

**CONTRACT STAGGERING AND  
UNEMPLOYMENT DURING THE GREAT  
RECESSION: EVIDENCE FROM SPAIN**

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# **CONTRACT STAGGERING AND UNEMPLOYMENT DURING THE GREAT RECESSION: EVIDENCE FROM SPAIN (\*)**

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## **Abstract**

We study the impact of (widespread) downward wage rigidity on the flows from employment to non-employment at the onset of the Great Recession. Downward wage (growth) rigidity is due to the fact that sector-level collective agreements in Spain are automatically extended to all firms, setting wage minima for workers in the same province-industry-skill cell. We identify the impact of wage rigidity on employment because, unlike settled ones, newly bargained contracts can adjust to aggregate shocks. Using the exact dates of bargaining periods of all sector-level contracts in Spain, we find that agreements reached after the fall of Lehman Brothers were for an average wage growth of 1.8%, while agreements signed before 15 September 2008 were for mean wage increases of 3.1%. Matching information on collective agreements with longitudinal Social Security records on workers, we document two findings. Firstly, the probability of job loss between 2009 and 2010 was 1 percent higher among workers covered by agreements signed before the fall of Lehman Brothers than among workers covered by contracts signed afterwards. Secondly, the analysis of a subsample of contracts with information about the exact province-industry-skill level minimum wage suggests that the impact of date of contract signature on wage changes and employment losses is confined to workers whose pre-recession earnings were below 1.2 times the contract-specific minimum wage. Those findings are consistent with the hypothesis that the staggering of contracts and the inability to renegotiate contracts amplify aggregate shocks. We end with a discussion of whether those results can be extrapolated to other sample periods.

**Keywords:** collective bargaining, labor demand, aggregate shock, wage rigidity.

**JEL classification:** J23, J50.

## Resumen

Una caída de la actividad agregada conlleva una reducción de la demanda de empleo, que es tanto mayor cuanto más rígidos sean los salarios. Este artículo examina el impacto de la rigidez salarial en España sobre la evolución del empleo entre 2009 y 2010. La extensión de los convenios colectivos de sector a todas las empresas en el ámbito negociado permite identificar a los trabajadores sujetos a salarios mínimos de sector —una fuente de rigidez salarial—. El grado de rigidez salarial varía entre ámbitos de negociación, ya que los convenios negociados tras una caída de la actividad agregada pueden ajustar los salarios pactados, lo que no es posible para los convenios ya firmados. Así, los convenios firmados tras la quiebra de Lehman Brothers pactaron un incremento salarial para 2009 inferior en 1,3 puntos porcentuales al acordado en los convenios firmados antes del 15 de septiembre de 2008. Si se enlazan datos individuales de trabajadores afiliados a la Seguridad Social con registros de convenios, se descubre que los trabajadores cuyo convenio de sector fue pactado antes de la caída de Lehman Brothers tuvieron una probabilidad de perder el empleo en 1 punto por ciento superior a la del resto. Las caídas en el empleo se concentraron en los trabajadores cuyo salario antes de la recesión estaba próximo a la tarifa de convenio. Esta evidencia sugiere que la dificultad para renegociar contratos amplifica el efecto sobre el empleo de las fluctuaciones en la demanda agregada. Finalmente, se discute en qué medida estos resultados se pueden extrapolar a otros períodos.

**Palabras clave:** demanda de trabajo, negociación colectiva, rigidez salarial, perturbaciones agregadas.

**Códigos JEL:** J23, J50.

## Introduction

The relevance of wage rigidity in generating employment fluctuations has been subject to considerable debate both in academic and policy circles during the last recession. Macroeconomic studies stress that binding wage contracts signed in different moments of the business cycle are a source of wage inflexibility that explains aggregate fluctuations in output and employment –see Gertler and Trigari (2008) or Olivei and Tenreyro (2007, 2010). However, the evidence regarding the degree of wage cyclicality and its impact on the allocation of labor is mixed.<sup>1</sup> In the policy arena, recent labor laws have been passed in Portugal, Greece or Spain with the explicit aim of facilitating wage adjustments. The rationale for such legal reforms was that the poor labor market performance in those economies was due to a high degree of wage rigidity –see OECD (2013).

This paper investigates empirically how widespread downward wage (growth) rigidity affected employment levels on the onset of the Great Recession. The source of wage rigidity stems from collective agreements bargained at the province-sector level that automatically apply to all firms in the bargaining unit –i.e., that are automatically extended. Those contracts specify minimum wage levels for ten skill groups for Spanish workers.

Our empirical strategy builds on the following insight from the macroeconomic literature: wage contracts are not renegotiated continuously, so the ability to adjust wage levels to aggregate shocks is confined to those employers and unions that bargain over new contracts. We use the fall of Lehman Brothers in September 15<sup>th</sup>, 2008 as an unanticipated demand shock that resulted in a large fall in employment.<sup>2</sup> At a time of heavy employment losses, wages in already settled contracts were unable to adjust downward, possibly leading firms to lay-off workers. On the contrary, contracts bargained at that time had the possibility of mitigating nominal wage growth, possibly softening unit labor costs and employment drops. In sum, the automatic extension of sector-level contracts, together with the difficulty of opting out from existing ones, generates substantial cross-sectional variation in the degree of wage rigidity. That cross-sectional variation in wage growth provides a unique opportunity to estimate the role of downward wage (growth) rigidity on employment destruction after a large fall in aggregate demand.

We use a register that contains all collective agreements signed in Spain. The dataset contains information about the wage growth settled in the contract, the duration of the bargaining period and the date of signature. The dataset permits inferring the information set that employers and unions can incorporate in their bargaining strategy.

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<sup>1</sup> See Elsby, Shin and Solon (2013) or Daly et al (2012) for a discussion about the relevance of compositional changes in accounting for wage changes over the business cycle.

<sup>2</sup> Total employment fell in Spain by 4% during the last *quarter* of 2008. To place the magnitude in perspective, the accumulated employment losses in the United States two *years* after the 2007 recession were 6%.

We then match the information on collective contracts with longitudinal information data from a four percent sample of Spanish Social Security records. The resulting matched sample permits estimating the effect on employment flows of downward wage (growth) rigidity.

The results suggest that between 2009 and 2010 wage growth and the probability of transition from employment to non-employment were significantly higher among workers covered by provincial agreements signed prior to the crisis than among the rest. An analysis with a subsample of collective contracts with information about minimum wage levels suggests that the impact of date of signature on wage growth and on the transitions into non-employment is heterogeneous and mainly due to workers whose pre-recession earnings were close to the minimum wages set in collective contracts.

Overall, our results are consistent with the hypothesis that the degree of wage rigidity generated by the automatic extension of provincial agreements and contract staggering amplified employment destruction between 2009 and 2010. We conduct several robustness checks to control for other factors that may correlate with the date of signature and employment and wage growth outcomes. Firstly, we use contract-level fixed effects that absorb any factor that affects all workers covered by the same collective contract. Those models identify the differential employment and wage outcomes of workers with pre-recession earnings close to the minimum wage in the collective agreement relative to workers whose pre-recession earnings are further away from the minimum. Comparing those differential outcomes across contracts signed before and after the fall of Lehman Brothers we can infer the impact of wage rigidity on employment outcomes. Secondly, we examine the particular case of construction, an industry where all province level agreements have set the same wage growth since 2002. We find no differential employment losses by date of contract signature in that industry, confirming that contracts with different signature dates but no differential wage growth do not feature differential employment losses. Overall, our findings suggest that contract staggering helps to propagate aggregate shocks by increasing flows into non-employment.

Our study contributes to the literature that assesses the extent of wage rigidity and its consequences. On one hand, a literature has inferred the relevance of wage rigidity by estimating the degree of cyclical of wage changes –see Haefke et al (2013) for the US, Martins et al. (2012) for Portugal or De la Roca (2012) for Spain. Those papers test of the cyclical of wages vary between new matches and incumbents, and adopt different strategies to control for the cyclical adjustment of match quality. Other studies infer wage rigidity from the distribution of longitudinal wage changes in administrative or survey data–see Altonji and Devereux (2000) or Dickens et al (2007).<sup>3</sup>

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<sup>3</sup> Elsby (2009) provides a critical review of that literature arguing that the existence of wage floors would generate persistently different wage drifts across countries. He builds and tests a model where firms anticipate a low probability of future wage cuts by reducing current wages. Such wage setting strategy mitigates the impact of wage rigidity.

However, those studies do not establish the impact of wage rigidities on employment outcomes. Among others, De Vicenti et al (2007) and Barwell and Sweitzer (2007) infer the impact of wage frictions on employment outcomes by comparing industries with a different level of (estimated) rigidity. Our study contributes to that literature in three dimensions. Firstly, the information about the bargaining periods of collective contracts naturally identifies the set of wages that are able to adjust to a large aggregate shock. Secondly, by using province-industry contracts, we can compare the degree of adjustment of wages set in the same three-digit industry across contracts bargained in different provinces. That is, we do not need to rely on cross-industry comparisons exclusively. Finally, we focus on the role of contract staggering, a widely used mechanism in the macroeconomic literature that features slow convergence to the wage levels desired by each firm and dispersion in wage growth. Other sources of wage rigidity –like absolute wage floors– would generate steady state differences in wages that are difficult to justify on theoretical grounds, see Elsbj (2009). Regarding the possibility of extrapolating our results to other economies or periods of time, we note that collective bargaining can be regarded as a particularly visible form of contract staggering, an institution that is not confined to European labor markets.

Finally, we contribute to the literature that assesses the role of explicit forms of wage rigidity in shaping employment outcomes. Martins (2014) conducts a longitudinal study of the evolution of firm-level employment levels in Portugal around the exact month when a collective contract is extended –i.e., when it becomes binding for all firms in the scope of the agreement. Guimaraes et al (2014), also using Portuguese data, compute the firm-specific increase in payroll that happens when a collective contract becomes binding for all firms –which they define as “upward nominal wage rigidity”. They find that one percent increase in payroll due to the extension of collective contracts reduce the number of employers in the firm by half a percentage point. Using Canadian data and a setup similar to ours, Card (1990) estimates the reaction of firm-level employment to changes in the real cost of labor caused by inflation surprises that do not translate into higher wages because contracts are already settled. We complement those studies by highlighting the role of collective contracts in amplifying the effects of a large aggregate shock. Furthermore, we study flows from employment into non-employment, a transition that is especially relevant from an aggregate perspective, because changes in firm’s employment levels include job-to-job changes that leave aggregate employment constant.

The study is structured as follows. Section 2 provides some institutional background and a framework for analysis. Section 3 describes the data and the empirical strategy. Section 4 details the empirical strategy. Section 5 describes the results using the full sample of provincial contracts and Section 6 focuses on a sample with information about minimum wage levels. Section 7 discusses whether or not the results can be extrapolated to other sample periods and Section 8 concludes.

## 2. Institutional Background

A salient feature of the Spanish system of industrial relations is that sectoral collective contracts bargained by employer federations and unions are extended to all firms in an industry. In other words, upon publication, the terms and conditions in a sectoral contract become binding for all employers within the scope of the agreement regardless of the rate of worker's unionization.<sup>4</sup> The conditions for such extension were originally laid out in the 1984 Worker's Act and require a minimum degree of representativeness of the bargaining parties. On the side of the employers, the Worker's Act requires that the employers in the federation employ at least 10% of workers in the sector. Furthermore, the Worker's Act requires that the unions that sign the agreement have as affiliates 10% of all employee representatives in the sector –see Ministerio de Trabajo (2008, 2012). Thus, despite a relatively low rate of union membership (about 15%), the coverage of collective bargaining in Spain is very high (above 75%, according to OECD, 2012). While the precise terms vary across countries, extensions also occur in Portugal, the Netherlands, Germany and other countries (see Du Caju et al., 2008).<sup>5</sup>

Extensions of sectoral contracts happen at various geographical levels. There are sectoral agreements covering employees the whole country, while the most disaggregated geographical level we are aware of is the municipality. However, the most common level of sectoral bargaining is the province. Card and De la Rica (2006) report that within the set of workers whose working conditions are covered by a collective agreement, 55% are subject to a province-sector one. There are 52 provinces in Spain, the average size being about one million inhabitants.

*The content:* Collective contracts establish not only minimum annual wages for a particular period, but also maximum working hours, the number of vacation days and the compensation for unusual working conditions, like extra time or night shifts. In principle, sectoral agreements could also regulate new hirings or the promotion of employees. However, it is typically argued that collective contracts mainly regulate wages and hours.

The extension procedure is achieved by publication in the Official State Gazette (*Boletín Oficial del Estado*), the same outlet where all legal acts are published. Publication guarantees that terms and conditions in a collective contract become binding for all firms in the sector. Furthermore, sectoral contracts establish minimum levels of annual earnings that vary according to each employee's skill level. Namely, whenever a new worker enters a firm, the employer must specify the position's skill requirement to

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<sup>4</sup> The procedure through which the contract becomes binding to all workers in the industry or region is called extension. The procedure varies across countries. In Portugal, once a contract is signed and made public, an explicit legal act must be issued to make it compulsory for all employers and employees. In Spain the contract becomes compulsory immediately upon publication.

<sup>5</sup> Bentolila and Dolado (1994), Bentolila, Izquierdo and Jimeno (2010), Izquierdo, Moral and Urtasun (2003) or Card and De La Rica (2006) describe the institutional setting in Spain. Guimaraes et al (2014) or Martins (2014) summarize the main features of the system in Portugal. For a broader description of collective contracting around the world, see Du Caju et al (2008).

determine the employee's contribution to the Social Insurance system. Collective contracts set minimum wages for each of those skill levels. Appendix Table A.1 provides an example of minimum wages set in the construction industry in Navarre in 2010. That collective contract establishes annual minimum wages for each skill level as well as its distribution in fourteen installments. We note that the monthly wages for the lowest skill group is 977 euros (fourth column, thirteenth row), well above the statutory minimum wage for that year (633 euros).

