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Empirical analysis of the relationship between labour cost stickiness and labour reforms in Spain

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Abstract

This study performs an empirical analysis on the relationship between labour cost stickiness and the decrease in employment protection in the Spanish labour reforms in 2010 and 2012. Following these reforms, the sticky behaviour of labour costs substantially decreased with respect to the pre-reform period. All constituents of total labour costs followed a similar pattern: wages, social security contributions and number of employees. Results are robust to different models, estimation methods, periods of time, and industries, as well as with respect to endogeneity concerns.

KEYWORDS

cost stickiness, employment protection legislation, labour cost stickiness, labour reform

JEL CLASSIFICATION

M410, K310

1 | INTRODUCTION

This study analyses the effects of the relaxation of employment protection, due to the last two labour reforms in Spain, on firms' labour costs and employment behaviour. Costs increase more when activity increases than they decrease with decreasing activity. This behaviour is referred to as cost stickiness in the accounting literature.

Cost stickiness has attracted much attention in accounting research since the seminal studies by Noreen and Soderstrom (1994) and Anderson et al. (2003). The latter adopted a methodological approach, widely used in subsequent accounting studies. The empirical research on

cost stickiness usually focuses on selling, general and administrative expenses, or operational costs (e.g., Ballas et al., 2022; Kama & Weiss, 2013; Li & Zheng, 2020; Liu et al., 2019). However, the sticky behaviour of labour costs (LC) has scarcely been analysed. The small number of studies on the sticky behaviour of LC is surprising due to the concern about the overall decline in the share of firms' value added and sales accounted for by LC in most OECD countries over the last few decades (Autor et al., 2020; Barkai, 2020; Hashimoto, 2017), and the still significant share represented by LC despite this decline.[1] The magnitude of LC calls for empirical research on the behaviour of these costs, especially in Spain, where the employment adjustments of firms when they face decreases in activity have dramatic consequences, as reflected in the astonishing unemployment rate of 25.7% at the peak of the last financial crisis in 2012 and 2013. Therefore, the scarce empirical research that exists focusing on LC, as well as the importance of these costs, are the motivations for our research.

Previous literature has identified several causes of asymmetric cost behaviour, such as managers making empire-building decisions for personal benefits (Chen et al., 2012), real earnings management to meet or beat stakeholder expectations (Kama & Weiss, 2013), myopic resource adjustment caused by factors such as corporate takeover threats (Cannon et al., 2020), manager expectations about future demand (Banker & Byzalov, 2014), and the inability of managers to adjust resources (Yasukata & Kajiwara, 2011).

Some authors (Kama & Weiss, 2013; Yasukata & Kajiwara, 2011) emphasise the inability of managers to adjust resources in contrast to the deliberate decision of managers to keep them, and even to increase them, when activity decreases. Research on LC stickiness also examines the factors influencing this asymmetry. Anderson et al. (2003) identify LC adjustments as the primary reason for the asymmetry of selling, general and administrative expenses. The authors suggest that the inability of managers to cut such resources is driven by the significant adjustment costs involved in employee search, selection, hiring, training and firing, which incentivise holding on to labour resources and deter managers from dismissing them, until uncertainties about further demand are removed (Anderson et al., 2013; Banker et al., 2014). In line with the assumption that cost stickiness is largely a feature of market-wide conditions and country regulations (Calleja et al., 2006; Holzhacker et al., 2015), some of the few empirical studies on LC stickiness attribute this asymmetric behaviour to hiring and firing costs mandated by employment protection legislation (EPL) (Banker et al., 2013; Golden et al., 2020). Ruselin et al. (2018) underline the predictive ability of cost stickiness for the future unemployment rate. Dierynck et al. (2012) investigate the influence of managerial incentives for meeting or beating the zero earnings benchmark on LC behaviour. Finally, Prabowo et al. (2018), Hall (2016) and Dalla Via and Perego (2013) analyse the impact of ownership structure on LC behaviour.

Only the final four of these studies use LC for their empirical analyses. The three other studies (Banker et al., 2013; Golden et al., 2020; Ruselin et al., 2018) base their hypotheses on LC behaviour or the future unemployment rate, but test them with operating costs, assuming that LC play the most important role in the behaviour of total operating costs. An additional concern with previous research on LC stickiness is that researchers do not analyse changes in labour conditions, as they use time-invariant measures of EPL at a country level.

The Spanish labour reforms enacted in 2010 and 2012 introduced severe changes in the Spanish EPL, and offer an interesting setting for analysing the relationship between the relaxation of labour protection and LC stickiness.

With a sample of Spanish firms, we find that these Spanish labour reforms significantly altered the sticky behaviour of total LC. After these reforms, LC and employment followed

[1]LC were between 60% and 70% of value added in most important OECD countries, such as the USA, Germany, France, Italy, Japan and the UK in 2010, according to data provided by Autor et al. (2020); LC are also 52% of total non-interest expenses and 30% of total expenses in the sample of US banks between 1997 and 2006 used in Hall's (2016) study; and a mean and median 22.1% and 15.6% of firms' revenues, respectively, in our sample.

an unusual pattern. Managers applied considerable cuts in labour resources in periods of decreasing sales. All constituents of LC followed a similar pattern: wages, social security contributions (SSC) and the number of employees. This cost behaviour occurred immediately after these reforms and there is evidence that they had longstanding effects, but this evidence is limited. The results are robust to different models, estimation methods, industries and endogeneity concerns. The reforms did not cause a compensating effect of increasing LC in periods of demand growth.

With this paper, we contribute to research on cost stickiness by examining LC, which has scarcely been studied to date. More specifically, to the best of our knowledge, there is no previous empirical study relating cost stickiness or LC stickiness to changes in labour protection over time within a country. We also contribute to the few studies on LC stickiness, conducted within the European context and, more precisely, within the South European context characterised by stringent market and labour conditions. In addition, we contribute with a detailed investigation of labour resource adjustment, breaking down labour adjustments into changes in LC, labour quantity and labour input prices. We finally contribute to the economic literature on the effects of EPL on LC and employment, in which much of the empirical research is inconclusive.

The next section explains the latest Spanish labour reforms, followed by a section containing a literature review and hypothesis formulation. We then formulate our empirical model, describe the sample, explain results and finish with a section of conclusions.

2 | THE SPANISH LABOUR REFORMS

Spain has undergone four major labour reforms during the democratic political regime (since 1975): in 1980, 1994, 2010 and 2012. The *Estatuto de los Trabajadores* (Spanish Workers Act) was enacted in 1980 with the purpose of creating a stable and democratic labour relations framework. The 1994 reform was intended to promote direct and flexible collective agreements between employers and employees and decrease short-term labour contracts. Both reforms are outdated, focused on implementing democratic procedures, and are of little interest for our research. In this study, we analyse the effects of the last two major reforms: the penultimate reform enacted in 2010 under the rule of the left-wing party *Partido Socialista Obrero Español*, and the latest reform, enacted in 2012 under the right-wing party *Partido Popular*.

The 2010 reform was undertaken under the pressure and urgency of a soaring unemployment rate, and with the aim of building more flexible labour relations to be able to adapt to business fluctuations. The reform was contested by trade unions and worker organisations and triggered a general strike. It was approved by the Congress of Deputies on 9 September 2010.

The main elements of this reform were the suspension of collective agreements in the event of an economic downturn, when managers could replace them with firm and individual agreements in order to make lower LC possible and ensure firms' operations. It also introduced the possibility of converting full-time employment agreements to part-time contracts, with partial unemployment subsidies paid with government funds. While severance payments for permanent contracts were reduced (from 45 to 33 days of wage per year worked at the firm, and to 20 days in case of companies facing losses), they were increased for temporary contracts (from 8 to 12 days of wage per year worked at the firm), with the government bearing a small share of the compensation payments in some specific cases. Temporary contracts had to be converted into permanent ones after 3 years under this new rule. An additional important element of this reform was the option given to companies to dismiss an employee who has been absent more than 20% of their working days in a two-month period, including in the case of illness.

The 2012 reform was an additional attempt to relax the remaining stringent labour conditions, and to promote the hiring of young and long-term unemployed people. The reform

introduced significant reductions in the SSC of firms for certain contracts, such as for occupational, training and permanent contracts. Other important measures in this reform were designed to enhance the internal flexibility of firms, such as the possibility to assign different tasks to their employees, even if they are lower status than the tasks specified in the terms of their contracts and job categories. Employees may also be relocated to different geographical areas, and their working hours may be changed if the firm needs to do so in order to perform its operations. With these new laws, firms are subject to fewer social and working constraints to meet their economic goals.

In the event of certain economic (such as losses or decreasing sales), technical, organisational and productive situations, firms are allowed to change certain labour conditions, including the option to apply salary decreases. In these cases, firms may also dismiss employees with significant reductions in severance payments, or temporarily suspend their contracts, with firms exempted from paying the corresponding wages and SSC, and the government assuming the corresponding payments.

With these labour reforms, employees lose some of the advantages acquired through collective bargaining at an industry or country level, and all administrative and legal procedures are simplified in case of lawsuits or disputes. The law recognises a wide array of factors that may provide legal support to managers' decisions and, in the case of grievances (from employees against the firm or vice versa), it increases the likelihood of the firm's economic interests prevailing in lawsuit rulings. Ultimately, the law entails an overall loss of job security and employment protection.

The detailed contents of these reforms can be found in the Spanish laws 10/2010, 35/2010 and 3/2012 (*Ley* and *Real Decretos-Leyes*, respectively). The overall outcome of these reforms is a substantial reduction in employment protection. As a result, employees are more prone, and obliged, to accept less favourable employment conditions and management decisions. The two reforms came into effect immediately after their enactment in September 2010 and February 2012. As the corporate world had persistently called for such reforms and had been eagerly awaiting and preparing for their enactment, many firms immediately made the decisions enabled by these reforms.

3 | LITERATURE REVIEW AND HYPOTHESIS

There are few empirical studies dealing with LC stickiness. Dierynck et al. (2012) use a sample of Belgian firms and find changes in LC, as well as in the number of employees, distinguishing between blue- and white-collar workers. They find differences in the behaviour between the two types of employees, which they attribute to the differences in their dismissal costs. Dalla Via and Perego (2013) focus on the cost behaviour of Italian small and medium-sized companies. They find minimal evidence of cost stickiness and conclude that LC are less sticky than other types of costs. Hall's (2016) study is limited to a sample of US banks and focuses on the influence of ownership structure on the managers' decisions with respect to LC. Prabowo et al. (2018) focus on the effect of state ownership on LC stickiness in various European countries. The authors find a positive relationship between stringent labour dismissal and LC stickiness.

Golden et al. (2020) find that the share of skilled labour is associated with greater operating cost asymmetry and assume that this asymmetry is caused by the higher costs of firing, searching for and selecting skilled compared to non-skilled employees. With a sample of observations spanning 21 years of firms from 19 countries, Banker et al. (2013) find that the costs associated with firing workers are associated with cost stickiness. These two studies do not use measures of LC. They analyse operating costs and attribute the factors causing the asymmetric cost behaviour to the effects on LC, given that they account for a significant share of operating costs.

Moreover, the latter study uses a single OECD measure of EPL for all years at a country level. Measures of EPL are regarded as generating fragile results in economic research on labour markets (see Mota et al., 2015 and Skedinger, 2010).

