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WAGE SETTING: REVIEWING THE ROLE OF LABOR PRODUCTIVITY VS. GENERAL FACTORS IN THE LIGHT OF THE GREAT RECESSION

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WAGE SETTING: REVIEWING THE ROLE OF LABOR PRODUCTIVITY VS. GENERAL FACTORS IN THE LIGHT OF THE *GREAT RECESSION*

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Abstract

Spain has suffered the greatest impact on its labor markets as a consequence of the Great Recession of 2008, compared to its EU partners. This study is based on a panel data model that is instrumented in order to explain the determining factors in the wage-setting process in Spain. From this startpoint, we try to assess the Great Recession's impact by analyzing the mechanisms by which changes in labor productivity are transmitted to real wages, depending on whether the concerned sector is considered dynamic or backward in terms of productivity growth. The spatial dimension of this process is also taken into account, by incorporating the 17 autonomous communities as cross-sectional units into the model. This allows us to analyze the existence of wage convergence phenomena between different regions and economic sectors. The model considers 17 cross-sectional units (the autonomous communities) in the period between the years 1955 and 2018. The study attempts to identify and assess the impact that the Great Recession has had on the dynamics of wage setting in the Spanish economy. To this end, a comparative static analysis is performed on a sample limited to the period between 1955 and 2007. Regarding methodology, the formulation is based on a cointegration model with an error correction mechanism, which allow us to estimate both a long-run equilibrium relationship and the terms of short-run dynamic adjustment. The results appear to support the thesis, backed by much of the specialized literatura, that the efficency wage model best explains the wage-setting process in Spain. This approach is characterized by the prominence of general labor markets conditions, such as average wage or unemployment rate, on wage setting.

JEL Codes: C23, C52, J01, J24, J31, J64

Keywords: Great Recession, dynamic *vs*. backward sectors, spatio-temporal analysis, club convergence test, cross-sectional dependence, wage setting, imitation effect.

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1. Introduction

In the context of the Great Recession and its impact on southern European peripheral countries, recent literature has largely attributed the trigger of the financial crisis to overinvestment in the real estate sector. From this perspective, the expansionary cycle collapsed with the outbreak of the crisis, revealing the serious weaknesses of an obsolete production system. This system was based on activities that were labor-intensive and had little added value. Many of these activities were linked to the construction sector (Pérez García, 2011).

Within the framework of the Diamond-Mortensen-Pissarides (DMP) theoretical model of labor market performance, this study attempts to shed light on the recent evolution of the mechanisms through which productivity fluctuations affect real wage development.

Analyzing the factors that determine wages across different economic sectors can help to explain the causes of major labor market imbalances, particularly the high and persistent unemployment rates in Spain. Typically, this analysis has been conducted in Spain using historical series of aggregate data (Dolado et al., 1986; Andrés et al., 1990; Andrés and García, 1991).

Fernández and Montuenga (1997) proposed a different approach, attempting to contrast alternative hypotheses regarding how wages in 14 industrial sectors respond to specific factors (labor productivity) or general economic conditions (average wage, unemployment rate…). Their results showed evidence of dual behavior: different wage developments depending on whether sectors experienced greater or lesser growth in productivity and production. "Dynamic" sectors versus "backward" sectors. In the most dynamic sectors, which grow above the national average and have greater financial leeway, wage increases are governed by relative payment criteria and largely respond to general conditions in the labor market (i.e., aggregate wage and unemployment rates). In contrast, in sectors characterized as backward, with productivity growth below the national average, wage increases appear closely tied to changes in productivity.

Setting wages regardless of the overall situation in labor markets could hinder the reallocation of employment to more dynamic sectors, especially in crisis-stricken sectors. To incentivize and maintain the productivity of their workers, the latter are paying them above competitive thresholds, which limits their ability to hire new workers. This situation could explain why the Spanish economy has had and continues to have serious difficulties reducing unemployment rates.

This paper aims to identify the wage-setting mechanism in Spain, taking into account territorial and sectoral dimensions and paying special attention to the relevance of collective bargaining in this process. Our analysis covers the period from 1955 to 2018, building upon previous studies' findings. To this end, we use the long-series module of gross value added (GVA) and regional employment by sector from the "RegData FEDEA-BBVA" database developed by De la Fuente and Ruiz Aguirre (2020). Our goal in estimating the model equation is to measure the impact of the Great Recession on wage-setting dynamics, quantifying possible variations in the relevance of internal and external factors in each sector. The analysis excludes the period following the health crisis caused by the SARS-CoV-2 (Covid-19) virus.

Using balanced panel data, we conduct a comparative static analysis between the full sample and a restricted sample from 1955 to 2007, which is the period up to the Great Recession's outbreak.

The model is formulated using advanced cointegration analysis techniques in order to identify stable, long-term equilibrium relationships between non-stationary variables. The model specification also incorporates an error correction term (ECT), which allows for the estimation of short-term dynamic adjustment terms.

The document is divided into 6 sections. Section 2 presents the literature review on the topic. Section 3 outlines the theoretical model that is taken as a basis for the empirical estimation. Section 4 explains the sources and main characteristics of data to be used referred to the model's variables, as well as the considered sectors and regions (cross-section units). Section 5 indicates the used methodology and the previous results referred to stationarity (unit roots), convergence and cointegration analysis, as well as defining the empirical model based on this latter, with the incorporation of an error correction mechanism. Section 6 presents the results of model estimation. Lastly, Section 7 presents the conclusions and economic policy recommendations based on the obtained results.

2. Literature review

The starting point for this analysis has conventionally been the collective bargaining of working conditions, following the model proposed by Layard et al. (1991). In the framework of DMP model, wage setting is conceived as a Nash-type negotiation process (Diamond, 1982; Mortensen, 1982). In this study, we now try to distinguish strictly competitive factors, tied to the evolution of productivity, from non-competitive factors that impact wage bargaining, related to labor markets general state. In an intersectoral analysis, which focuses on the mechanisms by which productivity variations are tranferred to real wages, we intend to identify and differentiate between aggregate and specifically sectoral effects into the process of equilibrium wage setting.

The wage-setting mechanism is connected to both labor and consumer goods markets, and consequently plays a key role throughout the economy. According to a neoclassical approach, an increase in labor productivity should translate into increases in wage level. Similarly, an increase in an economy's unemployment rate would put downward pressure on wages until equilibrium is reached, without involuntary unemployment. From a neo-Keynesian outlook, however, it is the downward rigidity of wages that gives rise to involuntary unemployment, against the backdrop of fluctuations in aggregate demand.

Montuenga et al. (2007) obtained evidence that sectoral wage dispersion had increased considerably in Spanish labor markets during the period 1964-1992. At first, it could be thought that this situation derived from the fact that sectoral productivity, on its part, presented a very high degree of dispersion. However, in fact, a weak relationship could be observed between sectoral wage setting and productivity trends, especially in the most dynamic sectors. The ultimate cause of this phenomenon, these authors suggested, could be due either to differences in the composition of the workforce by sector or to the wage-setting mechanism generally prevalent in Spanish industry: collective bargaining of working conditions.

Andrés and García (1991) had already pointed out that controlling the labor force by means of specific factors only eliminated part of the differences between wage levels observed in the different sectors. Therefore, the answer had to be sought in the wage setting mechanism generally in force.

In this context, Montuenga et al. (2007) try to elucidate which models most accurately fit the reality of Spanish labor markets: the insiders-outsiders model (Lindbeck and Snower, 1989); the efficiency wage model (Shapiro and Stiglitz, 1984); the trade union model; or the rent-sharing model. This is always done with the goal of formulating appropriate employment policy recommendations. Empirical research on the Spanish economy had focused on evaluating the bargaining power of insiders and testing the efficiency wage hypothesis. In general, the evidence seemed to suggest low insider power (Andrés and García, 1991 and 1993; Dolado and Bentolila, 1992; Draper, 1993), with the real labor markets situation being closer to the postulates of the efficiency wage hypothesis (Anchuelo, 1993). However, as Fernández and Montuenga (1997) point out, this evidence was not entirely conclusive given that the apparent non-significance of insider power may be due to the fact that the variable used to approximate it, the degree of wage indexation with respect to productivity fluctuations in each sector, did not display any significant effects. Testing this hypothesis empirically is complicated, since it requires the study of alternatives that imply important modifications to the baseline model.

Accordingly, Montuenga et al. (2007) opt to complete the basic model with a few additional explanatory variables. Some of them form part of the wage equation with complete certainty, or at least this is what the consensus of the scientific community indicates. This is the case of productivity and the alternative wage. However, others have not generated this consensus, and their real influence on the wage negotiation process is questionable. That is the case of companies position in the market (degree of concentration), their average size in the sector, their financial situation (ability to pay), turnover costs and union activity. To evaluate the real influence of these variables and decide whether or not to include them in the specification of wage equation, these authors make use of the "Global Sensitivity Analysis" methodology (also known by the acronym EBA, for "Extreme Bound Analysis"), proposed by Leamer (1985).

Montuenga et al. (2007) conclude that there is evidence of a dual and diverse behavior in different sectors regarding the process of real wages setting. In some sectors, the evolution of wage level would be tied to variables that would point to an efficiency wage structure, while in others, the explanatory variables would respond more to the insiders-outsiders model. Indeed, in the group of more dynamic sectors, wages tend to be set according to relative payment criteria, while in sectors considered backward, insider power is much more relevant.

Consistent with this standpoint, Bande et al. (2007, 2008) analyze the persistence of significant regional disparities in unemployment rates in Spain and their exacerbation during expansionary phases of the economic cycle. Unlike the traditional consideration of demand and supply factors in labor markets (e.g., sectoral composition of employment, characteristics of job seekers, interregional mobility and wage flexibility), this approach focuses on the role of institutional factors in labor markets. Many of these factors are established at a national level (e.g., minimum wage, unemployment benefits, taxation and level of social protection), and consequently, they are not useful for analyzing regional differences.

