Wage dynamics amid high euro-area unemployment

Wage growth in the euro area was quite strong before the onset of the global financial and economic crisis. Despite the significant deterioration in the growth outlook, private sector compensation in particular continued to climb in the aftermath of the crisis, though admittedly at a faltering pace. Developments differed substantially from one country to the next. It was only in 2014 that wage growth finally bottomed out.

There is a body of empirical research which suggests that wages in the euro-area countries respond more strongly to good labour market conditions than to bad. Wage rigidities might be behind these asymmetries. Harmonised firm-level survey data have revealed that downward nominal wage rigidity (DNWR) was at play between 2010 and 2013, the period encompassing the sovereign debt crisis. There is also evidence to suggest that institutional factors had a bearing on wage dynamics. Real wage rigidity does not appear to have played any major role.

Developments in the public sector proved to be particularly important. Public sector wages in a host of countries were superior to those in the private sector, and the gap actually widened significantly in some parts during the years leading up to the global crisis. The fiscal constraints which made themselves felt during the financial and economic crisis, and later on in the sovereign debt crisis, prompted some countries to introduce substantial wage cuts – some temporary, some permanent – in the public sector, and brought wage levels in the private and public sectors closer together again.

Greater wage flexibility, first and foremost in the private sector, would probably have helped overcome the crisis. Microdata analyses, at any rate, show that enterprises which were in a position to respond to dwindling sales by cutting wages managed to keep their employment situation steadier than those which could not avail themselves of this option. Also, a simulation study carried out with the aid of the NiGEM global economic model suggests that wage flexibility can be conducive to safeguarding employment.

Although conditions in euro-area labour markets have been improving again since the spring of 2013, wage inflation continued to lose traction initially. One likely reason for the flatter trajectory of wage growth was the absence of wage cuts in the years prior to that date; another was the dampening effect of the labour market reforms implemented in a number of countries.

Wage developments in the euro area

Worsening labour market conditions since financial and economic crisis …

Around 10% of the euro area's labour force is currently without paid employment. Conditions may have improved to a degree since the spring of 2013, but at a figure of roughly 16 million, unemployment is still 4.5 million up on its level prior to the onset of the 2008-09 global financial and economic crisis. Expressed in terms of the labour force, unemployment was up by 2.5 percentage points. The crisis caused demand to evaporate, sending employment levels abruptly lower and clearly exposing structural frailties in individual countries. As the sovereign debt crisis unfolded, labour market conditions worsened still further, most notably in the countries directly affected by the crisis. In spite of this, labour force participation levels rose almost consistently throughout that time, driven primarily by trend growth in the propensity of women to participate in the labour force.

… have braked wage growth

While demand was frail, there was an ample supply of labour in the markets, and that did not leave wage dynamics unscathed. Hourly wages,[1] which rose at an average rate of 2.9% in the years preceding the crisis (1999-2008) and even by as much as 3.7% (in 2000), followed a flatter trajectory in later years, but still expanded by 2.5% on average between 2008 and 2013. In fact, one year into the crisis, hourly wages were still growing by as much as 3.6%. This, however, was primarily a response to what was, at that time, a cyclical 2% cut in hours worked, which, due to factors including the existing collective wage agreements, was offset only in part by weaker growth in monthly wages, which still grew by no less than 1.5%. The years after that also saw hourly wages continue to grow at a relatively strong pace initially. This development came to an end in 2014, when poor productivity growth and low inflation rates reduced euro-area wage growth further to 1.1%, and it has remained muted ever since.

There were marked differences between the private and public sectors. While wage growth in the public sector was brought to an abrupt halt, it decelerated over a longer period of time in the private sector. The crisis-hit countries in particular saw public sector wage levels stagnate, or they were even cut. That said, public sector employees in those countries had often enjoyed above-average increases in compensation in the years prior to the crisis (the box on pages 35 to 37 looks at the gap between private and public sector compensation). In the private sector, on the other hand, mean hourly wages continued to rise perceptibly after the crisis erupted, though compositional effects triggered by layoffs of workers drawing below-average wages will probably have contributed to this in a number of countries.[2]

Adjustments mostly confined to public sector to begin with

Unit labour costs moved sharply higher, first on the back of the mounting slack brought on by the crisis and later also due to continued wage growth in downbeat economic conditions. Businesses were unable to respond by lifting their sales prices, triggering a persistent and noticeable increase in the wage share in the euro area, which eroded company profitability and was probably one factor in the rising unemployment and the weak investment that followed.

Lagged wage adjustment eroding company profitability

Mixed patterns at the country level

In the individual countries of the euro area, these underlying trends were sometimes masked by longer-term developments, the impact of country-specific shocks and different

Mixed picture across member states

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1 Measured in terms of gross salaries and wages per hour worked by employees. An analysis of the compensation of employees would produce a very similar picture.
2 The number of employees in the euro area for whom a primary education is the highest level of education dropped by more than one-quarter between 2007 and 2015, while those with a tertiary education increased by just over one-fifth. The crisis-hit countries also saw a drop in the number of salaried staff with a secondary education.

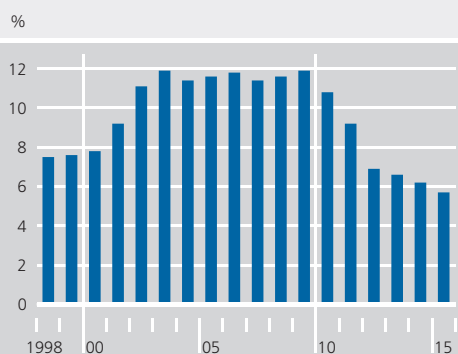# The wage gap between the public and private sector in the adjustment process

Wage and employment policies in the public sector play a significant role not only in public finances but also, given the size of the public sector, in the functioning of the labour market. Comparatively high wages in the public sector may result in queues forming for public sector positions. This can produce heightened levels of unemployment in the economy as a whole and increased wage pressures in the private sector.[1] If wages in the public sector are too low, there is a risk of a drop in the quality of public services[2] and an increased likelihood of corruption.[3]

In the euro area, wage data for most countries indicate that the average remuneration in the public sector is considerably higher than that of the private sector.[4] This is especially the case in some southern European countries. Nevertheless, it is often the case that the public sector requires higher qualifications than on average in the private sector, so the differences in the remuneration structures can be explained in part. However, the public sector wage premium is often greater for activities in the segment requiring the lowest qualifications.[5] By contrast, in many countries the wage levels for managerial positions are lower than in the private sector.[6] On the whole, the public sector typically has a lower wage dispersion than the private sector.[7]

It should also be noted that public sector employment contracts are often subject to special protection. Being a pay component, this advantage ought, if anything, to push down the wage paid out to employees.[8] On the other hand, the special protection afforded to public sector employees improves their hand in the wage bargaining

The gap between public and private sector wages in the euro area*

%

Source: Eurostat. * Data refer to gross wages and salaries per hour worked by employees. This chart compares the public sector (sections O to Q of NACE Rev. 2) and the private sector (all other sectors except agriculture).

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1 See A B Krueger (1988), The determinants of queues for federal jobs, Industrial and Labor Relations Review 41, pp 567-581; and P Gomes (2014), Optimal public sector wages, The Economic Journal 125, pp 1425-1451.
2 See S Nickell and G Quintini (2002), The consequences of the decline in public sector pay in Britain: a little bit of evidence, The Economic Journal 112 (444), pp F107-F118.
3 See R K Goel and D P Rich (1989), On the economic incentives for taking bribes, Public Choice 61 (3), pp 269-275.
4 In the euro area as a whole, gross wages and salaries in the public sector, at €21.70 on average per hour worked, were just under 7% above those in the private sector in 2015.
5 See M M Campos and M Centeno (2011), Public-private wage gaps in the period prior to the adoption of the euro: an application, Economic Bulletin, Banco De Portugal, pp 55-69; and D Depalo, R Giordano and E Papapetrou (2015), Public-private wage differentials in euro area countries: evidence from quantile decomposition analysis, Empirical Economics 49 (3), pp 985-1015.
6 See L N Christofides and M Michael (2013), Exploring the public-private sector wage gap in European countries, IZA Journal of European Labor Studies 2 (15); and F De Castro, S Matteo and H Steiner (2013), The gap between public and private wages: new evidence for the EU, European Economy – Economic Papers No 508, DG ECFIN, European Commission.
7 Both the greater homogeneity of employee profiles and the lower remuneration dispersion for the various characteristics are a factor in this regard. See D Depalo, R Giordano and E Papapetrou (2015), op cit.
8 See P Gomes (2014), op cit.

process. This may even increase the wage gap.[9]

According to a study by the European Commission, public sector employees in 2010 had a wage advantage over the private sector in most countries of the euro area, even after taking a range of structural differences into account. Only in four countries (Finland, Estonia, Latvia and Slovakia) was there a wage disadvantage for the public sector. In five countries (Germany, France, the Netherlands, Lithuania and Malta), the wage difference was statistically insignificant. There were wage advantages for high-skilled employees in eight countries (Italy, Spain, Belgium, Austria, Ireland, Portugal, Cyprus and Luxembourg).[10]

How the wage gap between the public and private sectors has evolved

The years running up to the financial and economic crisis – a period in which public finances were comparatively relaxed – saw wages in the public sector increase disproportionately in a number of countries. This trend, which was particularly noticeable in Italy and Spain, went into reverse during the adjustment process between 2010 and 2015, with the public sector then contributing substantially to wage moderation. The growth rate of hourly wages in the public sector was down by half on the pre-crisis years (2000-08), while the decline was much flatter in the private sector. Furthermore, wage growth began to decelerate sooner in the public sector than it did in the private sector.[11]

A variety of measures contributed to this. One was the decision taken in Italy in 2010 to freeze public sector wages from 2010 to 2013.[12] Wages were cut for some higher earners, and wage hikes from 2008 and 2009 were capped retroactively as well. In Spain, meanwhile, wages were cut or frozen in several stages by decree between 2010 and 2013, while wages were also frozen in Portugal between 2010 and 2013, and higher salaries were cut. In Greece, a wage freeze was adopted in 2009, though this was partially offset by other pay components. This was followed between 2010 and 2012 by a series of wage cuts, a bonus cut (such as Christmas bonuses) and later by a wage freeze. The pay scale was also unified in 2012.

