New evidence on wage adjustment in Europe during the period 2010-13

This article presents evidence from the third wave of the Wage Dynamics Network (WDN) survey, which was recently conducted in 25 EU countries to assess how firms adjusted to the various shocks and labour market reforms that took place in the European Union during the period 2010-13. The article focuses on wage rigidities and wage adjustment. The main results discussed can be summarised as follows: Downward nominal wage rigidity (DNWR) was prevalent in EU countries during the period 2010-13. Nevertheless, its incidence was lower during the period 2010-13 than during the first phase of the crisis (2008-09). This resistance of firms to cut base wages – in favour of freezing them – contributed to a lower frequency of wage changes during the period 2010-13 than in the period of economic stability prior to the crisis (2002-07). The survey evidence also suggests that firms used cuts in bonuses as a substitute for cuts in base wages to adjust their wage costs. Finally, a substantial percentage of firms in the euro area countries that undertook wide labour market reforms found it easier to adjust both employment and wages in 2013 than in 2010.

1 Introduction

Wage rigidity is at the heart of central banks' concerns, particularly during periods of economic instability and low inflation, and in the presence of segmented labour markets. Understanding wage rigidities, their sources and their patterns is essential for conducting monetary policy and designing appropriate structural policies. Inertial wage behaviour is an important factor behind price stickiness in the euro area, as suggested by the findings of the Inflation Persistence Network (IPN), a Eurosystem research network analysing the features and determinants of price setting in the euro area.[1] Downward nominal wage rigidity (DNWR) – resistance to wage decreases – might have implications for the choice of the optimal rate of inflation. In the presence of DNWR, a positive rate of inflation is needed to facilitate the adjustment of relative (real) wages and thus "grease the wheels of the economy". Hence, an inflation rate which is too low could, in the

[1] See Altissimo, F., Ehrmann, M. and Smets, F., "Inflation persistence and price-setting behaviour in the euro area: a summary of the IPN evidence", *Occasional Paper Series*, No 46, ECB, June 2006, and the article entitled "Price-setting behaviour in the euro area", *Monthly Bulletin*, ECB, November 2005. These showed that inertial wage behaviour is an important factor behind price stickiness in the euro area and therefore a key determinant of monetary policy transmission. Further evidence of this relationship is provided for 17 EU countries in Druant et al., "Firms' price and wage adjustment in Europe: Survey evidence on nominal stickiness", *Labour Economics*, Vol. 19, Issue 5, October 2012, pp. 772-782.

presence of DNWR, lead to long-term unemployment. Such considerations have generated a long-standing debate in macroeconomics which goes back to Tobin.[2]

The wage adjustment mechanism used by firms also plays a crucial role in the transmission of economic shocks. In fact, during the recent economic and financial crisis, the degree of wage flexibility determined, among other factors, the speed, nature and cost of adjustment in the presence of economic shocks.[3] In addition, identifying the sources of wage rigidities is essential to designing appropriate structural policies that facilitate adjustment to shocks.[4] More generally, wage flexibility is essential for the proper functioning of a multi-country monetary union with segmented labour markets, such as the euro area, where there is significant cross-country heterogeneity in labour market features and performance.[5] Indeed, with cross-country differences in the ability of firms to adjust wages in response to shocks, a country exhibiting stronger rigidity will suffer from a loss of competitiveness relative to countries that have more flexible labour markets.

In this context, the ESCB has developed an ad hoc survey on wage and price-setting behaviour at the firm level: the Wage Dynamics Network (WDN) survey. The WDN survey collects information that enables researchers to examine the effect on wages, employment and price adjustments of firms' characteristics, the economic environment and the institutional features of the labour markets where the firms operate. The third wave of the WDN survey (WDN3) was recently conducted and covers the period 2010-13. An important value added of the WDN3 survey is that it also collected information that can be used to evaluate the incidence of the various shocks and the relevance of recent labour market reforms that are deemed to affect labour market adjustments.

This article provides evidence on the features and sources of nominal wage rigidities across EU countries over the period 2010-13, drawing from WDN3 survey data. The article is structured as follows: Section 2 describes the main features of the WDN survey. Section 3 briefly discusses certain features that underlie the cross-country heterogeneity in wage rigidities and, more generally, in labour market performance in Europe during the period 2010-13. Section 4 presents stylised facts on nominal wage rigidities, covering wage stickiness and the frequency of base wage changes (4.1), downward nominal wage rigidity (4.2) and the use of

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2 Tobin, J., "Inflation and unemployment", *American Economic Review*, Vol. 62, Issue 1, February 1972, pp. 1-18. Tobin's argument has been formalised in Akerlof, G., Dickens, W. and Perry G., "The Macroeconomics of Low Inflation", *Brookings Papers on Economic Activity*, Vol. 27, Issue 1, 1996, pp. 1-76. Fagan and Messina found that the optimal steady-state rate of inflation varies between 0% and 2% for Belgium, Germany, Portugal and Finland while for the US it varies between 2% and 5%. See Fagan, G. and Messina, J., "Downward wage rigidity and optimal steady-state inflation", *Working Paper Series*, No 1048, ECB, April 2009.

3 Fabiani et al. showed that, during the first phase of the crisis (2008-09), the inability of firms to cut wages might have prevented the optimal adjustment of firms' labour costs and forced them to adjust employment rather than wages, thus contributing to job destruction. See Fabiani et al., "European firm adjustment during times of economic crisis", *IZA Journal of Labor Policy*, Vol. 4, Article 24, December 2015.

4 See also the box entitled "Downward wage rigidity and the role of structural reforms in the euro area", *Economic Bulletin*, Issue 8, ECB, 2015.

5 More generally, there is large heterogeneity across EU national labour markets.

bonuses and benefits as labour cost adjustment margins in addition to changes in base wages (4.3). Section 5 concludes.

2 The WDN survey: sample and data

The WDN survey offers a unique dataset to explore wage dynamics, accounting for institutional features, firm-specific features and the economic environment in which the firms were operating. It was launched by the Wage Dynamics Network, an ESCB research network focusing on identifying the sources and features of wage and labour cost dynamics that are most relevant for monetary policy.[6] The first wave of the WDN survey (WDN1) was carried out by 17 national central banks (NCBs) between the end of 2007 and the first half of 2008. It collected information from a period of economic stability and relatively stable growth, namely 2002-07. During summer 2009, ten NCBs conducted a more focused follow-up survey, specifically with the aim of understanding firms' reactions to the initial stage of the crisis (2008-09). This was the second wave of the WDN survey (WDN2).[7]

The third wave of the WDN survey (WDN3) was conducted by 25 ESCB NCBs between the end of 2014 and the first half of 2015. The aim of the WDN3 survey was to assess recent labour market adjustments and firms' reactions to the various shocks and labour market reforms that took place during the second phase of the crisis (2010-13). This wave collected information from over 25,000 firms from the following sectors: manufacturing, energy, construction, trade and transportation, market services, financial intermediation and, for some countries, non-market services.[8] By design, the sample is relatively balanced across firm size categories within each country and across the sectors considered. Its distribution closely follows the distribution of private employment in each country. However, the sample size varies across countries both in absolute terms and relative to the number of firms in each country. Thus, individual weights have been calculated for each firm to make the sample representative of the overall number of firms in each country and to account for the number of workers that the firm represents in a given country.

The WDN surveys are ad hoc surveys at the firm level that respond to specific information demands. This feature has resulted in different questionnaires across waves. Coverage in terms of countries also varies across waves, as does the sample of firms in each country. Thus the WDN surveys are not, strictly speaking, different waves of a panel, but have led to cross-country datasets with ample geographical and sectoral coverage. The main advantage of conducting an ad hoc survey at the firm level is its flexibility. Firms can be asked directly about the features of their wage and price setting, their reactions to shocks or their perceptions of the effectiveness and impact of reforms – information that would otherwise be difficult to

6 The WDN, as such, was in operation from July 2006 until December 2009.

7 Fully harmonised WDN1 survey data is available for Belgium, the Czech Republic, Estonia, Ireland, Greece, Spain, France, Italy, Lithuania, Hungary, the Netherlands, Austria, Poland, Portugal and Slovenia. The WDN2 survey was conducted in the following countries: Belgium, the Czech Republic, Estonia, Spain, France, Italy, Luxembourg, the Netherlands, Austria and Poland.