As our study uses both LC and within-country changes in regulations on labour protection, its results more directly convey the effects on LC stickiness and they are less likely be confounded by differences in social norms than those studies performed with cross-country differences in EPL measures. To the best of our knowledge, no previous study has analysed LC and employment adjustments when firms experience revenue decreases as a reaction to changes in labour regulations.

Economic theory and empirical research have not reached unanimous conclusions on the economic effects of EPL on employment and salaries, with various factors affecting the final effect (Skedinger, 2010). However, there is a certain degree of consensus that stringent EPL makes firms more reluctant to hire employees (Bertola, 1999), provides bargaining power to employees to protect their jobs (van der Wiel, 2010), and results in fewer employees being hired and fired in growth and downturn periods respectively, with respect to conditions of lower labour protection (Blanchard & Wolfers, 2000). In contrast, when sales decrease within a context of flexible labour market conditions, managers face few obstacles and costs with respect to dismissing employees. Hence, LC stickiness will decrease with less stringent EPL. Although employment protection may create more incentives for firms and workers to invest in human capital, which, in turn, may lead to higher productivity and wages (Belot et al., 2007), there is empirical evidence of the prevalence of the bargaining power effect (Druant et al., 2012) and workers shirking and absenteeism (Boeri & Jimeno, 2005; Scoppa & Vuri, 2014) with stringent EPL, which contribute to increasing labour costs and hinder resource adjustments. On the contrary, the reduction in employment protection, and its subsequent avoidance of shirking behaviour will allow firms to increase activity with less need to increase firm's workforce, because managers will be able to better use the full working capacity of their employees, thus moderating the rise of LC in periods of increasing activity. On the other hand, the existence of higher flexibility to dismiss employees and lower costs of dismissal may enhance the hiring of additional employees. Some other factors may be in play with lower employment protection, such as the likely increase in labour efficiency (as a consequence of mitigation agency issues, and specifically lowering shirking behaviour), the predominance of firm over industry agreements (with lower bargaining power for many employees at firm level and the subsequent consequence of lower wages for these employees), exemptions from SCC, etc., that may decrease LC per employee. The convergence of such different factors produces no certain effect of decreasing EPL on LC in periods of increasing activity. However, a reduction in employment protection, such as reducing dismissal costs, decentralising bargaining, the possibility of applying geographical mobility, etc., will contribute to a higher decrease in the firms' LC in periods of decreasing activity, not only because of the higher flexibility, but also because of the clearer assessment of their working capacity.

In the introduction, we identified several resource adjustment behaviours that result in asymmetric cost behaviour. However, some authors (Costa & Habib, 2020; Hartlieb et al., 2020) outline a different overview and argue that all studies on the drivers of asymmetric cost behaviour are grounded on three dominant theories: resource adjustment theory, managerial expectations and agency theory. We may summarise the three theories in resource adjustment decisions that maximise firm value and agency issues, and we primarily rely on resource decisions that maximise firm value. Managers fundamentally make decisions based on cost–benefit analysis. Once a resource is acquired, such as an employee being hired, it is not easy to dismiss them. Less stringent employment protection has a significant effect on the ease with which firms can lower the costs of labour resource adjustments and, in this way, reduce labour cost stickiness.

Therefore, according to the above arguments, the reduction of employment protection will increase managers' possibilities with respect to reducing firms' LC and employment and, consequently, we formulate the following hypothesis:

Hypothesis 1 *The decrease in employment protection is associated with greater labour resource reductions during periods of demand decline.*

4 | EMPIRICAL MODEL

Most empirical models of cost stickiness start with the basic model proposed by Anderson et al. (2003):

$$\Delta \ln LC_{i,t} = \beta_0 + \beta_1 \cdot \Delta \ln REV_{i,t} + \beta_2 \cdot D \cdot \Delta \ln REV_{i,t} + \varepsilon_{i,t} \quad (1)$$

where each observation refers to firm i in year t, β are the parameters to be estimated, and ε is the error term, $\Delta \ln LC$ is the log-change in LC, $\Delta \ln REV$ is the log-change in revenues, and D is a dummy indicating that revenues decrease with respect to the previous year. The Appendix presents a brief description of all variables.

We add the dummy variables $REF2010$ and $REF2012$ to indicate that an observation is regulated by the labour reforms of years 2010 and 2012, and interact them with $D{\cdot}\Delta \ln REV$, where β_3 and β_4 measure the association between both reforms and LC stickiness and provide a test for our hypothesis. We additionally control for the interaction effects between both labour reforms and $\Delta \ln REV$ on the $\Delta \ln LC$ when revenues increase, and formulate the following equation:

$$\begin{aligned} \Delta \ln LC_{i,t} = {} & \beta_0 + \beta_1 \cdot \Delta \ln REV_{i,t} + \beta_2 \cdot D_{i,t} \cdot \Delta \ln REV_{i,t} + \beta_3 \cdot D_{i,t} \cdot \Delta \ln REV_{i,t} \cdot REF2010_t \\ & + \beta_4 \cdot D_{i,t} \cdot \Delta \ln REV_{i,t} \cdot REF2012_t + \beta_5 \cdot \Delta \ln REV_{i,t} \cdot REF2010_t \\ & + \beta_6 \cdot \Delta \ln REV_{i,t} \cdot REF2012_t + \varepsilon_{i,t}. \end{aligned} \quad (2)$$

For the sake of simplicity, we use the same symbols β and ε for coefficients and error term in all models.

Similar to the full model proposed by Anderson et al. (2003) and most studies on cost stickiness (Anderson et al., 2013; Banker et al., 2013; Dalla Via & Perego, 2013; Kama & Weiss, 2013), we then add interaction variables with controls for factors influencing cost stickiness. There is no single model formulation in empirical research on cost stickiness. Some authors include standalone control variables (Chen et al., 2012; Costa & Habib, 2020; Dierynck et al., 2012; Hall, 2016; Holzhacker et al., 2015; Prabowo et al., 2018). We also use this formulation and estimate the following equation:

$$\begin{aligned} \Delta \ln LC_{i,t} = {} & \beta_0 + \beta_1 \cdot \Delta \ln REV_{i,t} + \beta_2 \cdot D_{i,t} \cdot \Delta \ln REV_{i,t} + \beta_3 \cdot D_{i,t} \cdot \Delta \ln REV_{i,t} \cdot REF2010_t \\ & + \beta_4 \cdot D_{i,t} \cdot \Delta \ln REV_{i,t} \cdot REF2012_t + \beta_5 \cdot \Delta \ln REV_{i,t} \cdot REF2010_t \\ & + \beta_6 \cdot \Delta \ln REV_{i,t} \cdot REF2012_t + \sum_{j=1}^{N} \gamma_j \cdot D_{i,t} \cdot \Delta \ln REV_{i,t} \cdot CONTROLS_{i,t} \\ & + \sum_{j=1}^{N} \theta_j \cdot CONTROLS_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (3)$$

where $CONTROLS$ are j control variables likely to influence LC stickiness, and γ and θ are parameters to be estimated. The Appendix contains a list and full description of these variables. As control variables we use employee intensity ($EMPINT$), asset intensity ($ASSINT$), return on assets (ROA), indebtedness ($DEBTTA$), successive revenue decreases ($DSUC$), loss in the prior year

(*LOSPRY*) and gross domestic product growth (*GDPGR*). Their definition and calculation can be found in the Appendix 1.

Some authors (Zanella et al., 2015) do not build interactions with control variables, and only include the control variables as standalone variables, while other authors (Calleja et al., 2006; Golden et al., 2020; Hartlieb et al., 2020) build more complex models with interactions between control variables and $\Delta \ln REV$ and $D \cdot \Delta \ln REV$. Liu et al. (2019) include standalone variables in addition to these interactions. We also formulate this more complex model:

$$\begin{aligned}\Delta \ln LC_{i,t} = {} & \beta_0 + \beta_1 \cdot \Delta \ln REV_{i,t} + \beta_2 \cdot D_{i,t} \cdot \Delta \ln REV_{i,t} + \beta_3 \cdot D_{i,t} \cdot \Delta \ln REV_{i,t} \cdot REF2010_t \\ & + \beta_4 \cdot D_{i,t} \cdot \Delta \ln REV_{i,t} \cdot REF2012_t + \beta_5 \cdot \Delta \ln REV_{i,t} \cdot REF2010_t \\ & + \beta_6 \cdot \Delta \ln REV_{i,t} \cdot REF2012_t + \sum_{j=1}^{N} \gamma_j \cdot D_{i,t} \cdot \Delta \ln REV_{i,t} \cdot CONTROLS_{i,t} \\ & + \sum_{j=1}^{N} \delta_j \cdot \Delta \ln REV_{i,t} \cdot CONTROLS_{i,t} + \sum_{j=1}^{N} \theta_j \cdot CONTROLS_{i,t} + \varepsilon_{i,t}\end{aligned} \tag{4}$$

where δ are also parameters to be estimated.

We calculate each dependent variable by taking the natural logarithm of each measure divided by its value in the previous year. $\Delta \ln LC$ is a generic dependent variable. We do not provide results for this variable, but for total LC (TLC, being $\Delta \ln TLC$ the dependent variable), its two components, gross wages or salary ($\Delta \ln WAGE$) and SSC ($\Delta \ln SSC$), and the number of employees ($\Delta \ln NEMP$). For additional analyses, we also use two different types of operating costs: $\Delta \ln OPE$ and $\Delta \ln DEPROT$ (defined in the Appendix).

In order to avoid biased results due to influential cases, we winsorise all continuous variables at 0.5% in each tail. We also mean-centre the continuous variables used in the interaction terms, to facilitate interpretation and to mitigate collinearity concerns (Chen et al., 2012).

5 | SAMPLE

All Spanish companies, both listed and unlisted, must disclose their financial statements and file them in a public registry. SABI, the Spanish subsidiary of the European AMADEUS database, collects these data in a standardised database. Firms meeting certain conditions, particularly the biggest companies, disclose detailed information of their financial statements within the framework of the *Plan General de Contabilidad Normal* (ordinary financial statements), including detailed labour cost information on gross wages and social security contributions. The Spanish accounting standards include two additional types of disclosure, the small and medium firm financial statements, and the abridged financial statements, that do not disclose such detailed information on labour costs. We form our initial sample by downloading data of firms, their reported labour costs and social security contributions (those reporting under the *Plan General de Contabilidad Normal*), from the Spanish SABI database.

As mentioned, the Spanish Parliament enacted two important labour reforms in 2010 and 2012, taking effects in firms in these years.

We downloaded the available information in SABI of all firms disclosing ordinary financial statements from 2000 to 2018. Considering the necessary lags to build our variables, we have a sample with data from 2002 to 2018, thus with an equal number of years before and after the enactment of these reforms. The first download provided 612,870 firm-year observations. We drop observations with negative values in total assets, sales, wages and social security contributions. We also drop observations with increases or decreases above 50% in revenues. Considering the necessary lags and information for our variables, our final sample consists of 173,342 firm-year observations and 23,568 firms, as can be seen in Panel A of Table 1.

