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WAGE DYNAMICS IN EUROPE
FINAL REPORT OF THE WAGE DYNAMICS NETWORK (WDN)

Executive Summary

This report summarises the main findings and policy conclusions of the Eurosystem/ESCB Wage Dynamics Network (WDN) since it started operations in July 2006. The objectives of the WDN were i) to identify the sources and features of wage and labour cost dynamics that are most relevant for monetary policy and ii) to clarify the relationship between wages, labour costs and prices both at the firm and macro-economic level. This was partly motivated by the finding in the Inflation Persistence Network (IPN) that cross-sector differences in the frequency of price changes were highly negatively correlated with the labour share, suggesting that stickiness in wages and labour costs may be one of the driving factors behind the slow adjustment of prices. Most of the analysis summarised in this report is based on data that comes from the period before the intensification of the financial crisis in the third quarter of 2008. However, during the past year an attempt was made to update some of the information (such as the survey) and to investigate to what extent the findings can explain the response of the labour market in the current crisis.

Against this background, the report first describes some of the medium-term developments in European labour markets focusing on the recent evolution of collective bargaining and wage setting institutions in the EU and the development of the wage structure in a selected number of EU countries.

Wage bargaining institutions (Section 2.1) are an important determinant of both wage dynamics and the wage structure. Over the past decade, three trends stand out. First, union density, measured as the percentage of employees affiliated with a trade union, has declined in practically all European countries. Second, in spite of this decline and the large heterogeneity across countries in union density, a large proportion of workers are still covered by some kind of collective wage agreement. The coverage rate is high in the euro area and Scandinavian countries (typically higher than 60 percent) and lower in the Central and Eastern European (CEE) countries (typically 30-40 percent). Third, in the euro area the dominant level of collective

bargaining is at the sector level. In most CEE countries on the other hand wage bargaining is highly decentralised and predominantly organised at the firm level. However, in both regions a general trend towards more decentralisation can be observed. All in all, within the EU two groups of countries can be identified. The first group consists of countries with a broadly regulated and centralised system of wage bargaining, characterised by the existence of extension procedures and a high level of collective bargaining coverage, and a dominance of wage bargaining at the sector level (the euro area and the Scandinavian countries). The second group, which includes the CEE countries and the UK, gathers countries where the wage bargaining is largely deregulated. Within the former group a subgroup is characterised by some form of indexation of wages to past inflation and a stronger government role in the labour market (Belgium, Cyprus, Finland, Luxembourg, Slovenia and Spain).

There is evidence that countries with a higher degree of bargaining co-ordination and stricter employment protection legislation exhibit a more compressed *wage structure*. Section 2.2 describes the evolution of the wage structure over the period from 1995 till 2002 in a selected number of EU countries for which the Structure of Earnings Survey was "readily" available.[1] In Belgium, Germany, Greece, Italy and the Netherlands, the wage distribution has widened as high paid jobs have experienced higher wage increases. In contrast, in Hungary, Ireland and Spain the observed wage distribution has become more compressed, as the largest wage increases have taken place for low paid jobs. Shifts in the demographic and educational composition of the work force can not explain these developments. Instead there is some evidence that technological progress has favoured mostly the lowest and the highest paid jobs, supporting the "routinisation" hypothesis.

There is also evidence of sizable wage differentials across sectors in those EU countries. Moreover, the ranking of sectors in terms of observed wage differentials is rather similar across countries and has remained relatively stable over the period from 1996 till 2002. Sectors that pay a higher wage premium are also sectors that earn higher profits, supporting rent-sharing theories. Cross-industry wage differentials are negatively correlated with the degree of competition in the industry, suggesting that firms share their rents with their workers (the more so the higher the collective agreement coverage).

Wage bargaining institutions also have an impact on the extent and the speed with which wages adjust in response to various economic shocks. In particular, they may impact three features of wage setting that determine the aggregate degree of real wage rigidity: the frequency, timing and synchronisation of wage changes, the relative flexibility of the wage of newly hired employees and the degree of wage indexation. Section 3.1 reports the micro and survey evidence on those features.

[1] The most recent Structure of Earnings Survey (2006) has only become available very recently and could not be included in this analysis.

Regarding the *frequency, timing and synchronisation of wage changes*, about 60 percent of the 17,000 firms surveyed report they typically change wages once a year. As a result, the average duration of wages (about 15 months), which matches the typical length of bargained labour contracts between one and two years, is longer than the average duration of prices (about 9.5 months). This survey evidence is confirmed by the analysis of micro data in a few countries for which quarterly wage data is available. Wages change less often when collective bargaining coverage is high and employment protection strong, and more often when bargaining takes place at the firm level and there is a formal or informal indexation scheme to inflation. Overall, the frequency of wage changes is more driven by national institutions, whereas the frequency of price changes is more driven by sector differences such as differences in the labour share and the degree of competition. There is strong evidence of time-dependence in wage-setting: 55 percent of firms report that wage changes are concentrated in a particular month. About one third of wage changes take place in January with an additional smaller peak in July. As a result, the degree of synchronisation of wage changes is larger than that of prices, but overall the timing of wage changes is characterized by a mix of staggering and synchronisation.

The implications of wage stickiness for labour market dynamics also depend on *the behaviour of the wages of newly hired employees*. Most of the variation in hours worked over the business cycle occurs at the extensive margin, i.e. through changes in employment rather than in hours per employee.[2] The behaviour of the wages of new hires is therefore a key determinant of how many vacancies firms decide to post and how many new workers to employ or to fire. Almost 80 percent of the firms surveyed report that the collective wage agreement or the internal pay scale is a more important factor in determining the wage of new hires than external labour market conditions. Less than 12 percent of firms surveyed in eight countries say that they would reduce wages of newcomers below those of workers with similar experience employed in the firm, if there is an abundance of unemployed workers in the labour market. A similar reluctance to differentiate wages exists in a booming economy. Firms reply that the dominant reasons for not differentiating wages of similarly qualified employees are fairness and the fear that such a differentiation may have a negative impact on worker morale and effort. In some industries, also labour regulations such as minimum wage legislation are an important factor in preventing a fall in wages. Also here, bargaining institutions and product market competition matter. External labour market conditions are relatively more important in CEE countries (36 percent) than in euro area countries (15 percent) in part because of the lower bargaining coverage. Similarly, for firms that appear to face more competition, that employ more high-skilled workers and that face a higher turnover of employees, external labour markets conditions matter

[2] As discussed in Section 5, there are some exceptions in the current downturn due to various, often subsidized programmes to shorten working hours and thereby avoid lay-offs.

relatively more. Micro evidence on the cyclicality of wages in a few countries does suggest that wages of job-movers are more procyclical than those of incumbents. However, this may be partly due to compositional effects: e.g. in booms the availability of high-paying jobs is typically higher than in recessions.

Finally, *the indexation of wages to inflation* varies considerably across EU countries. While formal automatic indexation schemes still exist in Belgium, Cyprus and Luxembourg, the adjustment of wages to past inflation is also very common in Spain and Slovenia. On average about one third of the firms surveyed reply that they have an internal policy that adapts base wages to inflation, mostly past inflation. However, in a number of countries with wage bargaining outside of the firm, this may not capture the entrance of inflation expectations in wage demands in the negotiation process.

Section 4 of the report analyses *the macro-economic implications of the three wage setting features* discussed above in the context of an estimated DSGE model for the euro area with sticky prices and wages, indexation of wages to lagged inflation and labour market frictions. A number of findings are worth highlighting. Although the model is estimated with macro data, the estimates of the degree of stickiness of wages of incumbents and new hires and the degree of indexation conform quite well to the micro evidence. The average duration of a wage contract of incumbent workers is estimated to be 4.4 quarters. Moreover, wages of newly hired workers are estimated to be as sticky as those of incumbent workers, consistent with high collective bargaining coverage in the euro area. The macro analysis finds that the degree of flexibility of the wages of new hires matters a lot for the aggregate degree of real wage rigidity and the employment response to various shocks. Finally, the degree of indexation to past inflation is estimated to be one third. Reflecting second-round effects, inflation indexation mostly leads to a higher volatility and persistence of inflation in response to shocks. Together these features help replicate the relative volatility in hours worked and the real wage in the euro area, as well as their persistence. The considerable degree of real wage rigidity leads to a small, but persistent real wage response and a relatively stronger employment response to various shocks including an unexpected change of monetary policy. The latter is consistent with alternative time series evidence on the effects of a monetary policy tightening. Differences in labour market institutions and the related real wage rigidity may partly explain why the elasticity of wages with respect to changes in unemployment is smaller in the euro area compared to the United States. Higher real wage rigidity complicates the conduct of monetary policy in the pursuit of price stability, as it increases the cost of stabilising inflation in the face of cost-push shocks, putting a premium on a firm anchoring of inflation expectations. It also slows down the adjustment process and gives rise to protracted changes in competitiveness within the monetary union, when countries are affected by asymmetric shocks.

Differences in labour market institutions and their effect on real wage rigidity can also explain some differences in labour market responses within the euro area. For example, WDN research has argued that sector-level wage bargaining, automatic indexation and less stringent employment protection legislation are factors that may explain the stronger employment reaction of Belgian firms relative to other countries in the euro area. One concern regarding the evidence on significant cross-country differences in the degree of wage indexation is that common shocks in the monetary union may lead to persistent differences in relative unit labour costs and associated changes in competitiveness. Indeed, there is evidence that, for example, an increase in oil prices leads to higher inflation and a loss of competitiveness in countries with pervasive wage indexation to past inflation developments. Finally, the macro analysis also shows that, everything else equal, a higher degree of synchronisation speeds up the response of wages to economic shocks.

The WDN has also investigated whether there are asymmetries in the adjustment of wages (Section 3.1.5). Both micro wage data and the WDN firm survey point to *the existence of significant downward rigidity in base wages* in the EU countries. There are, however, notable cross-country differences in the nature and the incidence of downward wage rigidity (DWR). As in the case of the US, nominal DWR is found to be dominant in the Netherlands, Greece, Germany, Austria and Portugal. In contrast, real DWR is found to be particularly relevant in Belgium, Finland, Luxembourg, Spain and Sweden. The WDN firm survey confirms the existence of strong DWR: with the exception of Germany, only a small percentage of firms (2.3 percent on average) declare that wages were ever cut during the five years before the time the original survey was held (end 2007- beginning 2008). The two most important reasons why wage cuts are rare are the impact on work morale and effort and the possibility that the most productive workers would leave as a consequence. In contrast to the US, in Europe also institutional restrictions, due to either labour regulations or collective agreements, are indicated to be a significant reason for DWR. DWR is also higher in countries with stricter employment protection legislation and higher collective bargaining coverage. A follow-up survey during the financial crisis confirms that, with a few exceptions (like Estonia), even in a deep crisis nominal cuts in base wages do not occur very often. In this smaller sample, the share of firms went up from 2.6 to 3.2 percent. However, the share of firms freezing wages increased more drastically from about 10% to 35%, with another 35% of firms indicating their intention to freeze wages in the future. The case of Estonia, where approximately 44 percent of firms claim they have cut wages in the current crisis, is telling given that its institutional framework for wage setting is quite flexible and that it recently has relaxed its employment protection legislation and lowered lay-off costs for employers.