8 For the list of countries covered, see Table 1.

collect. Where wages are concerned, surveys addressed to firms typically provide more accurate information than those addressed to households. Nevertheless, several shortcomings inherent in ad hoc surveys should be borne in mind, such as low response rates and potential misinterpretations of the questions. Moreover, responses may be influenced by the specific macroeconomic environment prevailing at the time of the survey.

3 Cross-country heterogeneity in the incidence of the crisis during the period 2010-13

The WDN3 survey provides firm-level information on several aspects that can be used to account for cross-country heterogeneity in European labour markets and wage rigidities.

3.1 The incidence of shocks

The diverse nature and intensity of the shocks that hit European labour markets may have contributed to the cross-country heterogeneity of their performance. The WDN3 survey provides detailed information on a variety of shocks that hit European firms during the period 2010-13.[9] Chart 1 provides a brief overview of the incidence of shocks across countries; it displays the percentage of firms that reported a decrease (or strong decrease) in total demand and access to credit. On average, 36% of EU firms reported a fall in demand; in the euro area 42% of firms experienced a fall in demand, while only 23% did so among non-euro area firms. At the country level, 71% of firms in Greece and 59% in Cyprus reported facing a demand shock, in contrast to Estonia and the UK, where less than 18% of firms reported this kind of shock. Heterogeneity similarly emerges when focusing on credit shocks. While 66% of firms in Greece, 48% in Cyprus, 45% in Slovenia and about 39% in Spain report more restricted access to credit, this is the case for only around 5% of firms in Estonia and Malta, and 11% in Latvia. Interestingly, the volatility of demand, rather than the level, appears to be a concern among the Baltic States, which, during the period 2010-13, were recovering from a large deterioration in the labour market.[10]

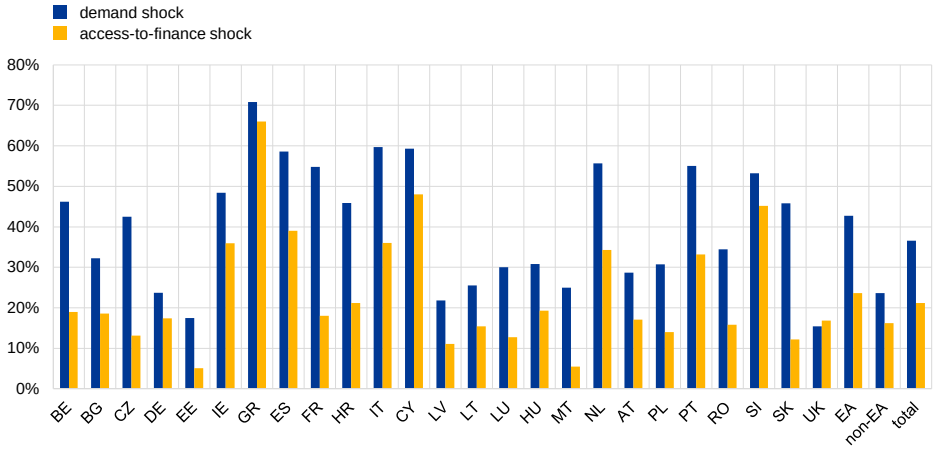
[9] When reporting the shocks, firms were asked to distinguish between domestic and external in the case of demand shocks, and between different financing methods (for financing new investment projects, refinancing, etc.) in the case of financial shocks. In addition, they were asked to provide information on the volatility of demand, customers' ability to pay and the availability of supplies.

[10] Not reported in Chart 1.

Chart 1

Percentage of firms suffering from a demand and access-to-finance shock during the period 2010-13

(percentage of firms; employment-weighted values)



Source: ECB calculations on the basis of the WDN3 survey.
Notes: Firms with fewer than five employees are excluded from the calculations. Figures are weighted to reflect overall employment and rescaled to exclude non-response. Figures for Ireland are unweighted. Totals are calculated across countries that have weights. Demand and access-to-finance shocks are defined as the percentage of firms experiencing a moderate or strong decrease in demand and access to finance respectively.

3.2 Collective wage bargaining in Europe

Wage bargaining institutions are likely to play an important role as regards wage dynamics and, more generally, the operation of the labour market. Theoretical literature assigns an important role in wage adjustment and wage rigidity to wage bargaining institutions, and an extensive body of empirical literature attempts to quantify this role. Such quantification, however, remains difficult and comparable information at the international level is limited. The WDN1 and WDN3 surveys provide information on the centralisation and coverage of collective wage agreements. Regarding centralisation, the surveys asked firms whether they apply a collective wage agreement negotiated and signed outside the firm and/or at the firm level.[11] The latter type of agreement is usually regarded as more flexible than the former, as it gives firms greater scope to react to economic circumstances specific to the firm.

[11] It is often the case that agreements at both levels coexist in the firm.

Table 1

Collective bargaining – level and coverage: country overview in 2013

	% of firms with a collective bargaining agreement			% of workers covered by a collective pay agreement
	Firm level	Outside the firm	Firm level or outside	
Belgium	30.8	63.0	72.0	94.4
Bulgaria	21.8	7.0	24.3	17.8
Czech Republic	30.6	10.0	39.0	33.2
Germany	16.1	47.2	56.9	48.3
Estonia	10.1	2.0	11.3	8.2
Ireland	8.1	7.7	14.5	6.9
Greece	26.2	42.8	60.1	71.4
Spain	31.0	77.3	95.2	96.3
France	28.9	82.9	88.8	94.4
Croatia	35.4	23.3	45.2	47.1
Italy	60.4	89	99.5	99.0
Cyprus	31.7	41.7	56.4	39.6
Latvia	16.7	2.3	18.9	18.3
Lithuania	17.4	1.9	18.2	16.0
Luxembourg	25.1	33.4	54.9	54.0
Hungary	20.2	6.7	23.2	20.3
Malta	31.0	0.5	31.0	23.8
Netherlands	61.1	49.3	82.9	89.4
Austria	27.4	88.0	98.8	80.4
Poland	17.9	1.0	20.9	20.9
Portugal	13.0	62.2	66.3	62.5
Romania	69.4	7.7	73.0	71.6
Slovenia	57.9	75.9	86.9	79.4
Slovakia	35.1	14.8	38.4	35.7
United Kingdom	17.4	7.2	32.7	21.3
Euro area	28.9	64.3	75.0	73.4
Non-euro area	23.1	6.5	34.2	28.2
Total	26.8	50.3	63.9	60.9
Total (WDN1 countries)	31.9	64.2	76.0	77.1

Source: ECB calculations on the basis of the WDN3 survey.
Notes: Firms with fewer than five employees are excluded from the calculations. Figures are weighted to reflect overall employment and rescaled to exclude non-response. Figures for Ireland are unweighted. Totals are calculated across countries that have weights.

The percentage of firms that apply some kind of collective wage agreement in 2013 is very high in the euro area countries surveyed, but lower than in 2007.

On average, around 75% of firms applied a collective wage agreement in the euro area in 2013, while in 2007 this figure was 95%. By contrast, in the non-euro area countries surveyed, only around 34% of firms applied a collective wage agreement in 2013, as opposed to 28% in 2007. It is noteworthy that in the Baltic States only a very small percentage of firms applied collective agreements (11-18% in 2013).[12]

[12] In Ireland, the partnership agreements which set out the framework for collective bargaining over pay in both the public and private sectors were abandoned in 2010 and most firms have been operating without a formal agreement on pay since. Nevertheless, is likely that they operate under informal agreements.

Differences between euro area and non-euro area countries are also apparent when looking separately at collective agreements signed at the firm level and those signed outside the firm. In the euro area, collective bargaining was still mostly signed outside the firm at the sector level (this applies to 64.3% of firms, accounting for the largest proportion of workers) – with the exception of the Baltic States, where wage bargaining was predominantly organised at the firm level. The latter is also the case for the non-euro area countries (see Table 1).[13] However, a trend towards more decentralised bargaining has been observed in Spain, Italy, the Netherlands and Slovenia.

The percentage of workers covered by any kind of collective agreement fell during the crisis period in most euro area countries.[14] Nevertheless, the evidence collected by the WDN3 survey confirms that a large proportion of workers are still covered by some kind of collective wage agreement. The coverage rate before the crisis was high – 68% on average and over 80% in the euro area – while in 2013 the average coverage was 60% across all sampled firms and 73% across euro area firms.