The pay gap between the public and private sectors in the euro area then narrowed from 12% in 2008 to 6% in 2015, which actually made it slightly narrower than when monetary union was launched. Qualification and remuneration profiles, too, now appear to have become more harmonious again in the euro area as a whole. This view is also supported by an econometric analysis of the European Commission's Structure of Earnings Survey, in which the influence of various third variables is

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9 A summary of the literature and empirical evidence can be found in K van der Wiel (2010), Better protected, better paid: evidence on how employment protection affects wages, Labour Economics 17 (1), pp 16-26.
10 See European Commission (2014), Government wages and labour market outcomes, European Economy Occasional Papers 190. According to this study, the wage premium decreased between 2006 and 2010 in Italy, Spain, Portugal, Belgium, Luxembourg and Malta, and increased in Austria, Ireland, Greece, Cyprus and Slovenia. Similar results are also obtained by L N Christofides and M Michael (2013), op cit.
11 See M M Campos, D Depalo, E Papapetrou, J J Pérez and R Ramos (2015), Understanding the public sector pay gap, Documentos de Trabajo, No 1539, Banco de España.
12 See LABREF database, Directorate General for Employment, Social Affairs and Inclusion, European Commission.

controlled.[13] Though the public sector still had a significant wage advantage of just under 4% in 2010 over the private sector when education and gender differences were taken into account, this gap had disappeared by 2014.

Differences in qualification and compensation per hour between the public and private sector

Public sector wage premium (%)

in 2008

in 2015

Public sector wage premium (%)

Difference in qualification in percentage points[1]

Source: Eurostat. **1** The qualification difference is measured as the difference in the percentage shares of public sector (sections O to Q of NACE Rev. 2) and private sector (all other sectors except agriculture) employees with a tertiary degree.

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13 A regression analysis is carried out in which the hourly wage differentiated by sector, gender, education and member state is the dependent variable and dummy variables are used for each of the values. While the country dummies explain much of the variation, education and gender, too, correlate significantly with the hourly wage (though adding the gender dummy does not alter the coefficients of the other regressors). The dummy variable for the public sector correlates substantially with the hourly wage in 2010, but this correlation was no longer evident in 2014.

Unemployment and wage dynamics in the euro area

%

Source: Eurostat. **1** Standardised unemployment rate. **2** Gross wages and salaries per hour worked by employees.

Deutsche Bundesbank

responses to global shocks, and sometimes amplified by them.

Germany's wage dynamics were somewhat unique in the euro area in that wage growth there picked up pace in the period after the crisis as unemployment levels declined. The years leading up to the crisis had seen only a small hike in German labour costs due in part to various labour market reforms. The crisis itself first saw hourly wages increase (because the cuts in hours worked were not fully compensated for), followed later by quite a strong boost in monthly wages as well. With productivity growth weak, this drove unit labour costs 2% higher on average over the past five years – quite unlike the rather sharp decline seen in the years immediately preceding the crisis.

Germany unusual in that wage growth was stronger post-crisis than pre-crisis

While Germany's idiosyncratic wage patterns go some way towards explaining the strong wage inflation which the euro area initially continued to experience in the wake of the crisis, the data for the euro area excluding Germany reveal that hourly wages also climbed between 2010 and 2013, by an average of 1¾%, after having risen at an annual rate of 3½% when the global financial and economic crisis was still raging in 2008-09.

Euro area excluding Germany, too, saw robust wage growth at first

Wage growth in France has been easing only gradually since 2009 despite a sharp upswing in unemployment levels. The underlying adjustment in employment may have helped to keep French productivity growth quite robust relative to other countries and moderate the increase in the country's unit labour costs. That said, France saw a tangible increase in the wage share, which will probably have impaired business profitability. The recovery in the French labour market has been no better than subdued to date.

France: wage growth easing only slowly despite mounting unemployment

Wage growth in Italy had become far detached from the practically flat productivity trend even before the onset of the crisis, and growth in the country's unit labour costs noticeably outpaced the euro-area average. Here, too, hourly

Italy: wage developments detached from productivity trends

wage growth, particularly in the private sector, decelerated at no more than a gradual pace during the years of crisis, even though the unemployment rate had doubled.[3] Labour productivity per hour worked stagnated in spite of the job cuts. This kept unit labour costs on a steep upward path, and the aggregate wage share remained elevated despite the extremely weak wage growth observed of late. At the current juncture, Italy's unemployment rate is still 6 percentage points up on its pre-crisis level.
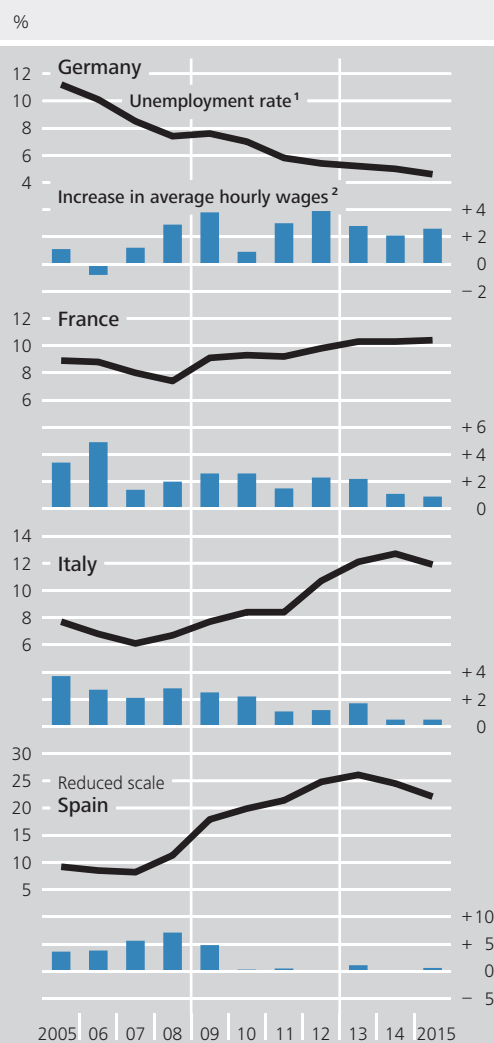
Spain: hefty labour market response brings wages to standstill

In Spain, meanwhile, the cyclical downturn was very much confined to the construction industry to begin with, before it spilled over into the rest of the economy. This triggered a wave of job losses which caused unemployment to balloon by nearly 10 percentage points between 2007 and 2009. Labour market conditions deteriorated still further in the four years after that. Average wage levels have been practically static since 2010, although they had risen by well above 10% on aggregate in the two years before that. Despite the severe economic crisis, average wage levels in the private sector continued to rise initially, albeit much less briskly.[4] In the public sector, some employees suffered temporary wage cuts. With productivity growth surging strongly on the back of layoffs of a large number of low-productivity employees and the flatter wage trend, the correction in unit labour costs, which had spiked in the years immediately preceding the crisis, made relatively quick progress. In fact, Spain's aggregate wage share is now down on its longer-term pre-crisis mean. For two years now, the Spanish economy has been on a recovery path, with strong growth rates and improving labour market conditions. However, persistently high levels of unemployment are depressing wage growth.

Ireland: flexible labour market

Developments were even more pronounced in a number of smaller member states which had been hit particularly hard by the economic crisis. Ireland slipped into a severe recession very early on when its real estate market cooled

Unemployment and wage dynamics in selected euro-area countries

%

Germany
Unemployment rate[1]
Increase in average hourly wages[2]

France

Italy

Reduced scale
Spain
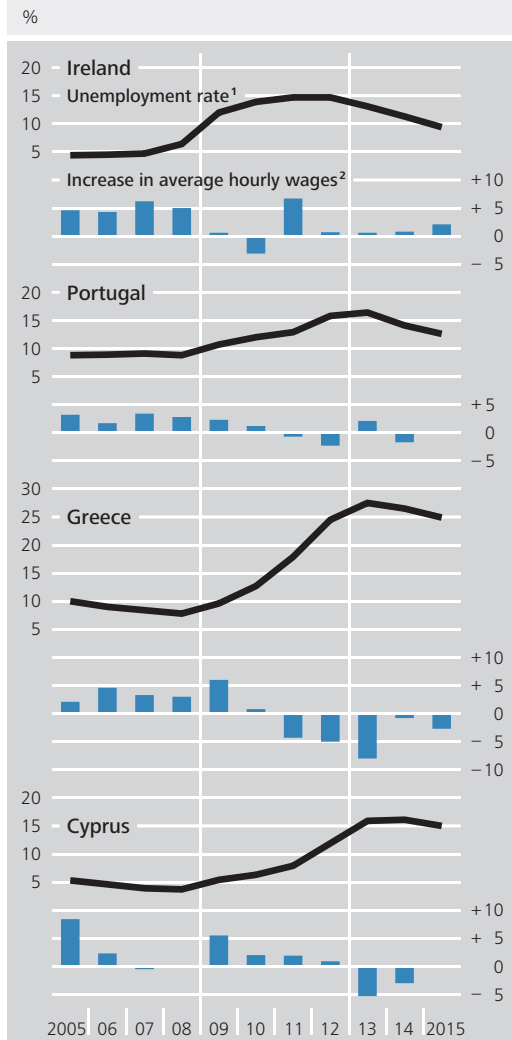
2005 06 07 08 09 10 11 12 13 14 2015