TABLE 1 Sample details

Panel A: Sample construction	
	Firm-year observations
Total firm-year observations with detailed disclosure in SABI from 2000 to 2018	612,870
Less negative or missing data in total assets, revenues, wages or SSC	52
Less revenue increases above 50% or missing data	37,920
Less revenue decreases below 50% or missing data	7065
Difference	567,833
Less missing data in the required variables	394,491
Final sample	173,342
Number of firms	23,568

Panel B: Sample composition by year	
Year	**Firm-year observations**
2002	5624
2003	6043
2004	6577
2005	7099
2006	7407
2007	7719
2008	7884
2009	11,954
2010	12,302
2011	12,951
2012	12,849
2013	12,774
2014	12,577
2015	12,728
2016	12,989
2017	12,846
2018	11,019
Total	173,342

Panel C: Sample composition by main industries	
Main industry	**Firm-year observations**
Agriculture & extractive industries	4215
Manufacturing, water & energy	58,753
Construction	12,136
Trade & services	98,238
Total	173,342

Panel B of Table 1 displays observations by year. The number of observations substantially increases in 2009, because the Spanish accounting standards experienced a major change in November 2007 with the enactment of the new *Plan General de Contabilidad* that began application in 2008. The improvement in the information disclosed by firms and collected by SABI, over time, particularly under the new accounting standards, explains the increase in the number of observations after 2008.

Our sample includes all economic activities, with the exception of financial institutions. The financial statements of this type of firms are not collected in the SABI database or AMADEUS. Panel C of Table 1 shows the sample composition by main industries, with almost 57% of observations in trade and service firms.

Table 2 shows descriptive statistics with winsorised values. In order to provide more meaningful comparison of descriptive statistics, we present non-centred values, while the remainder of the study is performed with mean-centred variables, as mentioned. The Kruskal–Wallis test indicates that there are significant differences between the three periods (2002–2009, prior to these labour reforms, 2010–2011, between both reforms, and 2012–2018, post reforms) in all dependent and independent variables. The Scheffé test reveals that, in almost all cases, there are significant differences between all pairs of comparisons between these three periods. Wages, SSC and employment usually grew less in 2002–2009 and in 2010–2011 than in 2002–2009, as well as wages and social security contributions per employee. Firms experienced the maximum proportion of sales decreases, successive sales decreases and losses in the previous year during 2010 and 2011.

We report Pearson correlations between our main variables in Table 3. All correlations are small in magnitude (the highest values are −0.418 between $REF2010$ and $REF2012$, and −0.414 between $DSUC$ and $\Delta \ln REV$). Variance inflation factors are high for some variables. When we consider all variables in the full model of Equation (4), the condition index is high, 24, but it is below the threshold of 30, conventionally considered to be associated with severe collinearity problems (Belsley et al., 2004; Midi et al., 2010).

6 | RESULTS

Given the panel data structure of our sample and the results of Hausmann tests, we perform firm fixed-effects estimations. As our models present heteroscedasticity, we perform all estimations with robust standard errors. We run estimations focusing on the model formulated in Equation (4) and for our four dependent variables $\Delta \ln TLC$, $\Delta \ln WAGE$, $\Delta \ln SSC$ and $\Delta \ln NEMP$.

6.1 | Main results

Table 4 shows results of fixed-effects estimations of Equations (1)–(4) when the dependent variable is $\Delta \ln TLC$. All columns present significant goodness of fit, with R-square overall ranging from 0.1610 to 0.1856.

TLC display the typical stickiness pattern. While they increase 0.394% for a 1% increase in revenues, they only decrease 0.292% (0.394 – 0.102) when revenues decrease 1%, as can be seen in column (1).

Column (2) includes our variables of interest. The most interesting result for the purpose of our study is that the significant ($p < 0.01$) and positive signs of both coefficients, β_3 and β_4 provide support for hypothesis H1. TLC increase 0.536% when revenues increase 1%, before the Spanish labour reforms under study, but they increase only 0.258% (0.536 – 0.278) and 0.324% (0.536 – 0.212) after the 2010 and 2012 labour reforms, respectively, for a 1% revenue increase. The lower increase is probably explained by the new circumstances after the

TABLE 2 Descriptive statistics

Variables	2002–2009 (period 1)		2010–2011 (period 2)		2012–2018 (period 3)		Kruskal–Wallis test	Scheffé tests: periods		
	Mean	Median	Mean	Median	Mean	Median		1–2	1–3	2–3
$\Delta \ln TLC$	0.058	0.059	0.020	0.021	0.039	0.035	***	***	***	***
$\Delta \ln WAGE$	0.061	0.062	0.009	0.015	0.028	0.030	***	***	***	***
$\Delta \ln SSC$	0.058	0.058	0.009	0.011	0.037	0.036	***	***	***	***
$\Delta \ln NEMP$	0.021	0.009	0.000	0.000	0.030	0.013	***	***	***	***
$\Delta \ln OPE$	0.019	0.043	0.020	0.029	0.026	0.034	***		***	***
$\Delta \ln DEPROT$	−0.066	−0.056	0.011	0.013	0.025	0.026	***	***	***	***
$\Delta \ln WPEMP$	0.038	0.039	0.020	0.020	0.008	0.009	***	***	***	***
$\Delta \ln SSCPEMP$	0.034	0.035	0.0200	0.019	0.017	0.017	***	***	***	
$WPEMP$	34,040.550	30,500.520	34,297.700	30,564.350	33,357.370	29,134.340	***		***	***
$SSCPEMP$	9018.921	8469.399	8830.181	8399.320	8882.852	8362.386	***	***	***	
$\Delta \ln REV$	0.012	0.040	0.011	0.026	0.022	0.035	***		***	***
D	0.380	0.000	0.417	0.000	0.375	0.000	***	***		***
$EMPLINT$	0.005	0.004	0.007	0.004	0.007	0.004	***	***	***	
$ASSINT$	1.587	0.795	2.621	0.916	2.705	0.880	***	***	***	
ROA	6.798	5.336	3.489	3.266	4.623	3.869	***	***	***	***
$DEBTTA$	50.378	52.669	28.433	25.360	26.349	22.366	***	***	***	***
$DSUC$	0.138	0.000	0.242	0.000	0.170	0.000	***	***	***	***
$LOSPRY$	0.040	0.000	0.229	0.000	0.191	0.000	***	***	***	***
$GDPGR$	1.655	3.000	−0.313	−0.800	1.278	2.400	***	***	***	***
$\ln NEMP$	4.437	4.369	4.166	4.127	4.203	4.174	***	***	***	***

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

TABLE 3 Pearson correlations

	Δln*REV*	*REF*2010	*REF*2012	*EMPLINT*	*ASSINT*	*ROA*	*DEBTTA*	*DSUC*	*LOSPRY*	*GDPGR*
Δln*REV*	1									
*REF*2010	−0.013***	1								
*REF*2012	0.028***	−0.418***	1							
EMPLINT	−0.053***	0.027***	0.069***	1						
ASSINT	−0.151***	0.02***	0.061***	0.164***	1					
ROA	0.249***	−0.084***	−0.071***	−0.097***	−0.13***	1				
DEBTTA	0.075***	−0.107***	−0.344***	−0.035***	−0.023***	−0.063***	1			
DSUC	−0.414***	0.08***	0.002	0.042***	0.044***	−0.211***	−0.078***	1		
LOSPRY	−0.096***	0.1***	0.135***	0.115***	0.141***	−0.394***	−0.049***	0.166***	1	
GDPGR	0.246***	−0.248***	0.041***	−0.053***	−0.031***	0.166***	0.257***	−0.218***	−0.172***	1

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

TABLE 4 Relationship between Spanish labour reforms and total labour cost (Δln*TLC*) stickiness. Firm fixed-effect estimations with robust standard errors.

	(1)	(2)	(3)	(4)
Variables	**Equation (1)**	**Equation (2)**	**Equation (3)**	**Equation (4)**
Δln*REV*	0.394***	0.536***	0.398***	0.400***
	(0.006)	(0.008)	(0.009)	(0.012)
D·Δln*REV*	−0.102***	−0.303***	−0.204***	−0.206***
	(0.010)	(0.012)	(0.015)	(0.017)
D·Δln*REV*·*REF*2010		0.373***	0.0930***	0.074***
		(0.017)	(0.025)	(0.027)
D·Δln*REV*·*REF*2012		0.315***	0.103***	0.078***
		(0.013)	(0.019)	(0.022)
Δln*REV*·*REF*2010		−0.278***	−0.065***	−0.050***
		(0.013)	(0.016)	(0.019)
Δln*REV*·*REF*2012		−0.212***	−0.038***	−0.018
		(0.010)	(0.012)	(0.015)
D·Δln*REV*·*EMPLINT*			9.538***	−12.65***
			(0.725)	(1.163)
D·Δln*REV*·*ASSINT*			−0.006***	0.007***
			(0.001)	(0.002)
D·Δln*REV*·*ROA*			0.0033***	0.001
			(0.001)	(0.001)
D·Δln*REV*·*DEBTTA*			0.001***	−0.000
			(0.000)	(0.000)
D·Δln*REV*·*DSUC*			0.108***	0.109***
			(0.012)	(0.012)
D·Δln*REV*·*LOSPRY*			0.022	0.096***
			(0.014)	(0.027)
D·Δln*REV*·*GDPGR*			−0.014***	−0.007*
			(0.002)	(0.004)
Δln*REV*·*EMPLINT*				18.06***
				(0.776)
Δln*REV*·*ASSINT*				−0.011***
				(0.002)
Δln*REV*·*ROA*				0.002**
				(0.001)
Δln*REV*·*DEBTTA*				0.001***
				(0.000)
Δln*REV*·*LOSPRY*				−0.061***
				(0.018)
Δln*REV*·*GDPGR*				−0.006**
				(0.003)

TABLE 4 (Continued)

	(1)	(2)	(3)	(4)
Variables	**Equation (1)**	**Equation (2)**	**Equation (3)**	**Equation (4)**
REF2010			−0.021***	−0.022***
			(0.002)	(0.002)
REF2012			−0.024***	−0.025***
			(0.001)	(0.002)
EMPLINT			4.553***	3.026***
			(0.279)	(0.271)
ASSINT			−0.002***	−0.001***
			(0.003)	(0.000)
ROA			−0.000***	−0.001***
			(9.11e-05)	(0.000)
DEBTTA			5.79e-05*	−1.32e-05
			(3.08e-05)	(3.49e-05)
DSUC			−0.016***	−0.016***
			(0.002)	(0.002)
LOSPRY			−0.056***	−0.051***
			(0.002)	(0.002)
GDPGR			0.005***	0.005***
			(0.000)	(0.000)
Constant	0.036***	0.037***	0.063***	0.063***
	(0.001)	(0.000)	(0.001)	(0.001)
Observations	173,342	173,342	173,342	173,342
Number of firms	23,568	23,568	23,568	23,568
Firm fixed effects	Yes	Yes	Yes	Yes
R-squared overall	0.161	0.163	0.178	0.186

Note: Robust standard errors in parentheses.
***$p<0.01$, **$p<0.05$, *$p<0.1$.

eruption of the financial crisis in 2008 and the subsequent caution of firms to add labour resources after the consequences of this economic downturn, but also by the likely avoidance of employees' agency behaviour after the labour reforms. The same argument may partly explain the greater sensitivity of TLC to activity decrease. However, such greater sensitivity of TLC to activity decrease would be less possible without the labour reforms. Before these reforms, TLC only decrease 0.233% (0.536 – 0.303) when revenues decrease 1%, while, in this case, and after both labour reforms of 2010 and 2012, the decrease in TLC is higher: 0.328% (0.536 – 0.303 + 0.373 – 0.278) and 0.336% (0.536 – 0.303 + 0.315 – 0.212) respectively, the former is significantly higher ($p<0.01$) than the corresponding increase when activity increases over the same period (0.258), but the latter is not significantly higher at $p<0.1$. After these labour reforms, the decrease of TLC when revenues decrease is higher than before: $\beta_3+\beta_5$ and $\beta_4+\beta_6$ are both jointly significant at $p<0.01$. The significant positive signs of $D{\cdot}\ln REV{\cdot}REF2010$ and $D{\cdot}\ln REV{\cdot}REF2012$ provide support for our hypothesis.

