterly data, we have yearly estimates, so in the figures we shade the whole year if any of its quarters belongs to a

recession.<sup>11</sup> Figure 6 shows that the probability of being in the real regime decreases slightly after 1999. Conversely, also starting in 1999, as inflation continues falling, the probability of being in the nominal regime increased sharply until 2004, decreased a little bit between 2005 and 2009, and then jumped after the 2009 recession. In summary, Figure 6 shows that, as found by some previous studies, as inflation decreases DRWR also decrease and DNWR increase, and that the latter become more acute during recessions in which inflation is also low. However, recall from Table 3 that in terms of proportions, DRWR are still the most important for the workers in our sample.

Figures 7 and 8 show the probabilities of being in the nominal and real regimes, together with the joint probability of being in that regime and being constrained. As seen before in Table 3, most of the observations in each of these regimes are constrained. However, for the nominal regime, the probability of being constrained increases during recessions, as seen in the narrowing of the vertical distance between  $P(N)$  and  $P(N\&C)$  in Figure 7. The distance between those two probabilities for the nominal regime closes the most after the 2009 recession, which implies that a greater proportion of nominal wage changes in that regime were actually constrained to be non-negative in that period. The distance between the corresponding probabilities for the real regime in Figure 8 seems to narrow only right before and during the 2009 recession.

Figure 9a shows the evolution of the estimated focal point for wage negotiations over the period. We plot the point estimate in each year, together with its 95 percent confidence interval. The figure also plots the lagged values of the annual inflation rate, the change in the minimum wage and the core inflation trend.<sup>12</sup> The focal point decreased from 1999 to 2004 as inflation did, but stayed above lagged inflation, the minimum wage change and the core inflation trend between 1998 to 2002. Starting in 2003, shortly after the Mexican central bank officially adopted inflation targeting, the confidence interval of the focal point includes the lagged values of these three variables until 2008. After 2008, the focal point of wage negotiations is below lagged inflation, the minimum wage change and the core inflation trend. In addition, its point estimate is close to zero (see also Table 3) and its confidence interval actually includes zero. As a consequence, we cannot reject the hypothesis that during the Great Recession the focal point was zero wage change. This fact reinforces the idea that DNWR became particularly acute during the latest recession in Mexico, because although

<sup>11</sup>We use the seasonally adjusted quarterly Mexican GDP in 2008 prices to calculate the quarter-to-quarter variation and identify these recession periods. The original series is available at *Banco de Informacion Economica, INEGI*, <http://www.inegi.org.mx/sistemas/bie>.

<sup>12</sup>Figure A1 in the appendix presents a similar graph, but using the current values of the inflation measures and the change in the minimum wage.



the probability of being in the real regime remained relatively high in 2009-2010, wages in that regime were indexed to a focal point not statistically different from zero.

In Figure 9b we plot once again the focal point and its confidence interval, together with the permanent annual inflation target of 3 percent announced by the Mexican central bank (Banco de Mexico) in 2002, and the inflation expectation for the next 12 months (available starting in 2000) from a survey of private-sector economists, conducted by Banco de Mexico.<sup>13</sup> The figure shows that the inflation expectation was below the wage indexation point between 2000 and 2003, but it was within the confidence interval of the latter between 2003 and 2008. It also shows that although the point estimate of the wage indexation parameter was above the 3 percent inflation target from 2002 to 2008, its confidence interval includes such target for most years after 2004. Thus, we cannot reject the hypothesis that the focal point for wage negotiations was equal to the inflation expectation (in 2003-2008) and Banco de Mexico's inflation target (in 2004-2010). This evidence suggests the strengthening of the credibility of the Mexican central bank after the adoption of inflation targeting. Finally, the inflation expectation was above the confidence interval of the focal point between 2008 and 2010, which could be attributed to the effect of the Great Recession on Mexican labor markets.

To analyze which variables have the strongest correlation with our estimated focal point, we ran first-differences OLS regressions.<sup>14</sup> Given that we have few observations (13 years), these results must be interpreted merely as suggestive correlations. In addition, we only explore the correlations with the actual inflation rate and the change in the minimum wage, because we have information on the inflation expectation only starting in 2000, which would result in even fewer observations. Table 4 shows the results of adding these variables, one at a time. Across columns, the focal point had the highest positive correlation with the lagged change in the minimum wage (0.71-0.79), whereas the correlation with the inflation rate is not significant at 5 percent. This suggests that although the behavior of the general inflation and the change in the minimum wage are similar and both are within the confidence interval of the estimated focal point, especially in recent years, the minimum wage is a relatively more important reference point for wage changes.

To provide context for this finding, minimum wages are set by the National Commission

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<sup>13</sup>This survey is conducted monthly by the Mexican central bank on a sample of about 30 economic analysts and consulting groups of the private sector in Mexico and abroad. The respondents are asked about their expectations for inflation, interest rates, GDP growth and exchange rates, among other variables. Please refer to "*Encuesta sobre las Expectativas de los Especialistas en Economía del Sector Privado*" at [www.banxico.org.mx](http://www.banxico.org.mx).

<sup>14</sup>We tested whether the dependent and the independent variables, and their first differences, were stationary using Dickey-Fuller tests. The original variables are not stationary, but their first-differences are.

of Minimum Wages (Comision Nacional de Salarios Minimos, CONASAMI), composed by representatives of workers, employers and the government. Previous studies show evidence of clustering of wage levels at exact multiples of the minimum wage in Mexico using both household surveys (Castellanos, 2005; Bosch and Manacorda, 2010; Fairris et al., 2008) and administrative data (Castellanos et al., 2004). Moreover, Fairris et al. (2008) show that this clustering is observed not only for formal workers, but also for informal ones. In addition, Fairris et al. (2008) show evidence suggesting that changes in the minimum wage affect overall wage changes, particularly for workers in the mid-to-lower tail of the wage distribution. In sum, the high correlation of our estimated focal point with the change in the minimum wage is consistent with previous studies.

## 7 Robustness Checks

We conduct several estimations to check the robustness of our main results. First, we re-estimate the model using the survey sampling weights. Second, we use the hourly wage calculated using the reported hours worked by the individual in the week previous to the survey, instead of the usual hours worked per week.<sup>15</sup> Figure 10 shows the probability of being in the real regime for our main estimation and for the two alternative exercises just described. Some differences can be observed, but they are relatively small. For instance, using the last week's wage yields a slightly higher proportion of workers in the real regime compared to our main results, but the average difference is about 0.015 for the whole period. Using sampling weights in the estimation also yields slightly different results, but the three estimates are fairly close to each other and behave similarly for most years. The estimated probabilities of the other regimes -nominal and flexible- are also comparable across these estimations, so they are omitted for brevity. Figure 11 shows that the corresponding estimates of the focal point obtained in these three exercises are also similar. Once again, using sampling weights in the estimation seems to affect the results a bit more than changing the wage variable, but the differences are small.