Source: Eurostat. **1** Standardised unemployment rate. **2** Gross wages and salaries per hour worked by employees.
Deutsche Bundesbank

off, sending the unemployment rate 10 percentage points higher between 2007 and 2011. This paved the way for substantial cuts in labour compensation, which had risen sharply

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3 Joblessness would probably have climbed even more steeply if firms had not hoarded labour, which was reflected by a stronger decline in average hours worked (between 2005 and 2015, mean hours worked fell at more than twice the rate seen in the preceding ten-year window). This is partly because benefits were granted for short-time working even where employees worked zero hours.
4 Compositional effects amplified the increase in average wage levels in these years. See also S Puente and S Galán, Analysis of composition effects on wage behaviour, Banco de España, Economic Bulletin, February 2014; and K Orsini, Wage adjustment in Spain: slow, inefficient and unfair?, European Commission ECFIN Country Focus, November 2014.

Unemployment and wage dynamics in selected euro-area countries

Source: Eurostat. **1** Standardised unemployment rate. **2** Gross wages and salaries per hour worked by employees.
Deutsche Bundesbank

made to public sector wages. Labour market conditions have been slowly improving since 2013, though wages are still under persistent pressure.

Conditions in Greece's labour market started to deteriorate gradually in 2008 before charting a more dramatic course – by mid-2013, nearly 28% of the labour force was without paid employment. Wages continued to increase quite strongly until 2009 but have been dropping since 2010, with the private and public sectors posting similar rates of decline. This came partly as a result of the reduction in the minimum wage and the revision of the public sector pay scale implemented as part of the adjustment programmes. Unit labour costs were likewise sharply lower, albeit not to the same extent as wages. Conditions continue to be very tense in the Greek labour market.

Pronounced wage correction in Greece

Cyprus was engulfed by a severe adjustment crisis in 2013 due to its close ties with the Greek financial system, which sent unemployment skyrocketing to just under 17%. Wages were slashed mainly in the public sector, but private sector compensation levels also softened somewhat. The Cypriot economy has been on a recovery path since the beginning of 2015, since which time the unemployment rate has fallen by 4 percentage points, and the pressure on wages is easing.

Public sector pay cut substantially in Cyprus

up until 2008, with the public sector being worst affected. The drop in private sector wages was minimal. The joblessness rate in Ireland has been receding steadily since back in 2012, and wages have also been recovering tangibly, albeit at significantly flatter rates than before the crisis struck.

Portugal: very arduous adjustment process

Labour market conditions in Portugal began to cloud over in the autumn of 2008. The subsequent economic recovery briefly stabilised the unemployment rate before it raced up to more than 17% in the midst of the sovereign debt crisis. Wage growth increasingly levelled off in the private sector, while massive cuts were

Similarities across countries

While the individual countries may be facing very different problems, it appears to have been easier in many countries to push through pay cuts in the public sector than in the private sector. Not even substantial private sector wage increases agreed on the basis of upbeat expectations immediately prior to the crisis were usually reversed. At the same time, countries with flexible labour market institutions such as Cyprus and Ireland so far seem to have weathered the challenges better than countries with more regulated labour markets.

Causes of limited wage adjustments

What is behind the limited wage adjustments?

This raises the question as to why wage dynamics in a host of euro-area countries have only adapted to the change in conditions to a limited degree. Various types of rigidities supported by institutional conditions might be at play here.

Nominal rigidity

Cuts in regular salaries rare

Terms and conditions of employment, including wage levels, are normally set out in contracts, and they are only reviewed and adjusted at lengthy, previously agreed intervals. This alone keeps wages rigid to a degree. What is more, it is rare for regular labour compensation to be cut, even in critical spells. Instead, it is often customary to freeze wages, which at least prevents labour costs from mounting any further. However, wage freezes might not go far enough to keep employment profitable, particularly if earlier pay rounds produced high wage increases on account of upbeat expectations.

Why are wages downwardly rigid?

One reason for nominal wage rigidity has to do with the way in which employees might respond. If wage cuts are likely to sap employee morale or effort, or even cause employees who are more productive than most to leave, it might be a worthwhile strategy for employers to lay off part of their workforce rather than cut wages.[5] That kind of response might make sense at businesses employing different types of employee, given that temporary or subcontracted employees do not enjoy the same level of labour protection as permanent in-house staff. By laying off these employees, firms can scale back their wage costs without cutting the (typically higher) wages of their core staff.

Jobs are particularly at risk whenever wage rigidities of this kind expose enterprises to liquidity problems. This might explain why some businesses have switched to paying bonuses when times are good instead of increasing their normal wage levels too far. Experience has shown that one-off pay components are easier to cut than the basic wage.[6] Another option is to reduce the number of hours worked while cutting monthly wage levels. Such reductions need not necessarily be proportionate, and they can, if appropriate, be supported by funding from the social security funds or the public sector. However, this strategy can only work if staff representative bodies function properly, are in a position to compromise, and have been granted sufficient leeway by management and labour.

Other possible strategies: cutting additional pay components or hours worked

Another factor that can cause a degree of wage rigidity is the existence, across most euro-area countries, of a statutory minimum wage, or at least of generally binding collective wage agreements which set a mandatory lower bound for pay. This can restrict the scope for wage cuts, at least in certain segments of the labour market, as long as the minimum wage itself is not reduced in response to a sharp deterioration in labour market conditions, as was the case in Greece.

Minimum wage as a source of wage rigidity

Econometric analyses of harmonised firm-level survey data show that wage rigidity in the euro area was a factor during the 2010-13 sovereign debt crisis (see the box on pages 42 to 44). At the aggregate level, this kind of downward nominal wage rigidity (DNWR) can open up an asymmetry in the relationship between unemployment and wages – a situation where

Evidence of downward nominal wage rigidity and implications

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5 See P Du Caju, T Kosma, M Lawless, J Messina and T Rõõm (2015), Why firms avoid cutting wages: survey evidence from European firms, ILR Review 68 (4), pp 862-888; and T F Bewley (1999), Why wages do not fall during a recession, Harvard University Press.
6 Besides cutting bonuses, enterprises faced with base compensation rigidity have also been making greater use of measures such as freezing promotions or reducing starting salaries. See J Babecký, P Du Caju, T Kosma, M Lawless, J Messina and T Rõõm (2012), How do European firms adjust their labour costs when nominal wages are rigid?, Labour Economics 19 (5), pp 792-801.

Wage rigidity and employment in the euro area: an analysis with firm-level data

The survey data gathered among employers in the third wave of the Wage Dynamics Network (WDN) of the European System of Central Banks (ESCB)[1] make it possible to investigate the relationship between wages and employment at the firm level.[2] The data are mainly of a qualitative nature and provide information on changes in the business environment of euro-area enterprises and their responses to it. The data cover the years 2010 to 2013.[3]

During those years, which were shaped by the sovereign debt crisis in the euro area, enterprises faced widely divergent developments. Almost half of the enterprises covered by the analysis suffered a decrease in demand. By contrast, demand increased for almost one-third. Remarkably, employment went down at only just over one-quarter of all enterprises (but at more than two-fifths of enterprises that suffered a decrease in demand), whereas employment went up at just over 30% of enterprises. Wages were lowered (meaning, in this case, base wages or piece work rates) at only 8% of enterprises (but at 14% of enterprises affected by a decrease in demand). A comparatively large percentage of enterprises

stated that wages had remained unchanged (30% of all enterprises; almost 40% of

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1 The ESCB set up the WDN in 2006 to examine in depth the major determinants of wage setting and their link to price setting. Amongst other things, a survey of firms was conducted using a largely harmonised questionnaire. The first wave covered the years 2003 to 2007, the second wave – in which the Bundesbank was not involved – the years 2008 to 2009. Evaluations of the survey data from the first and third wave for Germany may be found in Deutsche Bundesbank, Wage setting in Germany – new empirical findings, Monthly Report, April 2009, pp 17-29; D Radowski and H Bonin (2010), Downward nominal wage rigidity in services: Direct evidence from a firm survey, Economics Letters 106 (3), pp 227-229; and Deutsche Bundesbank, Adjustment patterns of enterprises in the German labour market during the Great Recession – selected results of a special survey, Monthly Report, July 2015, pp 33-39. See also https://www.ecb.europa.eu/pub/economic-research/research-networks/html/researcher_wdn.en.html for the final report and research papers as part of the first two waves of the WDN and on country-specific evaluations of the third wave.
2 The analysis presented here is part of a WDN research project. See P Marotzke, R Anderton, A Bairrao, C Berson and P Tóth (2016), Wage adjustment and employment in Europe, mimeo. All 25 countries participating in the WDN are included in the research paper. This article focuses on the results for the euro area.
3 For further results derived from these data, see European Central Bank, New evidence on wage adjustment in Europe during the period 2010-13, Economic Bulletin, Issue 5/2016, pp 53-75.