The existence of downward wage rigidities is also reflected in the macro response of wages to unemployment (Section 4.3.4). Estimated aggregate wage equations confirm that the elasticity of the real wage to changes in unemployment in a recession is lower than in a boom, although the difference is

statistically not very significant. One monetary policy implication of nominal DWR is that the central bank may want to maintain a small positive inflation buffer to grease the wheels of the economy. WDN research suggests that an inflation buffer of 2 percent is appropriate. Flexible labour markets are essential for the well-functioning of the European Monetary Union. With cross country differences in the degree of nominal and real DWR, the region which exhibits real DWR will suffer from a loss of competitiveness relative to the region that has more flexible labour markets in response to cost-push shocks.

One of the important objectives of the WDN is to clarify the link between wages, labour costs and prices. Section 3.2 provides some of the micro evidence on this link. About 60 percent of firms surveyed declare that they would use a strategy of increasing prices when faced with a permanent unexpected increase in wages. In particular in firms with a high labour share the pass-through of wages into prices is strong. A greater share of labour costs in total costs also reduces the flexibility of prices as captured by the frequency of price changes and increases the synchronisation between price and wage changes. WDN research based on the survey data shows that there is a significant positive impact of the frequency of wage changes on that of prices, whereas the effect in the opposite direction is not significant. One factor reducing the pass-through is the degree of competition. This evidence of a substantial, but partial, pass-through of wages into prices is more difficult to obtain using micro data. Pass-through coefficients vary from very small (e.g. in studies for France and Italy) to sizeable (in Sweden). A study of the impact of changes in minimum wages on restaurant prices in France does find a full long-run pass-through.

Finally, Section 5 briefly reviews the labour market adjustment during the current crisis. The labour market responses to the crisis have been very different across countries, depending on the depth of the recession, the nature of the labour market policies that have been adopted and labour market institutions. Overall, the response of wages to the large fall in demand has been very subdued: Only a few countries (Baltic states, Ireland) have seen a drop in compensation per employee. While it is too soon to do a full analysis of the labour market response, a preliminary analysis of the follow-up survey, in which firms were asked in the summer of 2009 how they have responded to the current fall in demand, shows that the combination of higher level collective wage bargaining and strong employment protection legislation reduces the ability to reduce wages and increases the adjustment through hours per worker, rather than through employment. Box 2, which provides a historical analysis of labour market developments in financial crises, highlights, however, that given the typically more persistent effect on growth the full impact on wages and employment may still be to come.

In conclusion, what are the main lessons to be drawn from the WDN's research?

First, a common theme of the description of the main findings is that collective bargaining institutions, employment protection legislation and product market competition are all important factors in shaping the response of wages, employment and prices to economic developments. Everything else equal, the combination of collective wage bargaining that takes place outside the firm, stringent employment protection and lack of competition in the goods market leads to higher wage rigidity and a stronger response of (typically temporary) employment to economic shocks. In turn, the rigidity of wages explains a relatively mute and persistent response of prices and inflation. Overall, this confirms the importance of institutions for the smooth functioning of the labour market, and the importance of wage rigidities for inflation.

Second, wage rigidities complicate monetary policy in at least two ways. First, they increase the cost of stabilising inflation in the face of cost-push and other shocks. On the one hand, this puts a premium on keeping inflation expectations anchored, as it is more costly to re-establish price stability once those expectations become unanchored. On the other hand, it suggests a medium-term orientation of monetary policy in the pursuit of price stability, in order to avoid excessive volatility in interest rates and economic activity. Second, nominal downward wage rigidity contributes to inflationary pressures and provides a rationale for maintaining a small positive inflation rate that allows easier adjustment of relative (real) wages and therefore "greases the wheels of the economy". Quantitative WDN research suggests that an inflation buffer of close to 2 percent is appropriate for these purposes.

Third, wage rigidities slow down the adjustment process across countries, regions and sectors, may lead to persistent inflation differentials within the euro area and induce competitiveness losses vis-à-vis more flexible economies, thereby reducing the cohesion of the monetary union. Moreover, heterogeneity in labour market institutions such as formal indexation schemes to past inflation may contribute to persistent inflation differentials in response to common shocks.

These lessons raise the natural question of what type of structural reforms would help speeding up the smooth functioning of monetary union. The WDN has not directly addressed this question. However, based on the findings summarised above two observations are worth making. First, reforms to improve the functioning of labour markets should be comprehensive to attain better labour market outcomes. Increasing wage flexibility, protecting workers rather than inefficient jobs, avoiding a dual approach to employment adjustment, as in the countries with high incidence of temporary employment, and improving competition in goods and services markets are mutually reinforcing mechanisms to ensure an efficient reallocation of resources in response to technological and other developments. Tackling only rigidities in wage bargaining, but not job protection, may not lead to the desirable degree of wage flexibility. Increasing only flexibility on the labour market side, but not competition, may simply induce a redistribution of rents, and not lead to a

more productive economy. Second, labour market institutions may serve other purposes, such as providing insurance, which by themselves may be welfare improving. Additionally, survey evidence on firms' responses regarding the reasons for wage rigidities suggests an important role for fairness and the fear that wage differentiation may negatively affect morale and productivity. Institutional reform therefore needs to be carefully designed in order to help to improve the productive capacity of the economy and to smooth the adjustment after negative shocks, but at the same time not undermine other welfare considerations. A comprehensive assessment of the consequences of employment protection legislation, collective bargaining procedures and unemployment benefits may help to improve the trade-offs associated with these considerations.

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WAGE DYNAMICS IN EUROPE
FINAL REPORT OF THE WAGE DYNAMICS NETWORK (WDN)[3]

1. Introduction

This report summarises the main findings of the Eurosystem/ESCB Wage Dynamics Network (WDN) since it started operations in July 2006. The WDN has studied wage and labour cost dynamics in the euro area and has investigated their implications for monetary policy, with the objectives of i) identifying the sources and features of wage and labour cost dynamics that are most relevant for monetary policy and ii) clarifying the relationship between wages, labour costs and prices, both at the firm and macro-economic level. Twenty four NCBs in the European Union have participated actively in the WDN research activities. In addition, observers from the Federal Reserve Board and the Bank of Japan occasionally participated in the meetings.

Regarding the first objective mentioned above, the WDN has been guided by the following research questions:

1. How do wages, labour costs and their various components adjust over the business cycle and in response to various shocks? Are there sectoral and regional differences? Have the dynamics of wages and labour costs been affected by changes in the monetary policy regime (the start of EMU)?
2. How often do wages change? Are wage rigidities nominal or real, symmetric or asymmetric? Do they differ across occupations, sectors, countries or regions?
3. What are the sources of wage and labour cost rigidity? How do they depend on goods and labour market characteristics, in particular what institutional settings are behind each type of rigidity? Have rigidities of wages and labour costs and their components been affected by structural changes in the macro

[3] This Report builds on the 2008 Progress Report of the WDN. It has been prepared and co-ordinated by Ana Lamo (ECB) and Frank Smets (ECB) with contributions from G. de Walque (NBB), G. Fagan (ECB), M. Krause (Bundesbank) and H. Le Bihan (Banque de France) on Section 4; J. Babecký (CNB), S. Fabiani (Banca d'Italia), S. Fahr (ECB), J. F. Jimeno (Bank of Spain) and C. van der Cruijsen-Knoben (De Nederlandsche Bank) on Section 5; and J. Kilponen (ECB), D. Lodge (ECB), R. Strauch (ECB) and J. Vanhala. (Bank of Finland) who prepared Box 2. This report has benefited from extensive comments received from WDN participants, the ESCB Heads of Research and members of the Monetary Policy Committee.

environment such as the globalisation of production, labour market reforms and changes in the degree of goods market competition?

Regarding the second objective, the following questions are being addressed:

4. How do changes in wages and other labour cost components at the worker's level translate into marginal costs and output and pricing decisions at the firm level?
5. How do wage and labour cost rigidities translate into price stickiness and inflation persistence?
6. What factors, such as labour market institutions, the degree of product market competition and globalisation, influence the extent and the speed with which labour costs pass through into output and prices?

To address these questions, the WDN is organised in four research groups: a macro, micro, survey and meta group. The table in Annex 1 provides a detailed list of the participants in each group. While the objectives of each group are aligned with the overall objectives of the WDN, each group has followed different lines of research.

1. The macro group explores the empirical characterisation of aggregate, country and sectoral wage and labour cost dynamics in the euro area, as well as the structural analysis of their determinants and their interaction with inflation dynamics.

2. The micro group uses micro data on wages and focuses its research on determining the nature and magnitude of possible rigidities across countries and sectors in the euro area and on the relationship between wage behaviour, labour cost and price setting at the firm level.

3. The survey group launched an ad-hoc survey on wage and price setting behaviour at the firm level that was conducted at the end of 2007/beginning of 2008. This survey provides a unique piece of information that is particularly valuable given the scarcity of comparable micro data available to researchers. In addition, the group conducted a follow-up, more limited survey during the summer of 2009 with the purpose of analysing firms' reactions to negative demand developments in the context of the current financial and economic crisis. Both surveys are described in more detail in Box 1.

4. The meta group has focused on summarising the overall WDN findings with the intention of drawing policy implications.

The current report builds on the 2008 WDN Progress Repor and extends it with an analysis of the macroeconomic and policy implications of the microeconomic findings, as well as an assessment of wage behaviour during the current crisis.

BOX 1: WDN surveys on wage and price setting behaviour at the firm level

A survey on wage and price setting behaviour at the firm level, developed within the WDN, was carried out by 17 national central banks (NCBs) between the end of 2007 and the first half of 2008 on the basis of a harmonised questionnaire. Recently, in the first quarter of 2009, Slovakia, Cyprus and Bulgaria have also conducted the survey based on the same harmonised questionnaire, while the survey is currently under way in Malta. This survey has led to a unique cross-country dataset on wage and price setting, unprecedented by international standards in terms of both geographical and sector coverage. The total sample size of the dataset is over 17,000 firms. By design, this sample is relatively balanced across firm size categories within each country and its sector distribution closely follows the distribution of employment in each country. The sample size, however, varies across countries both in absolute terms and relative to the population of firms in the country, therefore individual weights have been calculated for each firm to make the sample representative of the population of firms in each country and to account for the amount of workers that the firm represents in the population. This report concentrates on the 17 countries for which fully harmonized data is available (Austria, Belgium, Czech Republic, Estonia, France, Greece, Hungary, Italy, Ireland, Lithuania, Luxembourg, the Netherlands, Poland, Portugal, Slovenia, Slovakia and Spain). In addition, and when possible, evidence for Germany, Bulgaria and Cyprus is included.[4] The sector coverage comprises: manufacturing, trade, market services, non-market services, financial services and construction. The survey deepens our understanding of wage-setting practices, the frequency of price and wage changes, and the links between wage and price rigidities. It makes available new evidence on the extent and reasons behind different types of wage rigidities. Moreover, it covers other margins of cost adjustment beyond base wages such as bonuses, flexible forms of employment, etc. Finally, the survey addresses differences in firms' wage adjustments to alternative shocks. Overall, the unified survey is designed to widen our understanding of the effects of different labour market institutions on wage-setting practices.