For this reason, these authors focus on wage setting mechanism. For this purpose, they specify a wage equation in which two types of explanatory variables are contemplated: internal factors, which are represented by labor productivity in each sector and region, and external factors, which encompass the general conditions of labor markets performance (unemployment rate, average real wage, etc.), which on its part fall under the concept of alternative income or wage. As a result of the decentralization process in collective bargaining on working conditions that began after the "Interconfederal Agreement on Collective Bargaining 1985-1986" ("Economic and Social Agreement"), wage setting became mainly established on a sectoral basis, at a provincial or regional level.

The results obtained by Bande et al. (2007 and 2008) in their estimations, based on various definitions of the alternative wage, lead them to conclude that internal factors (productivity) only play a relevant role in wage setting in the case of backward sectors, but that both in these and in the more dynamic sectors the prevailing role belongs to labor markets general conditions, which are represented by the alternative wage. The most dynamic sectors have more financial leeway, due to their high productivity, so that the insiders shift their focus in salary negotiations from maintaining employment to increasing wages, taking the sectors and regions with upper salaries as a reference. The backward sectors are more constrained to take productivity fluctuations into account in wage setting, and this causes them serious difficulties in terms of maintaining employment. Insofar as relative payment rules ("imitation effect") are taken into account, unit labor costs will grow to an unaffordable extent in sectors with below-average productivity growth.

The same argument can be applied analogically when we study the differences between regions. In those regions where the variability in wages has been more alien to productivity evolution in each sector, a worsening of labor markets situation can be observed with respect to those in which the sectoral composition and the tie with productivity were in favor. And by virtue of the "imitation effect", which takes the wage levels of leading sectors and regions as a reference, the differences in unemployment rates between regions are exacerbated in the expansionary phases of the cycle (upturns) and attenuated in the recessionary ones (downturns). Unemployment in Spain, conclude Bande et al. (2007 and 2008), is not a national problem but a regional one. Given that institutional factors and wage setting mechanisms prevailing in the different regions, on a sectoral basis, are the cause of this situation, they propose deepening the decentralization process in collective bargaining and encouraging wage setting at company level. This would facilitate adjusting wages to productivity evolution and allow for maintaining and creating employment.

Some of these ideas and concepts underpin the measures adopted in the 2012 Spanish Labor Market Reform. These measures aimed to stop job destruction caused by the Great Recession, overcome rigidities in the labour market and establish a new institutional framework to enable the sustainable creation of stable, quality jobs. In line with this approach, Martini & Giannini (2020) proposed a model based on Italy's highly centralised collective bargaining system. This model establishes a long-term equilibrium relationship between nominal wages per worker and average labour productivity in each sector using cointegration techniques. This study takes a spatio-temporal perspective, comparing data from the 21 Italian regions over a 21-year period (1995–2015). The central role played by collective bargaining in the process, coupled with the regional perspective of the analysis, also makes this problem statement inspiring for the Spanish case.

3. Theoretical framework

3.1. Baseline model

Consistent with the approach of Bande and Fernández (1999), our model specification attempts to provide an adequate microeconomic foundation for a formulation that essentially responds to labor supply bargaining models. A complete description of this model can be found in the work of Layard et al. (1991). It has been applied to studies of the Spanish economy, as mentioned previously (Draper, 1993; Andrés and García, 1991). In negotiation models, the real wage is presented as a linear combination of internal - or sector-specific - factors, and external factors, that reflect labor markets general conditions.

These factors can be specified very broadly, taking into account diverse aspects such as degree of competition in each sector, average size of firms, union power, financial variables, or replacement rate of unemployment benefits (see Montuenga et al., 2007). However, most published empirical studies on Spanish labor markets have simplified the specification of the explanatory variables, according to the principle of parsimony, by focusing on the main internal and external factors. The internal factors are specified by incorporating the labor productivity variable for each sector (Π_{it}). Regarding the external factors, the alternative wage (w_t^{α}) and the unemployment rate (U_t) are considered representative of labor markets general situation. The alternative wage reflects the influence of relative payment criteria on wage setting, and the unemployment rate expresses the probability of unemployment in a given economy. Using the same logarithmic-linear approximation derived by Fernández and Montuenga (1997), wage equation is formulated as follows:

$$w_{it} = \beta_0 + \beta_1 \Pi_{it} + \beta_2 w_t^a + \beta_3 U_t + \varepsilon_t \qquad \textbf{(1)}$$

3.2. Revised model

For estimation purposes, the basic model has been modified since previous studies have shown the low significance of the unemployment rate and the collinearity problems between this variable and the aggregate wage. To avoid these issues, we have chosen to include only the alternative wage (w_t^{α}) in the model specification to represent external factors, i.e., labor markets general situation:

$$w_t^a = uw + (1-u)b \qquad \textbf{(2)}$$

where *u* is the unemployment rate as a percentage of labor force and *b* is a representative indicator of unemployment benefits.

On the other hand, the values obtained from estimation in levels for the Durbin-Watson statistic indicated the need to correct some autocorrelation problems by introducing lags in the model specification, for both the dependent and explanatory variables. With these corrections, wage equation can be expressed as follows:

$$w_{it} = \beta_0 + \beta_1 \Pi_{it} + \beta_2 w_{it}^{a} + \beta_3 w_{it-1} + \beta_4 \Pi_{it-1} + \beta_5 w_{it-1}^{a} + \varepsilon_t \qquad \textbf{(3)}$$

Incorporating into the model an error correction mechanism, which considers both short and long term equilibrium, the same equation could be formulated as follows:

$$\Delta w_{it} = \varphi_0 \,(w_{it} - \beta_1 \Pi_{it} - \beta_2 w_{it}^{a}) + \delta_1 \Delta \Pi_{it} + \delta_2 \Delta w_{it}^{a} + \varepsilon_t \qquad \textbf{(4)}$$

where φ_0 represents the error correction term, $w_{it} - \beta_1 \Pi_{it} - \beta_2 w_{it}^{a}$ is the long-run cointegration or equilibrium equation, y $\delta_1 \Delta \Pi_{it} + \delta_2 \Delta w_{it}^{a}$ the short-run dynamic adjustment terms.

4. Data and variables

De la Fuente and Ruiz Aguirre (2020) present the construction of sectoral module of the "RegData FEDEA-BBVA" database. This module contains regional data on employment (including employed and wage earners), gross value added (GVA) in nominal and real terms, the implicit GVA deflator, GVA per employed person, compensation of employees and average wages. These data are disaggregated into six major sectors: Agriculture and fishing; Mining, energy and water; Manufacturing industries; Construction; Market services, excluding Health, Education and Private Social Services; Public services, excluding Health, Education, and Social Services; and Health, Education and Social Services, including both private and public services. However, the market services sector is also tentatively disaggregated, as it is a broad and heterogeneous category in which subsectors with extreme behavior in terms of productivity, wages, and types of hiring coexist. For this reason, our analysis will consider the following eight sectors:

I.- Agriculture and fishing

II.- Mining, energy and water.

III.- Manufacturing industries.

IV.- Construction.

Va.- Financial services and insurance.

Vb.- Trade, hotels and restaurants, transport and communications.

Vc.- Rest of market services (except health and education).

VI.- Public or non-market services, plus health, education and social services, both private and public.

This module of the “RegData” database includes a series that initially covers a period of more than six decades (1955-2018). This makes it possible to conduct long-term sectoral studies and analyses from a regional perspective.

From a panel data analysis perspective, this study considers the 17 autonomous communities as cross-sectional units. Data referring to the autonomous cities of Ceuta and Melilla are excluded because they are not homogeneous or comparable to those of autonomous communities, at least in terms of scale and order of magnitude. Each autonomous community is identified by an order number and an abbreviation.

AACC
1 AND (Andalucía)
2 ARAG (Aragón)
3 AST (Asturias)
4 BAL (Baleares)
5 CAN (Canarias)
6 CANT (Cantabria)
7 CYL (Castilla y León)
8 CLM (Castilla-La Mancha)
9 CAT (Cataluña)
10 VAL (Valencia)
11 EXT (Extremadura)
12 GAL (Galicia)
13 MAD (Madrid)
14 MUR (Murcia)
15 NAV (Navarra)
16 PV (País Vasco)
17 RIO (La Rioja)

For the purpose of considering the cross-sectional dimension of the model, these will be therefore panel data units.

In relation to the model specification adopted for the analysis, all variables will be expressed in logarithms. Thus, the estimated coefficients will express the elasticity of the dependent variable, real wages (w_{it}), with respect to each of the explanatory variables, labor productivity (Π_{it}) and alternative wage (w_t^α).

Regarding real wages (w_{it}), we start from the panels corresponding to the 17 Spanish autonomous communities, in each of the sectors under consideration, for the variable "average wage": *w* = *RAS* (compensation of employees, expressed in current euros)/*employees*; applying to these data the GVA deflator corresponding to the sector for each of the regions over the period of reference - based on 2016 -, we obtain wages expressed in constant euros, i.e., real wages.

Labor productivity (Π_{it}) is obtained by dividing GVA at real prices by the number of employed persons in each region and sector, from 1955 to 2018. Thus, by incorporating this explanatory variable into the model equation, we try to capture the extent to which real wages respond to changes in labor productivity in each sector.

Regarding the alternative wage (w_t^α), there are two possible formulations of this variable. The first formulation, denoted by $w_t^\alpha(1)$, defines the alternative wage as the average of real wage values in each time unit of the period for each sector in the rest of autonomous communities. This approach aligns with that of Bande et al. (2007, 2008) and implicitly assumes the predominance of national and sectoral collective agreements as a starting point. These agreements tend to reduce wage dispersion between regions and suggest an imitation mechanism in which wages evolve according to national aggregates. This approach focuses on the territorial dimension of wage setting evolution during the period of reference to ascertain aspects such as convergence or dispersion between regions in different economic cycle phases.

A second characterization of the alternative wage, designated as $w_t^\alpha(2)$, estimates it from the average wage in the other sectors weighted by their respective shares in overall employment within each autonomous community. This variable is specified to provide an alternative representation of the influence of general labor markets conditions on the process of real wages setting.