Ordinal probit model of wage adjustment*

Marginal effects on predicted probabilities

Variables	Wages strong decrease	Wages moderate decrease	Wages unchanged	Wages moderate increase	Wages strong increase
Demand					
strong decrease	0.016***	0.035***	0.071***	− 0.096***	− 0.025***
moderate decrease	0.006***	0.014***	0.032***	− 0.039***	− 0.013***
unchanged (reference)					
moderate increase	− 0.007***	− 0.019***	− 0.058***	0.054***	0.030***
strong increase	− 0.010***	− 0.030***	− 0.100***	0.080***	0.059***
Observations	11,541	–	–	–	–
p-value	0.000	–	–	–	–
Pseudo R^2	0.123	–	–	–	–

* The table shows, depending on developments in demand, the estimated probability of a certain wage development compared with the reference category of unchanged demand. For instance, the estimated probability of a strong decrease in wages given a strong decline in demand is 1.6 percentage points higher than when demand is unchanged. Other regressors: share of employees with collective wage agreement, dummy variables for countries (of the euro area excluding Finland, which did not participate in the survey, and excluding Ireland, whose survey does not include all the variables considered), sectors (of the private economy) and firm size. The marginal effect for the indicator variables is the discrete change from the reference level. *** Statistically significant at 1%, based on robust standard errors.

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Ordinal probit model with instrumental variable, firms with declining demand*

Marginal effects on predicted probabilities

Variables	Wage equation				
	Wages strong decrease	Wages moderate decrease	Wages unchanged	Wages moderate increase	Wages strong increase
Collective wage agreement (share)	− 0.011***	− 0.023***	− 0.029***	0.048***	0.015***
Variables	Employment equation				
	Employment strong decrease	Employment moderate decrease	Employment unchanged	Employment moderate increase	Employment strong increase
Wages					
strong decrease	− 0.066**	− 0.095*	− 0.029	0.097***	0.093
moderate decrease	− 0.054**	− 0.073***	− 0.015	0.077***	0.066
unchanged (reference)					
moderate increase	0.124*	0.076***	− 0.053***	− 0.102***	− 0.045
strong increase	0.383**	0.068	− 0.200***	− 0.188***	− 0.063*
Observations	5,598	–	–	–	–
p-value	0.000	–	–	–	–
Correlation of the error terms	0.648***	–	–	–	–

* The upper table shows how the estimated probability of a certain wage development changes when the share of employees with a collective wage agreement rises. When the share rises by 1 percentage point, the estimated probability of a strong wage decrease, for example, falls by 0.011 percentage point. The lower table shows, depending on the wage adjustment, the estimated probability of a certain development in employment compared with the reference category of unchanged wages. For instance, the estimated probability of a strong decrease in employment given a strong decline in wages is 6.6 percentage points lower than when wages are unchanged. Other regressors: labour costs as a share of total costs, dummy variables for strength of the decrease in demand, ownership structure, negative shocks (access to external financing, customers' ability to pay and meet contractual terms, availability of supplies), bonuses, firing costs as a relevant obstacle in hiring workers with a permanent contract, credit restrictions (debt refinancing, investment, working capital), countries (of the euro area excluding Finland, which did not participate in the survey, and excluding Ireland, whose survey does not include all the variables considered), sectors (of the private economy) and firm size. The marginal effect for the indicator variables is the discrete change from the reference level. The model was estimated using Roodman's Stata command cmp; see D Roodman (2011), Estimating fully observed recursive mixed-process models with cmp, Stata Journal 11 (2), pp 159-206. ***** Statistically significant at 10%, ****** at 5% and ******* at 1%, based on robust standard errors.

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enterprises affected by a decrease in demand). This is a sign of downward rigidities in wages.[4]

An econometric model of wage adjustment can be used to reach conclusions about downward wage rigidities from asymmetries in responses to falling demand. In this context, the response variable of the ordinal probit approach is the change in base wages, with the following five degrees of change: strong decrease, moderate decrease, unchanged, moderate increase and strong increase. Response variables are developments in demand (again with five possible degrees of change) as well as information on the size of the enterprise and the percentage of employees with a collective wage agreement. Added to these are dummy variables for countries and sectors.

According to the estimation, the probability of wage increases rises when there is a positive development in demand compared with the reference category of unchanged demand, and the probability of wage cuts rises when there is a negative development in demand. However, the rise in the probability of wage cuts when there is a decrease in demand is considerably smaller

4 An often-used indicator for wage rigidity is the relationship between stable wages and wages that are not increased, ie the sum of reduced and stable wages (see W T Dickens, L Götte, E L Groshen, S Holden, J Messina, M E Schweitzer, J Turunen and M E Ward (2007), How wages change. Micro evidence from the international wage flexibility project, Journal of Economic Perspectives 21 (2), pp 195-214). One point of criticism with regard to this approach is that prevented wage cuts cannot be inferred directly from unchanged wages. In addition, enterprises which increase wages can also be exposed to wage rigidities. That is why it is important to also take rising wages and the reasons for wage changes into account.

than the rise in the probability of wage increases when there is an increase in demand. Moreover, a decline in demand significantly increases the probability that wages remain unchanged. By contrast, the probability of stable wages declines when there is an increase in demand. All this can be seen as evidence of downward nominal wage rigidities.

The possible impact of the identified rigidities on enterprises' employment decisions following a decline in demand may be examined in a similar model framework. The wage equation is extended in a simultaneous ordinal probit approach by an employment equation in which changes in employment (again, with five different degrees of change) are shown, depending on the change in wages.[5]

The results of the estimation show that the wage adjustment depends, as expected, on coverage by collective wage agreements.[6] The more employees in an enterprise who are subject to a collective wage agreement, the lower the probability of a wage cut or a wage freeze and the higher the probability of a wage increase. The impact of the wage adjustment on employment likewise proves to be significant. In enterprises which cut wages following a decrease in demand, a decrease in employment is less likely and the probability of a moderately positive employment development is higher. On the other hand, a wage increase raises the probability of a decline in employment.[7]

The effects of further variables taken into consideration in the estimation but not shown here are broadly in line with expectations. For instance, when access to external financing is restricted, the probability increases that employment and wages are reduced or at least stop rising. According to the estimation, enterprises with significant firing costs (for example as a result of employment protection legislation) cut wages less frequently. This is attributable to employees having greater power in wage negotiations. Remarkably, this has a slightly positive effect on the employment situation at the enterprises. A significant factor in this context could be that only those enterprises are included in the WDN survey that remained in the market. Finally, it can be demonstrated that in enterprises in which not only base wages but also flexible wage components play a part, base wages are reduced less frequently. In addition, employment appears to be more stable there.

Thus it may be seen that, at the level of the individual enterprise, greater wage flexibility tends to stabilise employment. Downward wage rigidities can, if they become binding, be associated with employment losses.[8]

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5 The mutual dependencies of wages and employment are taken into consideration by using the percentage of employees with a collective wage agreement as a so-called instrumental variable. This is based on the assumption that collective wage agreements have a direct effect only on wages and not on employment. This is consistent with the assumption of a "right to manage" approach, whereby employers and trade unions first hold negotiations about wages and employers subsequently choose the employment level taking the negotiated wage into account. See T Boeri and J van Ours, The economics of imperfect labor markets, Princeton University Press 2013, p 71. Deviations of severance rules and notice periods under collective wage agreements from legal requirements do not play an important role in the euro area. See also D Venn (2009), Legislation, collective bargaining and enforcement: Updating the OECD employment protection indicators, OECD Social, Employment and Migration Working Papers, No 89.
6 The assumed endogeneity of wages in the employment equation is confirmed by the significant correlation of the error terms.
7 The main estimation results prove to be robust in an estimation taking all enterprises into consideration (including enterprises that did not suffer a decrease in demand) and in an estimation of a greatly reduced model with only very few control variables.
8 Similar findings are reached using quantitative wage data for Italy by E Adamopoulou, E Bobbio, M De Philippis and F Giorgi (2016), Wage rigidities and business cycle fluctuations: A linked employer-employee analysis, Banca d'Italia Occasional Papers, No 338.

wage dynamics respond more strongly to good labour market conditions than to bad.[7]

Real wage rigidity

Wage index- ation: a source of real rigidity

For a long time, it was common practice in a host of countries for labour compensation to be adjusted for inflation at least once a year. That, the thinking went, would preserve the real purchasing power of employees. These "indexation clauses" were a relic from the days in which inflation rates were high, relatively speaking, and driven primarily by domestic factors. However, in times when price pressures are low, and inflation rates, moreover, are often driven by external forces, arrangements of this kind can set off developments that are detrimental to the economy as a whole. As a case in point, an increase in the price of oil will not normally improve a business's solvency. It is for that reason that indices adjusted for energy (and other components) are often used nowadays when adjusting wage levels.

Wages indexed to inflation

Even where wage indexation is not enshrined in law, it is often customary to index wages to realised or expected price inflation.[8] As long as wage indexation is geared to the central bank's medium-term stability objective, and adjusted for conditions in the economy (and the labour market, especially), it will not drag on the economy as a whole. However, a minimum degree of indexation might cause real wage levels that are excessively high on account of unwelcome developments in the past to become entrenched, which would have negative consequences for the labour market.[9]

Indexation suspended in some countries

Indexation arrangements are still in place in a number of euro-area countries, with wages in Belgium, Cyprus and Luxembourg mostly being indexed to past inflation rates. Partial indexation schemes exist in France, Slovenia and Malta. In other countries, including Italy and Spain, there is no legal requirement to compensate employees for past losses of purchasing power, though most collective wage agreements do contain indexation clauses. Due to the resulting adjustment rigidities, these rules have been suspended or softened in recent years, as was the case in Cyprus and Spain.