*Duration:* Contracts set working conditions for a pre-specified period. Contract duration varies over the business cycle, but among contracts signed in 2008 and 2009, 88% of all contracts had a validity period of two years at least. It is well known that infrequent bargaining may increase the degree of nominal inertia of the economy (Layard et al. 1991). In addition, it is not uncommon that the pre-specified validity period of a collective contract expires without unions and employers having reached the agreement to renew it. The interpretation by the Supreme Court in such cases is that all firms within the scope of the agreement are still subject to the working conditions and minimum wages set in the expired agreement –see Ministerio de Trabajo, 2008.

*Opting out clauses* The Worker's Act mentions some conditions that permit a particular firm to opt-out from a collective contract. Namely, in a period of economic hardship, opting out from a sectoral agreement is possible if both parties agree. If parties disagree, a joint committee in charge of supervising the agreement decides on the convenience of the opt-out (*Comisión de Seguimiento del Convenio Colectivo*). We are not aware of precise information about the number of successful opting out procedures during our sample periods, as estimates started to be published only in 2011. However, the latest two reforms in Spain in 2010 and 2012 attempted to determine verifiable conditions that permit opt-outs, the reason being that the procedure was cumbersome.<sup>6</sup>

On top of sectoral agreements, worker representatives and managers may negotiate wages and other working conditions in firm-level contracts. Around 15% of workers subject to an agreements are covered by firm-level agreements (according to the union's reports or Card and De la Rica 2006). Previous researchers have documented that firm-level contracting is most common among large firms and they set wages above the minimum in sectoral agreements.

We focus on sector contracts with provincial coverage for three reasons. Firstly, province-sector contracts achieve wide coverage through automatic extension, potentially generating aggregate wage rigidity. Secondly, theoretical models argue that rigidities generated by the intermediate level of bargaining are most likely to have allocative effects. The reason is that nationwide agreements internalize the impact of

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<sup>6</sup> Labor laws in 2010 and 2012 have attempted to facilitate the process of opting-out amidst considerable controversy. Opponents argue that attempts to facilitate opting out from collective contracts erode worker's bargaining power and boost wage inequality. Another reform in 2012 -outside our sample period- has facilitated the conditions under which a firm could temporarily deviate from a province level agreement.

wage growth, while firm-level bargaining is most responsive to idiosyncratic changes in the conditions of the worker and firm (see Calmfors and Driffill, 1988 or Jimeno and Thomas, 2013). Finally, two in 2010 and 2012 labor reforms in Spain have tried to weaken the automatic extension of sectoral agreements on the presumption that this contracting level prevents aggregate wage adjustments.

## 2.1 Framework

Consider a small firm that takes wages as exogenously fixed. The firm chooses employment levels so that the wage equals its marginal productivity –i.e., the firm has Right to Manage. A large aggregate demand shock such as the fall of Lehman Brothers translates fully into employment losses if the cost of labor remains fixed. However, if the bargained cost of labor fell as a response to the fall in aggregate demand, the reduction of the labor force would be mitigated –see Card (1990).

Following the previous example, collective contracts are not renegotiated on a continuous fashion, so firms under already settled agreements will experience severe employment losses after a large demand shock. In the data, those are the firms subject to contracts signed before the fall of Lehman Brothers. Conversely, the set of firms that can adjust to that aggregate shock provide a counterfactual employment growth under contract renegotiation –a set that we identify with those firms that are covered by collective contracts being bargained at the time of the shock. Under the assumption that all firms working in the same industry or region face (a) a similar demand shock and (b) similar technology, a comparison between the wage and employment changes of firms that are able to renegotiate contracts and those that are not permits recovering an estimate of the elasticity of the demand of labor with respect to its own wage.

Note that a key assumption here is that wages in collective agreements do adjust to aggregate shocks. Cahuc and Zybelberg (2004) review a set of static bargaining models between unions and employers where bargained wages do not react to changes in productivity.<sup>7</sup> Those models would not allow us to identify a labor demand curve. Alternatively, within a search and matching dynamic framework, newly bargained wages depend both on current and expected aggregate conditions. Koenig, et al (2014) discuss that the sensitivity of newly bargained wages to expected aggregate conditions falls with the interest rate but increases with the length of the contract. Among others, Gertler and Trigari (2008) and Olivei and Tenreyro (2007) successfully calibrate

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<sup>77</sup> In those models unions care about the earnings of employees and of the unemployed, while employers exert some degree of monopoly power in the product market. The employers have right to manage but bargain with the unions over wages. In equilibrium, wage levels are determined as a markup over the utility of leisure that depends on the wage elasticity of labor demand, the wage elasticity of firm profits and union's bargaining power. Demand shifters do not affect wages in such setting, and are fully absorbed by fluctuations in employment levels. Note that the prediction is testable by examining if contractual wage growth depends on the information set available at the date of signature.

macroeconomic models where the wage rigidities associated to contract staggering amplify aggregate shocks.<sup>8</sup>

We assess empirically the relevance of contract staggering by estimating reduced form models where the contractual and the actual wage growth depends on the information set available at the time of the renewal of collective contracts.

$$\Delta L_c = \gamma_0 + \gamma_1 \Omega_c + a_c + \varepsilon_c \quad (1)$$

$$\Delta w_c = \delta_0 + \delta_1 \Omega_c + a_c + u_c \quad (2)$$

Model (2) describes the determination of collective contract wages as a function of the information set available at the time of the signature ( $\Omega_c$ ), while Model (1) describes the evolution of the number of employees covered by the contract  $c$ .  $a_c$  is an unobserved demand shifter. Comparing  $\Delta w_c$  and  $\Delta L_c$  across contracts signed with different information sets -and holding  $a_c$  constant- one can identify the slope of the labor demand curve as the ratio between  $\gamma_1$  and  $\delta_1$ .

One can think of three caveats when interpreting (1) and (2) as a reduced form version of a labor demand curve at the sector level. Firstly, collective agreements only set minimum standards, so contractual wage growth mainly affects those employees whose earnings are initially close to the minimum. Secondly, there may be unobserved factors that correlate both with the date of signature and with the demand of labor, like local demand shocks. Thirdly, contracts may be applied in a more lax manner during a recession. We deal with each issue below.

Firstly, we use a subsample of contracts with information of the minimum contractual wage that allows us to identify those workers who are most likely to be affected by collective contract staggering. In particular, we can identify employees whose pre-recession earnings are closest to the minimum and who would be most likely to be displaced if the wage in the collective contract increases. Note that displacements would be composed mainly of existing matches with a very low surplus for the employer. However, it is not obvious how to identify the impact of collective contracts on job *creation*, because it is hard to identify workers most likely to be *hired* by an employer using pre-recession earnings.

Secondly, we use several strategies to estimate the local demand shocks embedded in the term  $a_c$ . The first strategy is to control for unrestricted province and three-digit industry dummies. In addition, when using employee-level outcomes we can also use contract-specific fixed effects –effectively, a fixed effect that interacts unrestricted province and three-digit industry dummies. Contract-level fixed effects absorb any trend that affects all workers covered by a collective contract. Still, we can identify the impact of wage rigidity on employment outcomes by comparing workers

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<sup>8</sup> We use the term “contract staggering” to denote the coexistence in each moment of time of different contracts stipulating different wage settlements because they were signed under very different economic conditions.

whose pre-recession earnings were close to the minimum wage to workers covered by the same collective contract but whose earnings are further away from the minimum. If the dispersion of wages induced by collective contract staggering matters, job losses will be most prevalent –in relative terms- among workers close to the minimum *and* who are covered by contract signed before the fall of Lehman Brothers.

A third concern is that we do not have information on the number of firms that opted out from the agreement during the sample period or about the degree of enforcement of contracts during a recession. We can test however for the prevalence of “informal” opt-outs by examining actual wage growth among job stayers. The idea is that if informal opting out procedures were prevalent in the data, the wage growth of job stayers should depend neither on the contract signature date nor on the distance of pre-recession earnings from the minimum wage.

A separate concern refers to the endogeneity of the date of signature. Danziger and Neuman (2005) show that uncertainty may cause unions and employers to delay the renewal of collective contracts. We assume that unions and employer federations could not postpone reaching agreements in anticipation of Lehman Brothers’ fall - and provide evidence in support of that assumption. However, it is possible that, once the shock occurred, the variation in the date of signature is determined by idiosyncratic expectations about the duration and the severity of the recession. In what follows, we treat as exogenous whether or not an agreement was reached before or after Lehman Brothers fall, but the exact date of the agreement, if it happened after September 15<sup>th</sup> 2008, is not necessarily exogenous.

### 3. Data

We use two main datasets. The first is the Census of Collective Agreements signed in Spain between 1990 and 2010 – the *Registro de Convenios y Acuerdos Colectivos*. The second is a 4% sample of all employees with an active record with the Social Security in 2010. The sample is *Muestra Continua de Vidas Laborales 2010 - MCVL* (Continuous Sample of Working Histories, CSWH 2010). We describe each source now.

Collective agreements must be registered at the Ministry of Labor using a pre-specified form to obtain legal validity. The form includes the type of agreement (sector or firm-specific), the period of validity and the agreed wage increase for that period. About 64% of contracts signed specify an ex-post adjustment if realized inflation exceeded a threshold specified in the contract. In such case, the staff of the Ministry updates the wage growth after communication with the unions and employer federations. In addition, the form includes an estimate of the number of workers covered by the agreement, as well as the industrial and geographical coverage (nation, region, province or municipality). Particularly important for the purpose of the study, the Census of agreements includes information on the bargaining period and the day in which the agreement was signed. Other information in the form is not always filled. In

particular, about 40% of forms included the skill-specific minimum wage in the agreements signed between 1994 and 2001. We updated that information to 2007 using the information in the agreement about annual wage growth.

The second sample is drawn from the *Continuous Sample of Working Histories* (CSWH), a register that collects monthly information on the employment status, the earnings and the skill level of each worker who had an active record with the Social Security System at some time in 2010.<sup>9</sup> The information is recorded electronically and includes each worker's retrospective labor market history –potentially, dating back to 1988.

The CSWH has a longitudinal design. In particular, the sample tracks any individual who is present in one of the 2005-2010 waves and who remains registered with the Social Security Administration. In addition, the sample is refreshed with new sample members so it is still representative of the population in each wave (Bonhomme and Hospido, 2012). We complement the 2010 CSWH with the labor market history of any individual who has ever been present in the sample between 2005 and 2009, to avoid possible sample selection biases caused by workers who left the labor market between the last quarter of 2008 and the first quarter of 2009.

### 3.1. Linking Datasets

The Register of Collective Agreements contains information about the province and the two-digit industry of the agreement. We read the text of provincial agreements to assign an industry at the three digit level. We then matched the Register of Collective Agreements and the Social Security records using the three-digit industry of economic activity and the province where the individual worked in 2008.<sup>10</sup>

#### *Sample coverage*

Our sample is composed of all employees in a province and industry cell where a sectorial agreement exists. The sample covers 50% of all employees in the Social Security sample.<sup>11</sup> The remaining 50% of the sample contains different cases. The first group excluded contains employees who are not covered by any collective contract.

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<sup>9</sup> Each worker with a record in the Social Security records is assigned a skill level by his or her employer –out from a list of 11 possible levels. In principle, the first two skill levels (1 and 2) are reserved to workers with college degree. However, employers may not grant that level to all college workers if the position does not require a high degree of qualification. Levels 3-8 denote lower qualification levels, while the latter two groups correspond to unskilled workers (laborers). The 11<sup>th</sup> group is reserved for workers below 18 years of age. Collective agreements use the same classification to establish minimum wage levels.

<sup>10</sup> In those cases when there are several provincial agreements in a given industry at the three-digit level, we have assigned to all the individuals in that particular cell the agreement that covered a higher number of workers.

<sup>11</sup> The summary statistics are provided in Table 1. The matched sample in that Table is not 50% of total records because of our restriction to job stayers in 2008.

According to the OECD, about 20-25% of Spanish employees are not covered by any collective contract. The second group excluded are workers in industries covered exclusively by nation or region-level contracts.<sup>12</sup> For example, 5% of the employees in Social Security records work in Financial Services or in Real Estate – shown in the first column of Table 1. However, those industries are only covered by nation-level contracts, so workers in Finance are not in our sample. Finally, specific two- or three-digit industries are not covered by any provincial contract.

The focus on collective agreements is not overly restrictive. Firstly, agreements bargained at the province level tend to “improve” the conditions settled in wider agreements either at the national or regional level. Secondly, as already mentioned, the province-industry level is the most prevalent bargaining unit, as it regulates the working conditions of 55% of all workers covered by any collective contract.<sup>13</sup> Importantly, the variation of wage settlements across provinces and industries permits controlling for separate effects of provinces and three-digit industry.<sup>14</sup>

We use all employees covered by provincial contracts with a validity period that spans 2009. We also require workers to be continuously employed in the firm since the day when the oldest agreement in the sample was signed until the last day of 2008. That restriction insures that we examine workers with a similar working history at the very beginning of the recession –i.e., they all have accumulated at least one year of tenure.<sup>15</sup> For that reason, we use collective contracts spanning 2009 that were signed between October 1st, 2007 and April 1st 2010. Including contracts signed earlier like, say, during the first quarter of 2007 would require us to use a sample of employees working in the firm already in 2006. A third of the working force in Spain is hired with fixed-term contracts, so using a sample of job stayers from January 1st 2007 to December 2008 would bias the sample excessively toward workers with high firing costs contracts.