Columns (3) and (4) show results for the full models, including control variables, formulated in Equations (3) and (4), respectively. TLC increase around 0.4% when revenues increase

TABLE 5 Relationship between Spanish labour reforms and gross wages, social security contributions and employment stickiness. Firm fixed-effects estimations of Equation (4) with robust standard errors.

	(1)	(2)	(3)
Variables	**Δln*WAGE***	**Δln*SSC***	**Δln*NEMP***
Δln*REV*	0.396***	0.407***	0.345***
	(0.013)	(0.014)	(0.015)
D·Δln*REV*	−0.202***	−0.207***	−0.197***
	(0.019)	(0.020)	(0.024)
D·Δln*REV*·*REF*2010	0.114***	0.095***	0.059*
	(0.031)	(0.033)	(0.034)
D·Δln*REV*·*REF*2012	0.112***	0.077***	0.055**
	(0.024)	(0.026)	(0.027)
Δln*REV*·*REF*2010	−0.079***	−0.076***	−0.039
	(0.022)	(0.023)	(0.024)
Δln*REV*·*REF*2012	−0.036**	−0.046***	0.008
	(0.016)	(0.018)	(0.019)
D·Δln*REV*·*EMPLINT*	−11.75***	−12.85***	−4.835***
	(1.339)	(1.513)	(1.772)
D·Δln*REV*·*ASSINT*	0.007***	0.005**	0.004**
	(0.002)	(0.002)	(0.002)
D·Δln*REV*·*ROA*	0.001	0.002	0.000
	(0.001)	(0.001)	(0.001)
D·Δln*REV*·*DEBTTA*	−0.000	−0.000	0.000
	(0.001)	(0.001)	(0.001)
D·Δln*REV*·*DSUC*	0.090***	0.111***	0.099***
	(0.013)	(0.013)	(0.013)
D·Δln*REV*·*LOSPRY*	0.092***	0.135***	0.139***
	(0.030)	(0.030)	(0.031)
D·Δln*REV*·*GDPGR*	−0.005	−0.002	−0.005
	(0.004)	(0.005)	(0.005)
Δln*REV*·*EMPLINT*	18.39***	18.91***	16.00***
	(0.867)	(1.048)	(1.277)
Δln*REV*·*ASSINT*	−0.0110***	−0.010***	−0.009***
	(0.002)	(0.002)	(0.002)
Δln*REV*·*ROA*	0.002**	−0.001	−0.000
	(0.001)	(0.001)	(0.001)
Δln*REV*·*DEBTTA*	0.001**	0.001***	0.001*
	(0.000)	(0.000)	(0.000)
Δln*REV*·*LOSPRY*	−0.0450**	−0.080***	−0.098***
	(0.021)	(0.021)	(0.021)
Δln*REV*·*GDPGR*	−0.008**	−0.012***	−0.004
	(0.003)	(0.004)	(0.003)
REF2010	−0.023***	−0.02141***	−0.009***
	(0.002)	(0.002)	(0.002)

TABLE 5 (Continued)

	(1)	(2)	(3)
Variables	**Δln*WAGE***	**Δln*SSC***	**Δln*NEMP***
REF2012	−0.028***	−0.013***	−0.001
	(0.002)	(0.002)	(0.002)
EMPLINT	2.960***	3.305***	19.65***
	(0.296)	(0.309)	(0.602)
ASSINT	−0.001***	−0.001***	−0.004***
	(0.000)	(0.000)	(0.001)
ROA	−0.0007***	0.000	0.0011***
	(0.000)	(0.000)	(0.000)
DEBTTA	−4.94e-05	0.000***	9.14e-05**
	(3.80e-05)	(4.11e-05)	(4.55e-05)
DSUC	−0.016***	−0.016***	−0.021***
	(0.002)	(0.002)	(0.002)
LOSPRY	−0.051***	−0.039***	−0.040***
	(0.002)	(0.002)	(0.003)
GDPGR	0.005***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)
Constant	0.060***	0.055***	0.028***
	(0.001)	(0.001)	(0.002)
Observations	147,096	145,942	170,826
Number of firms	21,504	21,407	23,471
Firm fixed effects	Yes	Yes	Yes
R-sq overall	0.180	0.153	0.035

Note: Robust standard errors in parentheses.
***$p<0.01$, **$p<0.05$, *$p<0.1$.

1% (coefficients of β_1 in columns (3) and (4)), but they increase less after the labour reforms: 0.3328% and 0.3497% ($\beta_1+\beta_5$ in these columns, respectively) over 2010–2011, and 0.3598% and 0.3821% ($\beta_1+\beta_6$ in these columns, respectively) after 2012. Moreover, TLC decrease even less when revenues decrease, 0.194% decrease for a 1% decrease in revenues ($\beta_1+\beta_5$ in both columns), and the decrease is higher after the labour reforms ($\beta_1+\beta_2+\beta_5+\beta_3$): 0.2218 and 0.2588 after 2010 and 2012, respectively, according to estimations in column (3), and 0.2181 and 0.254, respectively, after these years with data in column (4). More importantly for the purpose of our study, in both columns, the significant ($p<0.01$) and positive signs of both coefficients of interest, β_3 and β_4 again provide reinforced support for the relationship hypothesised in H1.

With respect to control variables, focusing on column (4) in Table 4, the significant positive coefficients of the interaction variables of $D{\cdot}\Delta\ln REV$ with *DSUC* and *LOSSPRY* are in line with expectations, indicating that firms experiencing revenue decreases in successive years and losses in the previous year are more prone to cut LC when activity decreases. The significant negative coefficient of the interaction variable with *EMPLINT* reveals the rigidities in terms of adjusting resources in firms that use more employees to support a given volume of sales. Economic growth is significantly related to greater stickiness, probably because managers usually have optimistic prospects of early recovery in a context of general economic upturn, and vice versa, which is in line with expectations. The significant positive sign of the

interaction variable with *ASSINT* is contrary to expectations and some previous results. Most coefficients of the standalone variables are also consistent with expectations.

We next analyse different constituents of TLC. We break labour adjustments into changes in gross wages, social security contributions and number of employees. Estimations for Equation (4) with these dependent variables are displayed in Table 5. Results are similar to those in Table 4. Our main variables of interest (β_6 and β_5) have significant positive coefficients, providing additional support for our hypothesis in all three constituents of TLC. According to our results, the Spanish 2010 and 2012 labour reforms provided firms with greater flexibility to adjust wages, social security contributions and the workforce in periods of decreasing sales.

Table 6 shows information about the relationship between the labour reforms and wages and SSC per employee (columns (1) and (2), respectively). The significant negative coefficients

TABLE 6 Relationship between Spanish labour reforms and wages and SSC per employee. Firm fixed-effects estimations with robust standard errors.

	(1)	(2)
Variables	***WPEMP***	***SSCPEMP***
Δln*REV*	−562.6	−1421
	(420.5)	(1098)
D·Δln*REV*	−1563**	408.1
	(685.9)	(1318)
REF2010	−22.86	−1228***
	(118.9)	(394.2)
REF2012	−720.8***	−1357***
	(137.6)	(449.6)
EMPLINT	−1.31e+06***	−1.30e+06***
	(63,533)	(210,089)
ASSINT	521.9***	317.4***
	(52.17)	(54.23)
ROA	−101.7***	−123.6***
	(8.079)	(43.06)
DEBTTA	−26.95***	−10.25
	(2.941)	(10.24)
DSUC	254.5***	224.1
	(96.85)	(152.1)
LOSPRY	337.2***	457.2*
	(118.4)	(240.5)
GDPGR	28.14*	194.8***
	(15.47)	(38.26)
Constant	33,684***	10,115***
	(97.73)	(304.2)
Observations	153,042	152,212
Number of firms	22,725	22,636
Firm fixed effects	Yes	Yes
R-squared overall	0.114	0.004

Note: Robust standard errors in parentheses.
***$p<0.01$, **$p<0.05$, *$p<0.1$.

of the standalone variables *REF*2010 (with the exception of column (1)) and *REF*2012 reveal that wages and SSC per employee are lower and increase less after the labour reforms. In addition to lower stickiness in LC and number of employees, LC per employee and their growth are also lower after these reforms.

Tables 4 and 5 provide interesting information, not only on LC stickiness, but also on the effect of the Spanish labour reforms on LC when demand grows and the corresponding net effect over demand rises and falls. Table 7 presents detailed analyses for $\Delta\ln TLC$ and $\Delta\ln NEMP$ with coefficients from columns (4) and (3) in Tables 4 and 5, respectively. According to these results, the Spanish labour reforms are significantly associated with less stickiness in both $\Delta\ln TLC$ and $\Delta\ln NEMP$ (see the lines 'Stickiness', for columns (4) and (5) in both Panels A and B). However, the 2012 reform did not provide additional significant stickiness with respect to the 2010 reform (see the line 'Stickiness' in column (6)). The significant higher values of the 'Slope in demand decrease' after the reforms with respect to pre-2010 (with the exception of the value of $\Delta\ln NEMP$ in column (4)) indicate that managers remove more resources as demand drops. The slopes in periods of increasing demand are not significantly different, and even significantly lower in column (4) in Panel A. These data do not seem to fit the argument that firms hire more as demand increases in less stringent labour protection conditions. The significant negative sign of β_5 in Panel A (column (4)) suggests that firms may use the flexibility to hire more efficiently as demand expands. It is also possible that the flexibility enabled managers to mitigate worker-level agency behaviours, such as, for example, shirking, between the 2010 and 2012 labour reforms. It may also indicate that wages and SSC per employee and their growth are lower after the labour reforms (as can be seen in Table 6). Some factors may be in play in periods of demand increasing. However, the slope in demand increase was no longer lower after 2012 (see the significant positive values of β_6 and β_5 in column (6)). The overall effect considering periods of increasing and decreasing revenues is a net reduction in firms' LC and employment with respect to pre-reforms periods, but not in employment after 2012 (see last rows in Panels A and B: 'Net saving in firms').

Table 8 shows results for non-listed (column (1)) and listed firms (column (2)) in our sample. The two groups exhibit a similar pattern of reduced LC stickiness after the labour reforms, but listed firms do not display significant coefficients in the interaction variable $D{\cdot}\Delta\ln REV{\cdot}REF2010$ (see columns (1) and (2)). Listed firms lobbied for more flexible conditions after 2010, such as those provided by the 2012 reform (see the significant positive coefficient of $D{\cdot}\Delta\ln REV{\cdot}REF2010$ in column (2)). These firms got more flexibility from the 2012 reform than from the 2010 reform. The coefficient of $D{\cdot}\Delta\ln REV{\cdot}REF2012$ for non-listed firms is also positive and significant (see column (1)), but of considerable smaller value than for listed firms.