As explained before, in our main estimation we do not impose a specific value for the focal point a priori, but estimate it jointly with the regime probabilities. As an additional check, we re-estimate the model imposing either the lagged change in the minimum wage or the lagged inflation rate as focal points and obtain the regime probabilities. Figure 12 shows our

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<sup>15</sup>As mentioned, both the ENEU and ENOE surveys include two questions: one about the hours worked by the individual in the week previous to the survey interview and another about the hours that the individual usually works per week, which is the one used for our main results.

main results for the probability of being in the real regime in comparison to these estimations. Given that in these alternative checks the focal point is imposed, the resulting estimate for  $P(R)$  is the proportion of wage changes that are subject to that particular indexation point. As shown in Figure 12, the probability of being in the real regime when the focal point is the change in the minimum wage is almost identical to that of our main results. This is not surprising given the high correlation between this variable and our main estimate for the focal point shown in Table 4. In contrast, the proportion of wage changes subject to the inflation rate is lower for most years. This confirms the relative importance of the change in the minimum wage as a reference point for wage changes.

Finally, we also re-estimated the model (i) using monthly earnings rather than the hourly wage, (ii) using the entire sample of cities available in each year (rather than only those that consistently enter the whole period), and (iii) introducing city-level fixed effects in the estimation. These additional checks, not shown but available upon request, yield similar results, except for (i). Using monthly earnings yields a lower probability of being in the real regime, and a larger one for the nominal regime. However, the focal point obtained from (i) is not comparable to the variables that are thought to have influence in wage negotiations, like inflation measures, inflation expectations or the change in the minimum wage.

## 8 Discussion

In summary, our results suggest that for our sample of salaried, private-sector job stayers, DRWR are the most prevalent in Mexico. Our estimated fraction of wage changes subject to DRWR is higher than the one estimated for Uruguay and Brazil by Messina and Sanz-de-Galdeano (2014) in the 2000s, and also compared to that estimated by Bauer et al. (2007) and Devicienti et al. for Germany and Italy, respectively.<sup>16</sup> A key difference between these studies and ours is that they use administrative data. In addition, we find that the extent of such real rigidities stayed roughly constant in Mexico over the period 1996-2011, even though inflation decreased. Such persistence of DRWR in a low-inflation context is mostly associated in the literature with the labor institutions in a given country.

Several provisions in the Mexican labor law (*Ley Federal del Trabajo*, LFT) constrain the downward adjustment of wages. The law entitles the worker to terminate the labor relationship, take legal action and receive compensation, if her employer decreases her wage (art. 51, part IV). In addition, the LFT could implicitly prevent wage adjustments for new hires by

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<sup>16</sup>For this comparison, we are referring to the estimated probabilities of belonging to each wage regime,  $P(N)$  and  $P(R)$ , in our study and in similar previous ones.

stipulating that a given worker cannot be paid a wage lower than that of other workers in the same firm or establishment for the same kind of job, schedule and "efficiency" (art. 5, part XI; art. 86). The law also entitles the worker to request modifications of her working conditions when her wage is not "remunerative", by resorting to the Conciliation and Arbitration Board (art. 57).

These and other legal provisions could also interact with the collective wage bargaining system to explain our findings. The government intervenes in the process through the registrations of unions and strikes, and in the conflict resolution, where substantial negotiation takes place, through the Conciliation and Arbitration Boards (O'Connel, 1999). Even though Fairris (2007) presents evidence of a decrease in unionization rates in Mexico from 26 percent in 1984 to 17 percent in 2000, the LFT extends collective agreements to all workers in the signing firm, including those not belonging to the union (art. 396).<sup>17</sup> In addition, the law potentially limits the possibility of negotiating wages downward by preventing collective contracts from stipulating worse working conditions, including pay, than those currently in place in the firm or establishment (art. 394). Furthermore, the contract remains valid even if the employer parts with the union, or if that union is dissolved (arts. 402 and 403). Similar provisions apply to the law contract (*contrato ley*), a collective agreement that a union with at least two thirds of the workers in a given industry or region negotiates with one or more employers. Such law contract covers all workers in such industry or region (chapter IV). In sum, wage-setting institutions in Mexico, which remained relatively stable during the period we analyze, together with the importance of the minimum wage already discussed, could potentially explain the extent and persistence of DRWR we find. In 2012, after the period covered by our data, an important labor reform was passed. Although many of the specific wage-setting provisions discussed in this paper did not change substantially, the reform could increase the flexibility of the Mexican labor market in the period after our analysis.

Regarding DNWR, we do find that, even though they affect a relatively lower fraction of workers in our sample throughout the period, they increase slightly as inflation decreases, as found by similar studies for other countries like Germany, Italy and the UK (Bauer et al., 2007; Devicienti et al., 2007; and Barwell and Schweitzer, 2007). In addition, DNWR seem to become particularly relevant during the 2009 recession.

A few caveats about our results. We focus on a selected sample of salaried, private-sector job stayers, which allows us to compare our results with the previous literature. However, this

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<sup>17</sup>Fairris (2006) calculates these unionization rates using a sample of salaried workers, formal and informal, from the Mexican Income and Expenditure Survey (*Encuesta Nacional de Ingresos y Gastos de los Hogares*, ENIGH).

also implies that one should be careful before extending our findings to all Mexican workers. In addition, the literature has found more wage rigidities among job stayers than job switchers, so our estimates might be an upper bound for the DNWR and DRWR in the Mexican labor market. We are also not studying wage rigidities arising in the public sector, which is still heavily unionized. Finally, we rely on self-reported wage measures typically available in household surveys. Some previous studies use administrative records to reduce the extent of measurement error in self-reported wage measures. However, our model corrects for measurement error and it is unclear whether administrative data in Mexico truly reflects actual wage changes. Kumler, Frias and Verhoogen (2014) find some evidence of subreporting in the administrative records of the Mexican Institute of Social Security (IMSS). Nevertheless, extending our analysis to such administrative data would be a necessary robustness check. In addition, the ability to clearly identify job stayers and the large number of observations in such records would be of great value, especially because in periods when inflation is low the model requires a large number of observations to separate DNWR from DRWR.

## 9 Summary and Conclusions

In this paper, we provide evidence on the existence and prevalence of DNWR and DRWR in the Mexican labor market during 1996-2011 using data from the ENEU and ENOE and maximum likelihood estimation. We add to previous studies for Mexico in several ways. First, we provide updated evidence on relative importance of both DNWR and DRWR. This is relevant because in recent years inflation has become lower and more stable in Mexico, which can change the relative importance of both types of rigidities, as suggested by previous literature. Second, we estimate the focal point of wage negotiations within the model and account for measurement error in wage changes. Third, we look at year-to-year changes in the estimated parameters to explore their evolution over time and their correlation with the macroeconomic environment.