Directly surveying firms to analyse wage adjustments has several generic advantages, including that it allows gathering information at the firm level that otherwise would be very difficult to collect. Nevertheless, several shortcomings inherent to ad hoc surveys such as low rates of response, potential misunderstanding in interpreting the questions, etc. should be kept in mind. In addition, the findings from the original survey refer to firms' behavior during a period of relatively stable growth and moderate levels of inflation in the majority of the countries examined. In order to examine the robustness of some of these findings in the current economic crisis, ten EU NCBs (Austria, Belgium, Czech Republic, Estonia, France, Italy, Luxembourg, the Netherlands, Poland, and Spain) conducted a follow-up, more limited survey during summer 2009.

The purpose of this follow-up survey is to analyse firms' wage setting behaviour and reactions to the negative demand shock in the context of the financial and economic crisis that started in fall 2008. The total sample of this follow-up survey covers around 5,700 firms. It was obtained by contacting the same firms that participated in the first survey. The average response rate was 53%. The characteristics of the follow-up survey regarding sampling, sector coverage, etc. are similar to those of the original WDN survey. Annexes 2 and 3 give an overview of the main characteristics of both surveys for each country. The harmonised questionnaires of both surveys contained a core set of questions, which were submitted by all countries. The questionnaires were further adapted to account for specific country characteristics and differences in institutional frameworks.

This report is organised as follows. After this introduction, Section 2 serves as a background to the study of wage rigidities and the linkages between wage and price setting in the following sections. It reports on some of the structural, medium-term features of labour markets in EU countries. In particular, Section 2.1 reports on a number of WDN projects that have characterised wage bargaining institutions and it highlights the main features of the European bargaining institutions that the WDN has found relevant in various studies.

[4] Unfortunately, the survey questionnaire for Germany was not fully harmonised. Data for Bulgaria and for Cyprus have not yet been pooled into the common data set.

Section 2.2 describes the WDN cross-country findings on the evolution and determinants of the wage structure and changes in inter-sectoral wage differentials in 9 EU countries. It relates these changes to changes in worker and job characteristics on the one hand, and to macroeconomic and structural trends on the other hand. Section 3 summarises the WDN micro findings on wage and price dynamics. Section 3.1 focuses on wage changes and wage rigidities. It first discusses the frequency, timing and synchronisation of wage changes (Section 3.1.1. and Section 3.1.2.) drawing on the information collected by the WDN survey and on studies on wage changes based on country-specific micro data. Section 3.1.3 presents some evidence on indexation and more generally on firms' policies to adjust wages to inflation. Section 3.1.4 focuses on the dynamics and determinants of wages of newly hired workers versus wages in continuing jobs. Section 3.1.5 summarises the evidence regarding downward nominal and real wage rigidity in European countries derived both from micro data following the International Wage Flexibility Project (IWFP) methodology and from the WDN survey and gives an overview of the incidence of different ways of adjusting labour costs, other than changes in base wages, used by firms. Finally, Section 3.1.6 focuses on how wages respond to shocks. Then Section 3.2 summarises the evidence on the interrelation between prices and wages. Section 3.2.1 focuses on the synchronisation of wages and price changes and Section 3.2.2 on how wages feed into prices.

Section 4 discusses the macro and policy implications of a number of findings presented in the previous sections. The discussion is organised around an estimated New Keynesian model that incorporates the features suitable to represent these findings. Section 4.2.1 presents the basic model and its extensions. Then the model is estimated in Section 4.2.2. Section 4.3 explores the macro and policy implications of the WDN findings in the light of the model. It examines the implications of the way wages are staggered, the duration of wage contracts, and the clustering of wages at the beginning of the year (Section 4.3.1), as well as other forms of real wage rigidity, namely wage indexation (Section 4.3.2) and rigidity of wages for newly hired workers (Section 4.3.3). Finally, Section 4.3.4, discusses the macro findings on downward wage rigidity and the implications of the evidence for monetary policy.

Section 5 concludes with some remarks on what we have learned from the micro and macro analysis regarding the role of institutions (Section 5.1) and on how the labour market has responded across countries in the current crisis with a focus on the role of institutions in that response (Section 5.2).

2. Medium-term features: Institutions and wage structure

As a background to the study of wage rigidities and the linkages between wage and price setting in the following sections, this section reports on some of the medium-term features of labour markets in selected EU countries. In particular, the section reports on a number of WDN projects aimed at characterizing wage bargaining institutions (Section 2.1) and the wage structure or distribution (Section 2.2) in these EU countries.

2.1. Wage bargaining institutions

Wage bargaining and other wage setting institutions play an important role in determining the dynamics of wages. As will be discussed later in this report, the WDN has repeatedly found evidence of the relevance of bargaining institutions in explaining some of the cross-sectional differences in the dynamics of wages. More generally, there is an extensive literature concerning the role of wage bargaining institutions in shaping labour market outcomes, wage levels, wage dispersion and wage flexibility. For a recent survey, see Freeman (2007).

Although the theoretical literature assigns an important role to wage bargaining institutions and an extensive empirical literature tries to quantify this role, the measurement of institutions remains difficult, and comparable information at an international level is still limited. The most comprehensive time series of quantitative information on union density, bargaining coverage, coordination and corporatism as well as minimum wages for a number of OECD countries is available from the OECD (see for example Elmeskov, Martin and Scarpetta, 1998). However, information for some EU countries is not available. Other international organisations such as the European Commission, the European Industrial Relations Observatory (EIRO) and again the OECD (e.g. in their Employment Outlook 2004, 2005) provide more detailed qualitative information, from ad-hoc studies, on particular aspects of wage setting institutions. Often this information is, however, difficult to compare across countries due to its non-standardised nature and the different coverage of countries, periods and institutional features.

Two key initiatives taken by the WDN address these problems by providing information on wage setting in a common format. First, the WDN collected information on national and sectoral collective wage bargaining institutions using a standardised questionnaire designed within the WDN and answered by national experts from 23 NCBs of the European Union, plus the US and Japan. The resulting dataset

provides information for two points in time (1995 and 2006), four sectors of activity (agriculture, industry, market services and non-market services) and the aggregate economy of the countries considered. The information collected includes not only institutional aspects like union density, coverage and coordination, but also other aspects that can be related to the relative flexibility/rigidity of wages across countries, such as the average length of wage agreements and elements considered during wage negotiations. Furthermore, it considers the role of the government in the determination of private sector wages and the incidence of minimum wages and wage indexation. For details, see Du Caju *et al*. (2008). Second, the WDN firm survey on wage and price setting (see Box 1) provides information at the firm level on several institutional features affecting wage setting: the degree of centralisation and coverage of wage bargaining and indexation mechanisms.[5] This information while having the advantage of being part of a firm level dataset is consistent with cross country data available at more aggregate, country and sector level.

The rest of this section will focus on three wage bargaining features that have been found to be particularly relevant in a number of the studies discussed in this report: union density, coverage of collective agreements and the level at which collective negotiations take place.

Union density.

There is a large heterogeneity across countries in the degree of trade union density measured as the percentage of employees affiliated with a trade union; it ranges from well over 70% in Denmark, Finland and Sweden to less than 10% in most of the Central and Eastern European (CEE) countries, France, Spain and also the US. Additionally, trade union density varies across sectors, being highest in the non-market services sector followed by the industrial sector and lowest in market services and agriculture. The level of trade union density has declined over the past decade in practically all European countries. Table 2.1 gives details on the evidence from the NCBs questionnaire and compares it with available information from the OECD and EIRO.

[5] The country sample differs from that of the WDN NCB questionnaire, the survey does not include US, Japan, UK, Sweden, Finland and Denmark, but in addition includes Estonia, Lithuania, and Slovenia.

Table 2.1 Union Density
(percentage of employees)

Source	WDN Questionnaire	WDN Questionnaire	OECD 2004	OECD 2009	EIRO 2006	EIRO 2009
Reference year	1995	2006	2000	2007	2000/4	2007/8
Austria	46	35	36.5	31.7*	33	35
Belgium	52	57	55.6	52.9	49	51.5
Bulgaria	na	na	na	na	na	*17.6*
Cyprus	60	65	na	na	70	58*
Czech Republic	L	L	27	21.0*	22	22
Denmark	89	82	74.4	69.1	80	69
Estonia	L	VL	na	na	14	7.6
Finland	78	69	76.2	70.3	71	74
France	8.2	VL	9.7	7.8	8	8***
Germany	28.7	21.7	25	19.9	8	22**
Greece	L	VL	na	23**	20	28
Hungary	19.7	16.9	19.9	16.9	17	16.9***
Ireland	27.6	45.8	na	31.7	38	31.4
Italy	L	L	34.9	33.3	34	34***
Japan	22.7	18.1	21.5	18.3	na	na
Lithuania	VL	VL	na	na	14	10
Luxemburg	51	48.1	33.6	41.8**	46	46
Netherlands	28.4	26.8	23.2	19.8	25	24
Poland	33	15	14.7	14.4*	17	16
Portugal	L	L	24.3	18.7***	17	22
Slovakia	na	na	na	23.6*	30	20
Slovenia	M	L	na	na	44	44
Spain	VL	VL	14.9	14.6*	16	17
Sweden	H	H	81.1	70.8	77	68
United Kingdom	29	25.8	32.2	28.0	29	28
United States	14.9	12.5	12.8	11.6	na	na

Sources: OECD 94-97: OECD Employment Outlook 1994, p.84 and 1997, p. 71; OECD 2009: OECD Employment Outlook 2009; EIRO 2009: EIRO country information (http://www.eurofound.europa.eu/eiro/country_index.htm). Notes: *, **and *** stand for 2006, 2005 and 2004 respectively as reference year Note: 0%<VL=Very Low<25%, 26%<L=Low<50%, 51%<M=Moderate<75%, 76%<H=High<100%.

Coverage of collective agreements.

In spite of the decline of trade union density over the past decade, a large proportion of workers are still covered by some kind of collective wage agreement. Moreover, extension procedures, which make a collective bargaining agreement binding for all employees and employers within its usual field of application, even if they did not sign the agreement, are still widespread in Europe. The coverage rate is high in euro area and Scandinavian countries and much lower in non-euro-area EU countries. In Austria, Belgium, France, Greece, Italy, the Netherlands, the Nordic countries, Portugal and Slovenia the coverage ratio is between 80% and 100% and has remained stable or has even slightly increased over the last decade (see Table 2.2). In contrast, coverage is low in most CEE countries (between 30% and 40%) and even lower

in Lithuania where it is similar to the level in Japan and the US (less than 20%). Collective agreements coverage is generally higher in large firms and is more common for high-skilled employees and full-time employees.