The small sample of listed firms may also play a role in the lack of significance of the interaction variable $D{\cdot}\Delta\ln REV{\cdot}REF2010$. Influential cases may also play an important role in these results. The listed firm subsample is small, the coefficients β_3, β_4, β_5 and β_6 are substantially different from those of the non-listed firms, and the listed firms exhibit an unusual swing from sticky to anti-sticky behaviour post 2011 relative to 2010–11, which cast doubts about the reliability of these results. We calculate the residuals of this regression, drop all observations with residuals below/above their mean plus/less three times the standard deviation and repeat the estimation. Results of this estimation for β_3, β_4, β_5 and β_6 (see column (3) in Table 8) are essentially the same as those in column (2). We additionally drop all observations with predicted values deviating three times the standard deviation from the mean, and again these coefficients are essentially the same (see column (4) in Table 8). In both estimations β_4 is positive and significant at $p<0.01$ and β_6 is negative and significant at $p<0.05$, while β_3 and β_5 are non-significant. It is worth pointing out that the considerable negative and significant value of β_2 in columns (3) and (4) suggests a higher rigidity of these firms to adjust resources in periods of decreasing revenues prior to the labour reforms. A plausible explanation is that listed firms

TABLE 7 Analysis of the effects of labour reforms on total labour costs (Δln*TLC*) and employment (Δln*NEMP*) in periods of demand increase and decrease and post- to pre-labour reforms.

	(1)		(2)		(3)		(4)		(5)		(6)	
	Pre-2010		**2010–11**		**Post-2012**		**Difference 2010–2011 to pre-2010**		**Difference post-2012 to pre-2010**		**Difference post-2012 to 2010–11**	
	Coefficient value		**Coefficient value**		**Coefficient value**		**Coefficient value**		**Coefficient value**		**Coefficient value**	
Panel A: Total labour costs (Δln*TLC*): coefficients from column 5 in Table 4												
Slope in demand increase	β_1		$\beta_1+\beta_5$		$\beta_1+\beta_6$		β_5		β_6		β_6-β_5	
	0.4	***	0.345	***	0.382	***	−0.050	***	−0.018	ns	0.032	**
Slope in demand decrease	$\beta_1+\beta_2$		$\beta_1+\beta_2+\beta_5+\beta_3$		$\beta_1+\beta_2+\beta_6+\beta_4$		$\beta_5+\beta_3$		$\beta_6+\beta_4$		$\beta_6+\beta_4$-β_5-β_3	
	0.194	***	0.21851	***	0.254	***	0.024	*	0.06	***	0.036	ns
Stickiness (difference decrease & increase)	β_2		$\beta_2+\beta_3$		$\beta_2+\beta_4$		β_3		β_4		β_4-β_3	
	−0.206	***	−0.132	***	−0.128	***	0.074	***	0.078	***	0.004	ns
Net savings in firms' LC							β_5-β_3		β_6-β_4		β_6-β_5–$\beta_4+\beta_3$	
(± LC saving/ increasing)							−0.125	***	−0.096	***	0.029	ns
Panel B: Employment (Δln*NEMP*): coefficients from column 3 in Table 5												
Slope in demand increase	β_1		$\beta_1+\beta_5$		$\beta_1+\beta_6$		β_5		β_6		β_6-β_5	
	0.345	***	0.306	***	0.353	***	−0.0389	ns	0.00759	ns	0.0465	**
Slope in demand decrease	$\beta_1+\beta_2$		$\beta_1+\beta_2+\beta_5+\beta_3$		$\beta_1+\beta_2+\beta_6+\beta_4$		$\beta_5+\beta_3$		$\beta_6+\beta_4$		$\beta_6+\beta_4$-β_5-β_3	
	0.148	***	0.168	***	0.210	***	0.02	ns	0.062	***	0.042	ns
Stickiness (difference decrease & increase)	β_2		$\beta_2+\beta_3$		$\beta_2+\beta_4$		β_3		β_4		β_4-β_3	
	−0.197	***	−0.138	***	−0.143	***	0.059	*	0.055	**	−0.004	ns
Net savings in firms' employment							β_5-β_3		β_6-β_4		β_6-β_5–$\beta_4+\beta_3$	
(± employment saving/increasing)							−0.098	*	−0.047	ns	0.051	ns

***$p<0.01$, **$p<0.05$, *$p<0.1$.

TABLE 8 Firm fixed-effects estimations of Equation (4) for non-listed and listed firms in the Spanish stock exchange market, with $\Delta \ln TLC$ as dependent variable and robust standard errors.

	(1)	(2)	(3)	(4)
Variables	**Non-listed**	**Listed**	**Listed removing outliers of residuals**	**Listed removing outliers of residuals and predicted values**
$\Delta \ln REV$	0.398***	0.458***	0.455***	0.477***
	(0.012)	(0.169)	(0.141)	(0.141)
$D{\cdot}\Delta \ln REV$	−0.204***	−0.387	−0.517**	−0.553**
	(0.017)	(0.276)	(0.227)	(0.226)
$D{\cdot}\Delta \ln REV{\cdot}REF2010$	0.073***	−0.022	0.114	0.095
	(0.027)	(0.352)	(0.283)	(0.286)
$D{\cdot}\Delta \ln REV{\cdot}REF2012$	0.070***	0.708***	0.788***	0.875***
	(0.022)	(0.269)	(0.239)	(0.248)
$\Delta \ln REV{\cdot}REF2010$	−0.051***	0.120	0.091	0.132
	(0.019)	(0.251)	(0.209)	(0.210)
$\Delta \ln REV{\cdot}REF2012$	−0.013	−0.443**	−0.347**	−0.389**
	(0.015)	(0.182)	(0.156)	(0.158)
$D{\cdot}\Delta \ln REV{\cdot}EMPLINT$	−12.82***	−0.480	1.512	−2.015
	(1.173)	(12.93)	(11.74)	(13.19)
$D{\cdot}\Delta \ln REV{\cdot}ASSINT$	0.007***	0.013*	0.014**	0.013**
	(0.002)	(0.007)	(0.006)	(0.006)
$D{\cdot}\Delta \ln REV{\cdot}ROA$	0.001	0.011	0.012	0.011
	(0.001)	(0.013)	(0.011)	(0.012)
$D{\cdot}\Delta \ln REV{\cdot}DEBTTA$	−0.000	0.003	0.0023	0.002
	(0.000)	(0.004)	(0.004)	(0.004)
$D{\cdot}\Delta \ln REV{\cdot}DSUC$	0.113***	−0.071	−0.164*	−0.188**
	(0.012)	(0.138)	(0.089)	(0.090)
$D{\cdot}\Delta \ln REV{\cdot}LOSPRY$	0.104***	−0.435*	−0.288	−0.258
	(0.027)	(0.255)	(0.215)	(0.227)
$D{\cdot}\Delta \ln REV{\cdot}GDPGR$	−0.006	−0.077*	−0.102***	−0.108***
	(0.004)	(0.041)	(0.035)	(0.035)
$\Delta \ln REV{\cdot}EMPLINT$	18.13***	8.411	5.979	9.800
	(0.780)	(10.72)	(9.609)	(9.469)
$\Delta \ln REV{\cdot}ASSINT$	−0.011***	−0.013**	−0.015***	−0.0153***
	(0.002)	(0.006)	(0.005)	(0.005)
$\Delta \ln REV{\cdot}ROA$	0.002**	−0.009	−0.010	−0.0105
	(0.001)	(0.009)	(0.009)	(0.009)
$\Delta \ln REV{\cdot}DEBTTA$	0.001***	−0.003	−0.002	−0.002
	(0.000)	(0.003)	(0.003)	(0.003)
$\Delta \ln REV{\cdot}LOSPRY$	−0.064***	0.285	0.173	0.173
	(0.018)	(0.184)	(0.148)	(0.153)

(Continues)

TABLE 8 (Continued)

	(1)	(2)	(3)	(4)
Variables	**Non-listed**	**Listed**	**Listed removing outliers of residuals**	**Listed removing outliers of residuals and predicted values**
Δln*REV·GDPGR*	−0.006**	0.028	0.041	0.041
	(0.003)	(0.033)	(0.027)	(0.027)
REF2010	−0.022***	−0.039	−0.028	−0.031
	(0.002)	(0.028)	(0.021)	(0.021)
REF2012	−0.025***	−0.023	−0.015	−0.010
	(0.002)	(0.022)	(0.0184)	(0.019)
EMPLINT	3.058***	3.016	2.259	2.872
	(0.273)	(2.371)	(2.011)	(2.359)
ASSINT	−0.001***	0.003**	0.0031***	0.003**
	(0.000)	(0.001)	(0.001)	(0.001)
ROA	−0.001***	0.001	0.002*	0.002*
	(0.000)	(0.001)	(0.001)	(0.001)
DEBTTA	−1.39e-05	7.89e-05	0.000	0.000
	(3.50e-05)	(0.0005)	(0.000)	(0.000)
DSUC	−0.016***	−0.004	−0.010	−0.010
	(0.002)	(0.025)	(0.016)	(0.017)
LOSPRY	−0.051***	−0.103***	−0.064***	−0.061**
	(0.002)	(0.030)	(0.023)	(0.023)
GDPGR	0.005***	0.001	0.001	0.001
	(0.000)	(0.003)	(0.003)	(0.003)
Constant	0.062***	0.067***	0.052***	0.054***
	(0.001)	(0.022)	(0.019)	(0.019)
Observations	172,061	1281	1245	1230
Number of firms	23,444	169	167	165
Firm fixed effects	Yes	Yes	Yes	Yes
R-squared overall	0.186	0.099	0.147	0.121

Note: Robust standard errors in parentheses.
***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

benefit from size and industry dominance positions. Most of them operate in industries that are heavily regulated by the Spanish government in terms of prices and operating conditions. As a consequence, listed firms are protected by considerable entry barriers and advantageous market positions, they experience lower competitive pressure and there is less urgency to reap quick benefits from these labour reforms. In fact, they did not react to the first labour reform. However, and surprisingly, they got more flexibility, and even an anti-sticky behaviour after the 2012 labour reform.

6.2 | Robustness tests

Fixed-effects estimations remove variables, such as indicator variables for industries, that do not change their values during all periods in the panel dataset, because they present collinearity with indicator variables for firms. Accordingly, industry effects are not included in the results in Tables 4–8. We therefore rerun estimations for Equation (4) with random effects and industry fixed effects using the two-digits codes of the Statistical Classification of Economic Activities in the European Union, known as NACE. Results (not tabulated for the sake of simplicity) are essentially the same as those in Tables 4, 5, 6 and 8, thus providing reinforced support for our hypothesis. The only exception is the non-significant ($p<0.1$) coefficient of $D{\cdot}\Delta\ln REV{\cdot}REF2012$ when the dependent variable is $\Delta\ln NEMP$.

We additionally repeat estimations with Equation (3), and results and analyses are similar to those of Tables 5–8, and provide reinforced support for our hypothesis.