Institutional factors

Wage bargaining level

Macroeconomic problems can arise if wage growth does not adequately reflect economic conditions. The level at which wage bargaining typically takes place is a factor in this regard. Where wage bargaining is largely centralised, wage bargainers will probably be mindful of the macroeconomic repercussions of what they agree upon. It is questionable, however, whether it is possible, under these circumstances, to differentiate labour compensation levels (by qualification, say, or by sector or region) to a sufficient degree. In decentralised bargaining arrangements, changes in an individual enterprise's productivity, its market position and its scope for setting prices have a bearing on wage setting. Tension in local labour markets and the qualification profile of the labour supply are also taken into account. Matters appear to be more challenging at the intermediate bargaining level, the risk here being that neither the macroeconomic repercussions nor the specific circumstances will receive suitable attention and that the interests of those already

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7 For more on this topic, see, for instance, A Kumar and P M Orrenius (2016), A closer look at the Phillips curve using state-level data, Journal of Macroeconomics 47, pp 84-102.

8 In an earlier Europe-wide business survey conducted by the European System of Central Banks, roughly one-sixth of employers stated that they index wages to inflation voluntarily, ie without applying any formal rule. See ECB (2009), Final report of the Wage Dynamics Network, p 34 (https://www.ecb.europa.eu/home/pdf/wdn_finalreport_dec2009.pdf).

9 For more information on this topic, see, for instance, S Fahr and F Smets (2010), Downward wage rigidities and optimal monetary policy in a monetary union, The Scandinavian Journal of Economics 112 (4), pp 812-840.

Wage indexation in the euro area

Country group	Form of index-ation and sectors covered	Limits/ derogations	Inflation measure	Adjustment interval	Remarks
Countries with full indexation – required by law or agreed by management and labour					
Belgium	Automatic	Wage inflation limited by wage norm and by wage develop-ments of the country's most important trad-ing partners.	Health index (national CPI excluding fuels, tobacco and alcohol)	Once a year in Q1	Currently suspended
Cyprus	Automatic	No limits. No rules for derogations.	National CPI (excluding increases in indirect taxes)	Twice a year	Suspended until end-2016
Luxembourg	Automatic	No limits. Dero-gations possible if management and labour agree.	National CPI	Twice a year	
Countries with full indexation – anchored in collective wage agreements					
Italy	Not automatic	Opening clause in collective pay agreements per-mits derogations.	Expected HICP inflation exclud-ing energy		
Spain	Automatic	Wage inflation additionally linked to prod-uctivity growth and price expectations.	National CPI		Partly suspended
Countries with partial indexation – minimum wage					
France	Automatic	No limit for min-imum wage. No linking of wages and salaries to minimum wage.			
Malta	Automatic	No limits. No rules for derogations.	Retail price index	Once a year	
Countries with partial indexation – individual sectors					
Slovenia	Automatic, public sector only	No limits. No rules for derogations.	HICP	Once a year	

Sources: Eurofound, European Commission, OECD, data for 2016.

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Wage bargaining systems in the euro area

Wage bargaining level	1999	2008	2014
Central level: binding norms for enterprise-level bargaining	Belgium Ireland Slovenia	Greece Ireland	Belgium
Combination of centralised and sector-level bargaining	Finland Greece	Belgium	Finland
Intermediate level (sector or industry)	Austria France Germany Italy Netherlands Portugal Spain	Austria Finland France Germany Italy Netherlands Portugal Slovenia Spain	Austria France Germany Italy Netherlands Portugal Slovenia Spain
Combination of sector and enterprise-level bargaining	Cyprus Luxembourg Slovakia	Cyprus Luxembourg Slovakia	Cyprus Greece Luxembourg Slovakia
Decentralised enterprise-level bargaining	Estonia Latvia Lithuania Malta	Estonia Latvia Lithuania Malta	Estonia Ireland Latvia Lithuania Malta

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in employment might override those of job-seekers.[10]

Shift of sorts towards decentralised bargaining

Bargaining at the sector level used to be the norm in most euro-area countries, but recent years have seen a shift towards more decentralised solutions.[11] Greater leeway has been created for company-level bargaining, at least. Belgium and Finland are now the only countries that still operate country-wide cross-sector bargaining systems.[12]

Role of employee protection and …

Alongside the wage-setting procedure, the design of employment protection can also have a bearing on the way in which wage dynamics respond to changes in labour market conditions. Employment protection legislation (EPL) is there to protect workers against employment risk, but it can potentially also strengthen the hand of those currently in employment, which can hinder the adjustment of wages. Recent years have seen a host of euro-area countries, notably Italy, Spain, Portugal and Greece,

noticeably loosen EPL through measures such as shortening notice periods, lowering the thresholds for mass layoffs or extending the maximum term of temporary contracts permitted by law.

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10 The various wage bargaining systems and their potential implications are outlined in L Calmfors and J Driffill (1988), Bargaining structure, corporatism and macroeconomic performance, Economic Policy 3 (6), pp 13-61; and L Calmfors (1993), Centralisation of wage bargaining and macroeconomic performance, OECD Economic Studies, No 21.

11 In Ireland, for instance, wage bargaining was decentralised to enterprise level after the breakdown in 2009 of attempts to sign off a centralised pay bargaining system. The 2011 reform in Greece did away with the binding nature of sector-level pay agreements, and bargaining became more flexible. In Germany, enterprise-level agreements had already grown substantially in importance during the pre-crisis era, either replacing or augmenting sector agreements. See also the points discussed in European Central Bank, New evidence on wage adjustment in Europe during the period 2010-13, Economic Bulletin, Issue 5/2016, pp 53-75.

12 This meant it was possible to impose a blanket wage freeze in Belgium in 2015 which was designed to restore cost competitiveness. For more information, see Conseil supérieur de l'emploi, Rapport 2016, June 2016.

... wage substitutes

Added to this, there are other aspects of the institutional framework which can determine how wages respond to labour market conditions. As a case in point, the existence of relatively generous statutory unemployment benefits, particularly in combination with a long drawing period, could make the risk of losing one's job seem less daunting for employees. Active labour market measures, however, might counteract this effect – for instance, if financial support is only available for those actively seeking work.[13]

Unemployment becomes entrenched

Protracted periods of unemployment often erode human capital. This can diminish the effective supply of labour and take the pressure off wages, causing unemployment to become entrenched.[14]

Determinants of wage dynamics in the euro area

Estimations of a wage Phillips curve for the euro area

The relationship between labour market conditions and wage growth in the euro-area countries can be investigated with the aid of an empirical wage Phillips curve model.[15] In this model, wage movements are consistent with those of labour productivity and prices over the long term. Additionally, short to medium-term wage growth depends on labour market conditions.

Model specifics

The model is estimated in a panel of country data for the euro area, with country and time-specific factors being captured by binary indicators – what are known as dummy variables. Given that some of the developments that occurred during the period under review (1999 to 2015) were extreme in nature, notably in a number of crisis-hit countries, the time effects are additionally coupled to an indicator for the programme countries[16] so as to prevent results from being driven by this group of countries.[17]

The estimation results confirm the notion that there is a long-term relationship between wages, prices and productivity. In the short run, the inflation rate has a weak influence on wage dynamics that is often not statistically significant. This would suggest that inflation expectations were quite well anchored across the entire sample period and that real wage rigidity did not play any major role. Measured in terms of the unemployment rate, underemployment dampens wage growth in a statistically significant, but not particularly strong manner. This estimation suggests that a 1-percentage-point increase in the unemployment rate curbs wage growth in the euro area by 0.2 percentage point.[18]

Wage dynamics show only a weak response to labour market conditions

If the headline unemployment rate is replaced by the short-term unemployment rate (jobseekers who have been out of paid employment for less than one year), wage growth becomes more than twice as responsive. This supports the view that the long-term unemployed have less of an effect on the wage formation process.[19] Where a distinction is made between cyclical and structural unemployment, data from the European Commission show that cyclical unemployment affects wage dynamics far more strongly than its structural counterpart. Those data also show that cyclical underemployment has a tangibly smaller influence on wage dynamics than does cyclical overemployment. Similar results are produced by research based on regional data for Germany, Italy and Spain, which show that the wage Phil-

Differences between short and long-term, and cyclical and structural unemployment

13 See A de Serres and F Murtin (2013), Do policies that reduce unemployment raise its volatility? Evidence from OECD countries, OECD Economics Department Working Papers, No 1020.
14 See A Lindbeck and D Snower (1988), The insider-outsider theory of employment and unemployment, Cambridge, MA, MIT Press; and A Lindbeck and D Snower (2001), Insiders versus outsiders, Journal of Economic Perspectives 15, pp 165-188.
15 This model is based on O J Blanchard and L F Katz (1999), Wage dynamics: reconciling theory and evidence, American Economic Review, Papers and Proceedings 89, pp 69-74.
16 Cyprus, Greece, Ireland, Portugal and Spain.
17 Further details on the estimating approach, the data used and the results can be found in the Annex on pp 52-55.
18 The model framework ignores potential endogeneity problems between wage growth and the explanatory variables such that the results ought to be interpreted as conditional correlations.
19 See also R Llaudes (2005), The Phillips curve and long-term unemployment, ECB Working Paper, No 441.

lips curve relationship exhibits non-linearities of that kind.[20] Given this evidence of asymmetries, it is reasonable to believe that DNWR has influenced aggregate wage dynamics in the euro area.[21]

Incorporating institutional factors

The model can also be used to explore what role the institutional framework plays in wage dynamics. With the aid of indicators for the institutional framework of the labour market, dummy variables are defined which place countries into different categories. Based on interaction terms between the dummy variables and a measure for conditions in the labour market, it is then possible to investigate whether countries with certain institutional characteristics exhibit more or less wage responsiveness to labour market conditions.[22]

Wage bargaining level influences wage dynamics

The ICTWSS database classifies countries according to how wage bargaining is organised.[23] According to the estimation, the wage response to labour market conditions in countries where bargaining takes place at an intermediate level is weaker than it is in economies with more decentralised or centralised bargaining arrangements.[24] Moreover, countries in which wages are also negotiated at the enterprise level show far stronger wage responses to changing labour market conditions. There is no evidence to suggest that minimum wages have a bearing, however.