Our findings suggest that a larger fraction of workers in our sample is subject to DRWR than to DNWR in the period 1996-2011. This might be due to the interaction of some institutional features of the Mexican labor market that remained relatively stable during the period we analyze, such as legal provisions constraining wage adjustment, the collective bargaining system and the importance of the minimum wage as a reference point for wage negotiations. However, we also find that, as inflation decreased, the relative importance of DNWR increased slightly, as found by similar studies for other countries like Germany, Italy and the

UK (Bauer et al., 2007; Devicienti et al., 2007; and Barwell and Schweitzer, 2007). Regarding the focal point for wage negotiations, we find that it decreased with inflation. From 2003 onwards, shortly after the Mexican central bank officially adopted inflation targeting, we cannot reject that the focal point was statistically equal to the value of lagged inflation, the change in the minimum wage and the core inflation trend. Nevertheless, the focal point seems to have the highest correlation with the lagged change in the minimum wage. After 2003, the confidence interval of the focal point also includes the permanent annual inflation target of 3 percent of the Mexican central bank in most years, which is evidence in favor of the increased credibility achieved by this institution. Finally, in 2009-2011, the focal point was not statistically different from zero, which suggests that DNWR were particularly relevant during the latest recession.

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Table 1. Annual proportional changes in wages and work hours for estimation sample. Full-time salaried workers who are job stayers in selected cities

	ENEU 1996-2004		ENOE 2006-2011	
	Mean	St. Dev	Mean	St. Dev
Annual change in nominal hourly wage (usual work hours)	0.14	0.45	0.04	0.42
Annual change in nominal hourly wage (hours worked last week)	0.15	0.46	0.04	0.44
Annual change in monthly nominal earnings	0.13	0.42	0.04	0.39
Annual change in usual work hours	-0.02	0.21	0.00	0.18
Annual change in hours worked last week	-0.03	0.24	0.00	0.23
Number of observations	50466		14623	

Note: In both periods, the sample consists of salaried workers in the private sector who work full time (30+ hours per week) and who did not change their industry and occupation between their first and fifth survey interview (a year). Only the 27 cities that were surveyed consistently during the whole period 1996-2011 are included.

Table 2. Estimates of the Notional Wage Change Equation 1996-2011

	Coefficient
Notional Wage Change	
Age	-0.024*** (0.008)
Age^2	0.0003*** (0.0001)
Education (years)	0.014 (0.015)
Education^2	0.001 (0.001)
Female	-0.115*** (0.033)
Formal job (=1 if job is covered by IMSS, =0 otw)	-0.168*** (0.048)
Contract (=1 if the worker has a written contract, 0 otw)	-0.143*** (0.052)
Industry dummies	Yes
Firm size dummies	Yes
Occupation dummies	Yes
Year dummies	Yes
P(DNWR)	
Year dummies	Yes
P(DRWR)	
Year dummies	Yes
Focal point	
Year dummies	Yes
Variance of wages	
Year dummies	Yes
Variance of focal point	
Year dummies	Yes
Probability of wages measured with error	
Worker herself answered survey	-0.146*** (0.033)
Year dummies	No
Variance of measurement error	
Worker herself answered survey	-0.009 (0.008)
Year dummies	No
Number of observations	66080

Note: Robust standard errors in parenthesis. The estimation sample consists of salaried workers in the private sector who work full time (30+ hours per week) and who did not change their industry and occupation between their first and fifth survey interview (a year) for 1996-2011. Only the 27 cities that were surveyed consistently during that period are included.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 3. Parameter estimates for downward nominal and real wage rigidities 1996-2011

	Focal point of wage negotiations							
	Prob(N)	Prob(R)	Prob(F)	Prob (N&C)	Prob (R&C)	Prob (C N)	Prob (C R)	
Year	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1996	0.12	0.87	0.01	0.13	0.11	0.80	0.90	0.91
1997	0.10	0.89	0.01	0.18	0.09	0.80	0.87	0.90
1998	0.10	0.89	0.01	0.17	0.08	0.80	0.86	0.89
1999	0.09	0.90	0.01	0.18	0.08	0.83	0.89	0.92
2000	0.11	0.88	0.02	0.16	0.09	0.77	0.85	0.88
2001	0.10	0.88	0.01	0.14	0.09	0.80	0.89	0.91
2002	0.14	0.85	0.01	0.09	0.12	0.77	0.89	0.90
2003	0.14	0.85	0.00	0.06	0.13	0.78	0.91	0.91
2004	0.16	0.83	0.01	0.04	0.14	0.73	0.88	0.88
2006	0.15	0.84	0.00	0.06	0.14	0.77	0.91	0.92
2007	0.15	0.85	0.00	0.04	0.14	0.80	0.94	0.94
2008	0.14	0.85	0.01	0.02	0.13	0.80	0.94	0.94
2009	0.14	0.85	0.01	0.01	0.13	0.81	0.95	0.95
2010	0.17	0.82	0.01	0.01	0.16	0.76	0.94	0.93
2011	0.14	0.85	0.01	0.02	0.13	0.80	0.93	0.93

Note: The estimation sample consists of salaried workers in the private sector who work full time (30+ hours per week) and who did not change their industry and occupation between their first and fifth survey interview (a year). Only the 27 cities that were surveyed consistently during the whole period 1996-2011 are included. Columns 1 to 3 report the probability of being in the nominal, real and flexible wage regimes for a given worker, respectively. Column 4 reports the estimated wage indexation point. Columns 5 and 6 report the joint probability of being constrained and in the nominal and real regime, respectively. Columns 7 and 8 report the probability of a wage change being constrained given that the worker belongs to the nominal or real wage regimes, respectively. According to the estimates of the model (not shown) 56 percent of wage changes are measured with error.