Given that the uneven number of firms across the sampled years might influence the empirical analysis, we use the propensity score procedure to produce one-to-one matched samples in which the characteristics of firms are similar over the different periods. We therefore use the standalone variables included in Equation (4) ($\Delta\ln REV$, *EMPLINT*, *ASSINT*, *ROA*, *DEBTTA*, *DSUC*, *LOSPRY*) and the dummy *DS* to estimate logit models (not displayed) to match the observations in period 2002–09 with those of period 2012–18, and the observations of 2007–08, the last 2 years with fewer observations in period 2002–09, with those of 2010–11. The procedure provides matched samples with the same number of observations, the estimations of which are displayed in Table 9. Column (1) displays results for the matched samples 2002–09 with 2012–18, column (2) shows results for the sample including the previous matched sample plus all observations in 2010–11, while results in column (3) refer to matched samples in all three periods: 2002–09, 2010–11 (matched with 2007–08, as mentioned) and 2012–18 (matched with 2002–09). All results are essentially the same as those of column (4) in Table 4 with respect to our variables of interest: significant positive signs of β_3 and β_4 in all cases, thus providing reinforced support for our hypothesis. Similar to previous results in Table 4, β_5 and β_6 present significant negative and non-significant signs, respectively. We additionally select all firms with at least 14 years of available data in the sample (out of 17 years in the total period), thus producing an almost balanced sample with observations of the same firms in both periods 2002–2009 and 2012–18. The corresponding estimations are displayed in column (4). Column (5) adds observations of years 2010–11 for these firms. Again, β_3 and β_4 are positive and significant in all cases, thus providing reinforcing support for our hypothesis. We finally estimate with a balanced sample of the 3921 firms remaining in the sample around the immediate 6 years around the labour reforms and the results are essentially the same for β_3 and β_4 (see column (6)).

In order to relieve endogeneity concerns due to correlated omitted variables, which may bias our results, we conduct an additional analysis by assessing the relationship between the labour reforms and other types of expenses. We expect that the Spanish labour reforms would not affect the adjustment of other operating expenses in response to decreases in activity. In order to test this expectation, we exclude LC from the total amount of all operating expenses (labelled as *gastos de explotación* in the Spanish accounting standards). We label these operating expenses excluding labour costs as OPE (and $\Delta\ln OPE$ the corresponding log-change: see the Appendix 1). It can be argued that the inclusion of a set of variable costs that do not present the sticky pattern, such as merchandise, in OPE may bias the analysis of the sticky behaviour of these expenses. Consequently, we remove these expenses and analyse the restricted group of depreciation and other operating expenses, namely services, taxation, impairment and provisions of trade operations, and other current non-financial expenses, which we label as DEPROT (and $\Delta\ln DEPROT$ the corresponding log-change: see the Appendix 1).

TABLE 9 Relationship between Spanish labour reforms and total labour cost ($\Delta \ln TLC$) stickiness with matched and balanced samples. Firm fixed-effect estimations with robust standard errors.

Variables	(1) Matched samples 2002–09 with 2012–18	(2) Matched samples 2002–09 with 2012–18, and all 2010–11 observations	(3) Matched samples 2002–09 with 2012–18 and 2007–08 with 2010–11	(4) Balanced samples (firms with at least 14 years of observations) 2002–09 and 2012–2018	(5) Balanced samples (firms with at least 14 years of observations) 2002–09 and 2010–2018	(6) Balanced samples (firms with 6 years of observations) 2008–2013
$\Delta \ln REV$	0.383***	0.387***	0.382***	0.384***	0.390***	0.408***
	(0.014)	(0.013)	(0.0132)	(0.025)	(0.025)	(0.039)
$D{\cdot}\Delta \ln REV$	−0.176***	−0.188***	−0.176***	−0.152***	−0.162***	−0.245***
	(0.020)	(0.018)	(0.019)	(0.036)	(0.035)	(0.056)
$D{\cdot}\Delta \ln REV{\cdot}REF2010$	-	0.0682**	0.059*		0.100*	0.139**
		(0.028)	(0.031)		(0.060)	(0.056)
$D{\cdot}\Delta \ln REV{\cdot}REF2012$	0.060***	0.076***	0.061***	0.082*	0.093**	0.203***
	(0.023)	(0.022)	(0.023)	(0.042)	(0.042)	(0.059)
$\Delta \ln REV{\cdot}REF2010$	-	−0.044**	−0.038*		−0.051	−0.090**
		(0.020)	(0.021)		(0.044)	(0.039)
$\Delta \ln REV{\cdot}REF2012$	−0.004	−0.010	−0.005	0.002	−0.004	−0.104**
	(0.016)	(0.015)	(0.015)	(0.029)	(0.029)	(0.049)
$D{\cdot}\Delta \ln REV{\cdot}EMPLINT$	−11.26***	−12.90***	−11.84***	−5.169	−4.561	−9.364**
	(1.701)	(1.467)	(1.578)	(3.565)	(3.300)	(4.488)
$D{\cdot}\Delta \ln REV{\cdot}ASSINT$	0.004	0.009***	0.004	0.009	0.011	0.008
	(0.004)	(0.003)	(0.003)	(0.008)	(0.008)	(0.014)
$D{\cdot}\Delta \ln REV{\cdot}ROA$	0.001	0.002	0.001	0.003	0.004*	−0.002
	(0.001)	(0.001)	(0.001)	(0.003)	(0.002)	(0.004)
$D{\cdot}\Delta \ln REV{\cdot}DEBTTA$	−0.001	−0.001*	−0.001	0.000	0.000	−0.001
	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)

TABLE 9 (Continued)

Variables	(1) Matched samples 2002–09 with 2012–18	(2) Matched samples 2002–09 with 2012–18, and all 2010–11 observations	(3) Matched samples 2002–09 with 2012–18 and 2007–08 with 2010–11	(4) Balanced samples (firms with at least 14 years of observations) 2002–09 and 2012–2018	(5) Balanced samples (firms with at least 14 years of observations) 2002–09 and 2010–2018	(6) Balanced samples (firms with 6 years of observations) 2008–2013
D·Δln*REV*·*DSUC*	0.111***	0.111***	0.109***	0.075***	0.078***	0.065***
	(0.014)	(0.012)	(0.013)	(0.024)	(0.022)	(0.022)
D·Δln*REV*·*LOSPRY*	0.133***	0.108***	0.123***	0.111*	0.090	0.036
	(0.048)	(0.035)	(0.047)	(0.062)	(0.060)	(0.068)
D·Δln*REV*·*GDPGR*	−0.003	−0.002	−0.003	−0.013	−0.015*	−0.013
	(0.005)	(0.004)	(0.005)	(0.008)	(0.008)	(0.017)
Δln*REV*·*EMPLINT*	20.16***	20.29***	20.59***	16.84***	16.75***	20.79***
	(1.081)	(0.956)	(1.041)	(1.649)	(1.606)	(2.504)
Δln*REV*·*ASSINT*	−0.009***	−0.014***	−0.010***	−0.005	−0.005	−0.010
	(0.003)	(0.002)	(0.003)	(0.007)	(0.006)	(0.009)
Δln*REV*·*ROA*	0.001	0.001*	0.002**	0.003**	0.002	0.004
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)
Δln*REV*·*DEBTTA*	0.001***	0.001***	0.001***	0.001	0.001*	0.001
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Δln*REV*·*LOSPRY*	−0.077**	−0.058**	−0.067*	−0.087**	−0.067	−0.048
	(0.036)	(0.025)	(0.036)	(0.043)	(0.041)	(0.049)
Δln*REV*·*GDPGR*	−0.009***	−0.009***	−0.009***	−0.006	−0.005	−0.015
	(0.003)	(0.003)	(0.003)	(0.006)	(0.006)	(0.014)
REF2010	-	−0.021***	−0.022***		−0.023***	−0.031***
		(0.002)	(0.002)		(0.003)	(0.003)
REF2012	−0.0230***	−0.024***	−0.024***	−0.023***	−0.023***	−0.027***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)

(Continues)

TABLE 9 (Continued)

Variables	(1) Matched samples 2002–09 with 2012–18	(2) Matched samples 2002–09 with 2012–18, and all 2010–11 observations	(3) Matched samples 2002–09 with 2012–18 and 2007–08 with 2010–11	(4) Balanced samples (firms with at least 14 years of observations) 2002–09 and 2012–2018	(5) Balanced samples (firms with at least 14 years of observations) 2002–09 and 2010–2018	(6) Balanced samples (firms with 6 years of observations) 2008–2013
EMPLINT	3.954***	3.781***	3.728***	2.422***	2.843***	6.511***
	(0.381)	(0.338)	(0.356)	(0.612)	(0.607)	(1.159)
ASSINT	−0.002**	−0.001**	−0.001***	−0.001	−0.000	0.003
	(0.0012)	(0.000)	(0.001)	(0.001)	(0.001)	(0.003)
ROA	−0.000*	−0.000***	−0.000**	−0.000**	−0.000**	−0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
DEBTTA	−3.70e-05	−3.57e-05	−3.68e-05	9.27e-05	8.91e-05	−0.000
	(4.13e-05)	(3.81e-05)	(3.93e-05)	(6.03e-05)	(5.90e-05)	(0.000)
DSUC	−0.017***	−0.017***	−0.017***	−0.013***	−0.0118***	−0.018***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)
LOSPRY	−0.051***	−0.054***	−0.051***	−0.050***	−0.0528***	−0.060***
	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)	(0.005)
GDPGR	0.005***	0.005***	0.005***	0.004***	0.00406***	0.007***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Constant	0.064***	0.064***	0.064***	0.055***	0.056***	0.072***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.004)
Observations	120,614	145,867	136,217	32,444	36,954	23,526
R-squared	0.217	0.209	22,254	0.268	0.261	0.221
Number of firms	21,942	22,668	0.209	2363	2363	3921
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R-sq overall	0.182	0.183	0.180	0.258	0.250	0.181

Note: Robust standard errors in parentheses.
***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

TABLE 10 Relationship between Spanish labour reforms and operating costs (labour costs excluded). Firm fixed-effects estimations with robust standard errors.