### 3.2 Final dataset.

We restricted the sample to workers –males or females- between 18 and 57 years of age in December 2007 and who had been employed at the firm since at least the last quarter of 2007. The resulting sample includes 116,306 workers. 17.6% of workers in the sample are high-skilled, 23% are mid-skilled and 59% are low-skilled. On the other

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<sup>12</sup> While there are 52 provinces in Spain, there are only 17 regions, or Autonomous Communities. Not all the regions (Autonomous Communities) have their own agreement

<sup>13</sup> See Izquierdo, Moral and Urtasun (2003) or Bentolila, Izquierdo and Jimeno (2010)

<sup>14</sup> Note that some of the workers in our sample will work in firms with their own collective contract. We cannot identify those workers because the CSWH lacks firm identifiers. However, firm level contracts typically improve the working conditions settled in province-sector ones, so those workers still comply with the contracts we examine.

<sup>15</sup> Employment destruction started in Spain the third quarter of 2007, but net losses were very small until the last quarter of 2008.

hand, the vast majority of workers in the sample (87%) is covered by an open-ended –or high firing cost- individual contract. The mean of the agreed wage increase for the collective contracts signed in 2008 with economic effect in 2009 was 310 basis points. The corresponding wage growth among agreements signed after the fall of Lehman Brothers was 186 basis points. Table 1 provides some summary statistics of the whole sample of employees in Social Security records –first column- and the sample we use after applying our sample selection criteria –second column. Finally, the last two columns compare the characteristics of workers in contracts that signed an agreement before or after September 15<sup>th</sup>, 2008.

Note that there are some differences across workers covered by contracts signed before and after the fall of Lehman Brothers, possibly due to the weight of construction and the Food & Accommodation industries among the “early signers” sample. Column 5 shows that controlling for province and industry dummies, the differences are small and not statistically significant in magnitude.

### **3.3 Subsample with information on collective agreement wage levels**

Unions and employers filling the form stopped recording minimum wages in the forms they submitted to the Register of Collective Agreements as of 2001.<sup>16</sup> For the period spanning 1994-2001, the basic wage by skill level was available for about 40% of contracts. Using the revised agreed wage growth (the ex-post agreed wage increase corrected by inflation) from 2002 to 2008 we have computed the minimum wages in 551 out of the 1305 provincial agreements binding as of 2008. In all cases, the wage level is available for the groups of the Spanish Social Security System: 1 and 2 (High Skilled), 4, 5, and 6 (Medium Skilled) and 10 (Low Skilled). The characteristics of the sample that includes contract-specific wage minima are presented in Tables 2 and A.2.

We note that construction is overrepresented in the sample with collective agreements, as it accounts for 30% of workers potentially covered by a sectorial agreement, while it is 20% in the matched sample of Social Security records and Collective Agreements. Furthermore, construction (Business Services, Health and Education) is even more (less) represented in the sample of contracts signed before the fall of Lehman Brothers. We discuss how we deal with that issue below, but it is important to keep in mind that construction cannot drive our results because since 2002 wage growth has been exactly the same across all provincial agreements in that industry –regardless of the date of signature of the provincial contract.

#### *Summary statistics of the sample with minimum wage levels*

Table 2 compares workers’ earnings in December 2007 to the minimum in their agreement for their skill group. We find some slippage, as about 10% of workers have wages below the collective agreement minimum. Some of those workers work part-time

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<sup>16</sup> The minimum wage is still compulsory, and it is published in the Official Bulletin as a regular Legal Act. Table A.1 is obtained from such Bulletin.

or may be upon special contracts –like unskilled youth- that permit earnings below the minimum in the agreement.

In December 2007, 8.4% of workers had gross earnings between 1 and 1.1 times the minimum. 11% of workers in the sample with wage minima have earnings between 1.1 and 1.2 times the minimum. Half of the workers in the sample had monthly earnings 1.4 times the minimum or higher. Table A.2 provides information about that distribution by industry and skill level.

Figure 2 casts additional light on the set of workers who are most affected by collective agreements. In particular, we show the distribution of nominal wages for the construction sector in Madrid and Barcelona for laborers (group 10, according to the Social Security classification) and foremen (group 8). Each graph includes a vertical line indicating the base wage in the collective agreement for the specific skill level - computed as explained above. The level of the wages set in collective contracts are binding for laborers -low skilled workers- but it becomes less binding for foremen. We did not include the histogram for the highest skill level (architects) for whom collective agreement wages are not binding at all.

Two points are worth noting. Firstly, the graphs show the distribution of wages after a long expansion. Typically, minimum wages in collective agreements become especially binding during a recession. Lacuesta et al (2012) document similar histograms in 1995 (i.e, soon after the 1993 recession) showing that minimum wages were binding in that period. Secondly, Table A.2 documents that collective agreements are specially binding in Construction and Food and Accommodation, but less so in Manufacturing or Business Services. That pattern is similar to the evidence about the bite of minimum wages in the United States, for example.

#### **4. Empirical strategy**

We estimate models of the transition from employment to unemployment as a function of the exact date when the corresponding collective contract was signed.<sup>17</sup> As suggested in the descriptive statistics of Table 1, contracts signed in different periods settle different wage changes. Therefore, firms in the same industry (province) in 2009 were subject to a different degree of “nominal wage push” depending on whether their collective contract was signed early in 2008 (when the full extent of employment destruction was hard to predict) or in 2009 -when bargaining parties could have observed accumulated employment losses of about 8%. The parameter of interest can

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<sup>17</sup> There are several forms of employment changes we could study. One such form is employment changes at the sector level. However, those outcomes may merely reflect reshuffling of workers across firms if workers basically leave sectors with an increase in labor costs to work in sector or firms with lower labor costs. Conversely, flows from employment to unemployment do not reflect reshuffling of workers across firms that leave total employment unaffected.

therefore be interpreted as the slope of a province-industry level "demand curve": higher wage increases should increase the probability of becoming unemployed in 2009.<sup>18</sup>

Hence, we use variation in the date when the contract was signed, interacted with the distance to the minimum wage floor. We fit the following Linear Probability Model:

$$Y_{i,s,p} = \alpha_0 + \sum_{k=k_1}^{k=k_3} \alpha_k 1(\text{signed } 2008_{s,p}) * 1(W_{i,s,p}^{2007} \leq kW_{s,p,g}) * 1(W_{i,s,p}^{2007} \leq kW_{s,p,g}) + \sum_{k=1}^{k=3} \alpha_k + \beta X_{i,s,p} + \theta_{s,p} + \varepsilon_{i,s,p} \quad (3)$$

$Y_{i,s,p}$  is the outcome of interest (wage growth in 2009 or employment losses in that year, described below).  $1(\text{signed } 2008_{s,p})$  is an indicator that takes value 1 if the collective contract was signed before September 15th, 2008 and 0 otherwise. The function indicates whether the wage increase settled for 2009 depends on the change in the information set of bargaining units after the fall of Lehman Brothers. We documented below that wage growth was higher than average among collective contracts signed before that date.

$1(W_{i,s,p}^{2007} \leq kW_{s,p,g})$  indicates the distance between the earnings of the worker in December 2007 and the collective agreement minimum. We experiment with three step functions: wages that are 1.1 times the minimum wage for the skill group (i.e., 10% above that minimum), between 1.1 and 1.2 times, and between 1.2 and 1.4 times the minimum wage. The omitted group are workers whose earnings in December 2007 were at least 1.4 times the minimum wage in the agreement.

Finally, we control for industry and province specific determinants of wage growth and employment losses by including 50 provincial dummies and three-digit industry indicators. As mentioned above, we include in some specifications a collective contract-specific fixed effect  $\theta_{s,p}$ . The latter term is an interaction of province and three-digit industry dummies that absorbs any trend in wage growth or employment destruction that affects all workers covered by the agreement. All models also control for nine dummies denoting the skill level of the worker -because minimum wages in collective contracts are specific for each skill group, as Table A.1 shows. Finally,  $X$  collects worker-level characteristics such as five age dummies in ten year bands and an indicator of whether the workers is covered by an open-ended or a fixed-term contract –

<sup>18</sup> One may expect the presence of demand shocks that simultaneously affect employment and wages. For example, the construction industry experienced a severe drop in 2008, and that drop was likely to have propagated to industries that provide inputs for the sector. In the presence of industry-specific demand shocks, an OLS specification linking transitions into unemployment to observed wage increases would be biased.

a measure of the severance payment and the firing costs that a firm must incur to lay-off a worker.

In the first stage, the dependent variable is yearly wage growth between December 2009 and December 2008:  $\Delta \log(W_{i,2009}) = \log(W_{i,2009.12}) - \log(W_{i,2008.12})$ . The main aim of this specification is to test if changes in wage settlements were most binding for workers whose wages in December 2007 were closest to the minimum. The sample used only contains full-time employees who stay in the firm in 2008 and whose earnings are not below the maximum contribution to the Social Security system.

The second specification uses as the dependent variable an indicator of whether the employee transitioned from employment into unemployment at some point in time between 2009 and 2010.<sup>19</sup> Namely, we use indicators of monthly transitions into unemployment, of whether the workers experienced at least 3 months of unemployment between 2009 and 2010 as well as an indicator of the fraction of days not worked during the 2009-2010 period. Models with flows from employment into unemployment as a dependent variable estimate Intention-To-Treat parameters that measure whether workers whose wage was closest to the statutory minimum and were covered by contracts signed before September 15<sup>th</sup> 2008 had a higher chance of transitioning into non-employment –relative to workers similarly close to their agreement floor but whose contract was signed in 2009.

The coefficient of interest is  $\alpha_1$ . Given the discussion about the degree of anticipation of the magnitude of employment destruction in the last quarter of 2008 a positive value of  $\alpha_1$  in the first-stage indicates that bargained wages adjust to the business cycle. That is, agreements signed before September 2008 settled higher wage increases than contracts settled in the early months of 2009. In addition those wage increases must have been especially relevant for workers whose wage was already close to the statutory minimum in their province-industry-skill group cell. Similarly, under the assumption of a downward sloping labor demand, workers covered by agreements settled in 2008 and close to the statutory minimum must have had a high chance of losing their job, because their employers would have experienced larger wage costs than the rest.

Figure 3 illustrates the identification strategy by means of an example. The Figure displays the histogram of monthly wages of waiters in December 2008 in two different provinces (Valencia and Granada). The vertical line at the left in each graph denotes the statutory minimum wage in the relevant province-industry-skill group. Employees and employers in Valencia signed their collective contract in 2007 and settled a 5% wage increase for 2009 -thus raising the statutory minimum from the first to the second vertical line. That is, restaurants and hotels in Valencia employing workers with earnings in 2007 between both statutory wages faced a 5% increase in the

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<sup>19</sup> Unemployment is defined not working for 15 days during the month, but maintaining the link with Social Security System. We use the terms unemployment and non-employment interchangeably.

payroll during 2009. Conversely, the collective contract for Food and Accommodation in Granada expired in December 2008 and no agreement was reached until 2010 -thus leaving the minimum wage in Granada unchanged. Unlike their counterparts in Valencia, owners of restaurants in Granada employing waiters whose earnings were close to the statutory minima faced no obligation of increasing their wage bill.

Under the assumption of a downward sloping labor demand, waiters in Valencia with earnings in December 2008 below 1.05 times the statutory minimum wage for 2008 should have experienced wage increases during the Great recession. Had such 5% increase been especially costly for employers, waiters in Valencia around the minimum wage must have had a higher chance of losing their job than waiters similarly close to the statutory minimum in Granada -where no wage increase was compulsory for employers. Our identifying assumption is that changes in wages agreed in the second case are due to more information about the amount of employment destruction during the 2008-2009 recession and do not reflect industry-province specific effects which are correlated with the date of signature and affect workers differentially by how close their statutory wage was from the minimum.

## 5. Results using the full sample

A central element of our empirical strategy amounts to determining the timing of an aggregate shock that is observable to all bargaining parties -i.e., the moment when unions and employers perceived a turning point in activity. We use the Lehman Brothers fall in September 15th, 2008 as the date of such turning point. That event arguably caused a disruption in the working of financial markets, and was possibly unanticipated by most agents in the economy.<sup>20</sup>

We provide evidence for a change in the growth in wages settled for 2009 in collective agreements signed around September 15th, 2008. We examine wage growth as settled in all province-industry contracts, as a function of the quarter when the contract was signed. We consider 5 quarters before Lehman Brothers and 6 quarters afterwards. The regression we run is the following:

$$\log(\Delta W_{s,p}^{2009}) = \gamma_0 + \sum_{s=1}^{s=N} \gamma_s D_s + \sum_{p=1}^{p=49} \delta_p D_p + \sum_{q=-5}^{q=6} \pi_q 1(\text{signature}_q) + \varepsilon_{s,p} \quad (4)$$

$\log(\Delta W_{s,p}^{2009})$  is the nominal wage growth settled in the agreement for sector  $s$  and province  $p$  for 2009.  $D_s$  is a (three-digit) industry fixed effect,  $D_p$  is a province-specific fixed effect and  $1(\text{signature}_q)$  indicates if the contract was signed in quarter  $q$ . Collective contracts signed between September 1<sup>st</sup> and September 15<sup>th</sup> 2008 are coded as if signed in the third quarter of 2008. We do not include an indicator for contracts signed in 2007q4, the reference period. The regression uses the matched

<sup>20</sup> Among other authors, Hudomiet et al (2011) document that the expectations of US households regarding future stock market returns changed around late 2008.

Social Security Sample-Register of Collective Contracts sample, which is equivalent to running the regression using contract-level data, but weighting each contract by the share in total employment of each industry-province cell.<sup>21</sup>

Figure 1 plots the set of estimated coefficients  $\pi_q$ , along with their standard errors -corrected for heteroscedasticity and arbitrary correlation across workers covered by the same collective agreement. Wage settlements effective in 2009 were very similar for all contracts signed in 2007q4 through 2008q3. However, contracts signed in 2008q4 settled a wage increase 50bp lower than those settled a quarter before. Figure 1 also shows that contracts signed later in 2009 and early 2010 settled progressively smaller wage increases. For example, wage settlements for 2009 signed retrospectively in 2010q2 included wage growth 150bp lower than those signed in 2008q3.