5. Methodology and prior results

5.1. Stationarity analysis

Panel data analysis must begin with a study of their structural characteristics, specifically stationarity. The classical method of linear regression assumes that the analyzed data are stationary. This implies that their generating process has constant mean and variance over time in both the time and cross-sectional dimensions. If the analyzed data do not meet this condition and are instead integrated or non-stationary, other estimation methods must be used. Otherwise, the application of conventional linear regression may result in a spurious correlation (Granger and Newbold, 1974).

In the field of panel data analysis, various unit root or stationarity tests address to the distribution's asymptotic characteristics and whether each panel member has the same number of observations over the time period under consideration (qualifying it as “strongly balanced," "balanced," or "unbalanced"). In relation to the data we are dealing with, we start with 17 sections — the autonomous communities — ($N = 17$), while the time period we will consider comprises 53 units — $T = 53$ — for the limited or restricted sample, and 64 units — $T = 64$ — for the complete sample. All the sections of the panel contain observations for each unit of the time period under consideration, so we can affirm that the panel data are "strongly balanced" in all the analyzed sectors.

Several tests have been proposed in the literature. The differences between them lie in the characteristics of the data and the null hypothesis definition. Traditional tests, such as Levin, Lin, and Chu (2002) - a unit root test for panel data – or Hadri (2000) - in which the null hypothesis is stationarity of panel data – lead in this case to contradictory conclusions (see Parra, 2025).

In a seminal paper, Perron (1989) demonstrated that structural changes can negatively impact the performance of unit root tests. Structural breaks occur as a result of shocks that are exogenous to the model, but nevertheless have persistent effects. These shocks can lead unit root tests to erroneous conclusions, causing them to accept the null hypothesis that the effects are permanent when, in fact, they are transitory.

For this reason, the presence of structural breaks is also a relevant factor in panel data analysis. Karavias and Tzavalis (2014) proposed unit root tests that account for structural breaks. Two deterministic component models are regarded: the first considers only fixed effects, while the second refers the possibility of structural breaks to constant terms and trends of the series. Although the dates of structural breaks are considered common to all series, the magnitude of these breaks may vary among the different series in the panel. These dates may be previously known or unknown. When the break dates are unknown, bootstrapping procedures are used to calculate the tests' critical and *p*-values. Errors may be non-normal, cross-sectionally dependent, and cross-sectionally heteroscedastic. The null hypothesis states that all panel series are unit root processes. Under the alternative hypothesis, some or all panel series are stationary with structural breaks in the deterministic terms (Chen, Karavias and Tzavalis, 2021). Karavias and Tzavalis (2019) extended these tests to include two structural breaks.

In Karavias and Tzavalis' test specification we incorporate a time trend, which we can observe in the series corresponding to the three considered variables, notwithstanding the structural breaks that are also observed in all of them. Consistent with what was previously pointed out about the implications of stationarity analysis in panel data, we also introduce cross-sectional dependence and heteroskedasticity in the specification of this contrast. With respect to the restricted sample, we point out a single structural break, whose date we place in 1986. We place this break in 1986 because a process of decentralization in collective bargaining on working conditions began in Spain that year. This process resulted in greater productivity relevance and, at the same time, a significant "imitation effect" in sectors with lower productivity growth with respect to the most dynamic sectors, in wage setting (Bande et al., 2007 and 2008). Regarding the full sample, we point out two structural breaks, dated 1986 and 2008, the latter year being the outbreak of the Great Recession.

The results of applying the Karavas and Tzavalis' test have been reproduced in Appendix I for both restricted and full samples[1]. The obtained statistics do not allow us to reject the null hypothesis of unit roots for any of wage equation variables in any sector, for either sample.

5.2. Convergence analysis

A first approach to the study of real wages evolution in Spanish autonomous communities can be made by means of what is known as convergence analysis.

Solow's (1956) economic growth theory proposed a growth model with diminishing returns to capital within the neoclassical paradigm. Within this framework, the convergence hypothesis is formulated, which states that poor countries and regions grow faster than rich ones in the long term, resulting in equalized GDP per capita.

This process is conventionally tested in terms of two concepts of convergence: β and σ. β convergence indicates an inverse relationship between growth rate and initial GDP per capita. σ convergence measures the variation in the standard error or standard deviation of the logarithm of GDP per capita. If this statistic's value decreases over time until it becomes practically equal to zero, then there is σ convergence. "True convergence" is designated as σ, since β is necessary but not sufficient for σ to exist (Barro and Sala-i-Martí, 1992). On balance, if convergence exists, then the cross-sectional variance of GDP per capita reaches over time value zero.

[1] This analysis is applied to series related to convergence clubs obtained as shown in next subsection.

These concepts have been adapted to various convergence analyses in general, including wages. This type of analysis has been recently boosted, mainly following the contribution of Phillips and Sul (2007), who have developed a statistic widely used as a tool for convergence analysis in panel data.

A simple but intuitive way of defining convergence between panel data series is to operate in terms of their relationship and not their difference or their linear combinations. We consider that X_{it} represents the natural logarithm of the variable of interest, in our case real wages (w_{it}), with *i = 1, 2,...17* (the 17 autonomous communities) and *t = 1955, 1956,...2018*. This variable can be decomposed as $X_{it} = \delta_{it}\mu_t$, where μ_t and δ_{it} are the common and idiosyncratic components, respectively. Phillips and Sul (2007) suggest verifying the convergence hypothesis by analyzing whether δ_{it} converges to δ. To do so, they first define the relative transition component:

$$h_{it} = \frac{X_{it}}{N^{-1}\sum_{i=1}^{N} X_{it}} = \frac{\delta_{it}}{N^{-1}\sum_{i=1}^{N} \delta_{it}} \qquad \textbf{(5)}$$

If there is really convergence, then $h_{it} \rightarrow 1$. The cross-sectional variation, H_{it}, is defined as follows:

$$H_{it} = N^{-1} \sum_{i=1}^{N}(h_{it}-1)^2 \overset{As}{\rightarrow} 0, \text{ cuando } T \overset{As}{\rightarrow} \infty$$

and should converge asymptotically to zero as T tends asymptotically to infinity. Based on these assumptions, the convergence test is formulated by estimating the *log t* regression:

$$log\frac{H_1}{H_t} - 2log[log(t)] = \alpha + \beta \log(t) + u_t \, , t = T_0, \ldots, T$$

where $T_0 = [rT]$. The parameter r determines the proportion of data that will be discarded before the regression is run. The recommended value is $r = 0.33$, or one-third of the total.

The identification of convergence clubs or clusters in a dynamic factors model of economic transition and growth is facilitated by an algorithm provided by Phillips and Sul (2009). In this case, we apply the Phillips and Sul's convergence test to real wage variable (w_{it}) in the sectors of activity under consideration to determine whether Spanish regions have undergone total convergence or exhibit a club convergence pattern.

Appendix II shows the results of the convergence tests: in sectors I (Agriculture and fishing), II (Mining, energy and water), III (Manufacturing industries), Va (Financial services and insurance), Vc (Rest of market services, except health and education) and VI (Public or non-market services, plus health, education and social services, both private and public) it can be observed a pattern of absolute convergence, namely, among all the autonomous communities; in sector IV (Construction), two distinct convergence clubs are clearly defined; finallly, sector Vb (Trade, hotels and restaurants, transport and communications) exhibits wage convergence within a club of fifteen autonomous communities, but no convergence is observed in Asturias and Murcia.

Based on these results, we set up different clubes within each economic sector for subsequent analysis of the existence of long-term equilibrium relationships (cointegration) and, in that case, estimation of the wage equation model.

5.3. Cointegration analysis

A unit root process becomes stationary when first differences are taken. This process is designated as an integrated process of order one - *I(1)* -. A linear combination of several *I(1)* series is said to be cointegrated when it is stationary (Engle and Granger, 1987). Cointegration tests verify the existence of a long-run equilibrium relationship between *I(1)* variables.

In the specific field of panel data, cointegration analysis adds a cross-sectional dimension to the time dimension. In this case, the long-run equilibrium relationship will also exist between the different units of the panel, if applicable.

Three basic approaches to cointegration tests in panel data are: Kao (1999), Pedroni (1999, 2004) and Westerlund (2005), which however yield contradictory results regarding the presence of a cointegration relationship among the variables comprising the wage equation, for both the restricted and full samples[2]. As Persyn and Westerlund (2008) have noted, despite the growing interest in cointegration analysis in panel data, many studies fail to reject the null hypothesis of no cointegration when economic theory postulates a long-run equilibrium relationship between the variables. An explanation for this problem is that most cointegration tests based on estimation residuals require that the long-run parameters of the variables in levels be equal to the short-run parameters of the variables in differences. Kremers et al. (1992) and Banerjee et al. (1998) define this phenomenon as "common factor restrictions", which results in a significant loss of power in cointegration tests based on residuals from an initial regression.

Westerlund (2007) proposed subsequently four alternative panel cointegration tests based on structural dynamics rather than residuals. These tests do not impose any common factor restrictions. The basic approach involves verifying the null hypothesis of no

[2] See the whole set of results in Parra (2025).

cointegration by testing whether the error correction term is equal to zero in the analyzed model. The statistics corresponding to these four tests conform to a normal distribution. They are all general enough to fit the specific short-run dynamics, as well as the trend and slope parameters of each panel unit and the cross-sectional dependence. The first two tests are "panel tests", in which the alternative hypothesis is that the panel is fully cointegrated. The last two are "group-mean tests", in which the alternative hypothesis is that at least one panel unit is cointegrated.

In order to isolate the possible impact of the Great Recession on wage setting in Spanish labor markets, we will limit our analysis to models for which we have verified the existence of a cointegration relationship in both the limited and full samples.

Regarding the other sectors, for which we could not verify a long-run equilibrium relationship, these are activities that, due to their characteristics, exhibit greater variability between regions depending on their economic importance in their respective territories.

The results of Westerlund's (2007) cointegration tests have been reproduced in Appendix III, with reference to the different economic sectors and convergence clubs defined in the previous section.