3.3 Labour market reforms during the period 2010-13

The crisis led some governments to engage in a number of labour market reforms and policies designed to facilitate labour market adjustment and foster competitiveness. This is another factor that may have influenced the reaction of firms to shocks and contributed to the observed cross-country labour market heterogeneity.[15] In the WDN3 survey, firms were asked whether adjusting employment (via a number of channels) and adjusting wages (of both incumbents and new hires) had become easier or more difficult than in 2010.[16] Chart 2 shows the percentage of firms in each country that found it easier to adjust employment in 2013 than in 2010 (it reports the average across the different channels), while Chart 3 displays the percentage of firms that found it easier to adjust wages in 2013 than in 2010. These charts show that it is precisely in the countries where the largest and most wide-ranging labour market reforms took place (mostly the “stressed” countries) that substantial percentages of firms found it easier to adjust labour costs in 2013 than in 2010.

13 See also Visser, J., *Database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts, 1960-2014 (ICTWSS)*, Version 5.0, Amsterdam Institute for Advanced Labour Studies, Amsterdam, October 2015, and the box entitled “Downward wage rigidity and the role of structural reforms in the euro area”, *Economic Bulletin*, Issue 8, ECB, 2015.

14 Comparing the evidence collected by the WDN1 survey with that of the WDN3 survey, coverage fell in every euro area country except France and, to a lesser extent, Italy.

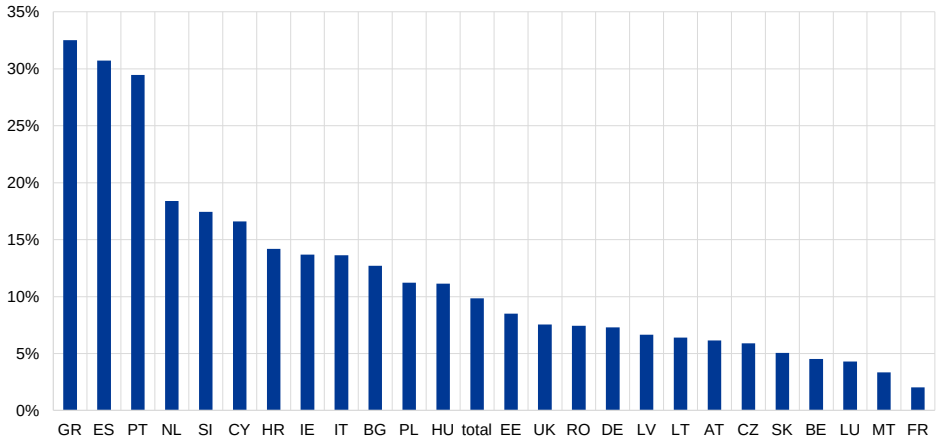
15 For a discussion on the structural reforms in the euro area, see the article entitled “Progress with structural reforms across the euro area and their possible impacts”, *Economic Bulletin*, Issue 2, ECB, 2015.

16 Box 1 in this article offers a detailed analysis of this information for stressed countries.

Chart 2

Percentage of firms that found it easier to adjust employment in 2013 than in 2010

(average across channels of adjustment; percentage of firms; firm-weighted values)

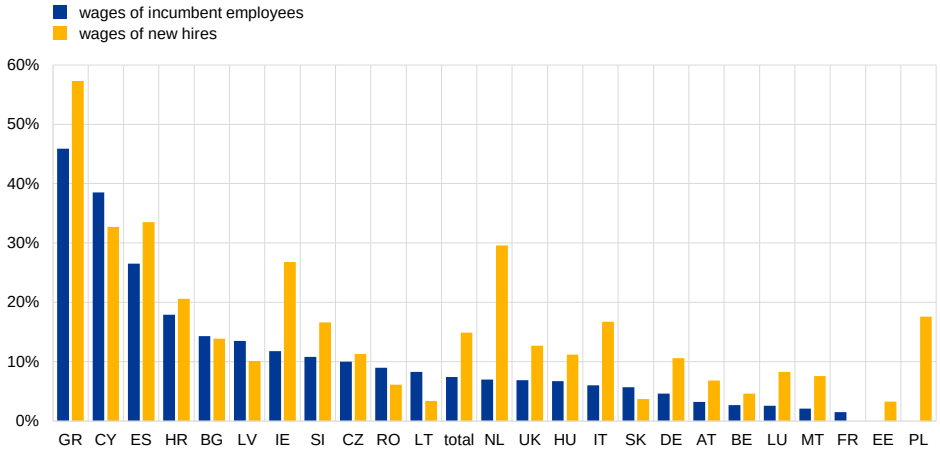


Source: ECB calculations on the basis of the WDN3 survey.
Notes: Firms with fewer than five employees are excluded from the calculations. Figures are weighted to reflect overall firm population and rescaled to exclude non-response. Figures for Ireland are unweighted. Channels of adjustment include collective and individual dismissals of employees for economic reasons, dismissals of employees for disciplinary reasons, temporary dismissals, employee hires, adjustment of working hours and employee reallocation.

Chart 3

Percentage of firms that found it easier to adjust wages in 2013 than in 2010

(percentage of firms; firm-weighted values)



Source: ECB calculations on the basis of the WDN3 survey.
Notes: Firms with fewer than five employees are excluded from the calculations. Figures are weighted to reflect overall firm population and rescaled to exclude non-response. Figures for Ireland are unweighted.

The firms' perceptions of the easiness of adjustments, as recorded in the WDN3 survey, could be seen as an indicator of the effectiveness of the labour market reforms implemented during the period 2010-13. However, it must be borne in mind that the easiness of adjustments may hinge on other factors. For example, 27% of Spanish firms reported that cutting the wages of incumbents in 2013 was easier than doing so in 2010, but when asked to identify specific reasons behind that change, they attributed particular importance to changes in workers' attitudes (see Box 1). This is likely to be a consequence of the intensity and duration of the crisis in Spain, rather than any regulatory changes.

Box 1

Firms' perceptions of changes in the ease of labour market adjustment and the role of reforms in stressed euro area countries during the period 2010-13 (based on the WDN3 survey)

This box discusses firms' perceptions regarding labour market adjustment in stressed euro area countries during the period 2010-13[17], **as these countries implemented a number of labour and institutional reforms during the crisis.**[18] It focuses on firms' responses to the WDN3 survey regarding labour market adjustment channels and how they were influenced by labour market reforms, workers' attitudes, trade union behaviour and the enforcement of laws. The box defines labour market adjustment channels in a very broad way but gives special attention to labour market reforms.[19] At the same time, WDN3 survey information on firms' perceptions also allows us to disentangle the impacts of demand-side factors, such as the severity of various shocks affecting stressed countries, and supply-side factors, such as changes in trade union behaviour and workers' attitudes.

Given substantial changes in the economic environment, along with considerable reform efforts in the stressed countries during the period 2010-13, firms in these countries adjusted via many channels. In particular, as discussed in this article, firms adjusted wages, employment and prices to increase their competitiveness and performance. For example, firms in most stressed countries reported that it was either just as easy or less difficult to adjust wages and/or employment in 2013 compared with 2010 (see Table 1). Overall, it seems that labour market adjustment was perceived to be easier than in the past in Greece, Spain, Cyprus and Portugal (i.e. firms that found it less difficult to adjust wages and/or employment significantly outnumbered those that found it more difficult), while firms' overall ability to make these adjustments did not alter much in Ireland, Italy and Slovenia. This is consistent with the different timings of labour market reforms in different countries. For instance, the effects of the earlier reforms of the first group of countries were more likely to be captured over the sample period of the WDN3 survey (2010-13). By contrast, significant labour market reforms in Italy were only implemented at a later stage, in 2012 and 2015, while labour market reform in Slovenia was implemented towards the end of the WDN3 sample period in 2013. Meanwhile, Ireland was already considered to be a relatively flexible economy before the crisis and experienced economic difficulties mainly in its first phase (2008-09); it is thus unsurprising that perceptions did not change much in Ireland over the period 2010-13.

Adjusting the wages of incumbents or new hires seems to have become less difficult overall in Greece, Spain and Cyprus (see Table).[20] Labour market reforms in these countries modified some of the most important institutional aspects of the labour market, such as the degree of

17 Following the definition used in the article entitled "The impact of the economic crisis on euro area labour markets", *Monthly Bulletin*, ECB, October 2014, stressed euro area countries (i.e. those defined as stressed during the period 2010-13) include Ireland, Greece, Spain, Italy, Cyprus, Portugal and Slovenia.