Table 4: First-differences regressions of the estimated focal point on inflation and the change in the minimum wage

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Change in the MW (t)	-0.739 (0.531)				-0.187 (0.652)	-0.685*** (0.194)	-0.543 (0.588)
Inflation (t)		-0.398* (0.211)			-0.340 (0.325)		-0.028 (0.238)
Change in the MW (t-1)			0.733*** (0.223)			0.712*** (0.124)	0.789*** (0.185)
Inflation (t-1)				0.129 (0.146)			-0.100 (0.155)
Constant	-0.019** (0.007)	-0.017** (0.006)	-0.003 (0.005)	-0.007 (0.008)	-0.019** (0.006)	-0.012*** (0.004)	-0.012** (0.004)
Observations	13	13	13	13	13	13	13
Adjusted R sq	0.148	0.272	0.502	-0.0516	0.208	0.677	0.612
F	1.939	3.544	10.78	0.781	1.858	62.35	37.86

Note: Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table A1. Descriptive statistics for estimation sample. Full-time salaried workers who are job stayers in selected cities

	ENEU 1996-2004		ENOE 2006-2011	
	Mean	St. Dev	Mean	St. Dev
Age	32.99	10.79	35.12	11.25
Years of education	8.57	3.98	9.47	3.86
Female	0.41	0.49	0.39	0.49
Formal job (=1 if job is covered by IMSS, =0 otw)	0.67	0.47	0.68	0.47
Industry dummies				
Agriculture, fishing and hunting	0.01	0.09	0.00	0.02
Mining	0.00	0.05	0.00	0.05
Electricity, natural gas and water	0.00	0.02	0.00	0.02
Manufacturing	0.25	0.43	0.23	0.42
Construction	0.07	0.26	0.13	0.34
Wholesale, retail, restaurants and hotels	0.31	0.46	0.31	0.46
Transportation, storage and communications	0.06	0.23	0.05	0.22
Finance, insurance and real state	0.02	0.14	0.02	0.15
Services	0.29	0.45	0.25	0.43
Government	0.00	0.00	0.00	0.00
Firm size dummies				
5 or fewer employees	0.31	0.46	0.29	0.46
6-10 employees	0.08	0.28	0.13	0.34
11-15 employees	0.05	0.21	0.07	0.26
16-50 employees	0.14	0.35	0.22	0.41
51-100 employees	0.07	0.25	0.10	0.30
101-250 employees	0.04	0.20	0.08	0.27
251 or more employees	0.32	0.47	0.10	0.31
Occupation dummies				
Professionals	0.03	0.18	0.04	0.19
Technicians	0.04	0.20	0.04	0.20
Education workers	0.01	0.10	0.02	0.14
Workers in the arts, entertainment and sports	0.01	0.08	0.01	0.08
Officers and chief executives	0.02	0.14	0.01	0.11
Workers in agriculture	0.00	0.07	0.00	0.02
Production supervisors	0.02	0.15	0.02	0.13
Production workers and operators	0.32	0.47	0.41	0.49
Administrative supervisors and managers	0.02	0.14	0.01	0.12
Administrative employees	0.12	0.32	0.12	0.33
Traders and sellers in establishments	0.15	0.35	0.15	0.36
Street vendors	0.00	0.03	0.00	0.04
Workers in personal services	0.10	0.29	0.11	0.32
Workers in domestic services	0.12	0.32	0.00	0.03
Security and surveillance workers (guards)	0.04	0.19	0.06	0.23
Other	0.00	0.00	0.00	0.00
Worker herself answered survey	0.27	0.44	0.30	0.46
Contract (=1 if the worker has a written contract, 0 otw)	0.66	0.48	0.60	0.49
Hours of work per week (usual)	48.76	9.44	50.09	10.01
Hours of work in the previous week	48.40	9.81	49.36	10.79
Real hourly wage (usual work hours in YEAR pesos)	21.08	27.64	24.06	19.31
Real hourly wage (hours worked previous week in YEAR pesos)	21.29	27.86	24.79	21.04
Number of observations	50466		14623	

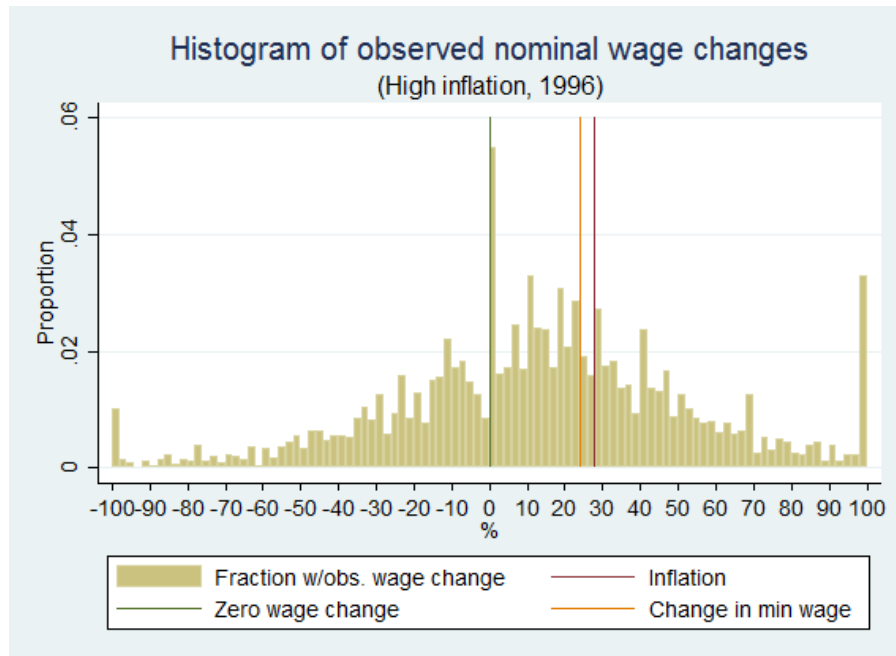
Note: In both periods, the estimation sample consists of salaried workers in the private sector who work full time (30+ hours per week) and who did not change their industry and occupation between their first and fifth survey interview (a year). Only the 27 cities that were surveyed consistently during the whole period 1996-2011 are included. Real wages were calculated using the Mexican Consumer Price Index (INPC).

Table A2. Differences in means between the sample of selected cities and the complete survey sample. Full-time salaried workers who are job stayers