5.6. Estimation of a panel data model with an error correction mechanism

So far, our analysis has focused on the presence of unit roots or stationarity in the series corresponding to the variables that comprise the wage equation we have defined, as well as on the existence of a cointegration or long-run equilibrium relationship between these variables. Another feature of panel data that has received considerable attention in recent macro-empirical literature is cross-sectional dependence, which must also be taken into account.

Panel data may be subject to generalized cross-sectional dependence, meaning all units in the panel are correlated. This phenomenon is generally attributed to the effect of unobserved common factors that affect each unit in the panel, albeit possibly in different ways (Basak and Das, 2018). Unobserved common factors represent latent variables (e.g., exogenous shocks) that simultaneously influence all cross-sectional units, leading to cross-sectional dependence and potential bias in standard estimators, as we pointed out in the previous section.

In these circumstances, the common correlated effects (CCE) model is the most appropriate approach for addressing the phenomenon of cross-sectional dependence, as it is robust to different types of cross-sectional dependence in relation to regressors with unit roots and heterogeneous slopes. The methodologies proposed by Chudik and Pesaran (2015), Eberhardt and Presbitero (2015), and Gegenbach et al. (2015) attempt to integrate the dual perspectives of cointegration in the temporal and spatial senses into a single framework. This approach is referred to as "common correlated effects mean group (CCEMG) estimation". It involves estimating heterogeneous error correction models with varying slopes between different units on panel data with cross-sectional dependence.

The proposed methodology first estimates individual error correction models for each panel member and then calculates the coefficients of the mean group, as well as those of the long-run equilibrium equation. The error correction model estimated separately for each panel member assumes that all variables in levels are *I(1)* and calculates the cross-sectional averages for each of them. The mean group coefficients are calculated as unweighted means of the coefficients estimated for each panel member. The standard error of the mean or the standard deviation is obtained using nonparametric procedures (Pesaran and Smith, 1995). The estimated long-run equilibrium (cointegration) coefficients and their significance for each panel member allow us to calculate the long-run average coefficients for the mean group, along with their standard errors, *t*-statistics, and *p*-values.

The second stage involves analyzing whether a cointegration relationship exists between the different variables, based on the estimated error correction terms (ECC). To this end, we calculate the error correction term of the mean group, the unweighted average *t*-statistic of the error correction terms of each panel member, and the corresponding *p*-value, referencing to critical values established by Gengenbach et al. (2015).

Finally, the Pesaran’s (2015) test is used to evaluate the null hypothesis of weak cross-sectional dependence of errors in the model against the alternative hypothesis of strong cross-sectional dependence. First, the test is applied to both endogenous and explanatory variables to reveal possible cross-sectional dependence in the untransformed variables. Second, the test analyzes residuals of regression to determine the extent to which the empirical model allows us to estimate a long-run equilibrium relationship excluding strong cross-sectional dependence. If the test rejects the null hypothesis of weak cross-sectional dependence in favor of the alternative hypothesis of strong cross-sectional dependence in this second stage, then the estimation results lack robustness and consistency since correlation has been detected in residuals.

6. Estimation results

Appendix IV contains the estimation results for sectors where the conditions for estimating a long-term equilibrium model are met. This model incorporates an error correction mechanism in the short-term dynamics, in accordance with the cointegration test results. We define wage equation using expression **(4)**:

$$\Delta w_{it} = \varphi_0 [w_{it} - \beta_1 \Pi_{it} - \beta_2 w^{\alpha}_{it}(\#)] + \delta_1 \Delta\Pi_{it} + \delta_2 \Delta w^{\alpha}_{it}(\#) + \varepsilon_t$$

where # = *1* or *2*, depending on whether it is one or the other alternative wage specification.

The results are presented according to the economic sectors and convergence clubs outlined in Section 5.2, and also in relation with the two options for alternative wage configuration defined in Section 4.

Thus, for alternative wage specification $w^{\alpha}_{it}(1)$ estimation results are exposed in relation to sectors III, IV (clubs 1 and 2), Va and Vb (club 1); for alternative wage specification $w^{\alpha}_{it}(2)$ results are referred to sectors I, II, IV (clubs 1 and 2), Vb (club 1), Vc and VI.

6.1. Alternative wage defined as $w^{\alpha}_{it}(1)$

Focusing first in estimation of models with alternative wage specification $w^{\alpha}_{it}(1)$, the model stability condition is met in all cases, since the error correction term (φ_0) has a negative sign, suggesting a convergent trajectory. A positive sign would imply an explosive trajectory, which cannot be economically interpreted.

Regarding sector III (Manufacturing industries), the adjustment speed decreased from 23% to approximately 16.5% per year, a reduction of six point five percentage points, due to the impact of the Great Recession. This significant decrease suggests that fewer short-term imbalances are observed following the 2008 economic crisis and the 2012 Labor Market Reform, allowing real wages to more easily adjust to long-term equilibrium values. Minimal fluctuations in the adjustment speed are observed for both club 1 and club 2 in sector IV (Construction). In sector Va (Financial services and insurance) the adjustment speed slowed, dropping from 29.2% to 27.2% per year. Similarly, in sector Vb (Trade, hotels and restaurants, transport and communications) the adjustment speed decreased, from 30.2 % to 25.4 % per year, after the Great Recession.

Based on the value of long-run average coefficients, it can be seen that in all cases general factors prevail over sectoral factors (labor productivity) regarding to changes in equilibrium real wages.

Comparative static analysis before and after the Great Recession in sector III, reveals an increase in the elasticity of real wages with respect to labor productivity compared to general factors: *0,297 (s.e. 0,084) → 0,359 (s.e. 0,100)*; *0,746 (s.e. 0,071) → 0,673 (s.e.*

0.077). Short-term dynamic adjustments also show a slight increase in labor productivity's influence and a slight reduction in general factors' influence [***δ_1:*** *0,141 → 0,173;* ***δ_2:*** *0,938 → 0,900*].

In club 2 of sector IV, the largest (13 autonomous communities), notwithstanding the prevalence of general factors, there is initially a more balanced relationship with respect to sectoral factors. In contrast, the impact of the Great Recession is reflected in a decline of labor productivity's share in wage setting: *0,402 (s.e. 0,095) → 0,323 (s.e. 0,095)*; *0,575 (s.e. 0,100) → 0,661 (s.e. 0,105)*.

Regarding sector Va, the prevalence of general factors in long-term equilibrium is indisputable, due not only to the difference in numerical values of the coefficients but also to the lack of statistical significance of those corresponding to labor productivity. The absolute predominance of general labor market conditions remains virtually unchanged after the impact of Great Recession. Obtained results in relation to the convergence club in sector Vb are very similar.

In all cases the root mean square error is below the 5% threshold, indicating that the model fits well.

Nevertheless, the Pesaran's test statistic for the regression residuals allows us to reject the null hypothesis of weak cross-sectional dependence in club 1 of sector IV, and also in the convergence club of sector Vb, so we cannot conclude that the obtained results in these two cases are robust and consistent.

Manufacturing industries (sector III) is an example of dynamic sector. Note that in this case we used the average wage in the same sector for the other regions throughout the period considered as the alternative wage specification. As already pointed out, this approach assumes the preponderance of national and sectoral collective agreements, indicating an "imitation effect" of real wages with respect to national aggregate evolution. Regarding this, Martínez Matute (2014) has observed the prevalence of collective agreements at a level higher than the company's in the secondary sector. However, there are exceptions, such as extractive industries, which we have classified in a different sector. Following the Great Recession and the 2012 Labor Market Reform, the role of labor productivity in wage setting has increased in a sector that can be characterized as dynamic, especially in the long term, although general factors continue to prevail. This greater alignment with sectoral productivity trends could explain the lower dynamic imbalances in real wages when comparing the full sample (1955–2018) to the limited sample (1955–2007).

Taking construction (sector IV) as a paradigm of backward sector and focusing on club 2, although general market conditions keep on prevailing, which tend to reduce wage dispersion between regions, labor productivity initially plays a significant, albeit secondary, role, especially in the long term. Nevertheless, the Great Recession seems to have limited the influence of internal factors in favor of external factors, allowing the "imitation effect" to play a greater role in wage setting.

6.2. Alternative wage defined as $w_{it}^{\alpha}(2)$

Next, we analyze the obtained results for the alternative wage specification $w_{it}^{\alpha}(2)$. First of all, the model stability condition is met in all cases, since the error correction term (φ_0) has a negative sign, which gives an idea of a convergent trajectory.

In sector I (Agriculture and fishing) the adjustment speed appears to have remained stable at around 20% per year. Similarly, in sector II (Mining, energy and water) the adjustment speed has remained virtually steady, at 16-17% per year. Regarding club 2 in sector IV (Construction), the adjustment speed decreases by nearly four percentage points, dropping from around 23% to 19% per year. In convergence club of sector Vb (Trade, hotels and restaurants, transport and communications) the adjustment speed decreases by nearly four percentage points, dropping from around 23% to 19% per year. In relation to sector Vc (Rest of market services, except health and education), the adjustment speed has remained virtually unchanged. Finally, in sector VI (Public or non-market services, plus health, education and social services, both private and public) the speed of adjustment has increased following the impact of the Great Recession, rising from 7% to 11.1% per year.

As for the determining factors in wage setting, with this alternative wage specification - $w_{it}^{\alpha}(2)$ - the results obtained are diametrically opposed to those corresponding to the other specification - $w_{it}^{\alpha}(1)$ -. These results are achieved by calcultating the weighted average of wages in other sectors, based on their respective shares of overall employment in each autonomous community, as alternative wage.

Thus, in relation to sector I, the value of the long-run average coefficients reveals the prevalence of internal factors (labor productivity) over external factors. However, the estimated coefficients are statistically insignificant. Regarding sector II, labor productivity prevail over general factors in equilibrium wages setting, both in the short and long term, before but not after the Great Recession. These two sectors exhibit dynamic behavior in terms of productivity growth.