Table 2.2 Coverage of collective agreements
(percentage employees)

Source	WDN Questionnaire	WDN Questionnaire	W&H 2000	OECD 2004	EIRO 2006	EIRO 2009	WDN survey
Reference year	1995	2006	1996	2000	2000/4	2007/8	2006
Austria	> 95	98	na	95	98	98-99	94.5
Belgium	> 90	> 90	na	90	96	96	87.8
Bulgaria	na	na	na	na	na	30	na
Cyprus	M	M	na	na	68	63	32.2
Czech Republic	L	M	na	25	35	35	50.1
Denmark	79	83	55	80	83	83	na
Estonia	na	L	na	na	22	25	8.7
Finland	> 90	> 90	95	90	82	90	na
France	93.3	97.8	90	90	90	90	66.9*
Germany	72	59	83	68	65	61	na
Greece	H	H	90	na	65	65	91
Hungary	45.1	38.5	45	30	42	25.5	18.4
Ireland	na	na	na	na	na	44	40.7
Italy	H	H	90	80	70	70	96.7*
Japan	20.2	16.1	na	15	na	na	na
Lithuania	VL	VL	na	na	15	15	15.6
Luxembourg	M	na	na	na	58	60	43.5
Netherlands	81	81	80	80	81	84	67.6
Poland	M	L	na	40	35	30	19.3
Portugal	H	H	na	80	87	90	55.0
Slovakia	na	na	na	na	50	35	57.1
Slovenia	~100	~100	na	na	100	96	na
Spain	82.5	78.5	82	80	81	60.3	96.8
Sweden	H	H	85	90	92	91	na
United Kingdom	34.5	33.5	48	30	35	34.6	na
United States	16.7	13.6	na	14	na	na	na

Note: * reference year 2004. Sources: OECD 1997: OECD Employment Outlook 1997; W&H (2000): Waddigton and Hoffman (2000); OECD 2004: OECD Employment Outlook 2004, Chapter. 3; EIRO 2009: EIRO country information (http://www.eurofound.europa.eu/eiro/country_index.htm).

Centralisation of wage bargaining.

Economic theory often predicts that the degree of centralisation in wage bargaining should have an impact on economic performance. In general, agreements bargained at the firm and occupational levels are more flexible than those bargained at sector or national level and are likely to give firms a greater margin of manoeuvre to react to economic circumstances. While a large empirical literature (see Aidt and Tzannatos, 2005 or Flanagan, 1999) concludes that it is difficult to find a robust relationship between the centralisation of wage bargaining and economic outcomes, the WDN studies often find it relevant for several topics

analysed. This is probably due to the use of firm level data from the WDN survey on the relevance of the various levels of bargaining.

According to the evidence collected by the WDN and other evidence summarised in Table 2.3, there is some heterogeneity across countries regarding the levels at which bargaining takes place. In the euro area countries, sector-level agreements are the most common and tend to dominate (i.e. cover the largest proportion of workers), while firm-level agreements even if they are also common in many euro area countries, are not the dominant ones. In contrast, wage bargaining systems are highly decentralized and predominantly organised at the firm level in the Czech Republic, Estonia, Hungary, Poland, Lithuania, Luxembourg, the UK and the US. Sectoral or national levels of wage agreements existed in some Eastern European countries in the mid 1990s, but no longer play a significant role. There is no evidence of significant heterogeneity in the wage bargaining level across sectors within countries.

Table 2.3 Dominant level of bargaining

Source	WDN Questionnaire	WDN Questionnaire	OECD 2004	EIRO 2006	EIRO 2009	WDN survey
Reference year	1995	2006	2000	2000/4	2007/8	2006
Austria	ind / occ	ind / occ	ind	ind	ind	higher
Belgium	ind	ind	ind	firm	firm	higher
Bulgaria	na	na	na	firm/ind	firm	firm
Cyprus	na	na	na	firm	firm	firm
Czech Republic	firm	firm	firm	firm	firm	firm
Denmark	firm / ind	firm / ind	firm / ind	ind	ind	na
Estonia	firm	firm	na	firm	firm	firm
Finland	ind	central	central	cross-ind	ind	na
France	firm / ind	firm / ind	firm / ind	firm	firm	higher
Germany	ind / reg	ind / reg	ind	firm/ind	firm/ind	higher
Greece	na	na	na	na	na	higher
Hungary	firm	firm	firm	firm	firm	firm
Ireland	central	central	ind / central	central	central	higher
Italy	ind	ind	firm / ind	ind	ind	higher
Japan	ind	ind	firm	na	na	na
Lithuania	na	na	na	firm	firm	firm
Luxembourg	firm/ind	firm/ind	na	firm	firm/ind	Higher
Netherlands	ind	ind	ind	ind	ind	higher
Poland	firm	firm	firm	firm	firm	firm
Portugal	ind	ind	ind / central	firm/ind	ind	higher
Slovak Republic	na	na	na	ind	firm/ind	firm
Slovenia	central	ind/central	na	ind/central	ind/central	higher
Spain	ind / reg	ind / reg	ind	ind	ind/central	higher
Sweden	ind / occ	ind / occ	ind	na	na	na
United Kingdom	firm	firm	firm	firm	firm	na
United States	firm	firm	firm	na	na	na

Sources: OECD 1997: OECD Employment Outlook 1997; W&H (2000): Waddigton and Hoffman (2000); OECD 2004: OECD Employment Outlook 2004, Chp. 3; EIRO 2009: EIRO country information (http://www.eurofound.europa.eu/eiro/country_index.htm). Ind=industry level, occ=occupation level, higher= higher than firm level.

Even though the dominant level of bargaining has not changed much, according to various EIRO reports there has been a general trend towards more decentralisation in a number of countries. For example in the Nordic countries the change-over to sector agreements is ending a long era of centralised bargaining, in addition these sector agreements often provide for significant firm level bargaining. Another example is Germany where firm level agreements are spreading quickly, although industry level bargaining is still the dominant one. Even in Spain where the bargaining structure has remained stable over the years, there has been an increasing number of company agreements since 2005. A remarkable exception to this trend towards decentralisation is Ireland.

All in all, even if there is still significant heterogeneity in wage bargaining institutions across Europe, two broad groups of countries can be identified. The first group mainly consists of countries with a broadly regulated system of wage bargaining, which is quite typical of Western European countries (Austria, Belgium, Cyprus Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Sweden, Slovenia and Spain). This group is characterised by the existence of extension procedures, a high level of collective agreement coverage, and the dominance of sector-level wage bargaining. The second group gathers the countries where the wage bargaining system is largely deregulated. This group includes the CEE countries (Czech Republic, Estonia, Hungary, Lithuania, and Poland) and the UK in the EU and also the USA and Japan. Du Caju *et al* (2008) perform a cluster analysis based on a larger number of institutions using the information collected in the NCB questionnaire and identify within the first group a sub-group of countries where some indexation of wages to inflation is prevalent and the government plays an important role in the labour market (Belgium, Cyprus, Finland, Luxembourg, Slovenia and Spain).

Another labour market institution that has been found relevant across WDN studies is employment protection legislation (EPL). The OECD has made a remarkable effort to quantify this variable (See Table A5.1 in the Annex). EPL is particularly high in Luxemburg, Spain, Portugal and Greece. The EU countries with lower EPL are Ireland, the UK and Slovakia. The OECD's EPL indicators show a falling trend over the last decade (less restrictive EPL). The reduction has been largest in Italy, Greece, Portugal, Slovakia and Sweden. In contrast, EPL has become more restrictive in Poland, Hungary, and Ireland.

2.2. Wage structure: characteristics and changes

Changes in the wage distribution

The evolution and the determination of the wage structure across different workers, occupations and sectors has been the subject of a large literature. Most of these studies have focused on the US and the UK and have provided ample evidence that the wage distribution has widened since the 1980s. There is, however, still an open debate about the nature, causes and the timing of this trend. Some authors claim that the widening of the US wage distribution was a one-time event associated with changes in labour market institutions (de-unionisation, changes in the minimum wages, etc.) and compositional effects (changes in labour force features), while others claim that it has continued throughout the 1990s and 2000s and was due to skill-biased technological change.[6] Regarding Europe, the conventional wisdom is that changes in the wage structure have been less marked than in the US (with the exception perhaps of the UK), and that the lack of wage flexibility and some labour market institutions have resulted in wage compression, which is in turn responsible for the increase in unemployment among unskilled workers in the 1980s and early 1990s (Krugman, 1994). More recently some empirical studies have documented changes in the wage structure of some European countries that seem similar to those observed in the US, but happened a few years later.

Despite the growing empirical literature on wage structure, there is no systematic accounting of cross-country differences in changes in the structure of wages across EU countries over the past decade. The WDN has contributed to filling this gap. Christopoulou, Jimeno and Lamo (2009) systematically examine cross-country differences in changes in the structure of wages in nine EU countries (Austria, Belgium, Germany, Spain, Greece, Hungary, Ireland, Italy and the Netherlands) over the period 1995 to 2002. The sample period slightly varies depending on the country. Annex 4 contains details on the sample used for each country and a brief description of the Structure of Earning Survey (SES), which is the dataset used in the analysis. In addition, a number of detailed country-specific projects were undertaken (Pointner and Stiglbauer, 2008 for Austria, Dybczak and Galuscak, 2008 for the Czech Republic and Christopoulou and Kosma, 2009 for Greece). These studies examine how real wages have changed during the sample period at different points along the wage distribution and disentangle the part of the observed changes in wages that is attributable to changes in the labour force and/or changes in job characteristics (compositional effects) from those due to changes in the returns to these characteristics (the so-called return effects). One should note that the compositional effects can be of a different nature: while changes in some characteristics of the

[6] For evidence on the first view see Di Nardo *et al*. (1996) and Lemieux (2006); for evidence on the second, see Autor, Katz and Kearney (2008), for the UK see for example Machin and van Reenen (1998) and their references.

labour force such as age, education or gender could be taken as predetermined or exogenous, changes in job characteristics (such as sector, tenure, etc.) are often the result of changes in supply and demand.