18 Reforms in Ireland, Spain and Portugal are described in detail in Box 2 of the article entitled "What is behind the recent rebound in euro area employment?", *Economic Bulletin*, Issue 8, ECB, 2015. Impacts of reforms in the stressed countries were also discussed in the article entitled "Progress with structural reforms across the euro area and their possible impacts", *Economic Bulletin*, Issue 2, ECB, 2015.

19 It should be recognised that the issue of labour market adjustment channels is much broader than investigated in this box. Furthermore, the limitations of the survey data should also be taken into consideration when studying the impact of reforms.

20 No information on these specific aspects of adjustment for Portugal is available from the WDN.

centralisation of the collective bargaining system, and dismissal costs and procedures.[21] It is therefore not surprising that the firms that said it was now easier to adjust or lower wages outnumbered those that said it was more difficult. By contrast, firms in Slovenia report that the ease of adjusting the wages of incumbents in 2013 remained broadly similar to that of 2010; the same applies to lowering the wages of new hires in Ireland. Furthermore, adjusting the wages of incumbents in Italy actually seems to have been somewhat more burdensome in 2013 than in 2010, while adjusting the wages of new hires remained broadly similar. Overall, increased wage flexibility, as reported by firms, should be seen as an important buffer against even higher potential increases in unemployment in stressed countries during the crisis. At the same time, it is important to bear in mind that wage policies should also reflect wider labour market conditions and productivity developments.

The ease of laying off employees for economic reasons or of adjusting working hours also seems to have increased in most of the stressed countries. This is reported particularly by firms in Greece, Spain and Portugal. In Cyprus and Slovenia, laying off employees for economic reasons eased to a lesser extent, and in Ireland and Italy it remained broadly unchanged. Firms in Ireland also reported that the ease of adjusting working hours was broadly similar in comparison with 2010, as did firms in Italy, Cyprus and Slovenia.[22] From the policy perspective, it is important that increased flexibility is combined with active labour market policies to allow workers to redeploy quickly to new sectors and job opportunities. Such a policy mix would reduce the duration of unemployment and further reduce structural unemployment in the euro area. In particular, firms will be more likely to increase employment in the future if there is more flexibility regarding the adjustment of labour requirements.

21 The impact of labour market institutions on wage developments is also discussed in detail in Box 4 in the article entitled “Increasing resilience and long-term growth: the importance of sound institutions and economic structures for euro area countries and EMU” in this issue of the Economic Bulletin.

22 Such a reading is broadly consistent with the changes in the employment protection legislation indicators published by the Organisation for Economic Co-operation and Development for the period 2008-13 for most of the stressed countries.

Table

Firms' perceptions at the end of 2013 regarding labour market adjustment channels in stressed countries, compared with the situation in 2010

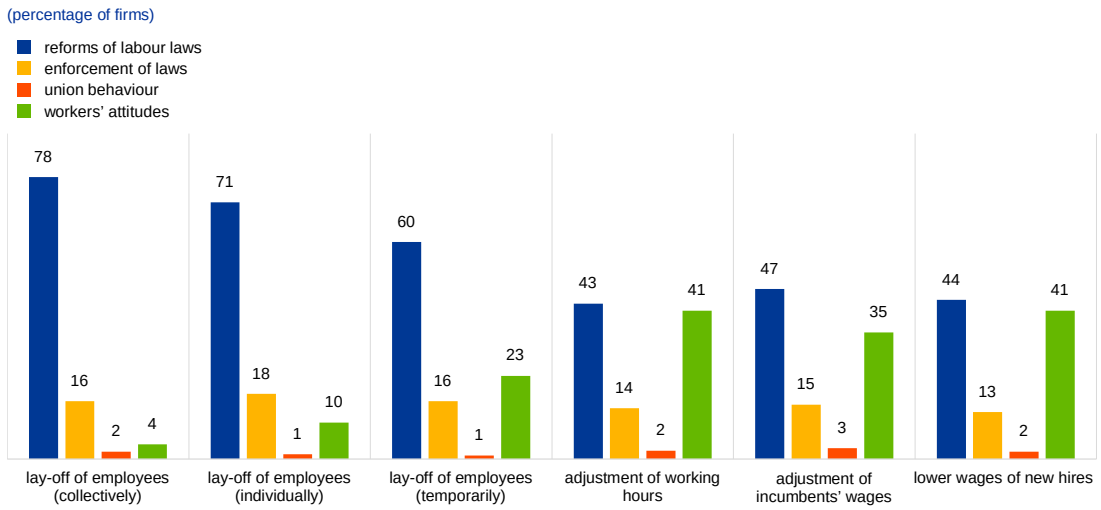
Actions	Lay off employees (collectively) (%)	Lay off employees (individually) (%)	Lay off employees (temporarily) (%)	Adjust working hours (%)	Adjust wages of incumbents (%)	Lower wages of new hires (%)
Ireland						
Much less/less difficult to…	8	12	13	19	12	27
Unchanged	74	66	69	63	62	53
More/much more difficult to…	18	22	18	18	26	20
Difference: less - more difficult	-8	-9	-3	3	-12	9
Greece						
Much less/less difficult to…	42	46	22	42	46	57
Unchanged	57	51	77	49	48	40
More/much more difficult to…	1	3	1	9	6	3
Difference: less - more difficult	41	43	22	33	40	54
Spain						
Much less/less difficult to…	42	47	29	30	27	33
Unchanged	48	42	55	61	60	58
More/much more difficult to…	10	11	16	9	13	9
Difference: less - more difficult	33	37	12	21	14	25
Italy						
Much less/less difficult to…	13	14	18	16	6	16
Unchanged	72	69	71	71	64	63
More/much more difficult to…	15	17	11	13	30	21
Difference: less - more difficult	-2	-2	7	3	-24	-5
Cyprus						
Much less/less difficult to…	13	23	18	22	39	33
Unchanged	78	64	77	65	46	62
More/much more difficult to…	9	13	5	13	15	5
Difference: less - more difficult	3	10	13	8	23	28
Portugal						
Much less/less difficult to…	32	33	31	32	*	*
Unchanged	56	52	59	58	*	*
More/much more difficult to…	12	15	10	10	*	*
Difference: less - more difficult	20	18	21	22	*	*
Slovenia						
Much less/less difficult to…	19	27	*	14	11	17
Unchanged	74	65	*	80	82	76
More/much more difficult to…	7	8	*	6	8	7
Difference: less - more difficult	12	19	*	7	3	10

Sources: WDN3 survey database, WDN3 country reports and ECB calculations.
Notes: Firms with fewer than five employees are excluded from the calculations. The percentages are derived from the weighted answers to questions to reflect overall firm population and are rescaled to exclude non-response. Figures for Ireland are unweighted. * denotes missing data.

Labour market reforms seem to be a notable factor behind the identified changes, especially in Greece and Spain.[23] The firms surveyed in these two countries indicated that reforms were an important reason for the increase in the ease of labour market adjustment, while changes in workers' attitudes in Spain also played a significant role, particularly as regards the wage channel (see Chart A). The latter may be partly explained by the strong increase in the unemployment rate in Spain over the period 2010-13.

Chart A

Factors behind labour market adjustment channels in Spain between 2013 and 2010



Sources: WDN3 survey database, WDN3 country report for Spain and ECB calculations.
Notes: Firms with fewer than five employees are excluded from the calculations. The percentages are derived from the weighted answers to questions to reflect overall firm population and are rescaled to exclude non-response.

Although structural reforms played a significant role in affecting firms' perceptions of adjustment in Greece, changes in the enforcement of laws and workers' attitudes also helped to increase labour market adjustment (see Chart B). This is consistent with various labour reforms in Greece, including the decentralisation of wage bargaining.[24] Although there was little improvement in the flexibility of labour market adjustment in Italy (see Table), the survey results suggest that the labour reforms implemented did influence labour market dynamics for some firms (see Chart C).