	(1)	(2)	(3)	(4)
	Δln*OPE*	**Δln*OPE***	**Δln*DEPROT***	**Δln*DEPROT***
Variables	**Equation (1)**	**Equation (4)**	**Equation (1)**	**Equation (4)**
Δln*REV*	1.001***	1.038***	0.507***	0.645***
	(0.006)	(0.012)	(0.010)	(0.062)
D·Δln*REV*	−0.068***	0.029*	−0.063***	−0.131*
	(0.010)	(0.017)	(0.016)	(0.075)
D·Δln*REV*·*REF*2010		−0.026		0.025
		(0.027)		(0.076)
D·Δln*REV*·*REF*2012		−0.013		0.087
		(0.020)		(0.076)
Δln*REV*·*REF*2010		0.014		−0.089
		(0.018)		(0.062)
Δln*REV*·*REF*2012		−0.005		−0.108*
		(0.014)		(0.063)
D·Δln*REV*·*EMPLINT*		−1.330		−1.610
		(2.130)		(2.150)
D·Δln*REV*·*ASSINT*		0.005		−0.001
		(0.004)		(0.003)
D·Δln*REV*·*ROA*		0.014***		0.006***
		(0.002)		(0.002)
D·Δln*REV*·*DEBTTA*		6.98e-05		−0.001
		(0.000)		(0.001)
D·Δln*REV*·*DSUC*		0.010		0.046**
		(0.012)		(0.020)
D·Δln*REV*·*LOSPRY*		0.221***		0.155***
		(0.031)		(0.041)
D·Δln*REV*·*GDPGR*		−0.001		−0.002
		(0.004)		(0.007)
Δln*REV*·*EMPLINT*		−0.654		4.791***
		(1.488)		(1.479)
Δln*REV*·*ASSINT*		−0.021***		−0.008***
		(0.003)		(0.003)
Δln*REV*·*ROA*		−0.002**		0.001
		(0.001)		(0.002)
Δln*REV*·*DEBTTA*		−0.000		0.001
		(0.000)		(0.001)
Δln*REV*·*LOSPRY*		−0.163***		−0.127***
		(0.021)		(0.026)

(Continues)

TABLE 10 (Continued)

	(1)	(2)	(3)	(4)
	Δln*OPE*	**Δln*OPE***	**Δln*DEPROT***	**Δln*DEPROT***
Variables	**Equation (1)**	**Equation (4)**	**Equation (1)**	**Equation (4)**
Δln*REV*·*GDPGR*		−0.0025		0.007
		(0.003)		(0.005)
REF2010		−0.010***		−0.016***
		(0.002)		(0.005)
REF2012		−0.011***		−0.012***
		(0.001)		(0.005)
EMPLINT		−3.345***		−0.493
		(0.365)		(0.416)
ASSINT		0.001		0.002***
		(0.001)		(0.001)
ROA		−0.007***		−0.004***
		(0.000)		(0.000)
DEBTTA		−0.000***		−4.83e-05
		(3.53e-05)		(8.45e-05)
DSUC		−1.90e-05		−0.012***
		(0.002)		(0.003)
LOSPRY		−0.067***		−0.060***
		(0.003)		(0.003)
GDPGR		−0.000		0.002***
		(0.000)		(0.000)
Constant	0.0133***	0.0332**	0.0141***	0.039***
	(0.001)	(0.001)	(0.0009)	(0.005)
Observations	133,258	133,258	101,017	101,017
Number of firms	20,712	20,712	19,002	19,002
Firm fixed effects	Yes	Yes	Yes	Yes
R-squared overall	0.611	0.632	0.191	0.204

Note: Robust standard errors in parentheses.
***$p<0.01$, **$p<0.05$, *$p<0.1$.

Table 10 shows estimations of Equations (1) and (4), the most simple and complex models used in this study, respectively, for these dependent variables. Columns (1) and (3) reveal the existence of the typical cost sticky behaviour of operating costs (negative and significant sign of $D{\cdot}\Delta\ln REV$). The non-significant coefficients on our experimental variables ($D{\cdot}\Delta\ln REV{\cdot}REF2010$ and $D{\cdot}\Delta\ln REV{\cdot}REF2012$) in columns (2) and (4) indicate that there is no relationship between the labour reforms and the stickiness of operating expenses. β_5 and β_6 are also not significant, with the exception of the latter in column (2), which is slightly significant at $p<0.1$ (see column (4)), which also suggests a certain potential of labour legislation to influence the rates at which managers adjust non-labour capital resources, with slightly less reliance on acquiring these resources as the legislation makes it easier to manage labour resources. All coefficients (β_3, β_4, β_5 and β_6) on both independent variables are non-significant (at $p<0.1$) in estimations with random effects controlling for industry effects (not tabulated), including β_6.

Overall, these results suggest that the sticky behaviour of operating costs has scarcely been affected by the Spanish labour reforms. In line with the purpose of these reforms, they have increased the flexibility with which firms can adjust LC when activity decreases, but they have scarcely influenced the flexibility in adjusting operating expenses. This additional analysis helps to substantiate our conclusion that the relationship between LC and the Spanish labour reforms is driven by the increasing firms' lenient conditions with respect to adjusting these costs following these reforms. According to these results, there is a reduction in the asymmetry of LC behaviour that does not exist in other operating expenses. The fact that our results do not reveal stronger operating expense cuts after the reforms suggests that the reduction in the asymmetric LC behaviour is not driven by omitted variables. Therefore, these results provide reinforced support for our hypothesis and relieve endogeneity concerns.

As an additional robustness test, we perform a dynamic analysis. We replace variables $REF2010$ and $REF2012$ by yearly indicator variables. The corresponding interaction and standalone indicator variables are added to Equation (4). The default period is 2008–09, because the fixed-effects estimation drops $D{\cdot}\Delta\ln REV{\cdot}YEAR2018$ for collinearity, thus not allowing the required comparison. A summary of these results (only the interaction variables with such yearly indicator variables, for the sake of simplicity) are presented in column (1) in Panel A of Table 11. According to these results, only three coefficients of the interaction variables between $D{\cdot}\Delta\ln REV$ and yearly indicators are significantly positive (at $p<0.05$), and three significantly negative with respect to the default years (2008 and 2009). Given that our main purpose is to compare the LC stickiness post- versus pre-reforms periods, we perform joint significance tests of all pairs of combinations between the nine and seven post- and pre-reforms periods respectively. Panel B of Table 11 offers these results for TLC. While 39 out of 63 pairs of comparisons (61.9%) cast significantly less stickiness after the labour reforms, in 24 (38.1%) of them there are no significant differences ($p<0.1$) in post versus pre-reform stickiness, and none of these periods are stickier than pre-reform periods at the $p<0.1$ significance level. Additionally, a test of the joint significance of all coefficients provides evidence of a significant higher stickiness in the overall periods post-reform at $p<0.01$.

Given that these results may be affected by the collinearity driven by so many interactions, we rerun the same estimation and analysis with Equation (3) instead of Equation (4). Column (2) in Table 11 displays the corresponding results and analysis. As can be seen, all interaction variables for periods previous to the labour reforms present no significant signs, while all coefficients of the corresponding variables for periods post-reforms are positive and significant. Panel B in this column shows that TLC are less sticky in all periods after the reforms than in previous periods, thus providing more clear support for our hypothesis than results in column (1), and suggesting that the sticky effect of these reforms is immediate and longstanding. Firstly, there is no delayed effect. Our results suggest that firms were eager and ready to apply the adjustments allowed by the labour reforms immediately after the enactment of these reforms. Secondly, the effects are longstanding, according to results in column (2), where they remain over all periods after these reforms. However, as mentioned, the results in column (1) are less conclusive in this respect, and do not support the longstanding effect.

We additionally replace our experimental variables with a placebo indicator. We remove the periods of time included between the two labour reforms, from 2010 to 2012. We then split the remaining sample between periods before and after the reform (2002–09 and 2013–18, respectively), and we use the year in the middle of both periods as the placebo indicator: 2006 and 2016, respectively. Table 12 presents the results of the estimation of the corresponding Equation (5) for both periods (columns (1) and (2)). There is no significant change in the sticky behaviour of LC within each of these subperiods: the coefficients of the interaction variables

TABLE 11 Dynamic analysis for total labour costs (Δln*TLC*): interactions between dummies for years (default period 2008–09) on *D*·Δln*REV* and Δln*REV*.

	(1)	(2)
Variables	**Equation (4)**	**Equation (3)**
Panel A: Regression estimates		
D·Δln*REV*·*YEAR*2002	−0.096	0.005
	(0.078)	(0.065)
D·Δln*REV*·*YEAR*2003	−0.058	0.049
	(0.081)	(0.066)
D·Δln*REV*·*YEAR*2004	−0.140*	−0.018
	(0.072)	(0.056)
D·Δln*REV*·*YEAR*2005	−0.194**	−0.059
	(0.080)	(0.061)
D·Δln*REV*·*YEAR*2006	−0.075	0.077
	(0.082)	(0.061)
D·Δln*REV*·*YEAR*2007	−0.183**	−0.046
	(0.079)	(0.059)
D·Δln*REV*·*YEAR*2008-9	Default years	Default years
D·Δln*REV*·*YEAR*2010	0.028	0.107***
	(0.043)	(0.041)
D·Δln*REV*·*YEAR*2011	0.082**	0.120***
	(0.041)	(0.041)
D·Δln*REV*·*YEAR*2012	0.177***	0.148***
	(0.043)	(0.034)
D·Δln*REV*·*YEAR*2013	0.153***	0.176***
	(0.041)	(0.042)
D·Δln*REV*·*YEAR*2014	−0.023	0.085*
	(0.055)	(0.048)
D·Δln*REV*·*YEAR*2015	−0.041	0.142***
	(0.073)	(0.051)
D·Δln*REV*·*YEAR*2016	−0.072	0.084*
	(0.065)	(0.049)
D·Δln*REV*·*YEAR*2017	−0.030	0.129***
	(0.065)	(0.050)
D·Δln*REV*·*YEAR*2018	−0.029	0.111**
	(0.064)	(0.052)
Δln*REV*·*YEAR*2002	0.078*	−0.009
	(0.046)	(0.032)
Δln*REV*·*YEAR*2003	0.059	−0.037
	(0.047)	(0.031)
Δln*REV*·*YEAR*2004	0.066	−0.038
	(0.046)	(0.029)

TABLE 11 (Continued)

	(1)	(2)
Variables	**Equation (4)**	**Equation (3)**
Δln*REV*·*YEAR*2005	0.111**	−0.007
	(0.051)	(0.030)
Δln*REV*·*YEAR*2006	0.051	−0.078***
	(0.052)	(0.029)
Δln*REV*·*YEAR*2007	0.116**	0.001
	(0.049)	(0.028)
Δln*REV*·*YEAR*2008-9	Default years	Default years
Δln*REV*·*YEAR*2010	−0.037	−0.103***
	(0.028)	(0.026)
Δln*REV*·*YEAR*2011	−0.041	−0.072***
	(0.027)	(0.028)
Δln*REV*·*YEAR*2012	−0.115***	−0.090***
	(0.034)	(0.030)
Δln*REV*·*YEAR*2013	−0.076***	−0.095***
	(0.029)	(0.029)
Δln*REV*·*YEAR*2014	0.042	−0.048*
	(0.034)	(0.027)
Δln*REV*·*YEAR*2015	0.0595	−0.093***
	(0.048)	(0.026)
Δln*REV*·*YEAR*2016	0.111**	−0.018
	(0.044)	(0.027)
Δln*REV*·*YEAR*2017	0.078*	−0.054**
	(0.0423)	(0.026)
Δln*REV*·*YEAR*2018	0.084**	−0.033
	(0.041)	(0.029)
Observations	173,342	173,342
Number of firms	23,568	23,568
Firm fixed effects	Yes	Yes
R-squared overall	0.200	0.180
Panel B: Differences between Panel A coefficients of the interactions between *D*·Δln*REV* and yearly indicators post versus pre-labour reforms (number of cases and percentages)		
Positive and significant signs	39 (61.9%)	63 (100.0%)
Negative significant signs	0 (0.0%)	0 (0.0%)
Non-significant signs	24 (38.1%)	0 (0.0%)
Total number of comparisons	63 (100.0%)	63 (100.0%)

Note: For simplicity, only the interactions with the experimental variable *D*·Δln*REV*·*YEAR* Δln*REV*·*YEAR* are displayed. As the estimation with one-year variables drops *D*·Δln*REV*·*YEAR*2018 for collinearity, we merge 2008 and 2009 as the default year. Robust standard errors in parentheses.