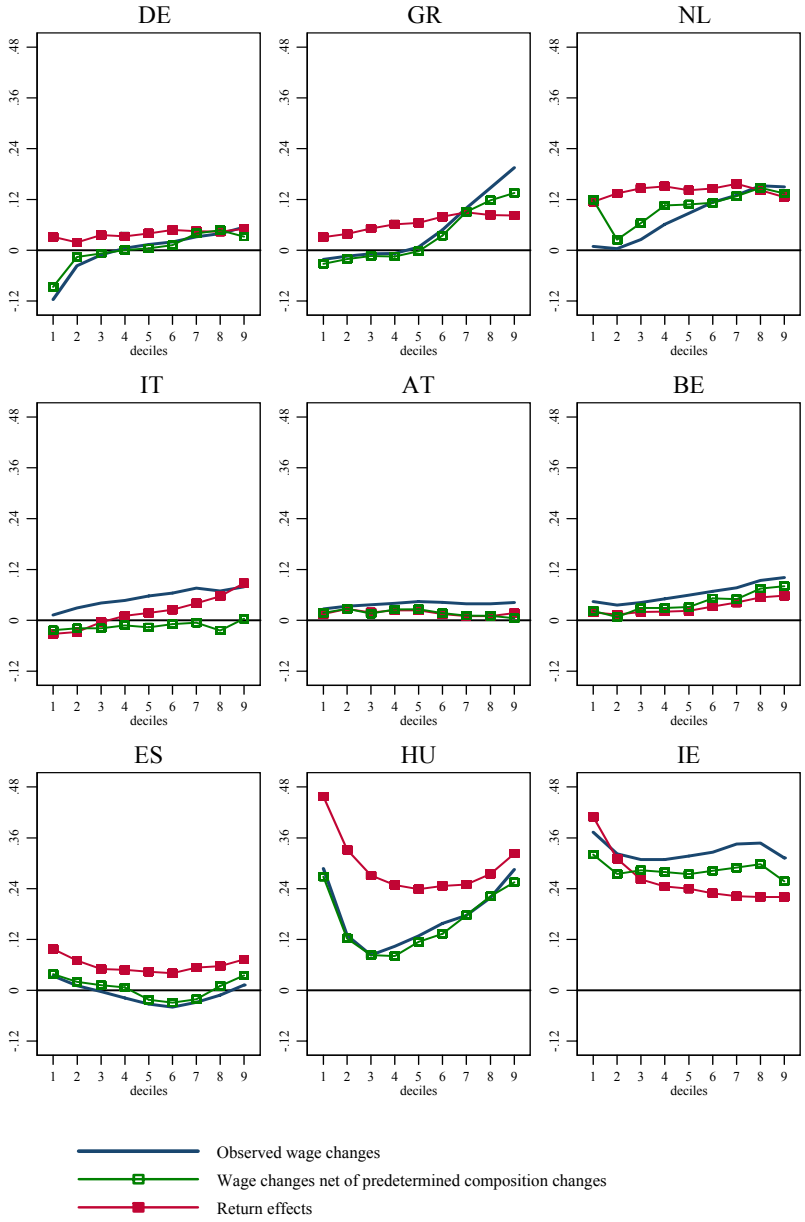
Changes in the distribution of wages across income levels between 1995 and 2002 show different patterns across the nine EU countries for which the WDN has available data. During this period, real wages have increased along the whole range of wage levels in these countries. There are only two exceptions: the lowest paid jobs in Germany and wages in the middle part of the wage distribution in Spain.

Figure 2.1 gives an overview of the magnitude and pattern of the changes observed in (log) hourly wage at each decile of the wage distribution for the whole worker population (blue line). In the Netherlands, Germany, Greece, Italy and Belgium wage growth rates trend upwards along the wage distribution, which is associated with a widening of the wage distribution. This apparent widening of the wage distribution remains after controlling for composition effects due to exogenous changes in worker's characteristics (green dotted line). However, in three of these countries, namely Netherlands, Germany and Greece it disappears when, in addition, one controls for changes in job characteristics (such as sector, tenure, etc.). In fact, once both kinds of compositional effects are controlled for, wage increases are roughly constant along the whole wage distribution (red dotted line). This suggests that composition effects due to changes in job's characteristics are responsible for the observed widening of the wage distribution in these countries. In Belgium and Italy, the widening of the observed wage distribution is less pronounced and holds after controlling for both kinds of compositional effects; in other words the widening of wage distribution is attributable to return effects.

In contrast, in Hungary, Ireland and Spain the observed wage distribution has become more compressed, as the larger wage increases have taken place for low paid jobs. This finding is even strengthened after controlling for composition effects and therefore attributable to return effects. In Austria, wage changes from 1995 to 2002 are positive, very small and also constant along the wage distribution.

In sum, the substantial exogenous changes in the composition of the labour force that have taken place in European countries over this period have hardly played any role in shaping the distribution of wage changes. While it is the contribution of demand and supply and more generally of economic and institutional developments that has been driving wage changes, mostly by affecting the returns to employee and job characteristics (Spain, Hungary and Ireland, and Belgium and Italy), but also by inducing compositional shifts (Netherlands, Germany and Greece). These results are quite similar across gender.

Figure 2.1 Real Wage changes and its components by decile



Source: Christopoulou, Jimeno and Lamo (2009). SES data.

The role of economic developments in the evolution of the wage distribution is confirmed when examining the responsiveness of changes in the wage structure in EU countries to macroeconomic and structural trends. The main findings are that observed changes in technology are positively associated with wage increases, with the effect being stronger for very high and very low paid jobs – a typical symptom of the routinisation hypothesis that technological change affects most positively non-routine tasks which are more

prevalent at the tales of the distribution. Globalisation is also associated with wage increases, but less so for the lowest wages.

It is notable that, while composition effects have been negative in Ireland, Belgium, Italy and Austria (very small in the last three cases), returns effects have been positive for all the nine countries of our sample, except for Italy at the lower end of the wage distribution. This result for Italy is consistent with the opening wage gap between younger new entrants and older workers in Italy, as documented in Rosolia and Torrini (2008).

Wage differentials across sectors

The WDN has also examined changes in relative wages across sectors and how these sectoral wage differentials relate to recent macroeconomic trends and institutions. Cross-sectoral differences in wages of workers with identical individual features and identical working conditions is typically interpreted as a sign of non-competitive features in the labour markets, such as efficiency wages (Krueger and Summers, 1988) or rent-sharing. Changes in these differentials are usually read as changes in the degree of competition of the labour market (see, for instance, Saint-Paul, 2005, Koeniger, Leonardi and Nunziata, 2007). Recent work on wage differentials for European countries includes several papers produced within the Pay Inequality and Economic Performance (PIEP) project, which used 1995 SES data. However there is no systematic accounting of cross-country differences in changes in sectoral wage differentials over the past decade. The WDN, using two waves of the SES data, has undertaken the task of examining relative wages across sectors. Du Caju *et al* (2009) summarise the WDN evidence on wage differentials across sectors or industries of eight EU countries (Belgium, Germany Greece, Hungary, Ireland, Italy, Netherlands and Spain) and a large number of sectors (from 30 to 48 depending of the country). In addition, a number of country specific papers examine the issue in detail for the respective countries (see for example Du Caju *et al* 2009 for Belgium, Nicolitsas, 2009 for Greece, and Galuscak and Pertold, 2008 for the Czech Republic).

There is evidence of systematic wage differentials across sectors or industries. The ranking of the sectors in terms of observed wage differentials is rather similar across countries and remained broadly unaffected between 1995 and 2002, while their dispersion varies across countries. Dispersion is relatively high in Hungary, Spain and Ireland and relatively low in Belgium and Germany.

These observed differentials cannot be fully explained by a large set of observed worker, job and firm characteristics. Differentials after controlling for these characteristics are still sizable and very persistent.

Furthermore, there is no evidence to support that these could be due to other unobservable worker characteristics. All in all, the evidence confirms the existence and persistence of wage differentials across similar workers, in similar jobs, but different sectors, in the eight EU countries of the sample. When exploring the role of industry specific characteristics and labour market institutions, Du Caju *et al* (2009) show that rent sharing and institutions play a role (and interact) in explaining these inter-industry wage differentials. Indeed, industry rents are positively correlated with industry wage differentials supporting the view that industries share rents with their workers (see Table 2.4, columns 1-5). The negative relationship between sectoral competition and industry wage differentials (columns 2 and 3) equally support rent sharing theories, the understanding being that more intense product market competition implies lower rents to be shared. Columns 4 and 5 show that rent sharing is more intense, the higher the percentage of firms with a firm-level collective agreement in the industry and the higher the collective agreement coverage. It should be noted that despite being small, the changes in wage differentials from the first to the second wave in our sample are significantly correlated with the change in industries' rents (see Column 6 Table 1). Finally, a fact that stands out (not shown in the table) is that the dispersion of conditional wage differentials is correlated with labour market institution indicators, suggesting that countries with stricter employment protection legislation and countries with a higher degree of bargaining co-ordination exhibit narrower wage dispersion. Overall, the evidence supports rent sharing, although with the available data other non-competitive explanations of the conditional differentials cannot be formally excluded.

Genre, Kohn and Momferatou (2008) also document wage differentials across sectors, using a panel of macro data for the euro area countries for the period 1991-2002. Even though they are unable to control for worker, job and firm characteristics, they find that average workforce characteristics and average firm-related characteristics explain part of the differentials, but country and sector idiosyncratic factors play a major role.

TABLE 2.4 Rent sharing and institutions as explanations of wage differentials

	(1)	(2)	(3)	(4)	(5)	(6)
			Levels			Change
Rents	0.049***		0.038***	0.074***	0.045***	0.026*
Real gross operating surplus per worker (GOS)	(0.014)		(0.011)	(0.020)	(0.016)	(0.015)
PM competition						
% of small firms in the industry		-0.347***	-0.295***			
		(0.057)	(0.076)			
Bargaining structures						
% firms with firm-level collective agreement *GOS				0.030*		
				(0.016)		
Collective agreement coverage* GOS					0.062***	
					(0.020)	
Observations	**526**	**517**	**423**	**229**	**206**	**260**
R^2	0.18	0.24	0.37	0.51	0.60	0.08

Source: Du Caju *et al.* (2009). Notes: Dependent variable is estimated industry wage differentials (as deviations from a measure of aggregate wage) after controlling for a large number of observed characteristics . SES data.. OLS regressions weighted by the average sample size of the regression used to calculate the wage differentials. Robust s.e. in brackets. *** p<0.01, ** p<0.05, * p<0.1. All regressions include country dummies and where appropriate also wave fixed effects. In column (6) GOS is measured as the change between the two waves.. GOS is not available for Ireland; information on the share of small firms per industry is missing for Greece. The sample in columns (4) and (5) include only the second wave since the bargaining structures data are only available at one point in time.

3. Wages and prices: The micro evidence

A proper understanding of the patterns, sources and implications of wage and labour cost dynamics is an essential requirement for the effective conduct of monetary policy. The findings from the previous Eurosystem research network, the Inflation Persistence Network (IPN), suggest that inertial wage behaviour is an important factor behind price stickiness in the euro area (see Altissimo *et al*, 2006). These findings place wage-setting policies at the heart of central banks' concerns. In addition, the flexibility of wages is also of great importance for the proper functioning of a multi-country monetary union with segmented national labour markets, such as the euro area. The degree of price and wage flexibility will, among other factors, determine the speed and cost of adjustment in the presence of emerging macroeconomic imbalances. Identifying the features of wage rigidities is of key importance in designing appropriate structural policies to facilitate this adjustment process. More generally, knowledge about the features and determinants of wage setting is key to understanding both the transmission process of monetary policy and the potential trade-offs with which monetary policy can be confronted, facilitates the shaping of monetary policy in the pursuit of price stability and helps increasing the precision of macroeconomic models and their empirical application to policy analysis.

3.1. Features of wage setting

Despite the relevance of the issue, empirical evidence comparable across countries and sectors on the features of wage setting and the stickiness of wages is rather scarce (see Taylor, 1999 for a review on the latter). The information collected by the WDN contributes to filling this gap. This section summarizes the WDN evidence on the features of wage setting, including: (i) the frequency of wage changes, (ii) time-dependence and synchronization of wage changes, (iii) prevalence and features of indexation and adjustments of wages to inflation, (iv) wage setting of new hires, (v) downward wage rigidity, and (vi) the response of wages to shocks. Section 3.2 will then deal with the interaction between price and wage dynamics.