Role of employment protection and other factors

Countries are classified according to the degree of employment protection based on the OECD employment protection legislation (EPL) indicators.[25] A dummy variable takes the value of one when, in a given period, a country is below the sample median, according to the OECD indicator. This is also incorporated into the estimation as an interaction term with the unemployment rate. The resulting estimations suggest that the wage response to labour market conditions is stronger if employment protection is looser.[26] If a distinction is then made between rules governing permanent and temporary contracts, it becomes evident that results are driven by the rules for temporary contracts. This might

have something to do with the fact that the rules for permanent contracts differ less from one country to the next, which means that it is particularly difficult to classify countries using a dummy variable. No evidence can be found here that wage substitutes and active labour market policy have any influence on wage dynamics.

Altogether, the estimations indicate that the influence of unemployment on wage growth dwindles when jobless figures are high. DNWR might be one explanation for this asymmetry. What the estimations also demonstrate is that the institutional framework of the labour market can influence the strength of the relationship between unemployment and wage growth, especially as far as the wage-setting arrangement is concerned. Employment protection might also have a bearing, but there is less evidence to support this view.

Wage responsiveness depends on institutional framework

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20 The empirical approach used for this research is based on the paper by A Kumar and P M Orrenius (2016), op cit, which uses regional panel data to present evidence of non-linearity in the path of the wage Phillips curves in the USA. Details can be found in the Annex on pp 52-55.
21 Other empirical papers likewise conclude that the wage response to the unemployment rate in the euro area varies across the economic cycle, and relate these asymmetries to downward wage rigidities. See R Anderton and B Bonthuis (2015), Downward wage rigidities in the euro area, GEP Research Paper 2015/09; and European Central Bank, Downward wage rigidity and the role of structural reforms in the euro area, Economic Bulletin, Issue 8/2015, pp 40-43.
22 Details can be found in the Annex on pp 52-55. While it would seem rather crude to use dummy variables to place countries into different categories, the indicators for the institutional framework do not move by much over time, which means that it is difficult to identify the relevant effects in an econometric model with fixed country effects.
23 See J Visser (2015), ICTWSS: database on institutional characteristics of trade unions, wage setting, state intervention and social pacts in 51 countries between 1960 and 2014, Version 5. Amsterdam Institute for Advanced Labour Studies.
24 De Serres and Murtin (2013) present an indicator that can make a crude distinction between centralised and decentralised wage bargaining systems on the one hand, and intermediate systems on the other. The indicator is calculated on the basis of variables taken from the ICTWSS database and is dubbed the "excess coverage of wage bargaining". See A de Serres and F Murtin (2013), op cit.
25 See OECD, Protecting jobs, enhancing flexibility: a new look at employment protection legislation, in OECD Employment Outlook (2013), pp 65-126.
26 The analysis of firm-level data (pp 42-44) also shows that more stringent EPL reduces the propensity to cut wages.

Macroeconomic implications of DNWR

Mechanisms for adjusting to country-specific shocks in a monetary union

This raises the question as to the importance of such rigidities in wage dynamics for the economy as a whole. Economies will be hit time and again by shocks which can trigger considerable losses in income and employment. Certain mechanisms that cushion those shocks function to a limited degree in a monetary union setting. This is notably the case for the single monetary policy, which only responds to deviations from its aggregate-level targets. Where a shock is confined to just individual member states or a group of countries in the euro area, the Eurosystem will take limited action, gearing its response mainly to the potential impact on the outlook for price developments in the euro area as a whole.

Macro simulation using NiGEM

In cases like that, the wage mechanism used in the individual labour markets plays a particularly important role.[27] This can be illustrated using simulations produced by the NiGEM global economic model developed by the National Institute of Economic and Social Research (NIESR).[28] While this model takes into account nominal rigidity, it assumes that wages can be adjusted symmetrically upwards and downwards.

DNWR intensifies employment losses and decline in investment

In this framework, a negative shock dampening aggregate demand in just a single euro-area country will typically trigger a sharp decline in the nominal hourly wage in that country's labour market.[29] If this adjustment is suppressed, enterprises will make more of an effort to cover their costs through job cuts,[30] which is also the outcome of the investigation based on enterprise data.[31] This results in job losses that are much heavier, and not just initially, than in a scenario of wages that are flexible to the downside. Also, the employment losses turn out to be persistent, at least in part, since the real product wage comes in higher than in the alternative scenario of flexible wages. This increase in the cost of the labour factor (again, compared with the reference scenario of flex-

ible wages) drives down potential output, causing enterprises to crimp investment. Household consumption, on the other hand, moves broadly in line with the reference scenario, because the dampening impact of lower employment on aggregate disposable income and the positive effect of the higher hourly wage roughly cancel each other out. The net impact of these contrary consumption effects, which is limited overall, can certainly tilt in different directions in the individual countries of the euro area. The downward pressure on consumer prices, however, is reduced perceptibly by stable nominal wages.

27 Galí and Monacelli (2016), on the other hand, question the notion that wage flexibility is particularly important above all in a monetary union setting. They assert that a possible indirect effect of wage cuts on the endogenous component of monetary policy is eliminated. Their paper claims that only an independent monetary policy can respond to disinflationary pressure (emanating from wage cuts) with a reduction in policy rates which, they say, impacts positively on aggregate demand, boosting employment. Nevertheless, Galí and Monacelli find that a reduction in wage costs has a beneficial effect on employment in a monetary union as well. See J Galí and T Monacelli (2016), Understanding the gains from wage flexibility: the exchange rate connection, American Economic Review 106 (12), pp 3829-3868.
28 NiGEM individually models the bulk of OECD countries as well as major emerging market economies and links them via foreign trade and the interest-exchange rate nexus. The model has New Keynesian features and also forward-looking elements on the financial and labour markets. See https://nimodel.niesr.ac.uk for further information on the model structure.
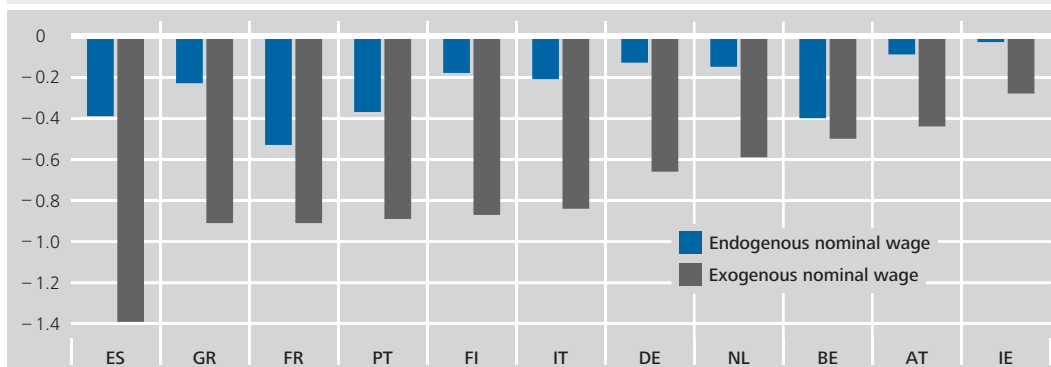**29** The demand shock chosen for this purpose is an exogenous and persistent drop in (real) government consumption equal to 2% of gross domestic product (GDP) without fiscal policy being rule-bound, which has the benefit of leaving intact the behavioural equations for household demand variables. Separate analyses are conducted for a total of 11 euro-area member states (Germany, France, Italy, Spain, the Netherlands, Belgium, Austria, Ireland, Finland, Portugal and Greece). Monetary policy responds according to the rule stipulated in the default model. As an unweighted mean of the simulation results for the individual countries, the demand shock depresses real GDP by 1% compared with the baseline in the first three years. This drives down the nominal wage by no more than 1½% compared with the baseline as a country average.
30 While the absence of any downside adjustment in the nominal wage path, as assumed here, can be regarded as an extreme assumption, similar tendencies would also come to the fore if the downward flexibility of nominal wages were curbed only gradually. See Deutsche Bundesbank, The importance of nominal wage adjustments in NiGEM simulations, Monthly Report, April 2011, pp 48-49.
31 See also the box on pp 42-44.

Importance of downward nominal wage rigidity for employment in selected euro-area countries given adverse country-specific demand shocks[*] in NiGEM simulations

Average[1] deviation in the number of persons in work from the baseline, expressed as a percentage

Source: Bundesbank calculations conducted with the aid of NiGEM (National Institute's Global Econometric Model). ***** Assumption of a persistent drop in (real) government consumption equal to 2% of GDP in the country shown. **1** Average for the first three years after the shock occurs.