	ENEU 1996-2004		ENOE 2006-2011 (national sample)		ENOE 2006-2011 (urban sample)	
	Difference in means	P-value	Difference in means	P-value	Difference in means	P-value
Age	0.005	0.929	-0.663	0.000	-0.071	0.575
Years of education	-0.023	0.310	-0.328	0.000	0.016	0.721
Female	-0.005	0.067	-0.017	0.001	0.001	0.904
Formal job (=1 if job is covered by IMSS, =0 otw)	0.023	0.000	-0.062	0.000	-0.009	0.107
Industry dummies						
Agriculture, fishing and hunting	0.0005	0.396	0.001	0.000	0.000	0.839
Mining	0.0002	0.455	0.004	0.000	0.000	0.659
Electricity, natural gas and water	0.0001	0.226	0.0002	0.416	0.0001	0.748
Manufacturing	0.021	0.000	0.005	0.264	-0.004	0.428
Construction	-0.006	0.000	0.034	0.000	0.004	0.256
Wholesale, retail, restaurants and hotels	-0.003	0.246	-0.009	0.063	-0.002	0.665
Transportation, storage and communications	0.006	0.000	-0.003	0.207	0.000	0.984
Finance, insurance and real state	-0.001	0.069	-0.002	0.221	0.000	0.872
Services	-0.017	0.000	-0.031	0.000	0.002	0.753
Firm size dummies						
5 or fewer employees	-0.018	0.000	0.050	0.000	0.008	0.116
6-10 employees	-0.002	0.235	0.001	0.738	0.000	0.928
11-15 employees	-0.001	0.577	-0.004	0.090	0.000	0.987
16-50 employees	-0.005	0.011	-0.021	0.000	-0.002	0.616
51-100 employees	-0.005	0.000	-0.016	0.000	-0.003	0.462
101-250 employees	-0.001	0.518	-0.009	0.002	-0.002	0.598
251 or more employees	0.031	0.000	-0.002	0.436	-0.003	0.394
Occupation dummies						
Professionals	-0.002	0.065	-0.008	0.000	-0.001	0.492
Technicians	-0.001	0.558	-0.003	0.144	0.002	0.480
Education workers	0.000	0.943	-0.003	0.063	0.001	0.483
Workers in the arts, entertainment and sports	-0.0004	0.315	-0.001	0.062	0.000	0.751
Officers and chief executives	0.0002	0.812	-0.002	0.036	0.000	0.919
Workers in agriculture	0.001	0.096	0.001	0.001	0.000	0.956
Production supervisors	0.004	0.000	-0.002	0.188	0.000	0.780
Production workers and operators	0.015	0.000	0.046	0.000	0.003	0.650
Administrative supervisors and managers	0.0001	0.943	-0.003	0.005	0.000	0.783
Administrative employees	-0.0004	0.831	-0.012	0.000	0.000	0.987
Traders and sellers in establishments	-0.008	0.000	0.004	0.322	-0.001	0.802
Street vendors	0.0002	0.220	0.0005	0.293	0.0003	0.464
Workers in personal services	0.0002	0.897	-0.009	0.007	0.000	0.915
Workers in domestic services	-0.009	0.000	-0.0002	0.522	0.0000	0.903
Security and surveillance workers (guards)	0.0005	0.673	-0.008	0.001	-0.002	0.482
Other	0.000	0.000	0.000	0.000	0.000	0.000
Worker herself answered survey	0.013	0.000	-0.008	0.105	0.003	0.529
Contract (=1 if the worker has a written contract, 0 otw)	0.020	0.000	-0.060	0.000	-0.006	0.278
Hours of work per week (usual)	-0.039	0.468	0.357	0.001	0.001	0.810
Hours of work in the previous week	0.023	0.687	0.364	0.001	0.001	0.807
Real hourly wage (usual work hours in YEAR pesos)	0.005	0.001	-0.010	0.000	0.002	0.324
Real hourly wage (hours worked previous week in YEAR pesos)	0.005	0.003	-0.010	0.000	0.003	0.300

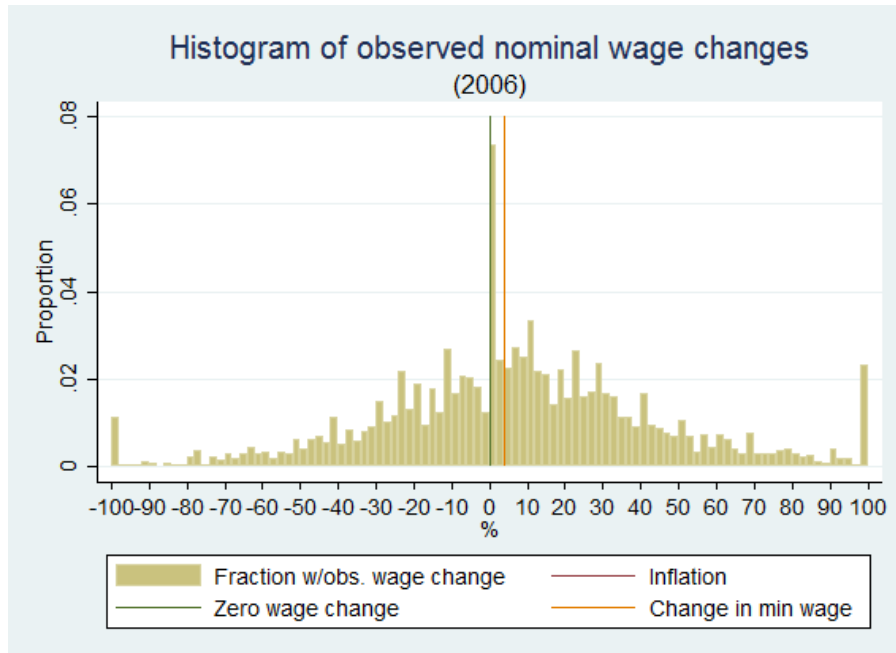
Note: Difference between the mean for the whole sample of cities and the 27 cities used in the estimation, which are consistently surveyed during the period 1996-2011. In all cases, the sample is of salaried workers in the private sector who work full time (30+ hours per week) and who did not change their industry and occupation between their first and fifth survey interview (a year). The reported p-value corresponds to the test for equality in means between samples.

Figure 1: Descriptive Evidence: Histogram, High-Inflation Year



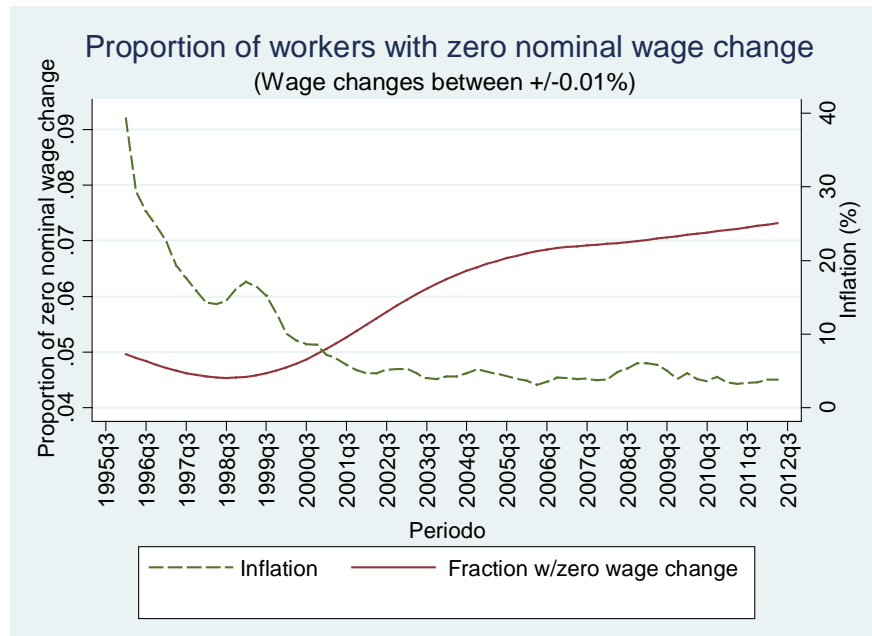
Note: Annual percentage change in nominal wage per hour for a sample of full-time, salaried workers in the private sector, who did not change their industry and occupation between their first and fifth interview, from ENEU.