3.1.1. The frequency of wage changes

The frequency of wage changes provides an indication of the degree of wage stickiness. It is an important parameter for macroeconomic analyses, where estimates of wage and price change frequencies can be used to calibrate price and wage stickiness in standard DSGE models with Calvo mechanisms.

Existing information on the frequency of wage changes is rather scarce and dispersed. The WDN survey provides new and unique information on the frequency of both price and wage changes at the firm level. The relevant evidence from the WDN survey is presented in Druant *et al*. (2009). In addition, several country studies conducted in the context of the WDN add to this evidence. Heckel, Montornes, Le Bihan (2008) and Lünnemann and Wintr (2009a) use micro economic datasets for France and Luxembourg respectively and Knell and Stiglbauer (2009) studies collective agreement data for Austria.

A major finding from the WDN survey is that wages change relatively infrequently. The typical frequency of wage change is once per year. On average, over all countries considered, 60% of the 17,000 firms surveyed report that they change wages once a year; while 26% change wages less frequently (see Table 3.1). The survey shows that firms change prices more frequently; only 40% of firms report that they change prices once a year and 7.4% that they change less frequently. As a result, the average duration of wages (about 15 months) is longer than the average duration of prices (about 9.5 months).[7] These estimates are in line with other estimates obtained from consumer and producer price micro data by the IPN (Dhyne *et al*, 2006, Vermeulen *et al*. 2005). They are also consistent with estimates of average contract length in collective wage agreements (of between one and 1.5 years), although the latter may be an upper bound.

[7] Given the data has been collected in the form of a discrete distribution over several ranges of frequencies some technical assumptions are required to estimate these durations, see Druant *et al* (2009).

The degree of cross-country heterogeneity is noticeable. The percentage of firms responding that they change wages "more frequently than once a year" ranges from 2.6% in Hungary and 4.2% in Italy to 33.9% in Greece and 42.1% in Lithuania. In spite of the cross country heterogeneity, there is no significant difference in the frequency of wage changes between firms in euro-area and non-euro area EU countries as a group.

Table 3.1 Frequency of wage change (WDN survey)

	More frequently than once a year	Yearly	Less frequently than once a year	Never/don't know
Total	**12.1**	**59.7**	**25.4**	**2.8**
Euro area	**11.4**	**59.9**	**26.7**	**2.7**
Austria	6.9	84.1	5.9	3.1
Belgium	22.0	64.8	9.8	3.4
Cyprus[1]	28.5	58.1	13.4	0.0
France	19.7	74.1	5.2	1.1
Greece[1]	33.9	56.4	9.7	0.0
Ireland	9.2	71.8	12.9	6.1
Italy	4.2	26.9	64.6	4.3
Netherlands	11.1	69.9	16.9	2.1
Luxembourg	7.0	93.0	0.0	0.0
Portugal	5.9	82.2	8.4	3.5
Slovenia	27.2	65.6	5.9	1.3
Slovakia	7.8	69.3	20.7	2.3
Spain	11.9	84.1	2.5	1.5
Non-Euro area	**14.0**	**59.5**	**23.2**	**3.3**
Czech Republic	11.5	64.1	23.0	1.4
Estonia	19.9	64.4	10.5	5.2
Hungary	2.6	75.0	12.2	10.2
Lithuania	42.1	44.0	7.5	6.4
Poland	13.6	56.3	28.2	1.9

Source: Druant et al. (2009) and WDN calculations. Notes: percentage of firms changing wages at each frequency. Figures weighted by employment weight, rescaled excluding non-responses. 1 The split up between frequencies of wage changes has to be interpreted differently for Greece and Cyprus, as the options never/don't know were not allowed in the Greek and Cypriot questionnaire. Results for Cyprus are not included in the aggregates.

The country differences in wage change frequencies are larger than those of price change frequencies, while the degree of cross-sector heterogeneity in the frequency of wage changes is limited, compared to that of price change frequencies. This is consistent with the findings in Druant et al (2009) that product market characteristics such as the degree of competition and the labour share are significant determinants of differences in the frequencies of price changes (rigidity), whereas institutional factors such as wage bargaining institutions influence wage rigidity (see Table 3.2). In particular, more frequent price adjustments are associated with higher intensity of competitive pressures and exposure to foreign markets, as well as with a lower share of labour costs in total costs (consistently, prices are found to be stickier in

business services). Conversely, wages tend to be more flexible in the presence of firm-level collective wage agreements whereas the stringency of employment protection legislation (EPL) and the coverage of collective agreements act in the opposite direction. Regarding the influence of bargaining institutions, an extreme example could be Italy where wage negotiations are conducted mainly at the national level and in that context wages are changed only every two years. Finally, larger firms do change wages more often than small firms. This result holds even when one controls for the sector.

Table 3.2 Price and wage rigidity
(frequency of wage and price changes)
(ordered probit estimates)

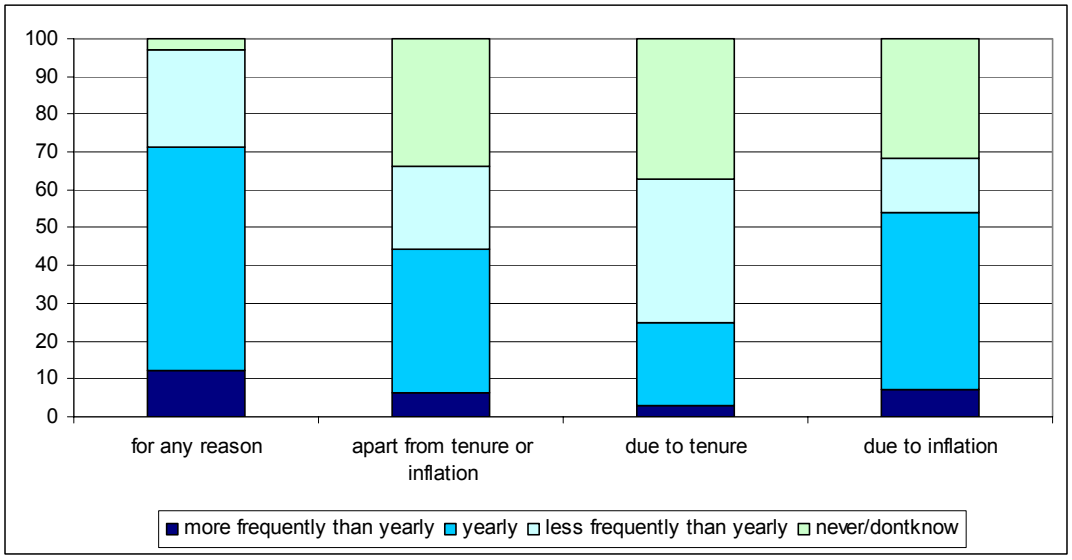
	PRICES	WAGE
Construction	-0.369**	-0.198**
Trade	-0.77**	0.108**
Market services	-0.035	0.12**
Financial intermediation	-0.672**	0.21*
20-49	-0.018	-0.094*
50-199	-0.124**	-0.207**
>200	-0.168**	-0.331**
Labour cost share	**0.508****	0.054
competitive pressures	**-0.301****	0.01
Export (% of sales)	**-0.139***	-0.013
share of white collars	**0.167****	
share of high skilled workers	**0.087***	
workforce turnover	**-0.15****	**-0.144****
share of bonuses on total wage bill	0.01	**-0.172****
collective agreement outside the firm	-0.067	**-0.055**
collective agreement at the firm level	-0.03	**-0.112***
coverage of collective agreement	0.055	**0.089***
EPL		**0.104****
Country dummies	yes	yes
Observations	5340	8993

Notes: (*) and (**) denote statistical significance at 5% and 1%, respectively. Source: Druant *et al*. (2009). The dependent variable increases with the degree of rigidity, ranging from 1 to 3, where 1=wages changed more frequently that once a year and 4=wages changed less frequently than once a year.

There is also a correlation between the frequency of wage changes and the presence of (formal or informal) indexation mechanisms of wages to inflation. Indeed when asking firms about the frequency of wage changes due to inflation, tenure or other sources, it is remarkable that inflation stands out as the most important factor triggering frequent wage adjustment (on an annual or infra annual basis), while the frequency of wage changes due to tenure is the lowest (see Figure 3.1).

Figure 3.1 Frequency of wage changes

(*percentages*)



Druant *et al*. (2009), Weighted figures (weights based on employment), rescaled excluding non-responses. Germany not included in the calculations.

3.1.2. Time dependence and synchronisation

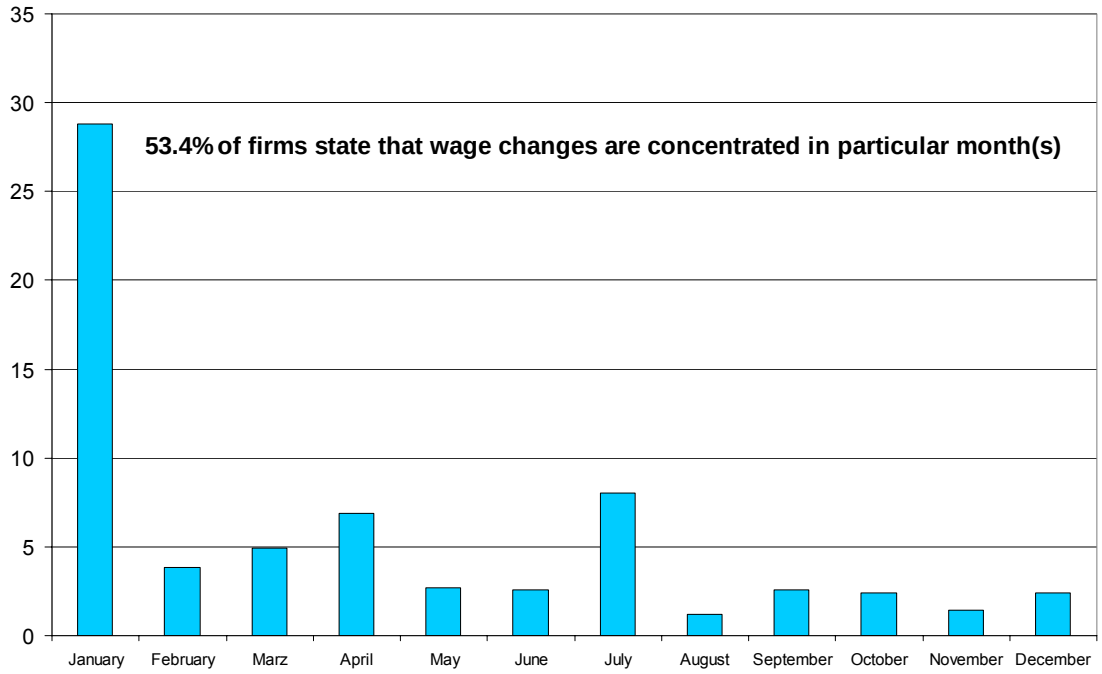
Another relevant source of nominal wage rigidities is the timing of wage adjustments. In order to account for the fact that firms do not change wages in response to every shock, the literature has modeled firms' strategies either as a time-dependent process, where the timing of the adjustment does not depend on the state of the economy, or as a state-dependent one when it does. In the presence of frequent shocks, the former might lead to stickier wages than the latter, provided that the time frame is quite large and the cost of adjustment is low. These different wage setting strategies have implications for monetary policy. In particular, the degree of bunching of wage-setting decisions may affect its transmission to the real economy (see for example Olivei and Tenreyro, 2007).