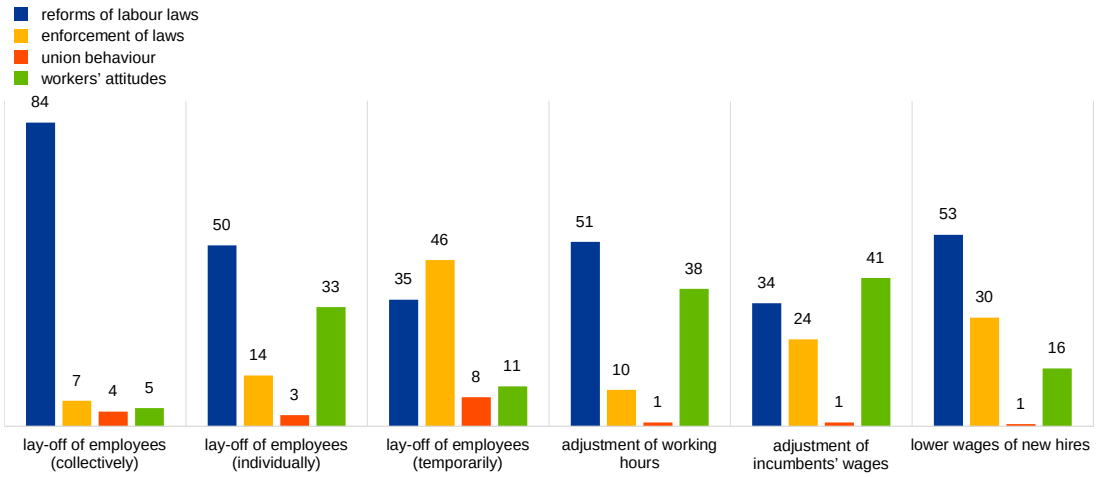
[23] Note that, in the WDN3 survey, only a limited number of countries were asked to identify specific reasons behind changes in the ease of labour market adjustment.

[24] See Visser, J., op. cit.

Chart B

Factors behind labour market adjustment channels in Greece between 2013 and 2010

(percentage of firms)

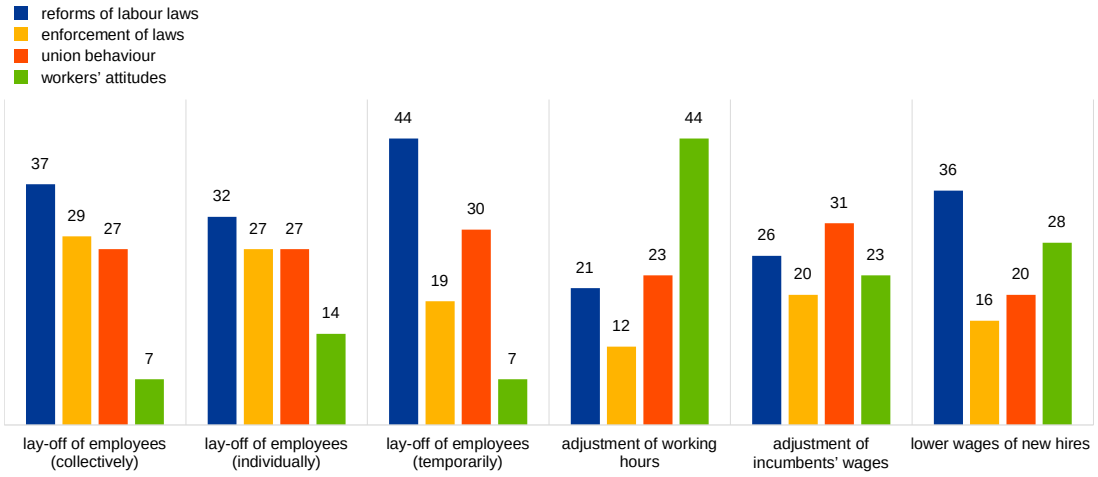


Sources: WDN3 survey database and ECB calculations.
Note: Firms with fewer than five employees are excluded from the calculations. The percentages are derived from the weighted answers to questions to reflect overall firm population and are rescaled to exclude non-response.

Chart C

Factors behind labour market adjustment channels in Italy between 2013 and 2010

(percentage of firms)



Sources: WDN3 survey database and ECB calculations.
Note: Firms with fewer than five employees are excluded from the calculations. The percentages are derived from the weighted answers to questions to reflect overall firm population and are rescaled to exclude non-response.

To further facilitate labour market adjustment and generate job creation, credible and effective labour market reforms are essential. The WDN3 survey shows that euro area countries that demonstrated stronger reform efforts made it easier for firms to adjust both employment and wages, thereby facilitating the wider adjustment process. This box shows that wage flexibility helped to reduce lay-offs during the adjustment period. Labour market efficiency indicators also show that euro area countries are still a long way behind the highest performing OECD member countries, hence more reforms are necessary for all euro area countries. Further labour and product market reforms are crucial to deliver the necessary flexibility and adjustment capacity required of euro area countries. This is particularly important given the slowdown in reform momentum over the

past two years across the euro area countries, as signalled by various indicators[25] and reflected in the very limited progress in implementing the European Commission's country-specific recommendations. However, reforms should also reduce labour market duality, thereby ensuring that adjustment is not unfairly placed on specific groups of workers, such as temporary or new employees. At the same time, active labour market policies – which enhance skills, job searching and employability – are required to facilitate labour market improvements and reduce current high levels of unemployment, with a particular focus on helping the young and long-term unemployed to find work.

4 Nominal wage rigidities

This section presents evidence on nominal wage rigidities, their sources and their consequences during the period 2010-13 and in comparison with the pre-crisis period (2002-07).

4.1 Frequency of wage setting

Wages are sticky and react with lags to changes in economic conditions; this inertial behaviour is a key factor influencing the transmission of monetary policy. The frequency of wage changes provides a measure of the extent to which wages are sticky. This measure is often used in the literature and in policy analysis. It is an essential ingredient in the calibration of standard dynamic stochastic general equilibrium models with staggered adjustment mechanisms, which are widely used for monetary policy analysis.

EU firms most typically adjust wages once a year. On average, during the period 2010-13, they adjusted wages every 17 months.[26] The WDN3 survey explicitly asked firms about the frequency of wage changes for their main occupational group. A similar question was included in the WDN1 survey, thus enabling a comparison between firms' behaviour during the period 2010-13 on the one hand and the period of economic stability prior to the crisis (2002-07) on the other. Chart 4 summarises the responses, grouping the potential answers into: (i) more frequently than once a year, (ii) once a year, and (iii) less frequently than once a year. Around 48.5% of firms in the 25 EU countries of the WDN3 sample reported that, during the period 2010-13, they changed their employees' base wages once a year; 40% changed wages less frequently than once a year; and only 4% did so more frequently than once a year. These aggregate figures hinder large cross-country heterogeneity; for example, the percentage of firms that adjusted wages less than once a year during the period 2010-13 ranges from 60% in Italy to

[25] See the article entitled "Increasing resilience and long-term growth: the importance of sound institutions and economic structures for euro area countries and EMU" in this issue of the Economic Bulletin.

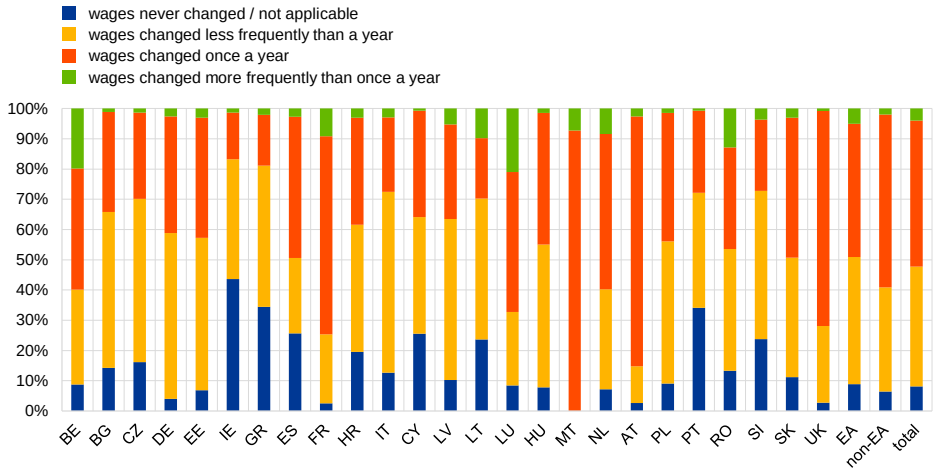
[26] Estimated following similar methodology to that of the WDN1 survey. See Druant, M. et al. "How are firms' wages and prices linked: survey evidence in Europe", *Working Paper Series*, No 1084, ECB, August 2009.

12% in Austria.[27] There is, however, substantially lower heterogeneity in the frequency of wage changes across sectors than across countries.