Construction (sector IV), in contrast, has traditionally been considered a backward sector in terms of productivity growth. With this alternative wage specification - $w_{it}^{\alpha}(2)$ -, in club 2, which includes 13 autonomous comunities, labor productivity appears to take precedence over external factors following the impact of the Great Recession, as indicated by the value of the long-run average coefficients.

In sector Vb labor productivity predominates in wage setting before and after the Great Recession, and its role has become even more prominent since then. Regarding sector Vc, the prevalence of internal factors (productivity) over external ones in wage setting is observed, both in the short and long term, but the coefficient corresponding to general factors shows, also in both cases, an opposite sign than what would be expected based on the assumed theoretical model. Lastly, in relation with sector VI (Public or non-market services, plus health, education and social services, both private and public), long-run average coefficients present again opposite sign than what would be expected in accordance with theoretical model. In this regard, it is worth clarifying that wage setting mechanism in the public sector presents very significant peculiarities compared to any other sector.

Except in relation to sector I, the root mean square error is below the 5% threshold in all cases, indicating that the model fits well.

Nevertheless, the Pesaran's test statistic for the regression residuals allows us to reject the null hypothesis of weak cross-sectional dependence in all cases, so these results lack robustness and consistency.

As can be seen, obtained results depend on the chosen alternative wage specification. Considering $w_{it}^{\alpha}(1)$, we note the predominance of general factors over labor productivity. In contrast, taking $w_{it}^{\alpha}(2)$ as the alternative wage, we observe the predominance of labor productivity in real wage setting. This disparity in results highlights the respective implications of the two alternative wage specifications. In the first case, $w_{it}^{\alpha}(1)$, the preponderance of general factors may stem from the prevalence of national and sectoral collective agreements, which suggests an "imitation effect" of real wages with respect to national aggregate evolution. In the case of $w_{it}^{\alpha}(2)$, the predominance of labor productivity comes from the reference wage levels of all other sectors in the corresponding region. But in this last case, based on the results of Pesaran's test, we are not in a position to make a valid statistical inference.

7. Conclusions

This study analyzes the wage setting process in Spanish economy using a panel data model that includes 17 cross-sectional units—the autonomous communities—during the period between 1955 and 2018. We seek to identify and assess the possible impact that the Great Recession may have had on the dynamics of this process. To this end, a comparative static analysis has been carried out using a sample limited to the period between 1955 and 2007.

To complete the study from a spatial-temporal perspective, a previous analysis of convergence of real wages among the various territories has been developed throughout the entire period under consideration. Among all the autonomous communities, wage convergence dynamics can be observed in most sectors of activity. Regarding sector IV (construction), convergence is evident among two groups: one composed by regions with the highest productivity growth and the other including the remaining regions. Finally, in sector Vb (trade, hotels and restaurants, transport and communications), convergence is generally observed except among the autonomous communities of Asturias and Murcia.

These results suggest that, regardless of equilibrium in cointegration, most sectors exhibit long-term co-movement or convergence among the autonomous communities. This evidence argues that structural problems arising from wage setting mechanism can be observed with varying nuances and emphases in all sectors and territories previously defined. It reveals that the problems of Spanish labor markets, particularly the equilibrium relationship between wages and unemployment, have a regional dimension rather than a national one (Bande et al., 2007 and 2008; Villaverde and Maza, 2002).

When estimating wage equation, we attempted to identify the dominant factor in wage setting by distinguishing between internal factors unique to each sector, such as labor productivity, and external or general factors. We have proposed two possible configurations for the variable representing the latter: the alternative wage (w_{it}^{α}). First, it is the average of the real wage values in each time unit of the period of reference for the other regions in each analyzed sector — w_{it}^{α} (1) —. Second, we calculated the alternative wage based on the average wage in the other sectors, weighted by their shares in total employment within each autonomous community — w_{it}^{α} (2) —.

Considering alternative wage w_{it}^{α} (1), we observed the prevalence of general factors (represented by the alternative wage) over sectoral factors (labor productivity) in wage setting across all sectors, both before and after the Great Recession. While internal factors remain in the background, depending on each sector's characteristics in terms of labor productivity growth, the Great Recession's impact has sometimes led to an increase or decrease in these factors' participation in real wages setting.

In sectors with dynamic labor productivity growth, such as manufacturing industries (III), general labor market conditions remain the main determinant of equilibrium wages. However, the Great Recession notably strengthened the role of labor productivity.

Concurrently, there has been a significant reduction in the value of adjustment speed, suggesting that short-term imbalances are less significant. The "imitation effect" has less incidence in wage setting due to this greater link with labor productivity evolution.

Conversely, in sectors traditionally considered as backward in terms of productivity growth, such as construction, the predominance of general factors in wage setting has been consolidated following the Great Recession, at least in the long term, among most autonomous communities. In other words, despite the relatively lower growth in labor productivity, the widespread application of relative payment criteria in wage setting has been observed, and an "imitation effect" has emerged in their determination. The speed of short-term adjustment has remained virtually unchanged, suggesting that the disconnection between wages and productivity trends may hinder the correction of existing labor market imbalances.

These results could help explain why the impact of a financial crisis, such as the Great Recession, was so intense in Spain compared to neighboring countries. Prior to the Great Recession, Spain's production model relied heavily on labor-intensive activities that generated minimal added value. The real estate sector, particularly construction and housing sale, exemplified this model. Because the wage-setting mechanism did not reflect labor productivity evolution in this sector, an intense "imitation effect" occurred with respect to the wage parameters of the most productive sectors and regions. Thus, wages are mainly set in response to general labor market conditions, such as the unemployment rate, unemployment benefit amounts, and alternative wages offered in other sectors. The "real estate bubble" is best understood when viewed through the lens of labor costs inflation.

In contrast, considering w_{it}^{α} (2) as alternative wage, it seems that labor productivity is a dominant factor in wage setting, both in sectors with dynamic productivity growth, such as mining, energy, and water (sector II), and in sectors characterized as backward, such as construction (sector IV), particularly following the impact of the Great Recession and the implementation of the 2012 Labor Market Reform. Nevertheless, the regression residuals obtained from all the analyzed cases on the basis of this alternative wage specification allow us to reject the null hypothesis of weak cross-sectional dependence. This means that the results obtained lack robustness and consistency.

In a nutshell, the obtained results based on the alternative wage specification w_{it}^{α} (1) seem to indicate the importance of the each sector’s national aggregate evolution in real wage setting. This approach allows for a better analysis of the territorial dimension of this process, highlighting wage convergence phenomena between regions throughout the economic cycle and the preponderance of national and sectoral collective agreements, with a tendency toward wage imitation.

Setting wages in a given sector according to national or regional labor markets general conditions, without considering productivity and the sector's specific circumstances within each region, affects job creation and competitiveness. Furthermore, if wages are mainly set in line with labor market performance in sectors and/or regions with the best records in terms of productivity growth and unemployment rates, those wages will not reflect the productive characteristics of the sector within that particular region. This could result in widening unemployment differentials.

Following this reasoning, Spain's path of decentralization in collective bargaining since 1986 has allowed productivity to play a greater role in wage setting, but it has also promoted a process of wage imitation, in which backward sectors attempt to align their wages with those negotiated in dynamic sectors. This effect is particularly relevant when an increasingly decentralized process coincides with an expansionary phase of the business cycle, as occurred in Spain during the period under consideration. During that period, unemployment differences between regions and sectors widened (see Jimeno and Bentolila, 1998; Lopez-Bazo et al., 2002; Bande et al., 2009). This occurred because negotiations in the most productive sectors were not limited by nationally set wage scales, as was the case during the period from 1978 to 1986. Additionally, imitation in backward sectors led to agreements on wage increases that exceeded productivity gains.

Even though wage bargaining is decentralized, the response of wages to differences in unemployment rates may decrease if the wage imitation effect is significant, as it is in Spain. This phenomenon is particularly evident during economic fluctuations when differences in productivity become more apparent. For example, the evolution of wages in Spain during the long expansionary phase of the cycle preceding the Great Recession (1994-2007) exhibited many similarities. Decentralizing salary negotiations to the industrial-regional level did not ensure increased wage flexibility in response to productivity fluctuations. This must be considered when reforming Spain's collective negotiation structure.

The obtained evidence suggests, among other things, that the prevailing dynamics in wage setting are preventing productivity gains from translating into increases in employment levels. Wage negotiations typically use levels corresponding to leading sectors and regions as a reference point, paying little attention to labor productivity evolution in different sectors. This may help explain why, in the Spanish economy, the equilibrium solution produces unemployment rates and wages that are much higher than those that would theoretically allow labor markets to “clear”. The weak link between real wages and sectoral productivity means that dynamic sectors are unable to absorb the jobs destroyed in backward sectors.

The 2012 Labor Market Reform aimed to create conditions and incentives that would encourage our production system to adapt to adverse shocks through price flexibility mechanisms associated with the recessionary phase of the business cycle. This could help prevent the accelerated and massive destruction of jobs that was common in the aftermath of major economic crises. To this end, the prevalence of agreements negotiated at company level was established to facilitate opting out of conditions set forth in higher-level sectoral agreements, which are typically regional or provincial. In the same line, reducing ultra-activity to one year enabled the negotiated conditions to adapt more effectively to the evolving conditions of labor markets. Additionally, there was a commitment to enhancing internal flexibility, allowing companies to one-sidedly modify substantial conditions of employment relationship, particularly wages, under certain justified circumstances.

In this context, wage flexibility measures were implemented as alternative mechanisms of “internal devaluation,” which would allow the production system, consisting mainly of small and medium-sized companies in Spain, to adjust to new relative prices of production factors and, in general, to cyclical fluctuations, as well as to fast technological changes taking place in the productive environment.

Evaluating the extent to which the 2012 Labor Market Reform effectively contributed to achieving these objectives is beyond the scope of our study, particularly since a new labor market reform has already been approved[3]. In any case, the approval of a new reform aimed at addressing serious issues of our labor markets and demanded from Spain in order to access the second stage of Next Generation EU funds, highlights that the long-awaited transformation of our production model is not yet a reality.