Figure 2: Descriptive Evidence: Histogram, Low-Inflation Year



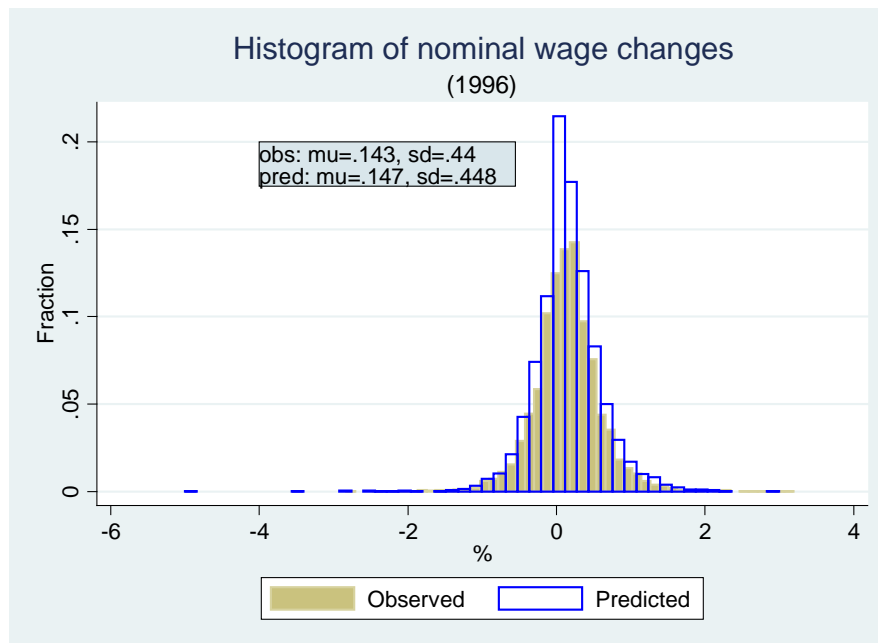
Note: Annual percentage change in nominal wage per hour for a sample of full-time, salaried workers in the private sector, who did not change their industry and occupation between their first and fifth interview, from ENOE.

Figure 3: Fraction of Zero Wage Changes Over Time



Note: The sample is composed of full-time, salaried workers in the private sector, who did not change their industry and occupation between their first and fifth interview, from ENEU (1995-2004) and ENOE (2005-2011). Inflation is measured as the annual percentage change in the National Consumer Price Index (INPC).

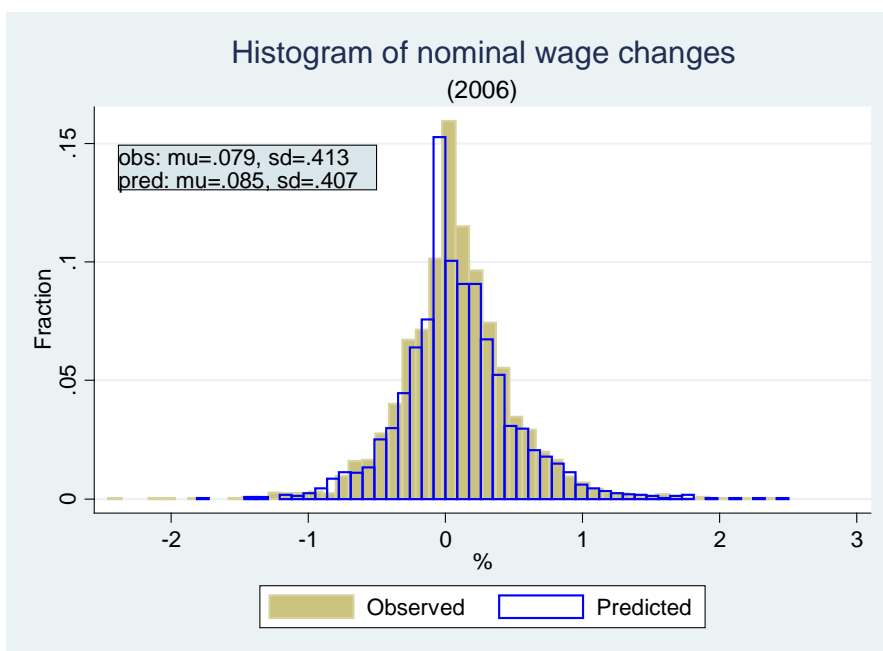
Figure 4: Performance of the model: High-inflation year



Note: The observed histogram is constructed as in Figure 1 using ENEU data. The predicted histogram comes from the estimation of the model.