Chart 4

Frequency of base wage changes over the period 2010-13

(percentage of firms; employment-weighted values)



Source: ECB calculations on the basis of the WDN3 survey.
Notes: Firms with fewer than five employees are excluded from the calculations. Figures are weighted to reflect overall employment and rescaled to exclude non-response. Figures for Ireland are unweighted. Totals are calculated across countries that have weights.

The frequency of wage changes in EU countries was lower during the period 2010-13 than during the pre-crisis period (2002-07). The estimated duration of the wage spell (the number of months for which wages remain unchanged) was 15 months on average in the sampled countries in 2007, compared with 16.8 months for the same countries during the period 2010-13. For the 25 countries of the WDN3 survey, the average wage spell was, as reported above, 17 months. This general reduction in the frequency of wage changes can be observed in every country. The low (and decreasing) frequency confirms the prevalence of wage inertia, which may have delayed adjustment to shocks at the country level.

The large cross-country differences in the frequency of wage changes during the period 2010-13 can be attributed not only to institutional features but also to features typically linked to the crisis, such as the incidence of shocks and the resistance of firms to cut wages in spite of these shocks. This has been formally explored using WDN3 survey data in a multivariate analysis for the 25 countries sampled. According to the findings, base wages are changed less often if the firm experiences credit restrictions or a decline in demand, and if it is reluctant to cut nominal wages. During a period in which economic conditions may in fact be calling for a wage reduction, the reluctance to cut nominal wages might prevent wage changes as firms freeze wages instead of cutting them. The evidence from the WDN3 survey data is that substantial numbers of freezes are largely responsible for the lower frequency of wage changes observed.[28] Institutional features in the labour

[27] In Malta, firms change wages at least once a year due to the annual Cost-of-Living Adjustment (COLA) mechanism (i.e. partial indexation to past inflation).

[28] See Section 4.2 on downward nominal wage rigidity (DNWR).

market also contribute to explaining the cross-country differences in wage stickiness: base wages are changed more often in the presence of collective bargaining and internal policies that adjust base wages for inflation.[29]

Looking ahead, wage inertia should eventually return to pre-crisis levels as the economic recovery progresses. Prima facie, higher wage inertia may suggest that wages will take more time to respond to economic recovery. Nevertheless, the lower frequency of wage changes over the period 2010-13 seems to be related to factors that are linked to the crisis; it is thus likely that the frequency of wage changes will eventually return to pre-crisis levels, in particular as wage freezes thaw. In any case, although higher than during the crisis, the pre-crisis frequency of wage changes is also indicative of the prevalence of wage inertia and delayed adjustment.

4.2 Downward wage rigidity

Downward nominal wage rigidity (DNWR) refers to the reluctance of firms to implement cuts in nominal wages and/or a resistance on the part of workers to accept such cuts. It is typically defined on the basis of nominal wage freezes. DNWR prevents wage cuts, meaning that firms keep base wages unchanged even if economic conditions justify a cut. The WDN survey, in its three waves, collected information on whether firms cut or froze the base wages of some of their employees and on the proportion of workers affected. Babecký et al. summarised the evidence on DNWR for the period 2002-07.[30] Fabiani et al. used WDN2 survey data to provide evidence on how wage rigidity led firms to adjust labour in response to the shocks during the period 2008-09.[31] This article summarises evidence on DNWR for the period 2010-13, drawing from the WDN3 survey.

A key finding of the three WDN surveys is that nominal base wage cuts are extremely rare among European firms. In 2007 around only 2.3% of firms in the sampled countries reported having cut wages in the previous five years. During the acute phase of the crisis, in the second half of 2008 and the first half of 2009, only 3.2% of the surveyed firms reported having cut wages.[32] The evidence from the WDN3 survey reveals that only 4% of the surveyed firms cut wages at least once over the period 2010-13.[33] There is, however, remarkable heterogeneity in wage cuts across countries. In 2013 about 55% of firms in Greece implemented wage cuts,

29 These results are in line with those of the WDN1 survey for the pre-crisis period (2002-07). See Druant, M. et al., "Firms' price and wage adjustment in Europe: Survey evidence on nominal stickiness", *Labour Economics*, Vol. 19, Issue 5, October 2012, pp. 772-782.

30 Babecký, J. et al., "Downward Nominal and Real Wage Rigidity: Survey Evidence from European Firms", *The Scandinavian Journal of Economics*, Vol. 112, Issue 4, December 2010, pp. 884-910.

31 See Druant, M. et al., "How are firms' wages and prices linked: survey evidence in Europe", *Working Paper Series*, No 1084, ECB, August 2009.

32 The low percentage of firms having reported nominal wage cuts in 2007 is not necessarily indicative of downward nominal wage rigidity but may simply reflect the absence of a shock large enough as a trigger. This is no longer the case as of 2009.

33 The incidence of wage cuts in terms of affected workers is also very low. In the pre-crisis period (2002-07), on average, around only 0.2% of workers a year were affected by wage cuts. During the period 2008-09, in spite of the depth of the shock, the incidence of wage cuts increased only moderately, affecting 1.8% of workers. Finally, during the period 2010-13 the incidence of wage cuts was also minor, ranging from 0.4% to 0.8% of workers per year.

followed by 37% in Cyprus and 25% in Croatia. At the other extreme, less than 2% of firms cut wages in Belgium, France, Italy, Luxembourg, Hungary and the Netherlands. During the period 2008-09 Estonia was the exception, with 40% of firms (accounting for 30% of employees) implementing wage cuts. All this seems to indicate that firms cut nominal wages only in the case of severe economic difficulties. In fact, an important factor determining the propensity to cut wages, which can, in part, explain the heterogeneity observed across countries, is the nature and intensity of the shocks that the firm faced. A first look at the data shows that about 8% of the firms that suffered a decline in demand cut base wages (against 4% on average), and this increases to 12% among the firms that in addition faced credit constraints. The proportion is largest, at 18%, among those firms that experienced a strong shock in demand as well as credit constraints.

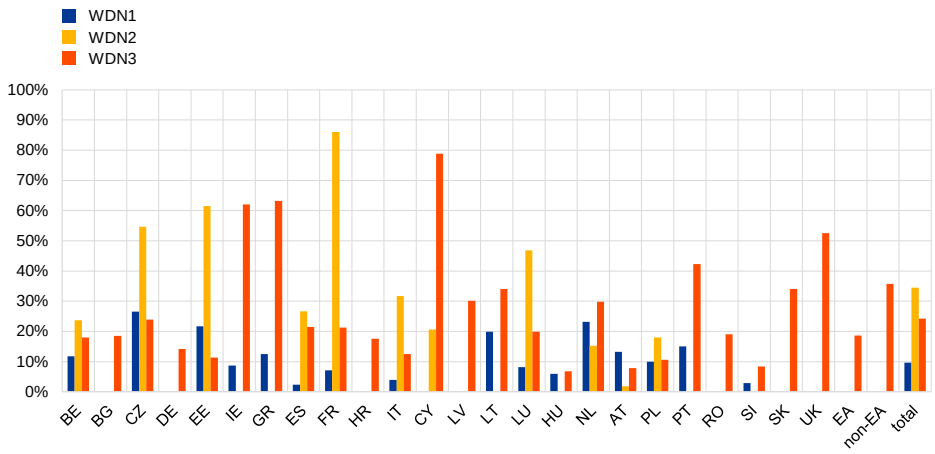
The percentage of firms that reported having frozen base wages increased dramatically at the beginning of the crisis and moderated somewhat during the period 2010-13. Of the firms sampled in the WDN1 survey, 9.6% reported that they had frozen base wages at least once during the period 2002-07. This percentage substantially increased to 34.5% of firms during the period 2008-09 in the countries covered by the WDN2 survey (with another 35% of firms indicating their intention to freeze wages in the future). In the WDN3 survey, 24% of the sampled firms reported that they had frozen base wages at least once over the period 2010-13 (see Chart 5).[34] This evidence on wage freezes, together with the low incidence of wage cuts, is indicative of the prevalence of DNWR. Overall, DNWR was still prevalent during the period 2010-13 in spite of the intensity and length of the crisis, but it seems that it reached its peak in the first years of the crisis (2008-09). There also appear to be substantial differences across countries in the incidence of wage freezes during the period 2010-13, with firms in Ireland, Greece and Cyprus having a greater propensity to freeze base wages in this period (see Chart 5). The heterogeneity in the incidence of wage freezes and wage cuts across sectors and firm size is not as pronounced as across countries. Construction was perhaps the sector with the lowest percentage of wage freezes, but it should be borne in mind that construction suffered huge employment cuts before that period. Preliminary research points not only to the nature and intensity of the shocks but also to institutional features and firm characteristics as factors behind the cross-country differences in DNWR.