While measures to increase wage flexibility and further decentralize collective bargaining to company level may facilitate adjustment in times of recession, they may also encourage the systematic use of temporary contracts and, in general terms, precariousness of employment. Therefore, it is important that labor market reform takes into account other equally relevant aspects, such as the current contract system, to promote stable, quality

[3] V. Royal Decree-Law 32/2021 of December 28 on Urgent Measures for Labor Reform, Guaranteeing Job Stability, and Transforming the Labor Market was published in Official State Gazette No. 313 on December 30, 2021.

employment and reduce the high rate of temporary employment. Another consideration is the taxation of hiring, which could be reduced by increasing indirect taxation. The latter would align our tax structure with those of European countries that have lower unemployment and inequality rates in their labor markets (Domènech et al., 2018).

Anyway, the results of our study show that for wage flexibility to work in both directions — allowing for adjustments during recessions and improvements during expansions — labor productivity must play a more prominent role in salary negotiations.

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APPENDIX I

UNIT ROOT TEST

Restricted sample (1955-2007)

Sector/convergence club	Variables	KARAVIAS & TZAVALIS (2014) unit root test	Sector/convergence club	Variables	KARAVIAS & TZAVALIS (2014) unit root test
I	w_{it}	-0.4228 (Statistic) -1.6449 (Asymptotic critical value) 0.3362 (p-value)	**IV/club 2**	w_{it}	-0.2460 (Statistic) -1.6449 (Asymptotic critical value) 0.4029 (p-value)
	Π_{it}	-0.2725 (Statistic) -1.6449 (Asymptotic critical value) 0.3926 (p-value)		Π_{it}	-0.2365 (Statistic) -1.6449 (Asymptotic critical value) 0.4065 (p-value)
	$w_{it}^{a}(1)$	-0.4401 (Statistic) -1.6449 (Asymptotic critical value) 0.3299 (p-value)		$w_{it}^{a}(1)$	-0.2404 (Statistic) -1.6449 (Asymptotic critical value) 0.4050 (p-value)
	$w_{it}^{a}(2)$	-0.0828 (Statistic) -1.6449 (Asymptotic critical value) 0.4670 (p-value)		$w_{it}^{a}(2)$	-0.0941 (Statistic) -1.6449 (Asymptotic critical value) 0.4625 (p-value)
II	w_{it}	-0.7175 (Statistic) -1.6449 (Asymptotic critical value) 0.2365 (p-value)	**Va**	w_{it}	-0.3280 (Statistic) -1.6449 (Asymptotic critical value) 0.3715 (p-value)
	Π_{it}	-0.4123 (Statistic) -1.6449 (Asymptotic critical value) 0.3401 (p-value)		Π_{it}	-0.5126 (Statistic) -1.6449 (Asymptotic critical value) 0.3041 (p-value)
	$w_{it}^{a}(1)$	-0.6748 (Statistic) -1.6449 (Asymptotic critical value) 0.2499 (p-value)		$w_{it}^{a}(1)$	-0.3039 (Statistic) -1.6449 (Asymptotic critical value) 0.3806 (p-value)
	$w_{it}^{a}(2)$	-0.1079 (Statistic) -1.6449 (Asymptotic critical value) 0.4570 (p-value)		$w_{it}^{a}(2)$	-0.1180 (Statistic) -1.6449 (Asymptotic critical value) 0.4530 (p-value)
III	w_{it}	-0.1717 (Statistic) -1.6449 (Asymptotic critical value) 0.4318 (p-value)	**Vb/club 1**	w_{it}	-0.1448 (Statistic) -1.6449 (Asymptotic critical value) 0.4425 (p-value)
	Π_{it}	-0.1361 (Statistic) -1.6449 (Asymptotic critical value) 0.4459 (p-value)		Π_{it}	-0.1523 (Statistic) -1.6449 (Asymptotic critical value) 0.4395 (p-value)
	$w_{it}^{a}(1)$	-0.1820 (Statistic) -1.6449 (Asymptotic critical value) 0.4278 (p-value)		$w_{it}^{a}(1)$	-0.1509 (Statistic) -1.6449 (Asymptotic critical value) 0.4400 (p-value)
	$w_{it}^{a}(2)$	-0.1121 (Statistic) -1.6449 (Asymptotic critical value) 0.4554 (p-value)		$w_{it}^{a}(2)$	-0.1028 (Statistic) -1.6449 (Asymptotic critical value) 0.4591 (p-value)
IV/club 1	w_{it}	-0.1522 (Statistic) -1.6449 (Asymptotic critical value) 0.4395 (p-value)	**Vc**	w_{it}	-0.2303 (Statistic) -1.6449 (Asymptotic critical value) 0.4089 (p-value)

	Π_{it}	-0.1449 (Statistic) -1.6449 (Asymptotic critical value) 0.4424 (p-value)		Π_{it}	-0.1565 (Statistic) -1.6449 (Asymptotic critical value) 0.4378 (p-value)
	$w_{it}^{a}(1)$	-0.1453 (Statistic) -1.6449 (Asymptotic critical value) 0.4423 (p-value)		$w_{it}^{a}(1)$	-0.2260 (Statistic) -1.6449 (Asymptotic critical value) 0.4106 (p-value)
	$w_{it}^{a}(2)$	-0.0464 (Statistic) -1.6449 (Asymptotic critical value) 0.4815 (p-value)		$w_{it}^{a}(2)$	-0.1146 (Statistic) -1.6449 (Asymptotic critical value) 0.4544 (p-value)
			VI	w_{it}	-0.1095 (Statistic) -1.6449 (Asymptotic critical value) 0.4564 (p-value)
				Π_{it}	-0.0779 (Statistic) -1.6449 (Asymptotic critical value) 0.4690 (p-value)
				$w_{it}^{a}(1)$	-0.1087 (Statistic) -1.6449 (Asymptotic critical value) 0.4567 (p-value)
				$w_{it}^{a}(2)$	-0.1345 (Statistic) -1.6449 (Asymptotic critical value) 0.4465 (p-value)

Full sample (1955-2018)

Sector/convergence club	Variables	KARAVIAS & TZAVALIS (2014) unit root test	Sector/convergence club	Variables	KARAVIAS & TZAVALIS (2014) unit root test
I	w_{it}	-0.4284 (Statistic) -1.6449 (Asymptotic critical value) 0.3342 (p-value)	**IV/club 2**	w_{it}	-0.2193 (Statistic) -1.6449 (Asymptotic critical value) 0.4132 (p-value)
	Π_{it}	-0.2610 (Statistic) -1.6449 (Asymptotic critical value) 0.3970(p-value)		Π_{it}	-0.2306 (Statistic) -1.6449 (Asymptotic critical value) 0.4088 (p-value)
	$w_{it}^{a}(1)$	-0.3914 (Statistic) -1.6449 (Asymptotic critical value) 0.3478 (p-value)		$w_{it}^{a}(1)$	-0.2018 (Statistic) -1.6449 (Asymptotic critical value) 0.4200 (p-value)
	$w_{it}^{a}(2)$	-0.0628 (Statistic) -1.6449 (Asymptotic critical value) 0.4750 (p-value)		$w_{it}^{a}(2)$	-0.0795 (Statistic) -1.6449 (Asymptotic critical value) 0.4683 (p-value)
II	w_{it}	-0.6267 (Statistic) -1.6449 (Asymptotic critical value) 0.2654 (p-value)	**Va**	w_{it}	-0.3667 (Statistic) -1.6449 (Asymptotic critical value) 0.3569 (p-value)
	Π_{it}	-0.3900 (Statistic) -1.6449 (Asymptotic critical value) 0.3483 (p-value)		Π_{it}	-0.4182 (Statistic) -1.6449 (Asymptotic critical value) 0.3379 (p-value)

	$w^{a}_{it}(1)$	-0.5999 (Statistic) -1.6449 (Asymptotic critical value) 0.2743 (p-value)		$w^{a}_{it}(1)$	-0.3299 (Statistic) -1.6449 (Asymptotic critical value) 0.3707 (p-value)
	$w^{a}_{it}(2)$	-0.0850 (Statistic) -1.6449 (Asymptotic critical value) 0.4661 (p-value)		$w^{a}_{it}(2)$	-0.0919 (Statistic) -1.6449 (Asymptotic critical value) 0.4634 (p-value)
III	w_{it}	-0.1552 (Statistic) -1.6449 (Asymptotic critical value) 0.4383 (p-value)	**Vb/club 1**	w_{it}	-0.1046 (Statistic) -1.6449 (Asymptotic critical value) 0.4584 (p-value)
	Π_{it}	-0.1225 (Statistic) -1.6449 (Asymptotic critical value) 0.4513 (p-value)		Π_{it}	-0.1115 (Statistic) -1.6449 (Asymptotic critical value) 0.4556 (p-value)
	$w^{a}_{it}(1)$	-0.1573 (Statistic) -1.6449 (Asymptotic critical value) 0.4375 (p-value)		$w^{a}_{it}(1)$	-0.1091 (Statistic) -1.6449 (Asymptotic critical value) 0.4566 (p-value)
	$w^{a}_{it}(2)$	-0.0862 (Statistic) -1.6449 (Asymptotic critical value) 0.4656 (p-value)		$w^{a}_{it}(2)$	-0.0847 (Statistic) -1.6449 (Asymptotic critical value) 0.4662 (p-value)
IV/club 1	w_{it}	-0.1293 (Statistic) -1.6449 (Asymptotic critical value) 0.4485 (p-value)	**Vc**	w_{it}	-0.1799 (Statistic) -1.6449 (Asymptotic critical value) 0.4286 (p-value)
	Π_{it}	-0.1305 (Statistic) -1.6449 (Asymptotic critical value) 0.4481 (p-value)		Π_{it}	-0.1173 (Statistic) -1.6449 (Asymptotic critical value) 0.4533 (p-value)
	$w^{a}_{it}(1)$	-0.1203 (Statistic) -1.6449 (Asymptotic critical value) 0.4521 (p-value)		$w^{a}_{it}(1)$	-0.1764 (Statistic) -1.6449 (Asymptotic critical value) 0.4300 (p-value)
	$w^{a}_{it}(2)$	-0.0350 (Statistic) -1.6449 (Asymptotic critical value) 0.4860 (p-value)		$w^{a}_{it}(2)$	-0.0923 (Statistic) -1.6449 (Asymptotic critical value) 0.4632 (p-value)
			VI	w_{it}	-0.0801 (Statistic) -1.6449 (Asymptotic critical value) 0.4681 (p-value)
				Π_{it}	-0.0584 (Statistic) -1.6449 (Asymptotic critical value) 0.4767 (p-value)
				$w^{a}_{it}(1)$	-0.0773 (Statistic) -1.6449 (Asymptotic critical value) 0.4692 (p-value)
				$w^{a}_{it}(2)$	-0.1059 (Statistic) -1.6449 (Asymptotic critical value) 0.4578 (p-value)

APPENDIX II

ECONOMETRIC CONVERGENCE TESTS

Following Phillips and Sul (2007 and 2009)

Data	**Wide**	→	**Long**
Number of observations	17		1,088
Number of variables	66		4
j variable (64 values)			year

The number of individuals (regions) is 17.