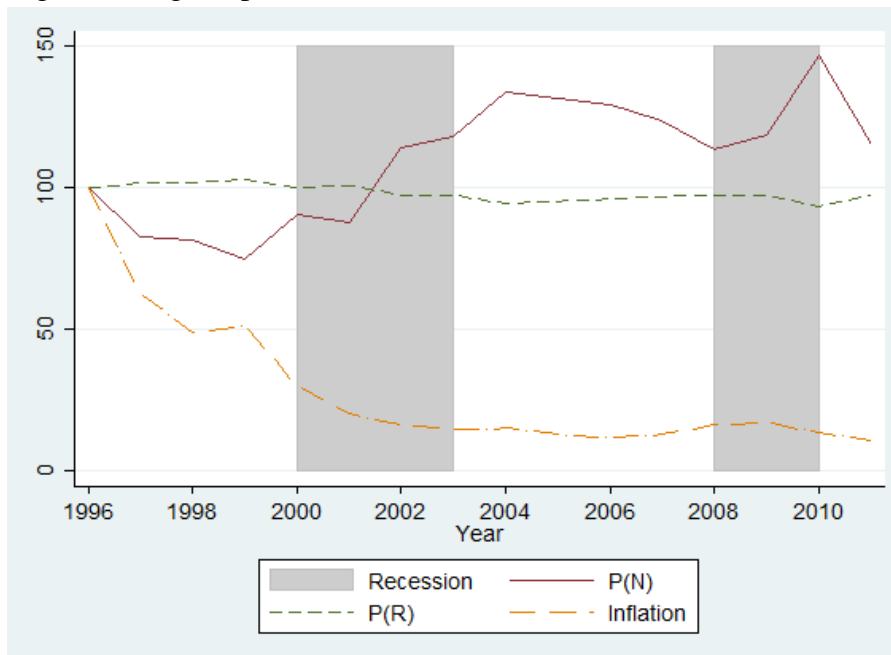


Figure 5: Performance of the model: Low-inflation year



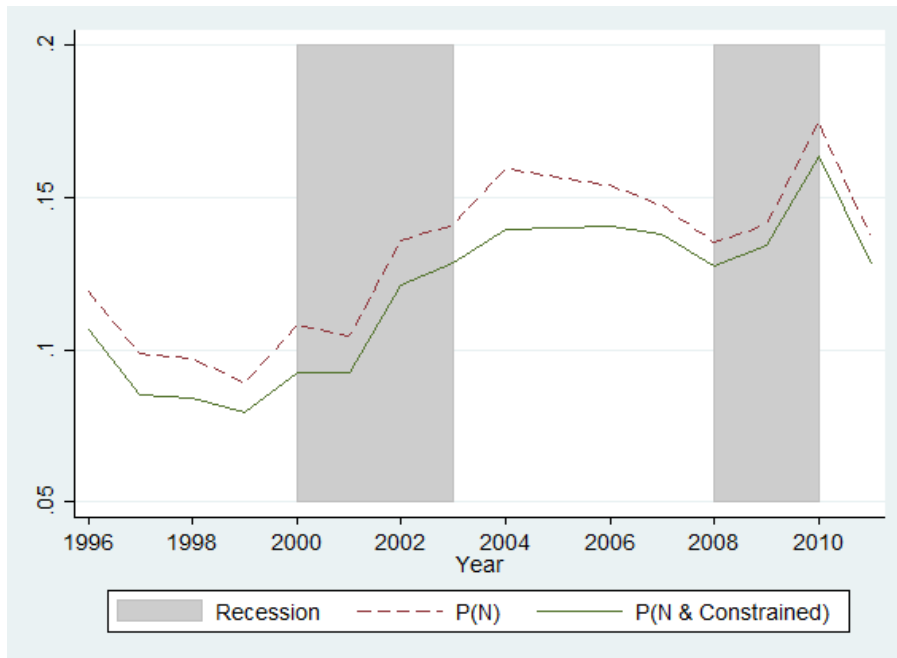
Note: The observed histogram is constructed as in Figure 2 using ENOE data. The predicted histogram comes from the estimation of the model.

Figure 6: Regime probabilities and inflation, (Normalized, 1996=100)



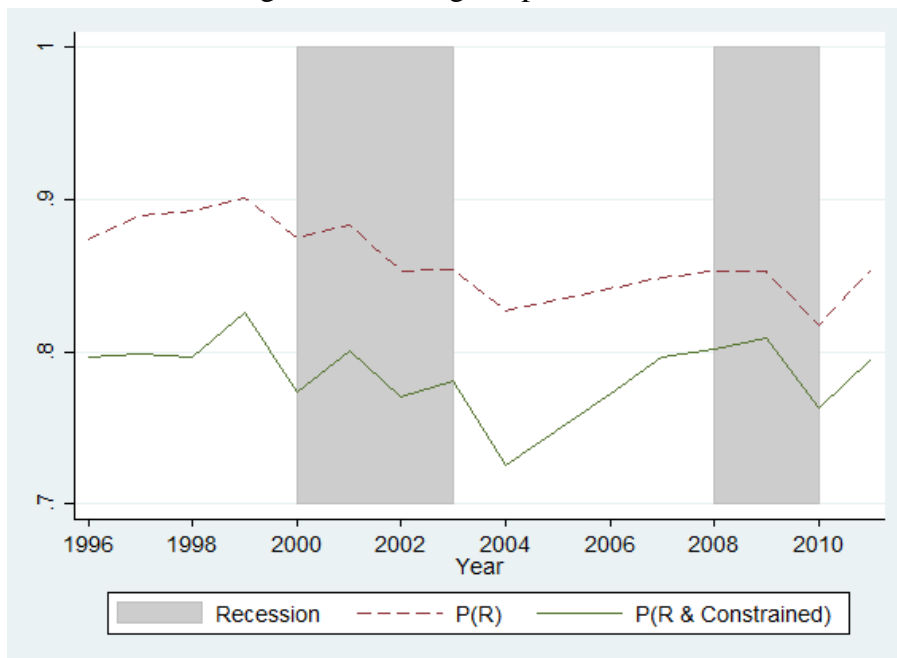
Note: P(N) and P(R) are the estimates for the probabilities of being in the nominal and real regime, respectively. Inflation is measured as the annual percentage change in the National Consumer Price Index (INPC). Recession years are those in which any of its quarters is part of a two-consecutive-quarters decline in real Mexican GDP. All variables are normalized to equal 100 in 1996.

Figure 7: Nominal regime probabilities



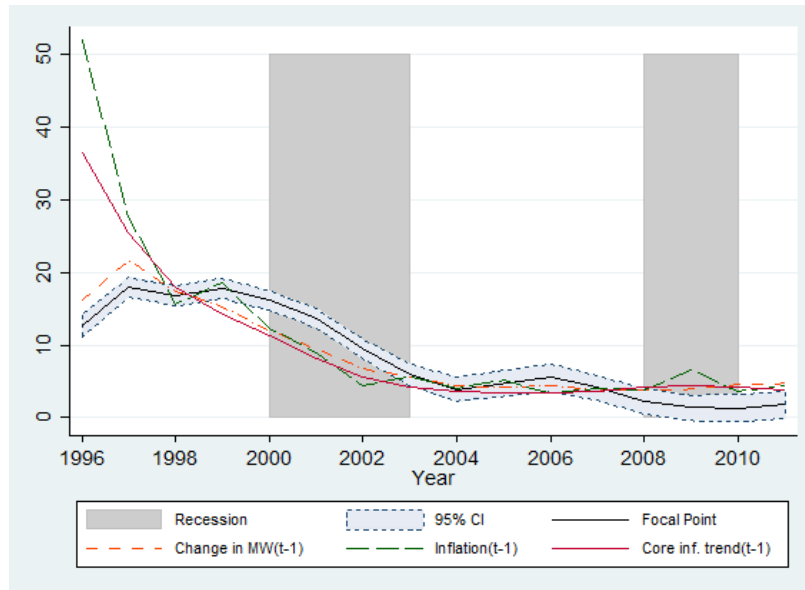
Note:  $P(N)$  and  $P(N \text{ \& Constrained})$  are the estimates for the probability of being in the nominal regime, and for the joint probability of being in that regime and constrained. Recession years are those in which any of its quarters is part of a two-consecutive-quarters decline in real Mexican GDP.