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

TABLE 12 Fixed-effects estimations of Equation (4) with robust standard errors for total labour costs ($\Delta \ln TLC$) with a placebo indicator for periods before and after the labour reforms.

	(1)	(2)	(3)	(4)
Variables	**2002–09**	**2013–18**	**2002–07**	**2015–18**
$\Delta \ln REV$	0.377***	0.361***	0.517***	0.515***
	(0.022)	(0.014)	(0.088)	(0.065)
$D{\cdot}\Delta \ln REV$	−0.160***	−0.134***	−0.194	−0.214*
	(0.035)	(0.028)	(0.188)	(0.121)
$D{\cdot}\Delta \ln REV{\cdot}REF2006$	0.012			
	(0.037)			
$\Delta \ln REV{\cdot}REF2006$	−0.015			
	(0.018)			
$D{\cdot}\Delta \ln REV{\cdot}REF2016$		0.014		
		(0.032)		
$\Delta \ln REV{\cdot}REF2016$		0.032*		
		(0.017)		
$D{\cdot}\Delta \ln REV{\cdot}REF2005$			−0.061	
			(0.095)	
$\Delta \ln REV{\cdot}REF2005$			0.102**	
			(0.044)	
$D{\cdot}\Delta \ln REV{\cdot}REF2017$				0.062
				(0.051)
$\Delta \ln REV{\cdot}REF2017$				−0.033
				(0.028)
$D{\cdot}\Delta \ln REV{\cdot}EMPLINT$	−8.070***	−10.78***	−9.020***	−13.42***
	(2.700)	(1.808)	(3.336)	(2.424)
$D{\cdot}\Delta \ln REV{\cdot}ASSINT$	0.003	0.006**	−0.003	0.004
	(0.005)	(0.004)	(0.008)	(0.003)
$D{\cdot}\Delta \ln REV{\cdot}ROA$	0.001	0.001	0.009**	0.001
	(0.002)	(0.002)	(0.004)	(0.003)
$D{\cdot}\Delta \ln REV{\cdot}DEBTTA$	−0.001	0.000	−0.002	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)
$D{\cdot}\Delta \ln REV{\cdot}DSUC$	0.079***	0.122***	0.060	0.0848***
	(0.020)	(0.024)	(0.044)	(0.032)
$D{\cdot}\Delta \ln REV{\cdot}LOSPRY$	0.167	0.042		0.074
	(0.169)	(0.040)		(0.055)
$D{\cdot}\Delta \ln REV{\cdot}GDPGR$	−0.002	−0.014	0.060	0.041
	(0.009)	(0.009)	(0.101)	(0.054)
$REF2006$	−0.007***			
	(0.002)			
$REF2016$		0.009***		
		(0.002)		

TABLE 12 (Continued)

	(1)	(2)	(3)	(4)
Variables	**2002–09**	**2013–18**	**2002–07**	**2015–18**
*REF*2005			−0.003	
			(0.005)	
*REF*2017				−0.001
				(0.003)
Δln*REV*·*EMPLINT*	18.53***	16.88***	20.13***	18.22***
	(1.622)	(1.184)	(1.676)	(1.446)
Δln*REV*·*ASSINT*	−0.007	−0.010***	−0.006	−0.008***
	(0.004)	(0.002)	(0.006)	(0.002)
Δln*REV*·*ROA*	0.002	0.001	−0.001	−0.000
	(0.001)	(0.001)	(0.002)	(0.002)
Δln*REV*·*DEBTTA*	0.001***	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Δln*REV*·*LOSPRY*	−0.159	−0.032		−0.047
	(0.153)	(0.024)		(0.032)
Δln*REV*·*GDPGR*	−0.020***	−0.001	−0.105**	−0.076***
	(0.007)	(0.005)	(0.046)	(0.027)
EMPLINT	5.933***	4.886***	4.527***	5.433***
	(0.800)	(0.496)	(0.986)	(0.729)
ASSINT	−0.001	−0.001	−0.002	−0.002**
	(0.000)	(0.001)	(0.002)	(0.001)
ROA	−0.001***	−0.001***	−0.001**	−0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
DEBTTA	−0.000**	−7.55e-05	0.000	−9.54e-05
	(6.41e-05)	(9.55e-05)	(0.000)	(0.000)
DSUC	−0.021***	−0.009***	−0.011**	−0.004
	(0.003)	(0.003)	(0.005)	(0.004)
LOSPRY	−0.062***	−0.047***		−0.037***
	(0.010)	(0.003)		(0.004)
GDPGR	0.006***	0.004***	−0.008	−0.002
	(0.001)	(0.001)	(0.005)	(0.003)
Constant	0.069***	0.035***	0.0873***	0.056***
	(0.002)	(0.001)	(0.010)	(0.007)
Observations	60,307	74,933	40,469	49,582
Number of firms	16,610	18,073	11,654	16,453
Firm fixed effects	Yes	Yes	Yes	Yes
R-squared overall	0.161	0.112	0.080	0.070

Note: Robust standard errors in parentheses. The placebo is the intermediate year of these periods: 2006 for years 2002–09, 2016 for 2013–18, 2005 for 2002–07, and 2017 for 2015–18.

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

between $D{\cdot}\Delta\ln REV$ and the middle years of both subperiods, $REF2006$ and $REF2016$, are not significant in any cases ($p<0.1$). The coefficient of $\Delta\ln REV{\cdot}REF2016$ is positive and significant at $p<0.1$, but the difference between the decreasing costs and increasing costs when activity decreases and increases is the same for the whole period (β_2: −0.134). In order to move results away from the labour reforms, we repeat the procedure and estimations with periods ending and starting 2 years before and after these reforms, respectively. The results shown in columns (3) and (4) show no significant coefficients ($p<0.1$) for the interaction variables of $D{\cdot}\Delta\ln REV$ with the middle years of both periods, 2005 and 2017, in all cases, reinforcing results on the non-significant influence of the placebo indicators. Overall, the results in Table 12 provide reinforced support for our hypothesis.

7 | CONCLUSIONS

The existing literature on cost stickiness argues that LC plays a central role in the asymmetric firms' costs behaviour. Few prior empirical studies measure and analyse LC. Some attribute LC stickiness to the existence of rigidities included in labour protection laws and find relationships between this asymmetric behaviour and the existence of greater dismissal costs for skilled and white-collar employees.

The Spanish labour reforms of 2010 and 2012 offer a unique setting to analyse the effects of the removal of some rigidities and employment protections on LC. We find evidence of an immediate substantial decrease in LC stickiness after these labour reforms. The evidence about its longstanding effect is not conclusive. Our results are robust to all constituents of LC and the different estimation methods, models and periods considered, as well as to endogeneity concerns.

Our results have important implications for scholars, managers, stakeholders and policymakers. They add new knowledge to the scarce empirical research on LC stickiness, and a unique assessment of the effects of the enactment of laws relaxing employment protection on LC behaviour. We also respond to previous calls for future research using suitable proxies for labour adjustment costs (Golden et al., 2020). We not only perform empirical analysis of LC stickiness, but also of the stickiness of TLC constituents such as wages, social security contributions and number of employees. This study could also have implications for managers and stakeholders, as it provides evidence of firms' reactions to changes in labour regulations, which may help managers to assess competitors' reactions. The results of this study may also be of interest to employees and trade unions, as they convey interesting information on the effects of changes in labour protection in periods of decreasing activity. Similarly, this study may be of interest to policymakers with respect to getting a precise quantification of the effects of market labour deregulation on firms' costs.

Our study analyses the effects of the Spanish labour reforms enacted in 2010 and 2012 on firms' LC behaviour. It examines the effects on firms that survived over the period studied, but it does not analyse the corresponding effects on the firms' survival, or on the firms' avoidance of failure. These are avenues for future research and limitations of our study. With respect to the specific issue of LC stickiness and labour market deregulation, more precise studies in different contexts, specific industries and types of firms are also avenues for future research. The analysis of the effects on specific groups of employees, such as female or lower paid workers are also avenues for future research.

DATA AVAILABILITY STATEMENT

Data available on request from the authors.

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APPENDIX 1

Definition of variables

Variable	Definition
Dependent variables	
$\Delta\ln LC$	Log-change in labour costs: natural logarithm of labour costs in current year divided by labour costs in previous year. Labour costs are a generic dependent variable. Results are provided for its constituents: total labour costs (*TLC*), gross wages (*WAGE*), social security contributions (*SSC*) and number of employees (*NEMP*)
$\Delta\ln TLC$	Log-change in total labour costs: natural logarithm of total labour costs in current year divided by total labour costs in previous year
$\Delta\ln WAGE$	Log-change in total gross wages: natural logarithm of gross wages in current year divided by gross wages in previous year
$\Delta\ln SSC$	Log-change in social security contributions: natural logarithm of social security contributions in current year divided by social security contributions in previous year
$\Delta\ln NEMP$	Log-change in number of employees: natural logarithm of the number of employees in current year divided by the number of employees in previous year
$\Delta\ln OPE$	Log-change in total operating expenses, excluding labour and financial costs: natural logarithm of total operating expenses in current year divided by labour costs in previous year
$\Delta\ln DEPROT$	Log-change in other operating expenses and depreciation: natural logarithm of these expenses in current year divided by these expenses in previous year
WPEMP	Wage per employee: gross wages, in constant values of 2018 (updated with Spanish inflation rates), divided by number of employees
SSCPEMP	Social security contributions, in constant values of 2018 (updated with Spanish inflation rates), divided by number of employees
$\Delta\ln WPEMP$	Log-change in wage per employee: natural logarithm of wage per employee in current year divided by *WPEMP* in previous year

Variable	Definition
Δln*SSCPEMP*	Log-change in social security contributions per employee: natural logarithm of social security contributions per employee in current year divided by social security contributions per employee in previous year
Independent variables	
Δln*REV*	Log-change in revenues: natural logarithm of revenues in current year divided by revenues in previous year
D	Indicator variable equalling 1 if revenues in current year are lower than revenues in previous year, and 0 otherwise
*REF*2010	Indicator variable equalling 1 for observations in 2010 and 2011, and 0 otherwise
*REF*2012	Indicator variable equalling 1 for observations in 2012 or afterwards, and 0 otherwise
WPEMP	Wage per employee: gross wages, in constant values of 2018 (updated with Spanish inflation rates), divided by number of employees
CONTROLS	Control variables
EMPLINT	Employee intensity: number of employees divided by revenues, in constant values of 2018 (updated with Spanish inflation rates)
ASSINT	Asset intensity: total assets divided by revenues
ROA	Return on assets: operating profits divided by total assets
DEBTTA	Indebtedness: short- and long-term debt divided by total assets
DSUC	Indicator variable equalling 1 for observations with two consecutive years with revenue decreases, and 0 otherwise
LOSPRY	Indicator variable equalling 1 for firms with loss in previous year, and 0 otherwise
GDPGR	Spanish gross domestic product growth
FIRM	Indicator variable equalling 1 for observations of a given firm, and 0 otherwise
ln*NEMP*	Natural logarithm of number of employees