We make two notes. Firstly, the equation models cross-sectional dispersion in nominal wage growth in 2009 as a function of the date of signature –i.e., there is no time variation involved in Model (4) and we do not adjust for inflation. Secondly, the lower wage growth in agreements signed later in 2010 does not necessarily imply that the adjustment of wages was sluggish. As mentioned above, the date of signature after a large shock may well be endogenous. For example, shortly after the fall of Lehman Brothers, unions and employers may have faced a considerably degree of uncertainty about the magnitude and duration of the recession. In such circumstances, some bargaining units may have chosen not to renegotiate the agreement. In the context of the practice of bargaining in Spain, a short delay in contract renegotiation freezes nominal wages at the levels specified in the expired agreement, an interim solution while uncertainty is resolved. Hence, after September 1th 2008, the profile of wage settlements by quarter of signature may just reflect heterogeneity in the duration of waiting periods –see Danziger and Neuman (2005).

In sum, the staggering of labor contracts caused substantial variation of wage growth across industries and provinces in 2009, forcing some employers to apply wage increases that reflected the situation in 2007q4 while other employers could apply lower wage increases. Furthermore, as we document shortly, the wage growth of job stayers suggests that those settlements were binding.

### 5.1. Employment outcomes, full sample.

We examine the impact of differential wage growth on employment outcomes by running separate versions of Model (3) using two different dependent variables. The first is a month-by-month regression of the probability that a job stayer during 2008 transits from employment into non-employment between 2009 and 2010. The covariates are  $1(\text{signed } 2008_{s,p})$  and a full set of industry and province dummies. The second regression is a month-by-month regression with the same covariates but the dependent

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<sup>21</sup> The dependent variable (nominal wage growth) is contract-specific, so it does not vary across workers. We have also ran the model using 1305 contracts, and the results are the same.

variable is a dummy that takes value one if a job stayer in 2008 is not employed.<sup>22</sup> The first model captures short run employment dynamics, while the second reflects medium run outcomes.

The point estimates of those regressions, along with each 95% confidence interval, are plotted in Figure 4. The differential rate of monthly job destruction among workers in collective contracts signed before September 15<sup>th</sup> 2008 fluctuates from month to month, becoming positive and statistically significant at the 10 percent level in June and September –see the top panel of Figure 4. The bottom panel of Figure 4 examines if the monthly job destruction rate translates into a higher non-employment rate. The fraction of workers covered in 2009 by a contract signed before September 15<sup>th</sup> 2008 who are not employed increases steadily, experiencing spikes in the same months where job destruction peaks. By the end of 2010, workers under agreements signed before the fall of Lehman Brothers were about 1% more likely to be non-employed than workers covered by an agreement signed afterwards. That result is consistent with the notion that wage dispersion brought about by contract staggering and the inability to opt out resulted in persistent job losses.<sup>23</sup>

## 6. Wage and Employment responses close to the minimum.

### 6.1 Wage responses

We determine how binding collective contracts were during 2009 and 2010. Table 3 shows the estimates of Model 3 when the dependent variable is the individual's wage growth computed between December 2008 and December 2009. The sample is restricted to workers who stay in their job in 2009 (and 2008) and who worked full time in both months. We also excluded workers whose earnings were censored at the Social Security maximum contribution.

Table 3 examines wage growth for workers whose monthly earnings were at most 10% higher than the statutory minimum in the province-industry-skill group cell, between 10% and 20% or between 20% and 40%. The omitted group are workers whose monthly earnings in December 2007 were 40% higher than the minimum in the collective agreement. Note that  $1(\text{signed } 2008_{s,p})$  is not identified in models that include agreement-level fixed effects. However, the interaction of the date of signature and the distance to the minimum in the collective agreement is identified.

The estimates in the fourth row, first column of Table 3 suggest that wage growth among job stayers whose earnings in December 2007 were very close to the

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<sup>22</sup> The variable takes value 1 if the worker was worked less than fifteen days during the month and zero otherwise.

<sup>23</sup> Employment losses are persistent in the sense that, as a group, workers signing their collective contract before September 15<sup>th</sup> are less likely to be employed in late 2010 than employees covered by contracts that could adjust. Model (3) cannot measure if contract staggering generates persistent individual job losses –i.e., if they generate Long Term Unemployment. To study such outcomes, we would need a duration model that explicitly models state dependence and multiple transitions.

collective contract minimum wage was 1.86 percentage points higher than wage growth in the omitted group. Such pattern can be partly attributed to mean reversion –wages originally close to the agreement minimum cannot fall much. However, wage growth was especially high among those workers close to the minimum in December 2007 and whose collective contract was signed before September 15<sup>th</sup>, 2008. The coefficient, shown in Table 3, column 1 row 1, is .010 (standard error: .0042). That is, wage growth was 2.86 percent ( $=.01+.0186$ ) among job stayers with earnings close to the minimum in contracts signed before Lehman Brothers. That pattern is consistent with the notion that newly signed contracts signed after a large aggregate shock settle low wage increases, and those are binding. The estimate is remarkably similar in magnitude when we control for collective agreement fixed effects, suggesting that sample selection or idiosyncratic shocks affecting province-industry cells do not play a large role in determining wage growth.

The validity period of most contracts signed before September 15<sup>th</sup> 2008 spanned both 2009 and 2010, so the wage growth among those settlements is also likely to be higher in 2010 than that among contracts signed afterwards. The estimates in the third column, first row of Table 3 confirm that hypothesis: wage growth between 2008 and 2010 was 1.76 percent higher among contracts signed before September 15<sup>th</sup> 2008. Crucially workers whose monthly earnings in December 2007 were at least 20% higher than the collective contract minimum experienced rather similar wage growth - regardless of the date of signature. Such pattern confirms that collective agreements mainly affect the evolution of minimum wages in the skill-province-industry group. One could argue that fairness considerations could lead employers to set similar wage increases for all workers despite of their “distance to the minimum”. The results in our sample do not support that hypothesis.

## 6.2. Employment responses

Next, we compare the employment outcomes of workers covered by collective agreements signed before the fall of Lehman Brothers to those of the rest of workers. Namely, we run models similar to Model (3) where the dependent variable is an indicator of non-employment in each month between January 2009 and December 2010. Guided by the results in Table 3, we select the group of workers whose wage grew most: those whose monthly earnings in December 2007 were at most 1.2 times the minimum wage in the agreement. Figure 5 shows the increase in the chances of not working starting in March 2009 among workers whose collective contract for 2009 was signed before the fall of Lehman Brothers (and pre-recession earnings below 1.2 times the minimum wage). The differential impact of date on signature on the probability of being non-employed fluctuates between 3% and 4%, positive and statistically different from zero still in late 2010. Note also that the shape of the profile is similar to that shown in Figure 4, which uses all workers but does not control for proximity to the minimum wage.

Table 4 presents OLS regressions that link the probability of transiting from employment to unemployment to the date of signature -interacted with distance to the statutory minimum. Each specification presents two measures of transitions from employment to unemployment. The first is an indicator of job loss during 2009, defined as the event "having three months or more of unemployment during 2009 and 2010". In addition, we also use as an alternative dependent variable the fraction of days not worked during 2009 and 2010.

Columns 1 and 2 in Table 4 present estimates of Model (3) using as a dependent variable an indicator of having spent in unemployment at least three months during the period 2009-2010. The standard errors are corrected for heteroscedasticity and arbitrary correlation between workers who are covered by the same collective contract. The pattern of the point estimates in the first and third row, first column of Table 4 implies that within the set of workers whose wage was less than 1.1 times the statutory minimum, those ruled by contracts signed before the fall of Lehman Brothers had a 5.7 higher percentage chance of transiting into unemployment (row 1, column 1 of Table 4). The estimate falls slightly to .053 when we include collective contract fixed effects. Among workers covered by agreements signed pre- Lehman Brothers fall but whose earnings were a bit higher -between 1.1 and 1.2 times the minimum wage- the estimate is .047. The lower magnitude (.047 vs .053) is consistent with the hypothesis that the impact of date of signature should fade away as we look at workers progressively further away from the minimum wage. Nevertheless, the estimates are not statistically different from each other.

We find little evidence of a differential date of signature effect among workers whose monthly earnings in December 2007 were at least 20% higher than the minimum wage for their skill group. For example, for workers whose pre-recession earnings were between 20 and 40% above the minimum and whose collective contract was settled before the fall of Lehman Brothers the estimate is .0116 (standard error .011) –see Table 4, second column, third row.

In the fifth column of Table 4 we use as the dependent variable the fraction of days spent in non-employment. The results are qualitatively similar to those in Columns 1 and 2. Within the set of workers whose monthly earnings in December 2007 were only 10% higher than the minimum wage in the agreement, those covered by a collective contract signed before the fall of Lehman Brothers spent 3.3 percent more time in unemployment than the rest. The standard error is 1 percentage point. Among workers whose earnings in December 2007 were between 10% and 20% higher than the relevant minimum wage, the impact of the date of signature on the percent of days not worked in the 2009-2010 period is 2.1 percent. The estimate is lower than the corresponding one for workers very close to the minimum (.021 vs .033), and it is statistically significant at the 7% confidence level.

### *Pre-existing trends.*

One concern about the evidence in Table 4 refers to the possibility that employment destruction was already falling in the province - industry cells that reached an agreement between the last quarter of 2007 and the third quarter of 2008. To test for such possibility, we examine rates of job destruction between 2006 and 2007, a period that includes the net employment loss in the last quarter of 2007. We select a sample of workers who stayed in the firm through 2005 and compute the minimum wage in the collective agreement as of December 2004. We then run a specification very similar to Model (3) but where the worker-specific earnings levels are those of December 2004.

The results are shown in Table 5. Regardless of the outcome examined, we find no impact of date of signature on the incidence of employment loss for any group of workers. For example, workers whose earnings in December 2004 were only 10 percent higher than the minimum in the collective agreement and who worked in the industries that would sign their agreement for 2009 between October 1<sup>st</sup> 2007 and September 14<sup>th</sup> 2008 had 0.75% less days in unemployment than the rest. The comparable estimate in Table 4 is 3.3 percent, about five times larger in magnitude.

### **6.3 Heterogeneity of the impact**

There are several dimensions that may affect how date of signature affect wage growth and employment losses. Collective contracts are typically set for more than one year. In the absence of renegotiation during the life of the agreement, a contract that settles high wage growth for two years is likely to increase labor costs by a higher amount than another contract that settles high wage growth for one extra year only - because the latter can be renegotiated already in 2009. Actually, the majority of contracts signed before the fall of Lehman Brothers settled wage increases for 2009 and 2010, while contracts signed afterwards settled wage increases for one year only.

We test the hypothesis by splitting the sample in the following form. Firstly, we assume that the duration of contracts signed prior to the fall of Lehman Brothers is exogenous, while the duration of contracts signed after September 15<sup>th</sup> may be determined by the observed aggregate shock and the subsequent increase in uncertainty. Hence, we generate two “treatment” groups. The first group are contracts signed before September 15<sup>th</sup> that settled wage agreements for 2009 only and the second group contains contracts signed before September 15<sup>th</sup> that settled wage growth for 2009 and 2010 (at least). All the contracts signed after September 15<sup>th</sup> are all “controls”, in the sense that the bargaining parties could all adjust wages to the aggregate shock.

The results in Table 6 suggest that the impact of wage rigidity on employment losses is driven by “long” collective contracts signed before the fall of Lehman Brothers. To achieve more precision in the sample split, we lump all workers whose monthly earnings were at most 1.2 times the minimum in their collective contract. Firstly, the yearly wage growth was relatively similar in 2009 between “long” and “short” contracts signed before the fall of Lehman Brothers. Wage growth in “short” contracts signed for 2009 only was .8 percent while the corresponding increase was 1.1

percent in the “long” contracts for that same year. However, workers covered by “long” contracts signed before Lehman Brothers –and whose earnings in 2007 were close to the minimum- experienced on average 2.9 percent more days in unemployment than similar workers covered by agreements signed afterwards. On the contrary, workers covered by “short” collective contracts experienced only .9 percent more days in unemployment. In other words, the higher the predictable growth in labor costs -due to long contracts with high wage growth- the higher the rate of employment destruction.

Secondly, we examine differential responses across workers with different levels of employment protection. Employment protection varies markedly among groups of workers: those who are on a fixed-term contract can be dismissed cheaply after contract expiration, while employers must pay rather large redundancy costs to dismiss workers on an open-ended contract. Such considerations would lead us to expect higher rates of employment losses among workers covered by Fixed Term Contracts.

Hence, we split the sample by whether or not worker has a “high firing cost contract”. It must be noted that our selection criteria of requiring workers to be working at the firm for at least 2008 results in a sample with a rather large share of employees with an open-ended contract. The results in Table 6 suggest similar employment losses among both sets of workers, a result that is again surprising at face value. The limited sample size of workers covered by a Fixed Term Contract precludes definite conclusions.

#### **6.4. Impacts by industry: a placebo with construction**

Table 7 examines differential effects by industry. The specification serves two purposes. Firstly, there are sectors where collective contracts are bargained at the provincial term but that do not set province-specific wage growth because they merely adopt the wage growth set in a nationwide agreement. Construction is one such sector. That is, even though there is within province dispersion in the date of signature of construction agreements, wage growth does not vary across provinces.<sup>24</sup>

We use that feature of provincial bargaining in the construction sector to provide evidence in support of our identifying assumption. Our main hypothesis is that differences in wage growth across provinces and industries caused by the information available to the parties at the time of contract signature was associated to job losses. However, collective contracts specify working conditions –like working hours, or other conditions that may affect firms’ labor costs in ways that are not immediately visible in wage growth. Agreements with a dispersion in signature dates but not in wage growth permit identifying the impact of changes in other restrictions in collective contract on employment destruction. Alternatively, that variation in signature dates permits identifying the role of confounding factors that correlate both with signature date and with employment destruction.