The number of time periods is 64.

The first 21 periods are discarded before regression (kq = 0.333).

Convergence variable: w_{it} (real salaries).

Time variable is year. From 1955 to 2018.

LOGT TEST

	coeff.	standard error	t-stat
Sector I	1.4471	0.4333	3.3395
Sector II	1.3423	0.2321	5.7830
Sector III	0.0841	0.2004	0.4196
Sector IV	-0.8854	0.2298	-3.8536
Sector Va	1.3650	0.4772	2.8413
Sector Vb	-0.2272	0.1399	-1.6243
Sector Vc	0.6556	0.1406	4.6624
Sector VI	2.8293	0.4676	6.0507

CLUB CLASSIFICATIONS

	Convergence	Club 1	Club 2
Sector I	Absolute	1-17	-
Sector II	Absolute	1-17	-
Sector III	Absolute	1-17	-

	Convergence	Club 1	Club 2
Sector IV	In 2 clubs	3,13,15,16	1,2,4,5,6,7,8,9,10,11,12,14,17
Sector Va	Absolute	1-17	-
Sector Vb	In club 1	1,2,4,5,6,7,8,9,10,11,12,13,15,16,17	3,14
Sector Vc	Absolute	1-17	-
Sector VI	Absolute	1-17	-

APPENDIX III

COINTEGRATION TESTS

Restricted sample (1955-2007)

Sector (w_{it}^{a}(#); # = 1, 2) /convergence club	Statistic	Value	Z-value	p-value	Sector (w_{it}^{a}(#); # = 1, 2) /convergence club	Statistic	Value	Z-value	p-value
I (1)	G_t	-1.549	-0.657	0.256	IV (2)	G_t	-1.853	-0.899	0.184
	G_a	-4.958	0.653	0.743	Club 1	G_a	-3.789	0.744	0.772
	P_t	-4.094	-0.174	0.431		P_t	-3.199	-0.997	0.159
	P_a	-2.733	-0.197	0.422		P_a	-2.636	-0.056	0.478
I (2)	G_t	-2.089	-2.782	0.003	IV (2)	G_t	-1.828	-1.537	0.062
	G_a	-7.130	-0.985	0.162	Club 2	G_a	-4.073	1.154	0.876
	P_t	-6.368	-1.885	0.030		P_t	-6.208	-2.130	0.017
	P_a	-4.903	-2.022	0.022		P_a	-3.856	-0.998	0.15
II (1)	G_t	-1.263	0.466	0.680	Va (1)	G_t	-2.063	-2.679	0.004
	G_a	-4.087	1.309	0.905		G_a	-10.653	-3.641	0.000
	P_t	-4.227	-0.274	0.392		P_t	-7.893	-3.032	0.001
	P_a	-2.946	-0.376	0.353		P_a	-7.777	-4.440	0.000
II (2)	G_t	-1.900	-2.040	0.021	Va (2)	G_t	-0.696	2.696	0.997
	G_a	-5.920	-0.073	0.471		G_a	-2,863	2.232	0.987
	P_t	-7.582	-2.798	0.003		P_t	-2.610	0.943	0.827
	P_a	-5.896	-2.858	0.002		P_a	-2.478	0.017	0.507
III (1)	G_t	-1.925	-2.139	0.016	Vb (1)	G_t	-1.832	-1.664	0.048
	G_a	-6.413	-0.444	0.328	Club 1	G_a	-8.108	-1.618	0.053
	P_t	-7.217	-2.523	0.006		P_t	-6.747	-2.347	0.009

	P_a	-5.495	-2.520	0.006
III (2)	G_t	-1.206	0.691	0.755
	G_a	-4.150	1.262	0.897
	P_t	-4.297	-0.326	0.372
	P_a	-3.927	-1.202	0.115
IV (1) Club 1	G_t	-2.866	-2.834	0.002
	G_a	-15.483	-3.533	0.000
	P_t	-5.241	-2.534	0.006
	P_a	-11.887	-3.831	0.000
IV (1) Club 2	G_t	-1.880	-1.714	0.043
	G_a	-8.859	-2.002	0.023
	P_t	-6.468	-2.325	0.010
	P_a	-6.827	-3.184	0.001
	P_a	-6.715	-3.332	0.000
Vb (2) Club 1	G_t	-2.406	-3.787	0.000
	G_a	-10.780	-3.510	0.000
	P_t	-8.072	-3.343	0.000
	P_a	-7.752	-4.151	0.000
Vc (1)	G_t	-1.698	-1.245	0.107
	G_a	-6.878	-0.795	0.213
	P_t	-6.692	-2.129	0.017
	P_a	-5.943	-2.897	0.002
Vc (2)	G_t	-3.371	-7.829	0.000
	G_a	-17.323	-8.670	0.000
	P_t	-13.177	-7.009	0.000
	P_a	-15.716	-11.119	0.000
VI (1)	G_t	-1.445	-0.249	0.402
	G_a	-5.485	0.255	0.601
	P_t	-4.655	-0.596	0.276
	P_a	-2.491	0.006	0.503
VI (2)	G_t	-2.040	-2.591	0.005
	G_a	-5.247	0.435	0.668
	P_t	-7.759	-2.931	0.002
	P_a	-5.244	-2.309	0.011

Full sample (1955-2018)

Sector (w_{it}^{a}(#); # = 1, 2) /convergence club	Statistic	Value	Z-value	p-value	Sector (w_{it}^{a}(#); # = 1, 2) /convergence club	Statistic	Value	Z-value	p-value
I (1)	G_t	-1.905	-2.061	0.020	IV (2)	G_t	-2.483	-2.102	0.018
	G_a	-6.124	-0.226	0.411	Club 1	G_a	-13.193	-2.695	0.004
	P_t	-5.737	-1.410	0.079		P_t	-4.770	-2.180	0.015
	P_a	-3.664	-0.980	0.163		P_a	-11.762	-3.780	0.000
I (2)	G_t	-2.367	-3.878	0.000	IV (2)	G_t	-2.238	-2.947	0.002
	G_a	-8.560	-2.063	0.020	Club 2	G_a	-4.538	0.848	0.802
	P_t	-7.544	-2.770	0.003		P_t	-7.423	-3.044	0.001
	P_a	-5.387	-2.430	0.008		P_a	-4.222	-1.268	0.102
II (1)	G_t	-1.549	-0.658	0.255	Va (1)	G_t	-2.063	-2.679	0.004
	G_a	-5.125	0.527	0.701		G_a	-10.653	-3.641	0.000
	P_t	-5.506	-1.236	0.108		P_t	-7.893	-3.032	0.001
	P_a	-3.544	-0.879	0.190		P_a	-7.777	-4.440	0.000
II (2)	G_t	-1.903	-2.053	0.020	Va (2)	G_t	-0.696	2.696	0.997
	G_a	-5.686	0.104	0.541		G_a	-2.863	2.232	0.897
	P_t	-6.993	-2.355	0.009		P_t	-2.610	0.943	0.827
	P_a	-4.835	-1.965	0.025		P_a	-2.478	0.017	0.507
III (1)	G_t	-2.036	-2.576	0.005	Vb (1)	G_t	-1.931	-2.031	0.021
	G_a	-8.316	-1.879	0.030	Club 1	G_a	-8.776	-2.091	0.018
	P_t	-7.944	-3.071	0.001		P_t	-6.734	-2.336	0.010
	P_a	-7.263	-4.008	0.000		P_a	-6.954	-3.521	0.000
III (2)	G_t	-1.106	1.084	0.861	Vb (2)	G_t	-2.723	-4.956	0.000
	G_a	-5.161	0.500	0.691		G_a	-12.209	-4.522	0.000

	P_t	-4.409	-0.411	0.341
	P_a	-4.927	-2.043	0.021
IV (1) **Club 1**	**G_t**	-2.483	-2.102	0.018
	G_a	-13.193	-2.695	0.004
	P_t	-4.770	-2.180	0.015
	P_a	-11.762	-3.780	0.000
IV (1) **Club 2**	**G_t**	-2.152	-2.651	
	G_a	-9.318	-2.304	0.011
	P_t	-7.215	-2.887	0.002
	P_a	-7.243	-3.490	0.000
Club 1	**P_t**	-9.491	-4.411	0.000
	P_a	-9.631	-5.636	0.000
Vc (1)	**G_t**	-1.708	-1.285	0.099
	G_a	-4.744	0.815	0.792
	P_t	-5.625	-1.326	0.092
	P_a	-2.862	-0.305	0.380
Vc (2)	**G_t**	-3.562	-8.579	0.000
	G_a	-19.178	-10.069	0.000
	P_t	-14.238	-7.807	0.000
	P_a	-17.757	-12.836	0.000
VI (1)	**G_t**	-1.708	-1.285	0.099
	G_a	-4.744	0.815	0.792
	P_t	-5.625	-1.326	0.092
	P_a	-2.862	-0.305	0.380
VI (2)	**G_t**	-1.956	-2.262	0.012
	G_a	-5.244	0.437	0.669
	P_t	-7.576	-2.794	0.003
	P_a	-5.248	-2.313	0.010