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Initial conditions in individual economy important

All in all, the simulations outlined above make it clear that DNWR can complicate efforts by individual economies to adjust to country-specific (or asymmetric) negative shocks. The simulations indicate that the employment losses in particular are heavier and more persistent. The actual initial conditions prevailing in each country will probably play a role in this regard. Downward rigidities and their macroeconomic repercussions are more likely to be felt during spells in which nominal developments are already weak.

employment terms and conditions – as is the case in Spain and Cyprus – is just one indication that wage deflation is pent up in this manner.[33]

In addition, the programme countries in particular responded to the crisis by initiating structural reforms which also had an impact on the labour market. Wages are therefore likely to have become more responsive to the persistently high levels of unemployment in these countries in recent years, which will have acted as a further drag on wage inflation.[34]

… reforms holding back wage inflation

■ Conclusion

Pent-up wage deflation and …

There is good reason to believe that the sluggish adjustment of wage dynamics may have intensified the economic crisis in the euro area and held back the recovery. Employment has been back on the increase for three years now, and the unemployment rate has fallen noticeably from a very high level. Even so, wage growth has been muted so far. Alongside feeble productivity growth and very low rates of inflation, this is probably also due to pent-up wage deflation in certain parts of the labour market on a scale that is to be expected following a crisis in which wage rigidities became entrenched.[32] The fact that newly hired employees are being offered significantly worse

32 See L Goette, U Sunde and T Bauer (2007), Wage rigidity: measurement, causes and consequences, The Economic Journal 117(524), pp F499-F507; and M C Daly and B Hobijn (2014), Downward nominal wage rigidities bend the Phillips curve, Journal of Money, Credit and Banking 46(S2), pp 51-93.
33 For more information, see M Izquierdo and J F Jimeno (2015), Employment, wage and price reactions to the crisis in Spain: firm-level evidence from the WDN survey, Banco de España Occasional Papers No 1503; and C P Charalambous, M C Polemidiotis and A Y Roussos (2016), Wage and price setting practices of Cypriot companies during the period 2010-2013, Central Bank of Cyprus Working Paper, No 2016/3.
34 See European Central Bank, Recent wage trends in the euro area, Economic Bulletin, Issue 3/2016, pp 21-23; and Banco de España, Collective bargaining, wage rigidities and employment: an analysis using microeconomic data, Economic Bulletin, April 2015, pp 1-6. Major structural reforms are summarised in European Central Bank, What is behind the recent rebound in euro area employment?, Economic Bulletin, Issue 8/2015, pp 54-71.

■ Annex

Panel estimations with all euro-area countries

The panel estimation of the Phillips curve for the 19 euro-area countries follows a model specification developed by Blanchard and Katz[35]

$$
\begin{aligned}
\Delta w_{ct} = \alpha_c &+ \delta\Delta p_{ct-1} + \gamma\Delta y_{ct} \\
&- \gamma(w_{ct-1} - p_{ct-1} - y_{ct-1}) + \beta_1 CU_{ct} \\
&+ \beta_1\max(0, CU_{ct}) + \lambda_t + \lambda_t * prog_c + e_{ct},
\end{aligned}
$$

where c indicates the countries and t the quarters. Letters in lower case denote logarithmic values and Δ represents the differential operator. For example, Δw_{ct} denotes nominal wage growth (measured by compensation of employees) in country c for quarter t. p stands for the consumer price index, which is incorporated into the model as a rate of change lagged by one period and is intended to approximate the expected inflation rate. y denotes productivity. The error correction term $(w_{ct-1} - p_{ct-1} - y_{ct-1})$ implies that, in the long term, wages depend on labour productivity and prices.

Data on wages (compensation of employees), prices (HICP), labour input (employees, total employment, and the respective number of hours worked), gross value added and unemployment are taken from Eurostat. Alongside country-specific constants α_c, binary, time-specific variables known as dummies (λ_t) are added to the model to capture unobserved shocks. The time effects are additionally interacted with an indicator for the programme countries ($prog_c$). The integration of a spline term allows potential non-linearities to be taken into consideration. In particular, the effect of unemployment on wages can differ depending on the labour market situation. Since unemployment rates vary strongly from country to country and there were sometimes substantial shifts in trend unemployment in a number of euro-area countries during the estimation period, the cyclical unemployment rate (CU_t), ie the difference between the actual unemployment rate and an estimated structural unemployment rate, is applied as an indicator for labour market slack. The European Commission's non-accelerating wage rate of unemployment (NAWRU)[36] is used for this, with annual data being converted through a linear interpolation to a quarterly frequency. Thus, the linear spline ($\max(0, CU_{ct})$) with a knot at zero allows cyclical underemployment and cyclical overemploy-

ment to affect wage developments by varying degrees.

First of all, the estimation results reveal the role of varying measures of labour market slack for wage growth. Since the dependent variable is modelled in log differences, the coefficient of the labour market slack indicator must be multiplied by 100 in each case in order to express the results in percentage points. The table shows results for the unemployment rate (U_{ct}), the rate of short-term unemployed persons (SU_{ct}), the cyclical unemployment rate (CU_{ct}) and the variant containing the additional spline term.[37] In the event of cyclical underemployment, the slope coefficient is obtained as the sum of the coefficients for CU_{ct} and the spline term. All estimations were performed for both hourly wages and monthly wages.

Country-specific estimations

In the country-specific estimations, annual regional data at the NUTS 2[38] level are used.[39] Corresponding data are available for Germany for the period from 1999 to 2013, for Italy from 1995 to 2014 and for Spain from 1999 to 2014. Most of these data were obtained from the national statistical offices of each country. Eurostat serves as the data source for regional unemployment rates for Germany and Spain.

The estimation approach broadly follows Kumar and Orrenius (2016)[40]:

$$
\begin{aligned}
\Delta w_{rt} - \Delta p_{rt-1} = \alpha_r &+ \gamma\Delta y_{rt} + \beta_1 U_{rt} \\
&+ \beta_2\max(0, U_{rt} - \bar{U}) + e_{rt}.
\end{aligned}
$$

Owing to the lack of specific consumer price indices for the NUTS 2 regions r, the HICP of the given country is used.[41] Δy_{rt} measures the change in

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35 See O J Blanchard and L F Katz (1999), loc. cit.
36 The European Commission's NAWRU indicators may be obtained from: http://ec.europa.eu/economy_finance/db_indicators/ameco/
37 The results also prove robust if a restricted cubic spline is used instead of a linear spline.
38 NUTS stands for "Nomenclature of Units for Territorial Statistics".
39 This results in 38 regions for Germany, 21 regions for Italy and 19 regions for Spain.
40 See A Kumar and P M Orrenius (2016), loc. cit.
41 In addition, estimations are performed using regional deflators (or the inflation rate at the federal state level) as indicators of regional price developments.

Estimations with country data for the euro area* – asymmetries

Item	Euro area			
	Hourly wages			
Δp_{ct-1}	0.2199**	0.2313**	0.1746*	0.1305
Δy_{ct}	0.1218***	0.1294***	0.1223***	0.1264***
$(w_{ct-1} - p_{ct-1} - y_{ct-1})$	− 0.1218***	− 0.1294***	− 0.1223***	− 0.1264***
U_{ct}	− 0.0023***	–	–	–
SU_{ct}	–	− 0.0050***	–	–
CU_{ct}	–	–	− 0.0032***	− 0.0053***
$\max(0, CU_{ct})$	–	–	–	0.0033**
Observations	1,230	1,227	1,230	1,230
Pseudo R-squared	0.354	0.349	0.361	0.368
	Monthly wages			
Δp_{ct-1}	0.1713	0.1853	0.1291	0.0900
Δy_{ct}	0.1019***	0.1047***	0.1016***	0.1053***
$(w_{ct-1} - p_{ct-1} - y_{ct-1})$	− 0.1019***	− 0.1047***	− 0.1016***	− 0.1053***
U_{ct}	− 0.0023***	–	–	–
SU_{ct}	–	− 0.0047***	–	–
CU_{ct}	–	–	− 0.0031***	− 0.0049***
$\max(0, CU_{ct})$	–	–	–	0.0029**
Observations	1,229	1,226	1,229	1,229
Pseudo R-squared	0.394	0.386	0.401	0.407

* Pseudo R-squared indicates the correlation between the dependent variable and the predicted values. Estimations contain country and time-specific fixed effects as well as additional time effects for the group of programme countries. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

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regional real labour productivity.[42] U_{rt} stands for the regional unemployment rate, α_r represents a region-specific constant and e_{rt} denotes the error term.[43] By adding a linear spline term with a knot at the country-specific long-term average unemployment rate $\bar{U}$, the Phillips curve is tested for asymmetry.

Again, estimations are performed for both hourly wages and monthly wages. Additionally, as an alternative to the aggregate inflation rate, regional deflators (or price indices for federal states in Germany) are used to approximate regional inflation rates.[44]

Panel estimations relating to the institutional framework

The empirical approach corresponds to the model framework chosen for all the euro-area countries, with the spline term being replaced by an interaction term between a dummy variable for the institutional framework ($INST_{ct}$) and the cyclical unemployment rate CU_{ct}:

$$\Delta w_{ct} = \alpha_c + \delta\Delta p_{ct-1} + \gamma\Delta y_{ct}$$
$$- \gamma(w_{ct-1} - p_{ct-1} - y_{ct-1}) + \beta_1 CU_{ct}$$
$$+ \beta_2 CU_{ct} * INST_{ct} + \beta_3 INST_{ct} + \lambda_t$$
$$+ \lambda_t * prog_c + e_{ct}.$$

The interaction term indicates whether – depending on the institutional set-up – the effect of unemployment on wage growth varies. The interaction terms are added to the model individually in succession in

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42 Regional real labour productivity is calculated on the basis of regional gross value added or, in Italy, regional GDP. For Germany, information in real terms is available only at the federal state level, but not the NUTS 2 level. Therefore, in the case of Germany, productivity growth is controlled for at the federal state level.
43 Kumar and Orrenius (2016) assume that productivity develops uniformly in all regions of a given country and that this therefore does not need to be controlled for as long as the model contains year dummies. The estimates presented here prove to be very sensitive to the addition of year dummies. This is likely to be due to the relatively small samples for these three countries. Kumar and Orrenius, by contrast, base their analysis on 1,600 observations across 50 regions for the period from 1982 to 2013. We have therefore refrained from using year dummies here.
44 The results also prove robust if a restricted cubic spline is used instead of a linear spline.