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<sup>24</sup> There are a few collective agreements in the construction sector that do specify differential wage growth. However, their coverage is very small.

The first column of Table 7 runs Model (3) for workers in construction. The interaction  $1(\text{signed } 2008_{s,p}) * 1(W_{i,s,p}^{2007} \leq kW_{s,p,g})$  is .0015, implying that workers close to the minimum statutory wage level as of December 2007 and whose collective contract was signed prior to September 15<sup>th</sup>, 2008 lost 0.15 % working days more than workers in the same province whose contract was signed after that date. Such lack of results counters the hypothesis that signature dates correlate with employment destruction for reasons unrelated to wage growth.

## 6.5 Estimates in different industries

The impact of contract staggering on the transmission of the aggregate shock could vary across industries for various reasons. Firstly, the employment impact depends on the degree of competition for workers, because minimum wage increases may not necessarily affect employment levels if firms have monopsony power. Secondly, the employment impact may depend on the employers' surplus in matches that set wages close to the minimum in the collective agreement. We document a relatively important set of workers whose wages are close to the minimum wage. If such concentration reflected a high bargaining power of unions, those matches would be especially “fragile” in the presence of a negative aggregate chock. That would not be the case if a lack of competition among employers results in wages compressed around minimum in collective contracts.

We document the separate impact of signature dates in three different industries: The first is manufacturing. The second is a composite of non-tradable service sectors, including Retail, Wholesale, Food and Accommodation and Transportation. Finally, we lump the rest of services as a different industry –such sector includes, among others, services to businesses, health and education.

The estimates in the second column of Table 7 show that date of collective contract signature had very little impact, if any, among manufacturing workers. The estimate is -.096 (standard error: .055) *negative* and imprecise. The lack of an effect of contract staggering in this case may be partly attributable to the comparatively small sample size, but also to the fact that the distribution of wages in manufacturing is not that compressed around minimum wages –see Table A.2. Firm level bargaining is relatively more common than in manufacturing than in other industries.

Finally, the last four columns of Table 7 provide estimates for the services industry. Column 3 shows the estimate of the interaction of signature date and distance to the agreement minimum on employment losses in Trade (including retail and wholesale), Food and Accommodation as well as Transportation. Column 4 shows employment impacts in the remaining industries, which include Business Services and Health and Education. We focus on the estimate of the coefficient of  $1(\text{signed } 2008_{s,p}) * 1(W_{i,s,p}^{2007} \leq 1.2W_{s,p,g})$  in a regression that explains transitions into non-employment that lasted at least three months. The results in Table 7 suggest that the effect of signature date are confined to services. Employment losses among

workers close to the minimum and whose contract was signed before the fall of Lehman Brothers were 4.6 percentage points higher than among the rest (standard error: 2.4). The estimates in personal or business services, health and education is even larger. A possible interpretation is that a substantial amount of job matches in services carry a relatively small surplus for employers –at least small enough such that those matches are discontinued when wage growth increases by about 2%.<sup>25</sup>

## **7. Can the results be extrapolated to other time periods?**

Collective bargaining practices may change as an economy becomes increasingly exposed to international competition. Alternatively, increases in aggregate unemployment may lead bargaining parties to re-consider the value placed in maximizing employment levels. Finally, two labor reforms in 2010 and 2012 have precisely aimed to facilitate firms' opting out from sectoral agreements. We discuss to what extent our results are specific of the 2008-2010 period.

Firstly, we have analyzed the wage behavior in a previous recession, one in 1993. During that period, unemployment reached 22% from a pre-recession level of 16%. In that period, Spain was not part of the euro, so the macroeconomic setting was rather different. In ongoing work, we compare wage growth of sectoral collective contracts that settled wages for 1993 and 1994 depending on whether they were signed before or after the beginning of the recession. The preliminary findings point at a similar adjustment, where contracts signed before the recession agreed on nominal wage increases 1.4 percentage points higher than contracts signed during the recession (about 6% wage growth signed for 1993 in contracts signed prior to the recession, compared to 4.6% wage growth among contracts signed during the recession). Despite of a rather different magnitude of the fall in aggregate activity and quite different inflation levels, the similarity of the wage response suggests that contract staggering has shaped the dispersion of wage growth at the beginning of other recessions.

Secondly, there has been some discussion about the effects of comprehensive changes in labor laws brought by the 2010 and 2012 legal reforms. Both were comprehensive packages that changed several labor institutions at the same time. Among other changes, the 2012 reform clarified the procedure for opting out, introduced a new contractual figure that small businesses could use to hire new workers and, finally, changed the severance payments in case of dismissals. Evaluating the impact of all those changes on wage setting is challenging –see Banco de España 2013. Our study emphasizes two main channels through which the staggering of contracts helps propagating aggregate shocks. The first is the existence of binding minimum wages set by collective contracts, and the second is the fact that wage growth is determined by sectoral contracts. We discuss to which extent those channels may have changed between 2007 and 2012.

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<sup>25</sup> Costain et al. (2010) provide a model that explain that fragile matches can arise in an expansion in an economy with dual labor markets.

We firstly consider the distribution of nominal wages relative to the minimum set in sectoral contracts in three moments in time: 2007, 2010 and 2012. Changes in the distribution of the distance between the wage of the worker and the minimum wage in the sector provides an indication of how binding collective contracts are. To mitigate compositional changes during those five years we use a sample of job stayers. The distribution is shown in Table A.3 that documents that, if anything, the fraction of workers with earnings below the minimum has not increased between 2007 and 2012. One would expect that easier opting out procedures would generate a number of workers that receive wages below the minimum in the sectoral agreements. The evidence in Table A.3 does not support the notion that the slippage of wages relative to contractual minima increased in 2012.

Secondly, a feature of wage growth that has received some attention is the frequency of zero nominal wage changes during the latter years. In principle, the frequency of zeroes in the distribution of wage changes is not very informative about the bite of collective contracts, because many such contracts expired between 2010 and 2012. In such case, minimum wages remain fixed at the level set in the expired collective contract, mechanically generating zero wage growth –see Section 2. To fix ideas, Figure A.2 shows the histograms of nominal wage changes among job stayers between 2010 and 2012 in our sample. In about 10% of cases workers have not experienced any nominal wage increase, a feature that has been discussed recently by international institutions like the IMF. However, Figure A.2 also displays concentration of nominal wage growth around values like 3%. In the left panel of Figure A2, we show the histogram of nominal wage changes of job stayers net of the change in the corresponding change of the minimum wage in the collective contract. Namely, we compute the following magnitude:

$$\Delta\tilde{w}_{i,j,s,2012} = \frac{w_{i,j,s,2012} - w_{i,j,s,2010}}{w_{i,s,j,2010}} - \frac{\bar{w}_{s,j,2012} - \bar{w}_{s,j,2010}}{\bar{w}_{s,j,2010}}$$

Where  $i$  denotes an individual,  $j$  is the industry covered by the agreement and  $s$  is the skill level of the worker. A value of  $\Delta\tilde{w}_{i,j,s,2012}$  of zero implies that wage growth tracks the growth set in the collective contract. Note that it includes the particular case of an expired collective contract, when neither the minimum wage in the agreement or the worker's earnings change between 2010 and 2012. We note that the distribution of wage changes –net of growth in the corresponding growth in the sectoral minimum wage- stretches around zero. Unlike the case of nominal wage changes, the distribution of  $\Delta\tilde{w}_{i,j,s,2012}$  only accumulates around zero.

In addition, as emphasized previously, sectoral wage changes are important mainly for workers whose earnings are close to the minimum. Figure A.4 examines how the distribution of  $\Delta\tilde{w}_{i,j,s,2012}$  varies with the distance in December 2010 between the worker's earnings and the minimum. We note that individual wage changes track the

growth settled in sectoral contracts mainly among employees whose initial wages are closest to the minimum (at most 1.20 times the minimum wage in the collective contract). Among workers whose earnings in December 2010 were at least 1.4 times the minimum we note a lower degree of accumulation at zero (5% vs 11%). In addition, we note that 50% of workers with high earnings –relative to the sectoral minimum– experienced wage increases short of the sectoral increase. The corresponding share among employees with wages close to the minimum is below 30%.

In sum, in spite of possible changes in the structure of collective bargaining we obtain three indications suggesting that sectoral contracts have shaped the evolution of wages during the 2010-2012 period: the fraction of workers with earnings below the minimum was fallen between 2007 and 2012, 2-year wage growth tracks sectoral contracts for a substantial share of workers, especially those whose earnings are close to the corresponding minimum in the collective contract.

## 8. Conclusions

A large literature has estimated the degree of wage rigidity in different economies as well as the degree of cyclicity of wages. However, it is difficult to assess empirically to what extent those possible wage rigidities translate into higher employment levels after a negative demand shock. Our study exploits the automatic extension of collective contracts in Spain to identify a particularly salient source of wage rigidities: minimum wages that apply to all employees of firms in the same industry-province cell. Secondly, we use the large number of industrial and provincial agreements to identify contract staggering in the data –i.e. very different contracts were signed after a large aggregate shock, thus allowing the identification of wage adjustments to a shock. Both features of the Spanish (and other) economies provide a natural setting to examine the extent to which a large aggregate shock propagates into employment losses. We combine information on the exact dates of collective agreements bargaining periods and longitudinal Social Security worker records to find that, during the last recession, a higher wage growth caused by the inability to renegotiate contracts led to higher flows from employment to unemployment.

When we use a subsample with information on the collective agreement minimum wage level as of 2007 (prior to the recession), we find that both wage growth and employment losses were confined among workers whose wages are close to the minimum in the collective agreement. The results imply that job stayers with pre-recession earnings 10% higher than the collective contract minimum and covered by a contract signed before the fall of Lehman Brothers experienced wage growth 2 percent higher than the rest. On the other hand, those workers with pre-recession earnings at most 10% higher than the minimum and whose contract was signed before the fall of Lehman Brothers spent about 3 percent more days in non-employment. That evidence is

consistent with the notion that contract staggering constitutes a source of employment fluctuations, consistent with many macroeconomic models.

The evidence is relevant for the policy debate. Firstly, our estimates suggest that the magnitude of wage increases among job stayers is similar to the percent time lost among job losers between 2009 and 2010. An interpretation is that, once one takes flows into non-employment into account, minimum wages in collective contracts have not helped in maintaining employee's earnings constant during a recession. Secondly, the particular form of wage rigidity created for the automatic extension of provincial agreements and multi-period bargaining had a role on the employment destruction during the 2008-2009 recession in Spain.

Further research must assess how important this source of wage rigidity was during other recessions. In addition, the role of downward wage rigidity on job creation is a key to assess the future implications of latter labor reforms in Spain and, more generally, to understand how the labor market reacts to economic shocks. These topics are left for further research.

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**Table 1: Summary statistics, by year of signature**

	Social Security Sample	Covered by sector collective agreements	Contract signed		Difference (net of province+industry)
			2007m9 - 2008m9	After 2008m9	
Agriculture, manufacturing and utilities (%)	17.5	12	11.6	12.3	
Construction (%)	10.5	21.4	24.6	20.2	
Trade, Food & Accomodation (%)	27.6	29.9	40.3	25.7	
Transportation (%)	6.0	4.4	6.2	3.7	
Finance and real estate (%)	5.1	0.16	0.3	0.02	
Services to businesses, health and education (%)	32.2	31.3	16.3	37.4	
Multi-year (%)	--	88.2	100	75.1	
Escalation clause (%)	--	64.3	82.2	44.2	
Mean settled wage growth 2009 (%)	--	2.60	3.10	1.86	1.24
[median]		2.9	3.5	1.5	2.00
(Standard deviation)		(1.20)	(.96)	(1.15)	
Age	39.4	39.0	38.8	39.14	-.34
		(10.7)	(10.7)	(10.4)	
Female	.43	.43	.40	.44	-.04
High skill (college) (%)	21.1	17.6	14.4	18.9	-4.5
Mid-skill (%)	35.7	34.7	32.3	35.6	-3.3
Low skill (%)	43.2	47.7	53.2	45.4	7.8
Fixed-term contract (%)	13.28	14.7	16.3	15.5	0.8
Number of workers (agreements)	301536	116306 (1305)	33676	82630	

The sample in the first column is drawn from employees in Social Security records between 18 and 59 years of age in December 2007.

The sample in the second column contains employees staying in the firm since October 1st 2007 until December 31st 2008 and for whom we identified a provincial collective contract. All worker characteristics refer to December 2007. The characteristics of collective agreements are those settled for 2009.

Escalation clause takes value one if the contract stipulates an adjustment for realized inflation if it exceeds a threshold level. The last column shows OLS coefficients of a regression of differences between the third and fourth column that controls for province and industry dummies.

**Table 2: Summary statistics of sample with information about wages, by year of signature**

	N=48,985	N=16,168	N=32,817
Agriculture, manufacturing and utilities (%)	10.7	10.0	10.4
Construction (%)	30.5	65.8	13.3
Trade, Food & Accomodation (%)	27.4	14.3	33.4
Transportation (%)	5.0	4.0	5.2
Services to businesses, health and education (%)	26.6	3.6	33.2
Mean settled wage growth (%)	2.24 (1.27)	3.44 (.83)	1.65 (1.00)
Age	37.33	37.13	37.4
Female (%)	38	20	47
High skill (%)	17	10.0	20.1
Mid skill (%)	35	21.6	41.5
Low skill (%)	47.7	68.5	37.5
Earnings in December 2007:			
Below min_wage (%)	9.7	11.0	9.0
Between 1 and 1.1 times min_wage agreement (%)	8.4	12.4	6.5
Between 1.1 and 1.2 times min_wage (%)	11.0	18.0	7.7
Between 1.2 and 1.4 times min_wage (%)	17.8	19.9	16.8
Above 1.4 times min_wage (%)	52.8	38.6	60.0

The sample contains employees staying in the firm since October 1st 2007 until December 31st 2008 and for whom we identified a provincial collective contract with information about province x industry x skill minimum wages.