[34] During the period 2010-13, 18% of the sampled firms in the countries covered by the WDN1survey froze base wages at least once.

Chart 5

Percentage of firms having frozen wages

(percentage of firms; employment-weighted values)



Source: ECB calculations on the basis of the WDN1 (2002-07), WDN2 (2008-09) and WDN3 (2010-13) surveys.
Notes: Firms with fewer than five employees are excluded from the calculations. Figures are weighted to reflect overall employment and rescaled to exclude non-response. Totals are calculated across countries that have weights. WDN1, WDN2 and WDN3 values refer to freezes applied at least once over the periods 2002-07, 2008-09 and 2010-13 respectively.

In the current period of recovery DNWR continues to be a key concern, as it may dampen wage increases. In the presence of DNWR, firms are also likely to moderate wage increases; in a period of low inflation such as the current one, this may trigger second-round effects, further dampening wage inflation. Elsby, and Stüber and Beissinger, among others, argue that, even if increasing nominal wages raises workers' effort and productivity, a wage cut of the same amount will reduce effort and productivity by a larger amount, such that reversing wage increases will incur an extra cost in terms of productivity.[35] As a consequence, forward-looking firms will moderate wage increases in the presence of DNWR.[36]

4.3 Other channels to lower firms' wage bill: bonuses and benefits

The relevance of DNWR depends on whether firms have other margins besides base wages to adjust labour costs. In fact, downward rigidity in base wages can be (partially) circumvented by including "flexible wage components" in the total wage bill. Bonuses and benefits are the main examples of these components. While companies avoid reductions in base wages for various reasons, reductions in

35 See Elsby, M., "Evaluating the economic significance of downward nominal wage rigidity", *Journal of Monetary Economics*, Vol. 56, Issue 2, March 2009, pp. 154-169, and Stuber, H. and Beissinger, T., "Does downward nominal wage rigidity dampen wage increases?", *European Economic Review*, Vol. 56, Issue 4, May 2012, pp. 870-887.

36 In fact, the two main reasons identified in the literature for firms' reluctance to cut nominal wages are (i) the belief that nominal wage reductions can damage worker morale and effort, and (ii) the possibility that the most productive workers would leave as a consequence. See Bewley, T., *Why Wages Don't Fall During a Recession*, Harvard University Press, 1999, and Babecký, J. et al., "Downward Nominal and Real Wage Rigidity: Survey Evidence from European Firms", *The Scandinavian Journal of Economics*, Vol. 112, Issue 4, December 2010, pp. 884-910.

bonuses are considered more acceptable.[37] The WDN1 survey opened up the possibility of studying the role of several flexible wage components.[38] The WDN3 survey focuses on the use of bonuses and benefits.

Table 2

Bonuses: an overview across countries in 2013

Country	Firms paying bonuses (%)	Bonuses as a percentage of total pay, unconditional (%)	Bonuses as a percentage of total pay, conditional (%)
Belgium	61.1	3.2	5.3
Bulgaria	55.8	5.2	9.4
Czech Republic	84.1	10.1	12.0
Germany	72.9	5.2	7.2
Estonia	79.6	12.9	16.3
Ireland	41.6	3.5	8.5
Greece	59.6	4.9	8.2
Spain	56.3	4.5	7.9
France	79.2	5.6	7.1
Croatia	54.8	4.5	8.1
Italy	77.4	5.6	7.3
Cyprus	54.2	4.2	7.7
Latvia	73.0	9.1	12.4
Lithuania	83.2	13.1	15.7
Luxembourg	51.3	4.0	7.7
Hungary	69.2	9.2	13.4
Malta	61.7	3.5	5.7
Netherlands	58.2	4.1	7.0
Austria	79.4	5.0	6.3
Poland	86.6	13.1	15.1
Portugal	99.0	24.9	25.1
Romania	59.4	5.8	9.8
Slovenia	85.3	10.4	12.2
Slovakia	93.2	15.1	16.2
United Kingdom	75.3	7.7	10.2
Euro area	73.5	6.2	8.4
Non euro area	75.9	8.8	11.6
Total	74.3	7.0	9.4
Total (WDN1 countries)	75.5	7.4	9.9

Source: ECB calculations on the basis of the WDN3 survey.
Notes: Firms with fewer than five employees are excluded from the calculations. Figures are weighted to reflect overall employment and rescaled to exclude non-response. WDN3 figures for Ireland are unweighted. Totals are calculated across countries that have weights. The unconditional percentage of bonuses in total pay is calculated across all firms (including those not paying bonuses). The conditional percentage of bonuses in total pay is calculated only across companies that pay bonuses.

37 Whether payments of bonuses can also be used to counteract the lower frequency of wage adjustment (or staggering in wage setting) depends on their frequency.

38 The WDN1 survey provides information, for 13 EU countries, on the use of the following channels to adjust the wage bill: bonuses and benefits, slow promotions, early retirement, changes in shift assignments or shift premia, and cheaper new hires. See Babecký, J.et al., "How do European firms adjust their labour costs when nominal wages are rigid?", *Labour Economics*, Vol. 19, Issue 5, October 2012, pp. 792-801.

Bonuses and benefits payments have declined considerably in comparison with the pre-crisis period. The average share of bonuses in the total wage bill of the firms sampled in 2007 was 11%, falling to 7.4% in 2013 for the subset of countries that participated in the WDN1 survey.[39] For the 25 countries participating in the WDN3 survey, the average was 7%. A smaller fraction of bonuses and benefits in the total wage bill may reflect slower economic growth in 2013 relative to the pre-crisis period (2002-07), but it is also suggestive of the increased role of bonuses in firms' labour cost flexibility.

Firms facing DNWR are more likely to use bonuses and benefits to reduce labour costs. The WDN3 survey asked firms whether they used bonuses and benefits as an adjustment mechanism to reduce labour costs during the period 2010-13. Regression analysis using WDN3 survey data shows that firms that are subject to nominal wage rigidities are more likely to cut bonuses in order to adjust labour costs. This finding confirms some degree of substitutability between wage flexibility and the flexibility of bonuses during the period 2010-13. Similar substitutability was also found for the period 2002-07 with data from the WDN1 survey.

Results indicate that bonuses and benefits played a role as shock absorbers during the period 2010-13. Demand and credit shocks are both associated with an increased use of flexible wage components as a means of adjusting costs. Moreover, regression analysis supports the view that the use of bonuses and benefits is not influenced by unionisation; cutting bonuses is thus likely to be a strategy developed outside formal collective bargaining.

Box 2

Sectoral wage Phillips curves and the capacity of WDN3 survey micro data to inform on their slope

This box aims to explain differences in the slope of the wage Phillips curve at the country and sector levels, resulting from structural characteristics of labour markets. Data on the performance of the euro area labour markets at the country and sector levels were combined with information from the WDN3 survey to explain one aspect of wage rigidity: the responsiveness of wage growth to economic slack. Country and sector-specific wage Phillips curves were estimated, focusing on the slope coefficient of the Phillips curve, which captures the responsiveness of wage growth to economic slack. The slope of the Phillips curve reflects how sticky wages are[40], which in turn depends on a variety of factors widely studied in the literature. WDN3 survey data were used to account for those factors and to examine their capacity to explain the estimated responsiveness of wage growth to economic slack.

The country and sector-level approach offers valuable insight into the underlying structure of the euro area economy. Every sector can be described in terms of a specific degree of economic slack and different labour market characteristics (e.g. composition of workers or labour market institutions) that affect wage growth. Such heterogeneity has been particularly notable since

[39] See Table 2. Conditional on firms paying bonuses, the figures were 16% in 2007 and 10% in 2013.

[40] The stickier the wages, the smaller the slope coefficient and the flatter the Phillips curve.

the crisis, as not all sectors were affected in the same way.[41] The heterogeneity could be captured by estimating the Phillips curve with sectoral rather than aggregate data and combining it with the information on firm and labour market characteristics from the WDN3 survey. It was then possible to assess how different characteristics of the labour markets across countries and sectors affected the responsiveness of wage growth to economic slack.