APPENDIX IV

ESTIMATIONS OF EMPIRICAL MODELS WITH ERROR CORRECTION MECHANISM

Mean-group error correction models with variable cross-sectional averages

Following Chudik and Pesaran (2015); Gegenbach, Urbain and Westerlund (2015); Eberhard and Presbitero (2015)

Group-specific linear trend included

No cross-sectional averages included

Dependent variable: $\boldsymbol{w_{it}}$

SECTOR I: Agriculture and fishing

All autonomous communities

$w_{it}^{a}(2)$	Restricted sample (1955-2007)		Full sample (1955-2018)	
	Coef.	**St. error**	**Coef.**	**St. error**
φ_0	-0.195***	0.030	-0.208***	0.029
β_1	0.380*	0.227	0.670***	0.152
β_2	0.231	0.167	0.376***	0.165
δ_1	0.399***	0.054	0.412***	0.051
δ_2	0.959***	0.084	0.997***	0.069
constant	-0.318	0.346	0.201	0.418
RMSE	0.0651		0.0709	
e: CD PESARAN (2015)	30.127	**p-value:** 0.013	29.146	**p-value:** 0.000

* Significative at 10 %
** Significative at 5 %
*** Significative at 1 %

SECTOR II: Mining, energy and water

All autonomous communities

$w_{it}^{a}(2)$	Restricted sample (1955-2007)		Full sample (1955-2018)	
	Coef.	**St. error**	**Coef.**	**St. error**
φ_0	-0.160***	0.082	-0.169***	0.018
β_1	0.398***	0.227	0.414***	0.079
β_2	0.938***	0.164	1.066***	0.143
δ_1	0.549***	0.036	0.548***	0.032
δ_2	1.250***	0.069	1.040***	0.071
constant	-0.556***	0.224	-0.794***	0.202
RMSE	0.0477		0.0496	
e: CD PESARAN (2015)	40.027	**p-value:** 0.000	47.317	**p-value:** 0.000

* Significative at 10 %
** Significative at 5 %
*** Significative at 1 %

SECTOR III: Manufacturing industries

All autonomous communities

$w_{it}^{a}(2)$	Restricted sample (1955-2007)		Full sample (1955-2018)	
	Coef.	St. error	Coef.	St. error
φ_0	-0.229***	0.035	-0.165***	0.021
β_1	0.297***	0.084	0.359***	0.100
β_2	0.746***	0.071	0.673***	0.077
δ_1	0.141***	0.019	0.173***	0.022
δ_2	0.938***	0.029	0.900***	0.028
constant	-0.106	0.093	-0.074	0.047
RMSE	0.0163		0.0186	
e: CD PESARAN (2015)	1.340	p-value: 0.180	1.918	p-value: 0.055

* Significative at 10 %
** Significative at 5 %
*** Significative at 1 %

SECTOR IV: Construction

Club 1: Asturias, Madrid, Navarra y País Vasco

$w_{it}^{a}(1)$	Restricted sample (1955-2007)		Full sample (1955-2018)	
	Coef.	St. error	Coef.	St. error
φ_0	-0.306***	0.070	-0.289***	0.031
β_1	-0.053	0.204	0.061	0.173
β_2	0.911***	0.143	0.902***	0.143
δ_1	0.235***	0.029	0.233***	0.031
δ_2	0.829***	0.070	0.770***	0.052
constant	0.097	0.263	0.099	0.263
RMSE	0.0238		0.0250	
e: CD PESARAN (2015)	-2.598	p-value: 0.009	-2.592	p-value: 0.010

* Significative at 10 %
** Significative at 5 %
*** Significative at 1 %

SECTOR IV: Construction

Club 2: Andalucía, Aragón, Baleares, Canarias, Cantabria, Castilla y León, Castilla-La Mancha, Cataluña, Valencia, Extremadura, Galicia, Murcia y La Rioja

$w_{it}^{a}(1)$	Restricted sample (1955-2007)		Full sample (1955-2018)	
	Coef.	St. error	Coef.	St. error
φ_0	-0.201***	0.032	-0.210***	0.028
β_1	0.402***	0.095	0.323***	0.095
β_2	0.575***	0.104	0.661***	0.100
δ_1	0.189***	0.033	0.197***	0.031
δ_2	0.863***	0.033	0.836***	0.033
constant	0.042	0.084	0.038	0.081

RMSE	0.0245		0.0257	
e: CD PESARAN (2015)	-1.498	**p-value:** 0.134	-0.233	**p-value:** 0.816

* Significative at 10 %
** Significative at 5 %
*** Significative at 1 %

SECTOR IV: Construction

Club 2: Andalucía, Aragón, Baleares, Canarias, Cantabria, Castilla y León, Castilla-La Mancha, Cataluña, Valencia, Extremadura, Galicia, Murcia y La Rioja

$w_{it}^{a}(2)$	Restricted sample (1955-2007)		Full sample (1955-2018)	
	Coef.	**St. error**	**Coef.**	**St. error**
φ_0	-0.231***	0.022	-0.189***	0.013
β_1	0.474***	0.163	0.734***	0.081
β_2	0.545***	0.227	0.094	0.090
δ_1	0.562***	0.046	0.576***	0.020
δ_2	0.913***	0.065	0.890***	0.047
constant	0.030	0.145	0.277***	0.081
RMSE	0.0346		0.0351	
e: CD PESARAN (2015)	30.767	**p-value:** 0.000	35.608	**p-value:** 0.000

* Significative at 10 %
** Significative at 5 %
*** Significative at 1 %

SECTOR Va: Financial services and insurance

All autonomous communities

$w_{it}^{a}(1)$	Restricted sample (1955-2007)		Full sample (1955-2018)	
	Coef.	**St. error**	**Coef.**	**St. error**
φ_0	-0.292***	0.043	-0.272***	0.036
β_1	0.032	0.061	0.042	0.044
β_2	0.975***	0.092	0.979***	0.060
δ_1	0.104***	0.025	0.096***	0.021
δ_2	0.890***	0.028	0.944***	0.017
constant	-0.025	0.130	-0.067	0.092
RMSE	0.0232		0.0239	
e: CD PESARAN (2015)	0.217	**p-value:** 0.828	-0.141	**p-value:** 0.888

* Significative at 10 %
** Significative at 5 %
*** Significative at 1 %

SECTOR Vb: Trade, hotels and restaurants, transport and communications

Club 1: Andalucía, Aragón, Baleares, Canarias, Cantabria, Castilla y León, Castilla-La Mancha, Cataluña, Valencia, Extremadura, Galicia, Madrid, Navarra, País Vasco y La Rioja

w_{it}^{a}(1)	Restricted sample (1955-2007)		Full sample (1955-2018)	
	Coef.	**St. error**	**Coef.**	**St. error**
φ_0	-0.302***	0.057	-0.254***	0.040
β_1	0.052	0.060	0.073	0.058
β_2	0.923***	0.067	0.901***	0.070
δ_1	0.068***	0.022	0.080***	0.023
δ_2	0.943***	0.028	0.936***	0.024
constant	0.072	0.074	0.057	0.065
RMSE	0.0156		0.0151	
e: CD PESARAN (2015)	-1.498	**p-value:** 0.134	-0.233	**p-value:** 0.816

* Significative at 10 %
** Significative at 5 %
*** Significative at 1 %

SECTOR Vb: Trade, hotels and restaurants, transport and communications

Club 1: Andalucía, Aragón, Baleares, Canarias, Cantabria, Castilla y León, Castilla-La Mancha, Cataluña, Valencia, Extremadura, Galicia, Madrid, Navarra, País Vasco y La Rioja

w_{it}^{a}(2)	Restricted sample (1955-2007)		Full sample (1955-2018)	
	Coef.	**St. error**	**Coef.**	**St. error**
φ_0	-0.263***	0.022	-0.243***	0.021
β_1	0.793***	0.061	0.866***	0.065
β_2	0.278***	0.068	0.087***	0.074
δ_1	0.330***	0.026	0.411***	0.019
δ_2	0.633***	0.030	0.624***	0.025
constant	-0.207***	0.075	0.035	0.062
RMSE	0.0220		0.0217	
e: CD PESARAN (2015)	37.282	**p-value:** 0.000	41.624	**p-value:** 0.000

* Significative at 10 %
** Significative at 5 %
*** Significative at 1 %

SECTOR Vc: Rest of market services (except health and education)

All autonomous communities

w_{it}^{a}(2)	Restricted sample (1955-2007)		Full sample (1955-2018)	
	Coef.	**St. error**	**Coef.**	**St. error**
φ_0	-0.150***	0.011	-0.147***	0.010
β_1	1.238***	0.115	1.152***	0.107
β_2	-0.245***	0.086	-0.157***	0.068
δ_1	0.532***	0.035	0.481***	0.033
δ_2	0.369***	0.028	0.327***	0.028
constant	-0.197***	0.137	-0.169	0.119

RMSE	0.0315		0.0310	
e: CD PESARAN (2015)	64.991	**p-value:** 0.000	79.521	**p-value:** 0.000

* Significative at 10 %
** Significative at 5 %
*** Significative at 1 %

SECTOR VI: Public or non market services, plus health, education and social services, both private and public

All autonomous communities

w_{it}^{a}(2)	Restricted sample (1955-2007)		Full sample (1955-2018)	
	Coef.	**St. error**	**Coef.**	**St. error**
φ_0	-0.072***	0.011	-0.111***	0.011
β_1	-0.126	0.291	0.331***	0.134
β_2	-0.565***	0.139	-0.197***	0.043
δ_1	0.396***	0.031	0.481***	0.033
δ_2	0.452***	0.032	0.327***	0.028
constant	1.177***	0.137	-0.169	0.119
RMSE	0.0238		0.0310	
e: CD PESARAN (2015)	67.426	**p-value:** 0.000	79.521	**p-value:** 0.000

* Significative at 10 %
** Significative at 5 %
*** Significative at 1 %