Min\_wage denotes the minimum wage in the agreement for the province x 3-digit industry and skill level of the worker.

All worker characteristics refer to December 2007. The characteristics of collective agreements are those settled for 2009.

**Table 3: Actual wage growth in 2009 and 2009-2010, by date of signature and distance to contract-specific minimum wage**

	Wage growth 2008-2009		Wage growth 2008-2010
	(1)	(2)	(3)
1. Contract signed before September 15th 2008 * (min_wage<Earnings 2007.12 <1.10*min_wage)	.0102 (.0042)**	.0134 (.0046)***	.0176 (.0057)***
2. Contract signed before September 15th 2008 * (1.1 min_wage<Earnings 2007.12 <1.20*min_wage)	.0057 (.0041)*	.0087 (.0046)*	.004 (.006)
3. Contract signed before September 15th 2008 * (1.2*min_wage<Earnings 2007.12 <1.40*min_wage)	.0019 (.0028)	.0032 (.0033)	.010 (.0049)**
4. Earnings in 2007.12 between min_wage and 1.1 times minimum wage	.0186 (.0032)	.0189 (.0034)	.0304 (.0043)
5. Earnings in 2007.12 between 1.1 times min_wage and 1.2 times minimum wage	.0149 (.0028)	.0155 (.0030)	.0302 (.0033)
6. Earnings in 2007.12 between 1.2 times min_wage and 1.4 times minimum wage	.0096 (.0019)	.0103 (.0025)	.0193 (.003)
7. Collective contract signed before September 15th 2008	.0008 (.003)	--	--
Constant	.0046 (.0016)	.0083 (.0006)	-.0043 (.0008)
Collective contract fixed-effect	no	yes	yes
Number of observations (contracts):		31675 (558)	25981 (556)
R-squared	.0137	.0281	.0463

The sample used in columns 1 and 2 contains workers who stayed in the same firm all through 2008 and 2009 and who are full time employees in December 2008 and 2009. We use employees whose earnings in those two months were below (above) the censored maximum (minimum). The dependent variable is the difference between the logarithm of monthly earnings in December 2009 and that in December 2008 and the covariates, aside from those shown, are provincial dummies and three-digit industry dummies (in column 1) and collective agreement fixed effects in columns 2 and 3. The model is estimated by OLS, and the standard errors permit arbitrary correlation between observations in the same collective agreement. The sample in column 3 includes job stayers in the firm between 2008 and 2010.

**Table 4: Wage growth by date of signature and distance to contract-specific minimum wage**

Dependent variable: Set of covariates:	1(90+ days in U 2009-2010)			Days in U 2009-2010/730		
	Basic	Basic	Extended	Basic	Extended	
	(1)	(2)	(3)	(4)	(5)	(6)
1. Contract signed before September 15th 2008 * (min_wage<Earnings 2007.12 <1.10*min_wage)	.057 (.021)**	.053 (.022)**	.053 (.022)**	.034 (.010)***	.0334 (.0118)**	.0329 (.0118)**
2. Contract signed before September 15th 2008 * (1.1 min_wage<Earnings 2007.12 <1.20*min_wage)	.057 (.018)**	.0469 (.019)**	.0475 (.029)**	.024 (.010)***	.021 (.012)*	.0212 (.012)*
3. Contract signed before September 15th 2008 * (1.2*min_wage<Earnings 2007.12 <1.40*min_wage)	.013 (.012)	.0116 (.0112)	.0121 (.0128)	.010 (.007)	.009 (.0075)	.0093 (.0075)
Earnings in 2007.12 between min_wage and 1.1 times minimum wage	.075 (.011)	.0837 (.012)	.077 (.011)	.038 (.0076)	.041 (.0076)	.0396 (.0076)
Earnings in 2007.12 between 1.1 times min_wage and 1.2 times minimum wage	.066 (.013)	.074 (.012)	.067 (.013)	.035 (.0084)	.040 (.0084)	.0372 (.0083)
Earnings in 2007.12 between 1.2 times min_wage and 1.4 times minimum wage	.0489 (.007)	.052 (.007)	.047 (.007)	.023 (.0041)	.025 (.0041)	.0235 (.0041)
Contract signed before September 15th, 2008	.0216 (.010)	--	--	.009 (.006)	--	--
Constant	.159 (.008)	.15 (.006)	.176 (.0147)	.084 (.004)	.082 (.003)	.089 (.008)
Collective agreement fixed effect	no	yes	yes	no	yes	yes
Number of observations (collective contracts):				44017 (561)		
R-squared	.093	.095	.097	.0819	.0872	.0881

(a) Coefficients of OLS regressions of the dependent variable in the second row on dummies indicating the distance between the distance between the monthly wage of the worker in December 2007 (2007.12) and the minimum statutory wage in the province - industry - skill group. The omitted group in all specifications are workers whose earnings in December 2007 was at least 1.4 times the statutory minimum wage.

(b) The sample contains all workers in the Social Security records who were employed in the same firm since October 1st 2007 until December 2008

(c) The coefficient of interest is the interaction of the distance to the statutory wage and the date of signature of the contract. All models but (1) and (3) include 561 collective contract fixed effects. The basic list of covariates include 9 dummies with the skill group of the worker and a dummy for a fixed-term contract. The extended set of covariates adds 5 age dummies, and an indicator of female worker. Standard errors -in parentheses- clustered by province-industry

**Table 5: The probability of not working in 2006-2007 of industry-province bargaining units that signed before Lehman Brothers fall**

Dependent variable:	1(90+ days in U 2006-2007)		(Days in U 2006-2007)/730	
	Basic set covariates	Full set	Basic set of covariates	Full set
	(1)	(2)	(3)	(4)
Signed before 2008m9 *	-.0149	-.0165	-.0075	-.0083
(min_wage < Earnings 2004.12 < 1.10 min_wage)	(.0168)	(.0167)	(.0101)	(.0100)
Signed before 2008m9 *	-.0161	-.0168	-.0105	-.0108
(1.10 min_wage < Earnings 2004.12 < 1.20 min_wage)	(.0158)	(.0155)	(.0085)	(.0084)
Signed before 2008m9 *	.0000	.0025	.0021	.0032
(1.20 min_wage < Earnings 2004.12 < 1.40 min_wage)	(.0122)	(.0121)	(.0057)	(.0056)
Min_wage < Earnings 2004.12 < 1.10 min_wage	.0566	.0456	.0274	.0226
	(.0119)	(.0088)	(.0061)	(.0061)
(1.1 Min_wage < Earnings 2004.12 < 1.20 min_wage)	.0654	.0548	.0334	.0288
	(.0100)	(.0010)	(.0058)	(.0057)
(1.20 Min_wage < Earnings 2004.12 < 1.40 min_wage)	.0422	.0336	.0213	.0175
	(.0086)	(.0090)	(.0040)	(.0043)
Constant	.093	.105	.0453	.046
	(.004)	(.010)	(.0235)	(.005)
Collective contract fixed effect	yes	yes	yes	yes
Number of observations (collective contracts):			35626 (502)	
R-squared	.103	.105	.0269	.0451

(a) The Table shows coefficients of a regression of the dependent variable is either a dummy indicating if the worker did not work for than 3 months in 2006-2007 or the actual share of days not worked during that period. The specification is the same as in Table 4 but the minimum wage in the collective agreement is the one in December 2004.

(b) The sample contains all workers in the Social Security records who have been employed in the same firm at least between December 2005 and December 2006

**Table 6: The probability of not working in 2009-2010 , sample splits**

<i>Panel A: Differential effect by the duration of contracts -if signed before 2008m9</i>				
Dependent variable:	Contracts signed in 2008 expiring in 2009		Contracts signed in 2008 expiring after 2010	
	Actual wage growth	% Days in U 2009-2010	Wage growth	% Days in U in 2009-2010
	(1)	(2)	(3)	(4)
Signed before 2008m9 *	.0079	.009	.011	.0290
(min_wage <Earnings 2007.12 < 1.20min_wage)	(.0066)	(.0114)	(.0042)***	(.0110)**
Signed before 2008m9 *	-.0058	.001	.0055	.011
(1.2 min_wage <Earnings 2007.12 < 1.40min_wage)	(.0057)	(.0095)	(.0036)	(.0085)
Min_wage<Earnings 2007.12 <1.10 min_wage	.0169	.0428	.017	.041
(1.20 Min_wage<Earnings 2007.12 <1.40 min_wage)	(.0024)	(.007)	(.0024)	(.007)
	.103	.0272	.103	.0255
	(.0024)	(.0042)	(.002)	(.0042)
Constant	.0105	.0711	.0076	.082
	(.00068)	(.002)	(.0007)	(.003)
Number of observations (collective contracts):		32264 (379)	29704 (534)	41479 (512)
<i>Panel B: Differential effects by severance payments in individual contract</i>				
Dependent variable:	Fixed term contract		Open ended contract	
	Actual wage growth	% Days in U 2009-2010	Wage growth	% Days in U in 2009-2010
Signed before 2008m9 *	.0026	.021	.012	.0257
(min_wage <Earnings 2007.12 < 1.20min_wage)	(.014)	(.024)	(.0041)***	(.009)**
Signed before 2008m9 *	.0043	.024	.0036	.008
(1.2 min_wage <Earnings 2007.12 < 1.40min_wage)	(.044)	(.020)	(.0038)	(.008)
Min_wage<Earnings 2007.12 <1.10 min_wage	.0160	.0280	.017	.036
(1.20 Min_wage<Earnings 2007.12 <1.40 min_wage)	(.011)	(.0156)	(.0024)	(.0065)
	.0054	-.010	.110	.027
	(.011)	(.0114)	(.002)	(.0042)
Constant	.015 (.0029)	.188 (.018)	.0076 (.0007)	.0766 (.077)
Observations:	4136 (335)	6018 (324)	27539 (547)	37999 (555)

**Table 7: The response of days not worked, by industry 2009-2010**

Dependent variable:	Construction		Manufacturing		Food and Accomodation (1)		Business services (2)	
	U >=90 days	% Days in U	U >=90 days	% Days	U >=90 days	% Days	U >=90 days	% Days
	(1)	(2)		(2)	(3)	(4)	(5)	(6)
Signed before 2008q4 * (20pp above minimum)	.010 (.022)	.001 (.010)	-.096 (.055)	-.026 (.0489)	<b>.046</b> <b>(.028)*</b>	.015 (.017)	<b>.074</b> <b>(.043)*</b>	<b>.0444</b> <b>(.0196)**</b>
Signed before 2008q4 * (20pp <wage< 40pp)	-.016 (.022)	.001 (.014)	.024 (.030)	-.012 (.019)	-.006 (.018)	-.008 (.010)	.028 (.044)	.021 (.023)
Wage in 2008 20 pp above minimum	.10 (.018)	.060 (.007)	.084 (.037)	.055 (.023)	.070 (.013)	.031 (.006)	.061 (.011)	.028 (.007)
Wage in 2008 20-40pp above minimum	.068 (.0188)	.028 (.013)	.059 (.016)	.038 (.011)	.055 (.011)	.029 (.006)	.047 (.012)	.018 (.006)
Constant	.19 (.018)	.11 (.008)	.17 (.018)	.088 (.012)	.133 (.007)	.067 (.003)	.054 (.011)	.070 (.004)
Number of observations:	13406 (84)		4693 (235)		15481 (178)		11899 (65)	
R-squared	.123	.08	.134	.133	.042	.041	.073	.0294

Covariates: 5 age dummies, type of labor contract and an indicator of female worker, collective contract fixed effects and indicators of skill level

(1) Retail, Wholesale, Food and Accomodation and Transportation (2) Personal and business services, health, education

(a) Industry-specific coefficients of OLS regressions of the dependent variable in the second row on dummies indicating the distance between the distance between the monthly wage of the worker in December 2007 (2007.12) and the minimum statutory wage in the province - industry - skill group. The omitted group in all specifications are workers whose earnings in December 2007 was at least 1.4 times the statutory minimum wage.

(b) The sample contains all workers in the Social Security records who were employed in the same firm since October 1st 2007 until December 2008

(c) The coefficient of interest is the interaction of the distance to the statutory wage and the date of signature of the contract. All models but (1) and (3) include 561 collective contract fixed effects. The basic list of covariates include 9 dummies with the skill group of the worker and a dummy for a fixed-term labor contract. The extended set of covariates adds 5 age dummies, and an indicator of female worker. Standard errors -in parentheses- account for heteroscedasticity and arbitrary correlation across observations within the same 3-digit industry x province cell.