The wage Phillips curve specification linked wage growth to a sectoral measure of economic slack[42], sectoral productivity growth and country-level inflation expectations. The Phillips curve regressions were run for five sectors in each of the euro area countries (93 regressions in total). These sectors followed the same categorisation used in the WDN3 survey: (i) manufacturing, (ii) electricity, gas and water, (iii) construction, (iv) business services and trade[43], and (v) financial intermediation.

The majority of the slope coefficient estimates from the country and sector-level wage Phillips curve regressions had the expected positive sign. For the second part of the analysis using WDN3 survey data, however, staff only used slope coefficients from the Phillips curves where all estimated coefficients of the explanatory variables had signs in line with economic theory.[44]

Several factors are described in the literature as having an impact on wage stickiness, which in turn affects the slope of the wage Phillips curve.[45] These factors include a firm's size[46], the proportion of highly skilled and white-collar employees in the firm[47], the percentage of the firm's costs attributable to labour[48], the presence of alternative means of cost adjustment (bonuses, etc.)[49], the degree of indexation and frequency of wage adjustment[50], and the use of wage cuts and freezes[51]. All these factors could be proxied using answers from the WDN3 survey. The estimated slope coefficients were regressed on the WDN3 survey variables using a cross-sectional regression.

41 See "Euro area labour markets and the crisis", *Occasional Paper Series*, No 138, ECB, October 2012, and "Comparisons and contrasts of the impact of the crisis on euro area labour markets", *Occasional Paper Series*, No 159, ECB, February 2015.

42 The sectoral value-added growth gap, calculated as the growth rate of value added relative to its long-term moving average, is used as a measure of sectoral slack.

43 In the original WDN3 dataset, "business services" and "trade" are two separate sectors. Here, they are combined for consistency with the sectoral data available for the wage Phillips curve estimation.

44 A similar approach (using only "models with "correct" parameter signs") was used by the Deutsche Bundesbank in the article entitled "The Phillips curve as an instrument for analysing prices and forecasting inflation in Germany", *Monthly Report*, 2016, April, pp. 31-45.

45 For a related analysis on how institutional rigidities – such as labour and product market institutions and regulations – may reduce the responsiveness of euro area wages to unemployment, see Box 4 in the article entitled "Increasing resilience and long-term growth: the importance of sound institutions and economic structures for euro area countries and EMU" in this issue of the Economic Bulletin.

46 See Du Caju, P. et al., "Understanding sectoral differences in downward real wage rigidity: workforce composition, institutions, technology and competition", *Working Paper Series*, No 1006, ECB, February 2009, and Druant, M. et al., "Firms' price and wage adjustment in Europe: Survey evidence on nominal stickiness", *Labour Economics*, Vol. 19, Issue 5, October 2012, pp. 772-782.

47 See Messina, J. et al., "The incidence of nominal and real wage rigidity: an individual-based sectoral approach", *Working Paper Series*, No 1213, ECB, June 2010, and Druant, M. et al., ibid.

48 See Druant, M. et al., ibid.

49 See Messina, J. et al., ibid., and Druant, M. et al., ibid.

50 See the article entitled "The Phillips curve relationship in the euro area", *Monthly Bulletin*, ECB, July 2014.

51 See Babecký, J. et al., "Downward Nominal and Real Wage Rigidity: Survey Evidence from European Firms", *The Scandinavian Journal of Economics*, Vol. 112, Issue 4, December 2010, pp. 884-910, and Du Caju, P. et al., ibid.

Table

Regression results: factors affecting the responsiveness of wage growth to economic slack

	Responsiveness of wage growth to economic slack
Size	0.2413*
Highly skilled	-0.0174**
White-collar	-0.0042
Labour-to-total cost ratio	0.0229
Bonuses-to-total wage bill ratio	0.0022
Indexation of base wages to inflation	-0.7006*
Frequency of base wage changes	0.0854
Use of wage freezes	-0.0032
Use of wage cuts	0.0083**
Constant	1.7386
R2	60.6

Source: WDN3 survey data.
Note: * p-value <0.05, ** p-value <0.1.

The firm size, the proportion of highly skilled employees and the proportion of employees affected by wage cuts all had a significant influence on the responsiveness of wage growth to economic slack and had signs in line with economic theory (see Table). In particular, wage flexibility (and therefore the slope of the Phillips curve) was negatively related to the proportion of highly skilled employees owing to the high costs associated with their recruitment and training. This tends to limit wage cuts for such workers and thus decreases wage flexibility. There are several reasons why wages tend to be more flexible in large firms: (i) they are more likely to sign firm-level collective pay agreements that are usually regarded as more flexible than agreements signed outside the firm; (ii) they have more complex compensation structures; (iii) they often offer extra wage components that contribute to wage flexibility; and (iv) they tend to have more dispersed wages. The reluctance of firms to cut wages is typically used to define downward nominal wage rigidity. In this sense, a higher proportion of employees actually affected by wage cuts points to lower wage rigidity.

The effect of indexing base wages to inflation was difficult to interpret in the present case because the WDN3 survey did not specify whether wages were indexed to past inflation (in line with the common understanding of indexation) or to future inflation expectations. Nevertheless, the negative sign of the coefficient on indexation could suggest that indexation, when operative, dominates wage setting irrespective of economic developments.

While the coefficient estimates of the proportions of white-collar employees and employees affected by wage freezes, and of the share of bonuses in the firm's total wage bill, had signs that are in line with economic theory and the literature, they were insignificant. It is therefore difficult to draw any conclusions about their impact on the slope of the Phillips curve. However, their insignificance could be a reflection of the limited sample size, which was dictated by data availability, and the fact that, while the wage Phillips curve was estimated over the period 1997-2014, the cross-sectional regression could only be based on data from the WDN3 survey (i.e. the period 2010-13). This may explain, for example, the insignificance of the proportion of employees affected by wage freezes; the latter increased substantially during the crisis, but the Phillips curve estimated over the longer period may not have fully captured this change.

Overall, the analysis in this box shows that the WDN3 survey data on firm and labour market characteristics can explain some of the variation in the responsiveness of wage growth to economic slack across sectors and countries. Despite the limitations related to data availability and the construction of the sample, the analysis provides valuable information on which firm and labour market characteristics seem to matter for the responsiveness of wages to labour market conditions. These findings contribute to ECB staff's understanding of wage growth dynamics at the aggregate level, which is particularly important in the current period of muted wage growth.

5 Conclusions

Understanding wage rigidities is crucial for conducting monetary policy effectively and for designing appropriate policies that facilitate macroeconomic adjustments. Drawing on evidence from the WDN3 survey, a firm-level survey recently conducted in 25 EU countries, this article contributes to a better understanding of wage rigidities in the European Union after the Great Recession, namely during the period 2010-13. A number of tentative conclusions can be drawn from this evidence.

First, EU firms most typically adjust wages once a year. Around 49% of firms in the 25 EU countries sampled report that, during the period 2010-13, they changed their employees' base wages once a year, while 40% changed them less frequently than once a year.

Second, the frequency of wage changes in EU countries was lower during the period 2010-13 than during the pre-crisis period (2002-07). This seems to be at least partially attributable to the resistance of firms to lower base wages, i.e. to the prevalence of DNWR.

Third, DNWR was indeed prevalent during the period 2010-13, in spite of the length and intensity of the crisis, although to a lesser extent than during the period 2008-09. Nominal base wage cuts are extremely rare among European firms, and this was the case even during the crisis. Meanwhile, the percentage of firms that reported having frozen base wages increased dramatically with the crisis, reaching its peak during the period 2008-09, before declining over the period 2010-13.

Fourth, the WDN3 survey evidence confirms some degree of substitutability between wage flexibility and the flexibility of bonuses during the period 2010-13. Firms facing DNWR are more likely to use bonuses and benefits to reduce labour costs; this may help to circumvent the DNWR constraint. Results also point to a (probably moderate) role of bonuses and benefits as shock absorbers during the period 2010-13.

Last, a substantial percentage of firms in the countries where labour market reforms have been implemented (mostly in the "stressed" countries, where the crisis was most profound) found it easier to adjust both employment and wages in 2013 than in 2010.

Further analysis to gain a fuller understanding of these wage rigidities and their consequences is ongoing. The WDN's main research objectives also include understanding employment and price adjustment and, more generally, how firms have adjusted to the various shocks and labour market reforms that took place during the period 2010-13.