Figure 8: Real regime probabilities



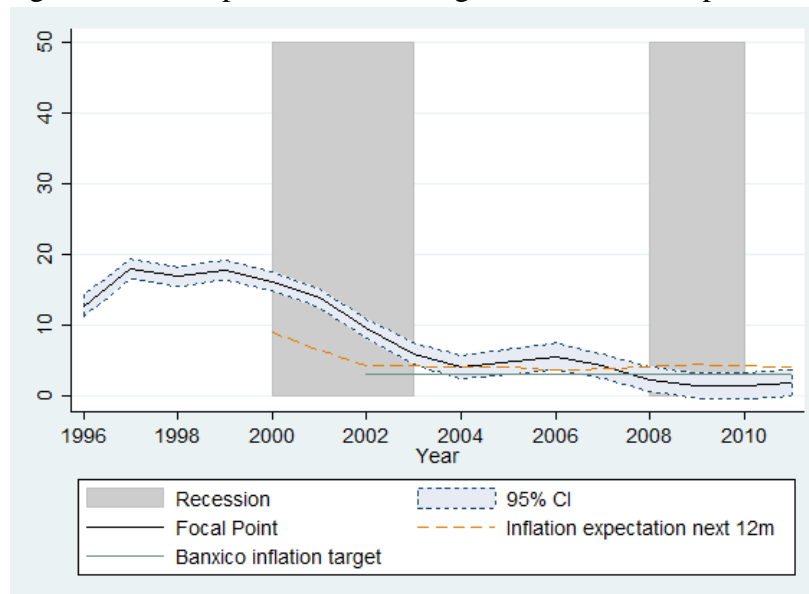
Note:  $P(R)$  and  $P(R \text{ \& Constrained})$  are the estimates for the probability of being in the real regime, and for the joint probability of being in that regime and constrained. Recession years are those in which any of its quarters is part of a two-consecutive-quarters decline in real Mexican GDP.

Figure 9a: Focal point, inflation (t-1) and change in the minimum wage (t-1)



Note: The focal point of wage negotiations is estimated by the model. Inflation is measured as the annual change in the National Consumer Price Index (INPC). The annual change in the minimum wage is from CONASAMI. The core inflation trend is calculated by applying a Hodrick-Prescott filter to core INPC inflation. Lagged values (t-1) are those for the previous year. Recession years are those in which any of its quarters is part of a two-consecutive-quarters decline in real Mexican GDP. All variables are expressed as percentage.

Figure 9b: Focal point, inflation target and inflation expectations



Note: The focal point of wage negotiations is estimated by the model. Banxico's inflation target is 3 percent since 2002. The inflation expectation is taken from a survey of private-sector economic analysts conducted by Banxico since 2000. All variables are expressed as percentage. Recession years are those in which any of its quarters is part of a two-consecutive-quarters decline in real Mexican GDP.

Figure 10: Probability of being in the real regime (robustness)



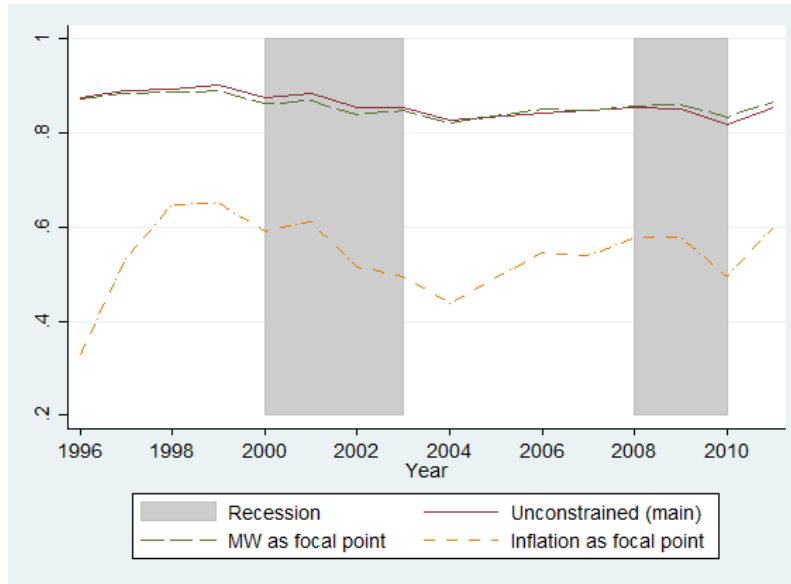
Note: The main results for  $P(R)$ , obtained using usual hours of work to calculate wage and no survey sampling weights, are compared to those obtained: (i) when using hours worked during the week before the survey and no sampling weights; (ii) when using usual work hours and sampling weights. Recession years are those in which any of its quarters is part of a two-consecutive-quarters decline in real Mexican GDP.

Figure 11: Focal point (robustness)



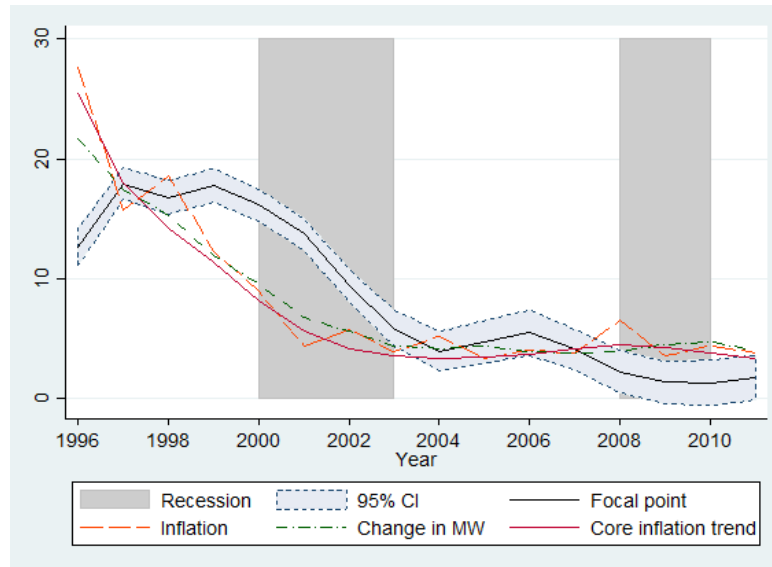
Note: The main results for the focal point of wage negotiations, obtained using usual hours of work to calculate wage and no survey sampling weights, are compared to those obtained: (i) when using hours worked during the week previous to the survey and no sampling weights; (ii) when using usual work hours and sampling weights. Recession years are those in which any of its quarters is part of a two-consecutive-quarters decline in real Mexican GDP. All variables are expressed as percentage.

Figure 12: Probability of being in the real regime when imposing the focal point



Note: The main results for  $P(R)$ , obtained when the focal point of wage negotiation is unconstrained are compared to those obtained when the lagged values of the following variables are imposed as focal points: (i) inflation; (ii) the change in the minimum wage. Recession years are those in which any of its quarters is part of a two-consecutive-quarters decline in real Mexican GDP.

Figure A1: Focal point, inflation (t) and change in the minimum wage (t)



Note: The focal point of wage negotiations is estimated by the model. Inflation is measured as the annual change in the National Consumer Price Index (INPC). The annual change in the minimum wage is from CONASAMI. The core inflation trend is calculated by applying a Hodrick-Prescott filter to core INPC inflation. Values (t) are those for the reported year. Recession years are those in which any of its quarters is part of a two-consecutive-quarters decline in real Mexican GDP. All variables are expressed as percentage.