## TABLA DE RETRIBUCIONES BRUTAS DEL CONVENIO DE LA CONSTRUCCIÓN Y OBRAS PÚBLICAS DE NAVARRA

*Revisión salarial. Efectos: 1-1-2010 a 31-12-2010. Incremento: 4,5%*

NIVELES	SALARIO BASE	COMPL. CONVENIO	PLUS EXTRASAL.	TOTAL MES	JULIO	NAVIDAD	VACACIONES	TOTAL ANUAL
II Titulado Superior	2.102,35	555,97	65,54	2.723,86	3.467,27	3.467,27	3.467,27	40.364,27
III Titulado Medio	1.725,24	467,14	65,54	2.257,92	2.873,88	2.873,88	2.873,88	33.458,76
IV Encargado General	1.670,51	453,53	65,54	2.189,58	2.795,09	2.795,09	2.795,09	32.470,65
V Jefe Admon. 2. <sup>a</sup>	1.498,57	410,43	65,54	1.974,54	2.519,81	2.519,81	2.519,81	29.279,37
VI Delineante 1. <sup>a</sup>	1.285,55	357,97	65,54	1.709,06	2.179,21	2.179,21	2.179,21	25.337,29
VII Capataz	1.262,40	355,72	65,54	1.683,66	2.144,91	2.144,91	2.144,91	24.954,99
VIII Oficial 1. <sup>a</sup>	1.234,36	358,33	65,54	1.658,23	2.110,66	2.110,66	2.110,66	24.572,51
IX Oficial 2. <sup>a</sup>	1.085,89	326,52	65,54	1.477,95	1.878,53	1.878,53	1.878,53	21.893,04
X Especialista	1.022,26	315,92	65,54	1.403,72	1.782,02	1.782,02	1.782,02	20.786,98
XI Peón Especializado	1.004,83	317,78	65,54	1.388,15	1.760,69	1.760,69	1.760,69	20.551,72
XII Peón Ordinario	969,67	313,00	65,54	1.348,21	1.708,38	1.708,38	1.708,38	19.955,45
XIII Aspirante Admon.	689,31	222,80	65,54	977,65	1.239,23	1.239,23	1.239,23	14.471,84
XIV Aprendices:								
De 16 y 17 años: 1.º año	597,24	179,58	65,54	842,36	1.033,19	1.033,19	1.033,19	12.365,53
De 16 y 17 años: 2.º año	651,53	195,91	65,54	912,98	1.127,12	1.127,12	1.127,12	13.424,14
De 18 a 21 años: 1.º año	705,83	212,24	65,54	983,61	1.221,05	1.221,05	1.221,05	14.482,86
De 18 a 21 años: 2.º año	760,12	228,56	65,54	1.054,22	1.314,97	1.314,97	1.314,97	15.541,33

**Table A.1. Set of skill-specific minimum wages in a collective contract**

Each row denotes a skill level. Each column denotes a wage concept, and the last column reflects yearly minimum earnings by skill level. The collective contract is that of the construction industry in Navarre for the year 2010.

**Table A.2. Wage distribution relative to the minimum, by industry and skill**

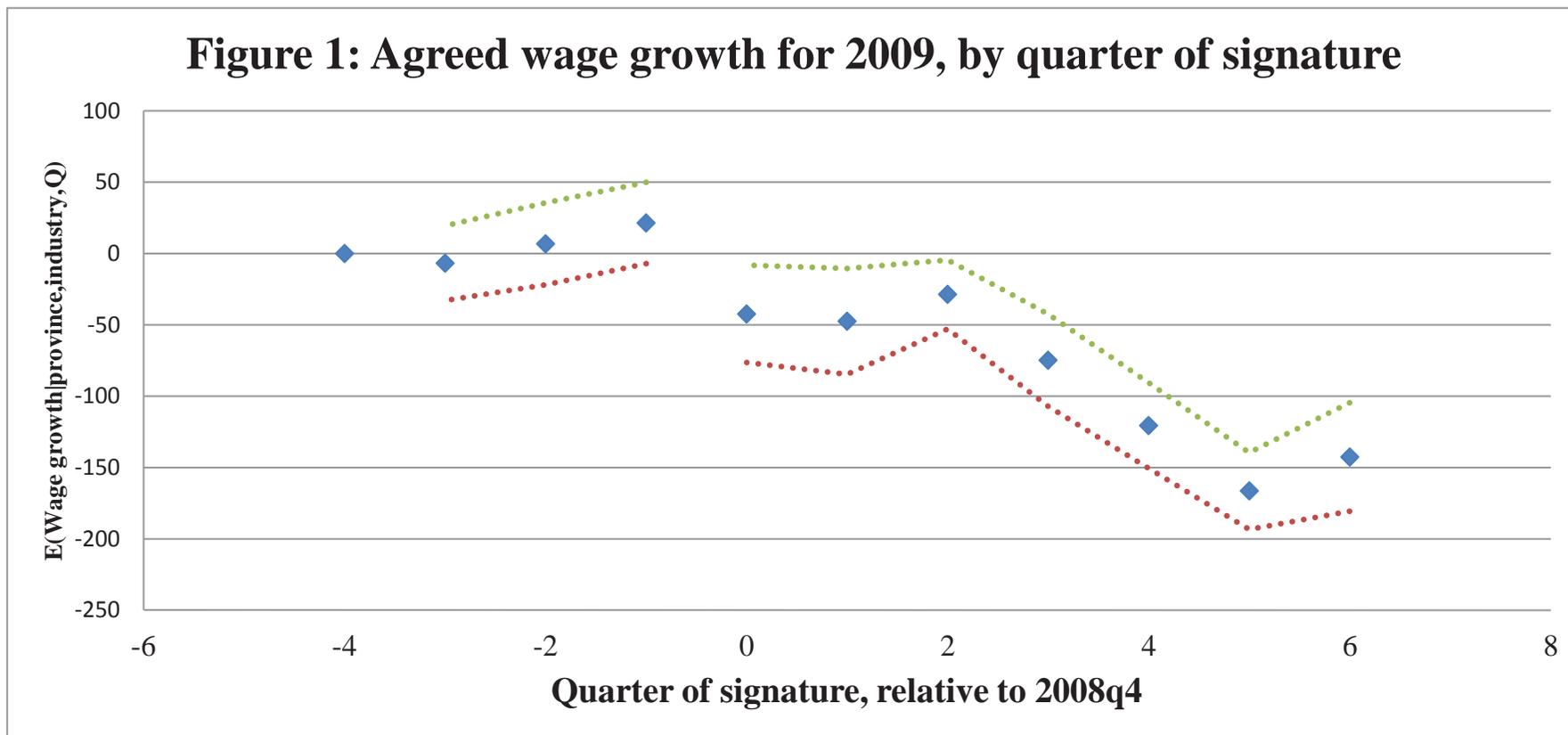
	Industry				Skill level		
	Manufacturing	Construction	Trade, F&A	Other services	High	Medium	Low
Age	38.5	37.2	35.92	37.86	37.2	36.3	38.11
Female	.218	.12	.57	.61	.40	.646	.2
High skill	.10	.13	.11	.33	--	--	--
Low skill	.72	.70	.29	.43			
Earnings in December 2007:							
Below min_wage	.042	.09	.13	.08	.046	.11	.10
Between 1 and 1.1 times min_wage agreement	.024	.16	.08	.04	.023	.07	.11
Between 1.1 and 1.2 times min_wage	.047	.21	.09	.05	.03	.09	.15
Between 1.2 and 1.4 times min_wage	.25	.18	.20	.12	.07	.16	.22
Above 1.4 times min_wage	.64	.35	.49	.70	.83	.56	.40
Sample size	4396	14934	13218	13011	8451	17145	23389

All statistics in the Table are sample averages of the matched sample of Social Security records and collective contracts with information about wage levels.

**Table A.3 Wage distribution, relative to the minimum in the collective contract**

	2007	2010	2012
Wage below minimum in agreement	.054	.04	.036
Wage between minimum and 1.1 times minimum	.078	.06	.058
Wage between 1.1 and 1.2 times the minimum	.106	.091	.087
Wage between 1.2 and 1.4 times the minimum	.213	.226	.206
Wage above 1.4 times the minimum	.549	.592	.612
Sample size	32526	32536	32536

Sample of job stayers. Estimates differ from those in Table A.2. because the sample contains job stayers between waves only

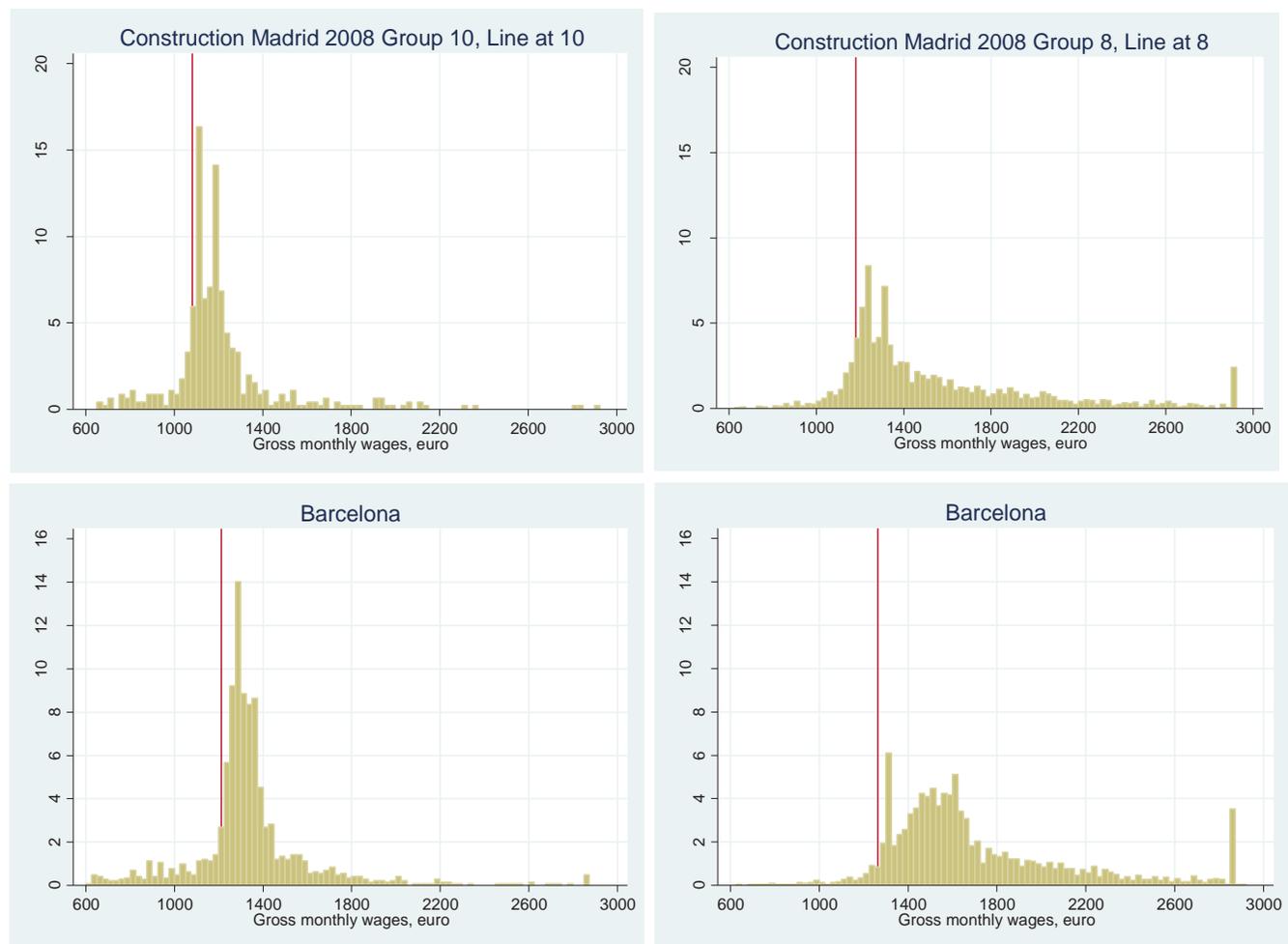


The graph shows OLS estimates of quarter dummies of signature a regression where:

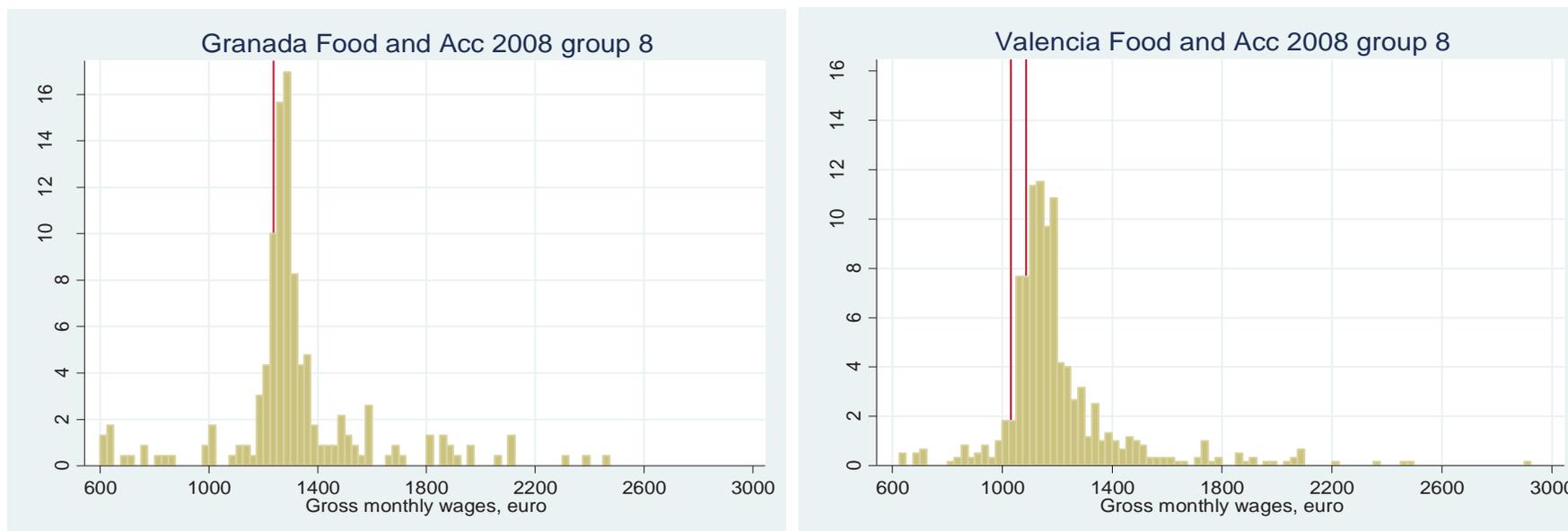
- (a) The dependent variable is agreed wage growth for 2009 (in basis points)
- (b) Quarter of contract signature dummies between 2008q1 and 2010q2, 2007q4 is omitted.
- (c) The covariates are 49 province dummies and 141 industry dummies.

The standard errors permit arbitrary correlation at the province-industry cell.