Estimations with regional data* – asymmetries

Item	Germany		Italy		Spain	
	Hourly wages – aggregate inflation rate					
Δy_{rt}	− 0.0117	0.0020	0.2660***	0.2678***	0.3423***	0.3736***
U_{rt}	− 0.0035***	− 0.0051***	− 0.0024**	− 0.0057***	− 0.0020***	− 0.0035***
$\max(0, U_{rt} - \bar{U})$		0.0022***		0.0050***		0.0021***
Observations	445	445	252	252	242	242
R-squared	0.316	0.335	0.126	0.175	0.422	0.457
	Hourly wages – regional deflators (inflation rate at federal state level in Germany)					
Δy_{rt}	− 0.0026	0.0123	0.2217***	0.2224***	0.6345***	0.6517***
U_{rt}	− 0.0034***	− 0.0051***	− 0.0012**	− 0.0026***	− 0.0006***	− 0.0014***
$\max(0, U_{rt} - \bar{U})$		0.0024***		0.0021**		0.0012***
Observations	416	416	252	252	242	242
R-squared	0.297	0.320	0.091	0.103	0.268	0.284
	Monthly wages – aggregate inflation rate					
Δy_{rt}	0.3525***	0.3626***	0.4041***	0.3932***	0.4685***	0.4892***
U_{rt}	− 0.0030***	− 0.0044***	− 0.0029***	− 0.0054***	− 0.0021***	− 0.0035***
$\max(0, U_{rt} - \bar{U})$		0.0020***		0.0037***		0.0022***
Observations	445	445	357	357	242	242
R-squared	0.476	0.488	0.245	0.281	0.412	0.447
	Monthly wages – regional deflators (inflation rate at federal state level in Germany)					
Δy_{rt}	0.3623***	0.3731***	0.3558***	0.3515***	0.7976***	0.8089***
U_{rt}	− 0.0029***	− 0.0045***	− 0.0017***	− 0.0031***	− 0.0007***	− 0.0015***
$\max(0, U_{rt} - \bar{U})$		0.0021***		0.0019***		0.0012***
Observations	416	416	378	378	242	242
R-squared	0.484	0.497	0.177	0.189	0.354	0.369

* Estimations based on the fixed effects estimator. R-squared relates to variations within the regions (within R2). *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

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the light of multicollinearity and the interpretability of the coefficients.

The excess coverage of wage bargaining (ECWB) indicator[45] is calculated from the ICTWSS database[46], which contains information on the adjusted bargaining coverage rate and the union density rate.[47] The indicator is calculated from the difference between these two subindicators.[48] The countries are divided into two groups based on a dummy variable with the cross-country median being used as the threshold value.[49] For countries where wage-setting arrangements tend to be centralised or decentralised, the dummy variable is set to 1. In countries where negotiations tend to take place at an intermediate level, it takes the value 0. Alternatively, the indicator "level" from the ICTWSS database is used, which states the most frequently encountered level for wage negotiations in a given country. The indicator takes a value between 1 (decentralised bargaining) and 5 (centralised bargaining). In the estimations, a dummy variable is set to 1 for countries where bargaining also takes place at the enterprise level (bargaining levels 1 and 2). In the third option, for countries without a minimum wage (based on a variable of the ICTWSS database), a dummy variable takes the value 1.

The OECD's EPL indicators[50] are used with regard to employment protection.[51] A distinction is made between permanent and temporary employment

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45 See A de Serres and F Murtin (2013), op cit.
46 See J Visser (2015), op cit.
47 Missing data points are filled by linear interpolation. See also P Gal and A Theising (2015), The macroeconomic impact of structural policies on labour market outcomes in OECD countries: A reassessment, OECD Economics Department Working Papers, No 1271. In addition, missing data points for the past few years are extrapolated on the basis of the value for the latest available year.
48 Experience shows that the ECWB takes low values if wage negotiations are held centrally (high bargaining coverage rate and high union density) or are decentralised (low bargaining coverage rate and low union density) and high values if wage bargaining takes place at an intermediate level.
49 The threshold value is chosen on an ad hoc basis as there is no obvious criterion. Here, the median is chosen instead of the mean because it is less susceptible to potential extreme values.
50 Employment protection legislation.
51 Indicators are available only up to 2013. For 2014 and 2015, the dummy variables are extrapolated on the basis of the figure for 2013.

Estimations with country data for the euro area* – institutional framework

Item	Wage setting			Employment protection			Support for job-seekers	
	ECWB	Level	Minimum wage	Overall	Permanent contracts	Temporary contracts	Active measures	Transfers
Hourly wages								
Δp_{ct-1}	0.1305	0.1300	0.1333	− 0.0478	− 0.0913	− 0.0529	0.1843**	0.1501
Δy_{ct}	0.1311***	0.1287***	0.1238***	0.1453***	0.1347***	0.1497***	0.1160***	0.1344***
$(w_{ct-1} - p_{ct-1}$								
$\qquad - y_{ct-1})$	− 0.1311***	− 0.1287***	− 0.1238***	− 0.1453***	− 0.1347***	− 0.1497***	− 0.1160***	− 0.1344***
CU_{ct}	− 0.0017***	− 0.0017***	− 0.0028***	− 0.0011**	− 0.0022***	− 0.0014***	− 0.0026***	− 0.0044***
$CU_{ct} * INST_{ct}$	− 0.0024***	− 0.0024**	− 0.0018	− 0.0020***	0.0007	− 0.0023***	− 0.0011	0.0009
$INST_{ct}$	0.0052	0.0022	− 0.0033	− 0.0043	− 0.0000	− 0.0068***	− 0.0072**	− 0.0005
Observations	1,230	1,230	1,230	888	888	888	916	1,051
Pseudo R-squared	0.374	0.373	0.368	0.419	0.407	0.423	0.440	0.387
Monthly wages								
Δp_{ct-1}	0.0851	0.0820	0.0846	− 0.0912	− 0.1283	− 0.0892	0.1856*	0.1329
Δy_{ct}	0.1070***	0.1058***	0.1010***	0.1163***	0.1125***	0.1206***	0.0869***	0.1066***
$(w_{ct-1} - p_{ct-1}$								
$\qquad - y_{ct-1})$	− 0.1070***	− 0.1058***	− 0.1010***	− 0.1163***	− 0.1125***	− 0.1206***	− 0.0869***	− 0.1066***
CU_{ct}	− 0.0016***	− 0.0015***	− 0.0027***	− 0.0013**	− 0.0022***	− 0.0015***	− 0.0034***	− 0.0042***
$CU_{ct} * INST_{ct}$	− 0.0023***	− 0.0024***	− 0.0019	− 0.0013	0.0008	− 0.0018***	− 0.0002	0.0008
$INST_{ct}$	0.0019	0.0006	− 0.0054**	0.0019	0.0006	− 0.0054**	− 0.0052**	− 0.0016
Observations	1,229	1,229	1,229	887	887	887	915	1,050
Pseudo R-squared	0.414	0.414	0.411	0.402	0.397	0.408	0.480	0.416

* Pseudo R-squared indicates the correlation between the dependent variable and the predicted values. Estimations contain country and time-specific fixed effects as well as additional time effects for the group of programme countries. ******* $p < 0.01$, ****** $p < 0.05$, ***** $p < 0.1$.

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contracts. Based on a dummy variable, the countries are divided into two groups according to the strength of the relevant indicator, with the cross-country median acting as the threshold value in each case. For countries with more flexible employment protection (ie where the value of the relevant indicator is lower than the median of the sample), the dummy variables take the value 1. Furthermore, an overall index for the rigidity of employment protection is calculated on the basis of the two subindicators.[52]

Finally, we analyse how the structure of unemployment benefits affects wage sensitivity in terms of the labour market situation. This aspect is investigated on the basis of two OECD indicators. One indicator is based on the net replacement rate of unemployment benefits.[53] The second indicator captures spending on active labour market policy.[54] Again, based on these indicators, dummy variables are defined which take a value of 1 for countries where benefit payments or spending on active labour market policy measures are higher than the corresponding median value.

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[52] See OECD, Protecting jobs, enhancing flexibility: A new look at employment protection legislation, in: OECD Employment Outlook 2013.

[53] The indicator chosen here is based on the average for two different income levels, three different types of family and a period of unemployment lasting 60 months. The indicator takes into account potential additional financial assistance, eg in the form of a housing allowance. The indicator is available for the period from 2001 to 2013. The calculated dummy variable is extrapolated for 2000 as well as 2014 and 2015 on the basis of its values in 2001 and 2013 respectively.

[54] Expenditure per person registered as unemployed is normalised using per capita income (GDP per capita). The information on spending on active labour measures is available only up to 2013. For 2014 and 2015, the calculated dummy variable is therefore extrapolated on the basis of the figure for 2013. See A de Serres and F Murtin (2013), op cit.