Both the WDN survey results and available micro data suggest that there are regular patterns in the timing of wage changes. Indeed, about 54% of the surveyed firms report that wage changes are concentrated in a specific month. Among the firms that declare such a "time-dependent" pattern, wage changes are mostly concentrated in January (see Figure 3.2). Overall, about 30% of wages are changed in a systematic fashion in such a month. The prominent role of January in wage changes is a feature observed in every country, although in the case of France an important proportion of wage changes also concentrates in July. However, the percentage of firms that report a time-dependent wage-setting rule, as well as the degree of staggering

within the year, is subject to substantial cross-country variations. In general, time dependence is much less important in non-euro-area countries, probably due to the much lower incidence of collective bargaining.

Figure 3.2 Timing of wage changes

Percentage of firms that concentrate wage changes in (a) particular month(s)



Source: Druant *et al*. (2009) and WDN calculations. Note: weighted figures, weights based on employment, rescaled excluding non-responses. Germany not included in the calculations.

Overall, the timing of wage changes is characterized by a mix of staggering and synchronisation. There are wage changes at any given month, but there is a peak in wage adjustment in January.

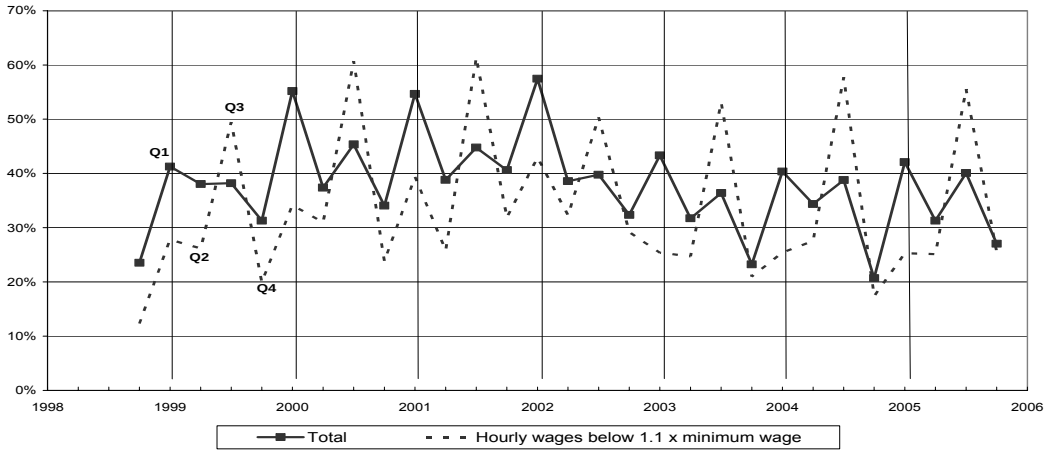
The broad patterns of the frequency and timing of wage changes emerging from the WDN survey evidence are confirmed by the analysis of micro data available at an infra-annual level. The peak in the frequency of wage changes at the beginning of each year is consistently found in micro data studies. Using quarterly data from collective agreements in Austria over the period 1980 to 2006, Knell and Stiglbauer (2009) report that on average 46% of wage agreements are signed in the first quarter of the year. Heckel *et al.* (2008) report the quarterly time series of the frequency of wage change in France over the period 1998-2005 (see Figure 3.3)**.** There is a peak in the first quarter, all over the sample period. The second peak in the third quarter is related to the indexation mechanism of the minimum wage, which is updated on the first of July, and is more clearly observed for low-wage workers. Overall, all these studies report a mix of wage staggering and synchronisation (in the first quarter), although the extent of staggering varies across countries. Based on an

administrative monthly data set, Lünnemann and Wintr (2009a) report that 75% of the overall wage changes in a typical year in Luxembourg take place in months with wage indexation and in January. On average, more than 25% of all wage changes occur in January, reflecting the predominant share of collective wage agreements entering into force in this month. This suggests that the frequency of wage adjustment in Luxembourg may overstate the true degree of wage flexibility at the discretion of the firms.

Also the estimate of the frequency of wage change and duration of wage spells with quantitative micro data remains in line with the survey evidence.

Figure 3.3 Frequency of base wage changes (France)

Percentage of wage earners that change base wages each quarter



Source: Heckel *et al.* (2008). Data from ACEMO survey.

Evidence from micro studies on the role of inflation in triggering more frequent wage changes is mixed. For example, Heckel *et al*. (2008) find a limited role for elapsed inflation in explaining the probability of a wage change. The study relates to a period of low and stable inflation. Focussing on Hungary, Katay (2008) reports that the average number of wage changes was 1.2 in 2000 and has gone down to 1. This change could be related to the decline in inflation in Hungary in the first part of the decade.

Also confirming survey evidence, Heckel *et al*. (2008) and Lünnemann and Wintr (2008) report for France and Luxembourg respectively that heterogeneity across firm size is significant. Other things being equal, larger firms do change wages more often than small firms.

3.1.3. Indexation and adjustment of wages to inflation

As discussed in Section 3.1.1 inflation stands out as the dominant factor triggering frequent wage adjustment (at an annual or infra-annual frequency; see Figure 3.1). Although sectoral heterogeneity is quite limited in this respect, the variability across countries is instead remarkably large. While in Luxembourg. Austria, Belgium or Spain over 80% of firms change wages annually or more frequently due to inflation, in Italy only a small fraction of firms do so.

Formal indexation of wage changes to inflation based on legislative provisions for the economy as a whole is relatively rare in Europe. It applies only to three European countries: Belgium, Cyprus and Luxembourg. However, indexation can also be less formal, e.g. when there is no regulation covering the whole economy but the incorporation of price increases in some segments of the labour market is widely accepted. In addition, it is also possible that some types of wages are automatically indexed according to law - often minimum wages - while others are not. The WDN collected country and sector specific information on this formal and less formal indexation mechanisms via the NCB's questionnaire that was answered by national experts from 23 NCBs of the European Union, plus the US and Japan (for details see Du Caju *et al,* 2008 and section 2.1 of this report).

In addition, the WDN survey collected information on the prevalence of firm policies to adjust wages to inflation at the firm level. Firms were asked whether or not they have a policy that adapts changes in base wages to inflation. If so, firms were asked to report whether the adjustment is automatic or not, is subject to a formal rule or not, and whether it refers to past or expected inflation[8]. On average about one third of the more than 17,000 firms surveyed do have an internal policy that adapts base wages to inflation. Of these, nearly half adopt an automatic indexation mechanism, mostly based on past inflation. The other half has a policy that adapts wages to inflation without applying any formal rule. There is some variability across sectors; firm's policies linking base wages to inflation are less common in market services and more widespread in financial intermediation and construction. In most of the cases the link is not formal and tends to be backward looking.

Table 3.3 summarises the survey evidence on the relevance across countries of these firm-level policies of adjusting base wages to inflation. For comparison the last column of the table gives information on formal and informal country level indexation as reported in Du Caju *et al.* (2008). A considerable fraction of firms in every country of the sample, with the exception of Italy, has some kind of adjustment of wages to inflation at work. This adjustment is very common in Luxembourg (almost 100%), Belgium (98%) and

[8] The Netherlands did not include this question in the national questionnaire.

Spain (70%); in these countries automatic indexation mechanisms are prevalent. Italian firms, on the other hand, do not (or almost do not) adapt wages to inflation. Expected inflation seems to be more important than past inflation for wage setting only in the case of Portugal. However, in a number of countries with wage bargaining outside the firm, the replies at the firm level may not capture the entrance of inflation expectations in wage demands in the negotiation process.

Table 3.3 Policy of adjusting base wages to inflation: country overview

	Firm-level policy of adjusting base wages to inflation					Country-level indexation (*)
	Automatic		Informal		Total	
	Past	Expected	Past	Expected		
AT	8.6	1.3	9.2	2.8	23.6	Very low
BE	98.2	0.0	0.0	0.0	98.2	High
BG*	7.9	2.5	8.9	3.3	22.6	
CZ	7.0	5.2	27.9	24.1	59.8	None
CY*	38.7	2.1	6.4	1.8	48.5	High
DE	*na*	*na*	*na*	*na*	*27*	None
EE	2.9	1.8	35.4	20.8	53.8	None
ES	38.3	16.2	10.9	5.0	70.4	High
FR	8.9	2.0	21.2	8.0	33.1	Very low
GR	14.8	5.2	12.1	10.6	47.1	None
HU	7.2	4.2	14.0	5.9	33.0	None
IE	6.0	2.7	18.5	10.4	30.0	None
IT	1.2	0.5	2.6	1.5	6.2	Very low
LT	7,3	3.7	24.3	12.9	48.1	
LU	100	0	0	0	100	High
PL	4.7	2.5	17.3	6.1	30.6	Very low
PT	2.7	6.5	13.3	29.1	51.8	None
SI	20.3	2.7	32.2	5.1	60.3	Low
SVK	16.1	4.8	24.4	9.6	59.9	
Total	**13.2**	**3.9**	**12.7**	**6.9**	**35.7**	
Non euro area	**5.5**	**3.2**	**19.8**	**10.2**	**38.1**	
Euro area	**16.3**	**4.1**	**9.7**	**5.5**	**34.7**	

Figures weighted by employment weights, rescaled excluding non-responses. Source: Druant, *et al.* (2009). Euro area and total do not include Germany. (*) Percentage of workers covered by wage indexations clauses: Very low: 0-25%; Low: 26-50%; Moderate: 51-75%; High: 76-100%.Source: Du Caju *et al.* (2008). *Bulgaria and Cyprus are not included in the aggregates as data have not been pooled into the cross country data set, figures nevertheless are broadly comparable with the rest.

In general, adapting changes in base wages to inflation is a slightly less widespread practice in the euro area countries (34.7% of firms), than in the non euro area countries covered by the survey (38.1%) In the case of Germany, firms were not explicitly asked whether or not they have a policy that adapts changes in base wages to inflation. Nevertheless, when asked about the two main factors that determined the most recent wage increases, 27% of German firms replied that inflation was one of them.

The fact that about 35% of firms from seventeen different countries report having policies that adapt wages to inflation is not inconsistent with the more limited prevalence of indexation pointed out by institutional

evidence on wage indexation, because such policies do not necessarily imply the existence of a formal indexation rule. This is indeed the case of the Czech Republic, Estonia, Hungary, Ireland, Lithuania, Poland and Portugal, where the vast majority of firms that have a policy that adapts changes in base wages to inflation indicate that nevertheless no formal rule is applied.