Figure 2. Histogram of wages in December 2007 in construction in the two largest Spanish provinces: laborers (group 10) and foremen (group 8)



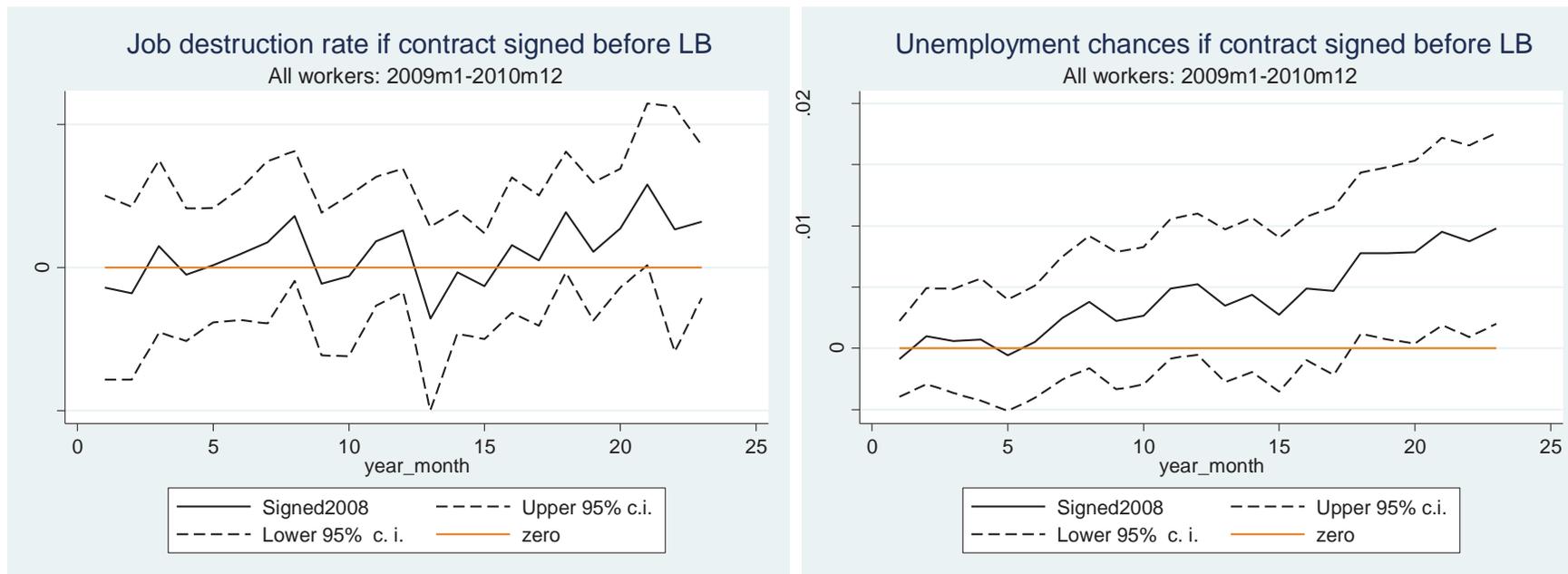
**Figure 3: An illustration of the source of variation: the wage distribution in selected provinces -Valencia and Granada.**



The Figures display histograms of monthly wages in Food and Accommodation as of 2008 in two provinces, Valencia and Granada. The Food and Accommodation agreement in Valencia was signed in 2007, and it set a 5% wage increase. That in Granada was signed in 2010, after expiring in 2009, and the agreed wage increase was below 1%.

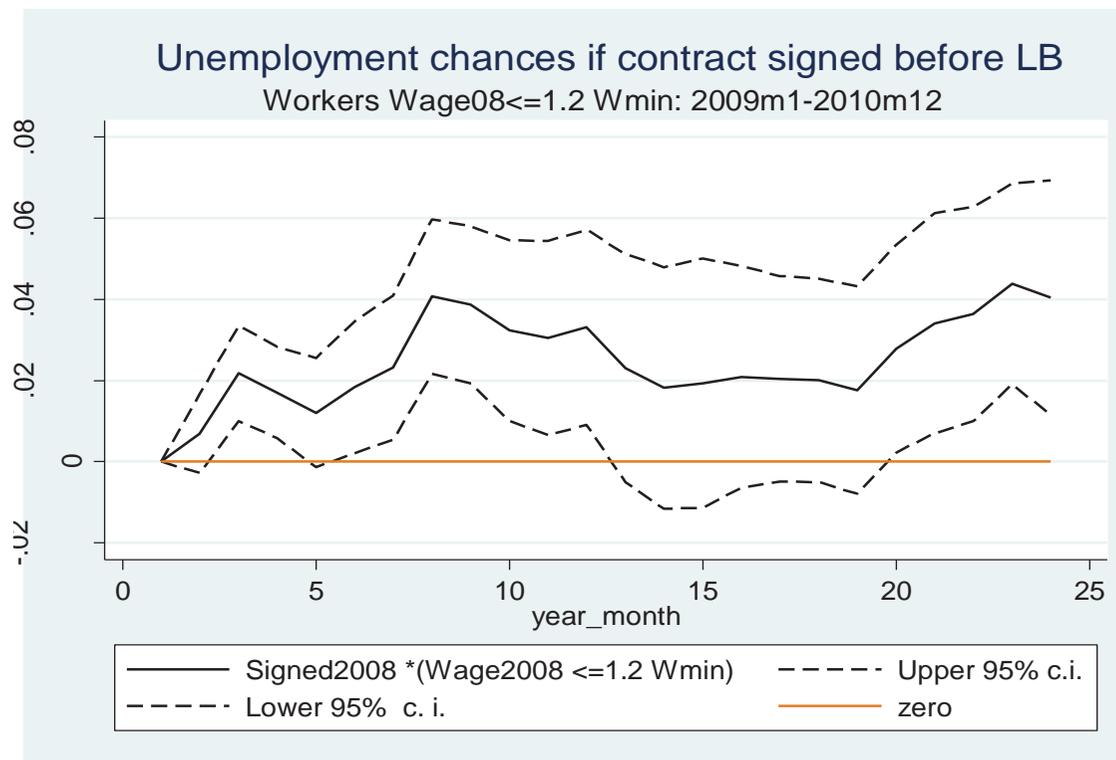
There are two vertical lines in each Figure. The line in the left represents the minimum statutory wage for waiters in 2008 in each province. The second one is the statutory minimum wage in 2009 (not visible in Granada, as it coincides with that in 2008).

**Figure 4: Employment destruction among workers covered by a collective agreement signed between October 2007 and September 15th 2008**

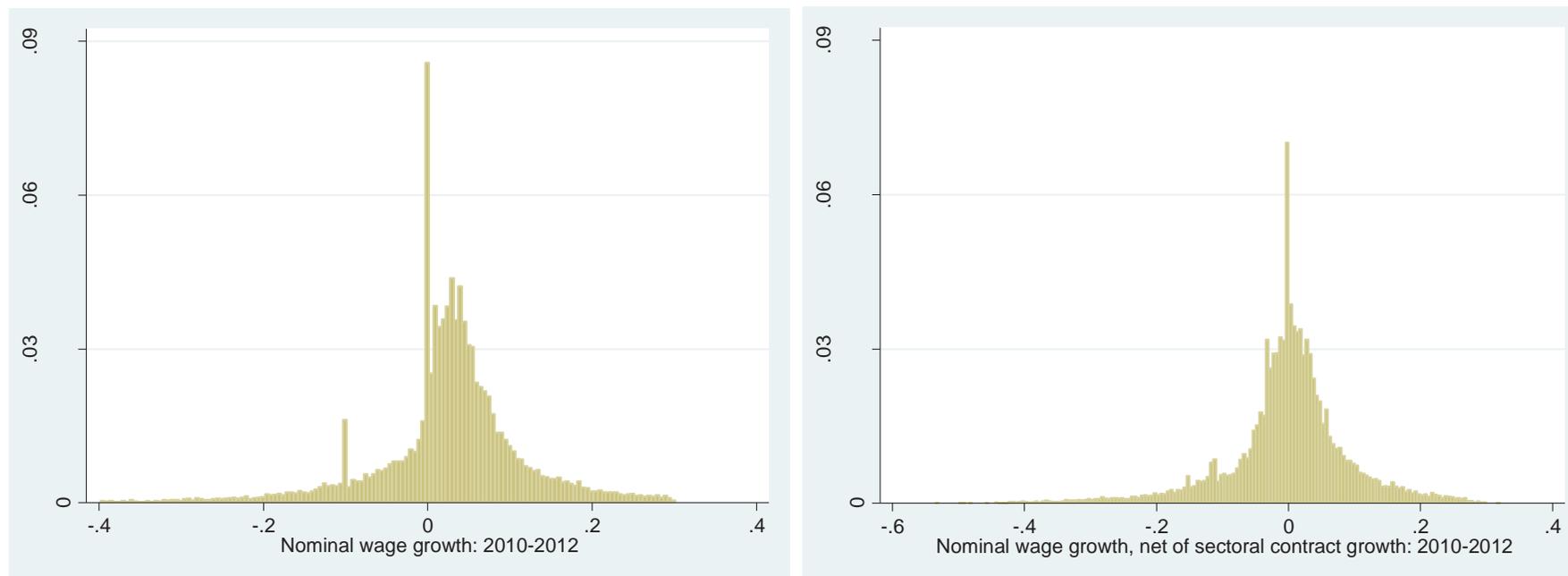


OLS estimates and confidence intervals of the variable "Signed before September 15th, 2008" in 24 regressions of monthly transitions into unemployment (left graph) or the probability of staying in unemployment (graph in the right). Controls include province and three-digit industry dummies.

**Figure 5: Employment outcomes among workers covered by a collective contract signed before LB and whose earnings are at most 20% above the collective contract minimum.**

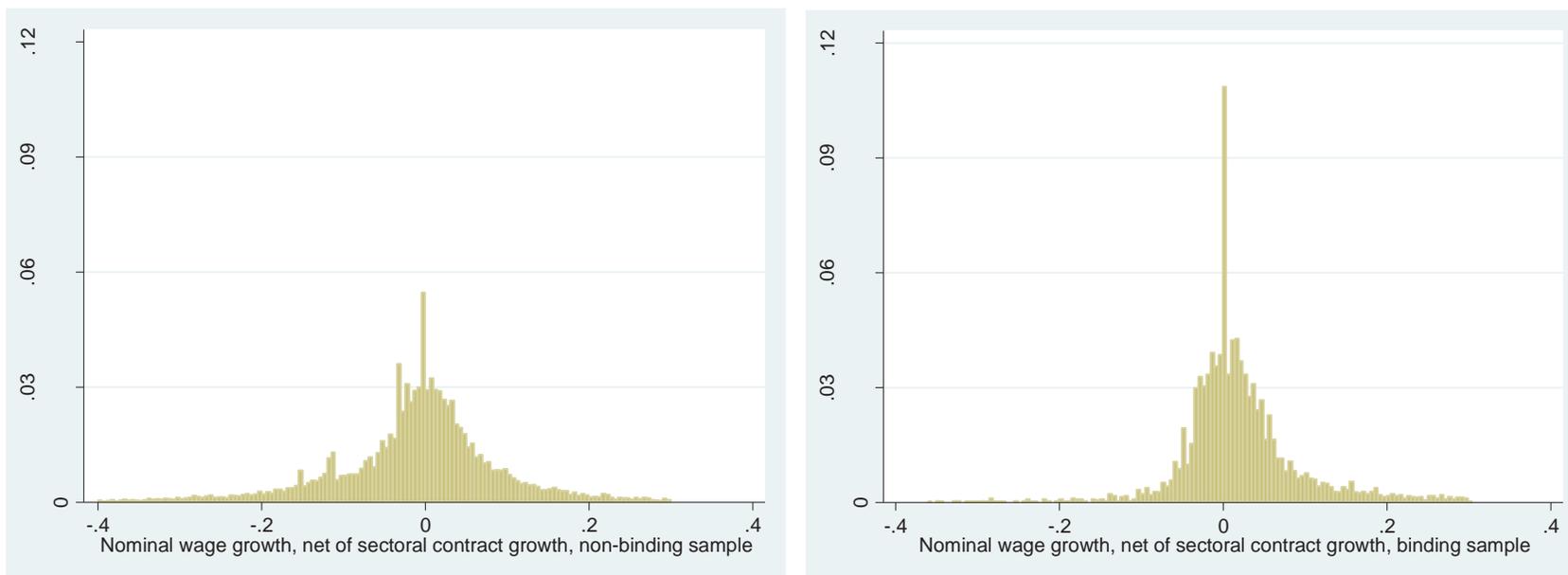


The graph plots the OLS estimates and confidence intervals of the interaction variable "Collective Contract signed before September 15th, 2008" and (Earnings in December 2007 < 1.2 min wage) in 24 regressions with an indicator of job loss among in each month between January 2009 and December 2010. All regressions control for three-digit industry and 49 province dummies.

**Figure 6: Earnings growth: 2010-2012.**

The left panel plots histograms of the nominal wage growth between December 2010 and December 2012. The right panel shows the distribution of the difference between actual wage growth and wage growth settled in the corresponding sectoral contract. The sample includes job stayers in the same firm whose earnings fall above (below) the minimum (maximum) contribution limit.

**Figure 7: Earnings growth net of sectoral agreement minimum earnings growth: 2010-2012.**



The graph plots histograms of the difference between actual wage growth between December 2010 and December 2012. The left panel contains a sample of job stayers for whom minimum wages are not binding -whose earnings in December 2010 were 40% above the collective contract minimum for the year 2010. The right panel contains a sample of job stayers for whom minimum wages in the sectoral collective contract bind – i.e. their earnings in December 2010 were between the minimum wage and 1.2 times the minimum wage.

Accumulation at zero indicates that monthly earnings growth between 2010 and 2012 follows the growth in the minimum wage in the corresponding sectoral agreement during the same period. Negative (positive) values indicate that earnings between 2010 and 2012 grew less (more) than minimum wages in the sectoral contract did during the same period

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