The analyses of available micro data provide additional information on the way aggregate prices and inflation feed in to wages. Heckel *et al.* (2008) estimate a model of wage dynamics at the individual level, allowing for infrequent wage changes using French data. The size of wage changes is found to be related to past and expected inflation, with a higher weight of past inflation. Knell and Stiglbauer (2009) estimate an econometric model for the change in collective bargained wages in Austria. Inflation expectations are found to have a significant impact on bargained wages, but past inflation is found to be insignificant. Indexation to (past and expected) inflation is, however, only partial because "reference norms" (that depend on the past development of wages) appear to play a more substantial role than inflation developments. The empirically most relevant reference norm is the "leadership norm", that is the change in the wage rate in a leading sector (the metal industry).

On the whole, while formal indexation schemes are limited to a number of countries, about one third of European firms over 17 countries seem to have a policy that adapts somehow base wages to inflation.

3.1.4. Wages of newly hired workers

The distinction between wages of new hires and wages of incumbents has received renewed attention in the context of explaining labour market flows and unemployment volatility. Recent macro literature has argued that wages offered to newly hired employees may respond differently to aggregate labour market conditions than those of employees in ongoing employment relationships and that this is relevant as firms' hiring decisions depend on what the firm will have to pay to its newly hired workers rather that on the wages paid to incumbents (see for example Pissarides 2009 and Haefke *et al*. 2008).

Most micro evidence based on individual wage data for the US suggests that the wages offered to new workers are more responsive to changes in the unemployment rate than the wages of those workers in ongoing employment relationships. Pissarides (2009) surveys this evidence and concludes that, on average, a one percentage point rise in the unemployment rate is associated with a 3% decline in new workers' wages, whereas the corresponding elasticity for those in ongoing employment relationships is only about one-third of that. In contrast, survey evidence for US (Bewley, 2007) and Sweden (Agell and Lundborg, 2003) suggests that the wages of new workers are tightly linked to those of incumbents.

Research in the WDN contributes to this literature. While there is evidence from micro data that wages of new hires are more responsive to changes in the unemployment rate than those in continuing jobs, direct survey evidence suggests that for most firms internal factors are more important in driving wages of newly hired workers.

Using a matched employer/employee data set for Portugal, Carneiro, Guimarães, and Portugal (2008) were able to analyze the heterogeneity of wage responses to aggregate labour market conditions over 20 years in Portugal, distinguishing between new hires and existing workers. A one percentage point increase in the unemployment rate correlates with a falling wage for new hires by 2.5%. In contrast, wages in continuing jobs just fell by 1.5% on average. While this does not mean that wages for new hires are fully flexible, the degree of rigidity is much lower than for ongoing employment relationships.

In contrast, evidence from the WDN survey suggests that the wage of newly hired workers follow the internal pay structure of the firm rather than external or market conditions. In fact around 80% of the firms surveyed report that internal factors such as the collective agreement or the wages of similar employees in the firm are the more important factors driving wages of newly hired workers. When explaining their choice, firms allude to fairness considerations and the need to prevent a negative impact on effort. This is analyzed in detail by Galuscak *et al* (2009). Despite the overall finding that the wages of new workers are tightly linked to those of incumbents in all countries, there is significant cross-country variation in this respect. Cross-country differences are found to depend on institutional factors (bargaining structures): Countries in which collective agreements are more prevalent and collective agreement coverage is higher, report to a greater extent internal pay structures as the main determinant of hiring pay. Within country differences are found to depend on firm and workforce characteristics. There is a strong association between skills (positive) and tenure (negative) and the importance of external factors in determining the hiring pay. Product market conditions also seem to have an impact on what are the main determinants of hiring pay: competition increases the importance of external factors.

The findings in Carlsson, Messina and Nordström Skans (2009) are consistent with the survey evidence. Using matched employer-employee data for Sweden, they find that, once worker and firm heterogeneity (both observed and unobserved) has been taken into account, there are no differences in the response of wages of newcomers and incumbents to productivity shocks.

3.1.5. Downward wage rigidities

The debate about the implications that downward wage rigidity might have for the choice of the optimal rate of inflation has became topical during the recent period of moderate levels of inflation in the euro area.[9] This has triggered a growing body of empirical literature looking at whether wages are in fact subject to downward rigidity. Recent studies using micro data have focused on the distributions of wage changes across individual workers (Dickens *et al*, 2007) or sectors (Holden and Wulfsberg, 2007) to assess and estimate the extent of downward wage rigidity. Following the pioneering work of Blinder and Choi (1990), another branch of the empirical literature has relied on survey evidence to determine the prevalence and sources of downward wage rigidity.

In view of the potential importance of this topic, the WDN devoted considerable efforts to identifying and measuring the extent of downward wage rigidity (DWR) in European countries. In line with the existing literature, two types of downward rigidity were considered. First, downward nominal wage rigidity (DNWR) relates to the inability of firms to implement (and, correspondingly, the reluctance of workers to accept) reductions in nominal wage rates. Second, downward real wage rigidity (DRWR) similarly reflects the inability of firms to increase wages at rates below the prevailing rate of inflation.[10] In measuring DWR, two approaches were followed by the WDN. The first uses micro data on the wage changes of individual workers (either from surveys or administrative data) and estimates rigidities using the methodology pioneered in the International Wage Flexibility Project (IWFP) (see Dickens *et al,* 2007 for a summary). While the original IWFP work provided a comprehensive cross-country study of the incidence of wage rigidities, the coverage of European countries was incomplete and, in the case of some countries, the samples were very outdated.[11] For this reason, it was deemed useful to extend and update the IWFP analysis (see Messina *et al* 2008).[12] The second approach looks at DWR from the point of view of the firms using their responses to the questions in the WDN survey on wage setting. The WDN survey collected information on wage rigidity for the period prior to the current crisis and then again during summer 2009 to examine the robustness of the results in the recent economic crisis. Research at the WDN also explored the factors which explain the incidence of downward rigidities and the reasons for differences across countries.

[9] The debate goes back to the old question of whether inflation can "grease" the wheels of economy. Tobin (1972) argued that if central bankers aim at too low inflation rates they might hamper the functioning of labour markets as it will be difficult to cut wages while higher inflation would allow easier wage adjustments and "grease the wheels of the economy".

[10] Obviously, the case of zero inflation the two concepts become indistinguishable.

[11] In the case of Belgium, for example, the IWFP sample related to the period 1978-1985.

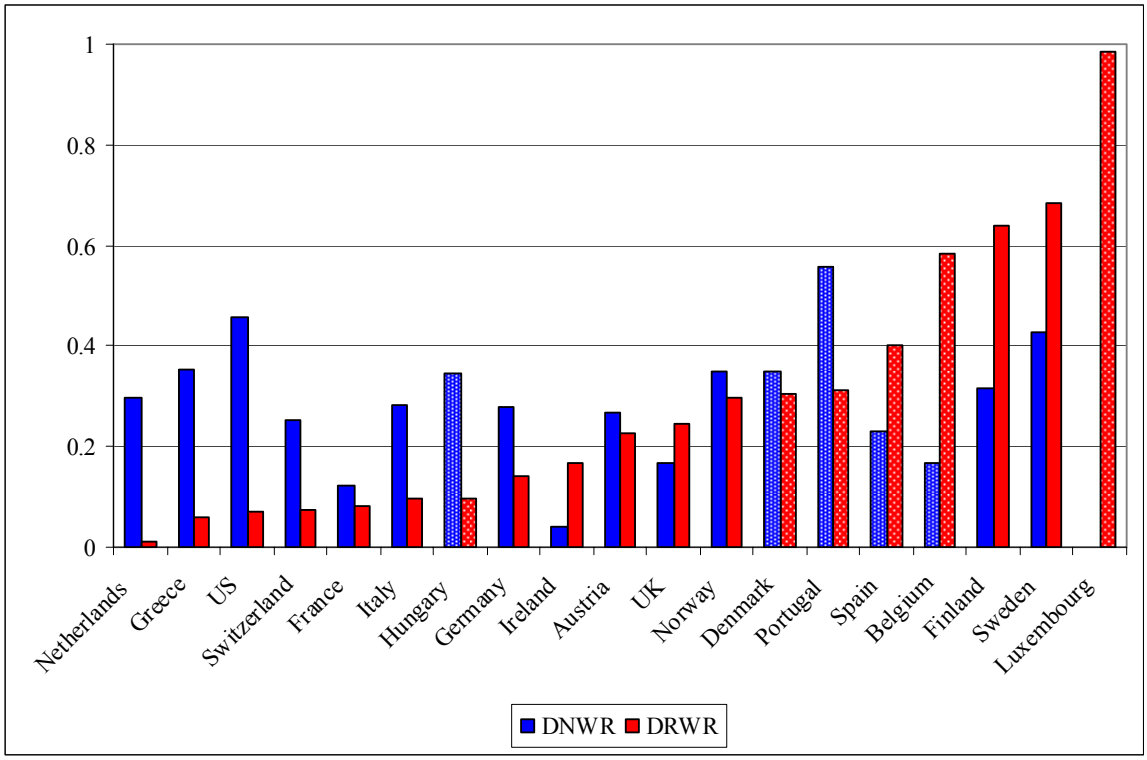
[12] In the context of the WDN, new results using the IWFP methodology were produced for Belgium (Du Caju *et al* 2009), Hungary (Katay 2008), Luxembourg (Lünnemann and Wintr, 2009b), Spain (Izquierdo *ongoing work*)

The essence of the IWFP methodology is a comparison of the actual wage change distribution with a notional wage change distribution which is assumed to prevail in the absence of DWR. For each country, histograms of wage changes are constructed based on the individual micro data. In order to correct for measurement error, a methodology described at length in Dickens and Goette (2006) is adopted in order to guarantee, to the extent possible, the comparability of results across countries and data sources. DWR is assumed to distort the wage change distribution. In the case of DNWR, there will be a bunching of wage changes at zero and a relative lack of mass at negative wage changes, both reflecting the absence of cuts in nominal wages. In the case of DRWR, a bunching of wage changes in the vicinity of the inflation rate together with a lack of mass below the inflation rate is expected, reflecting the lack of real wage cuts.

The main results of the IWFP analysis can be summarised by two indicators which measure the fractions of workers who are potentially subject to, respectively, downward nominal and downward real rigidity. These are shown in Figure 3.4 for a number of European countries (with the US as a comparator). These results show that there are marked differences across countries regarding the incidence of DWR. DNWR appears to be particularly prevalent in the US. For European countries the situation is more mixed. DNWR appears to predominate strongly in Germany, Greece, Italy, the Netherlands and Portugal while being somewhat more important than DRWR in France, Austria, and Norway. Elsewhere real rigidities appear to be more prominent, and are particularly strong in Luxembourg, Spain, Belgium, Sweden and Finland.

Messina *et al* (2009) using the IWFP methodology for four countries (Belgium, Denmark, Portugal and Spain) investigate the extent to which there are differences in DWR along other dimensions, such as across sectors and worker types. They find statistically significant differences across sectors in the pattern of DWR. Messina *et al* (2009) also find evidence of higher real wage rigidity for prime-age and white-collar workers in line with efficiency wage theories. Nonetheless, national factors are found to be the dominant factors, while the differences across sectors, worker types and firm types are more modest. Focusing on the case of Belgium, Du Caju *et al.* (2009) report similar findings. Lünnemann and Wintr (2009b) find that any potential differences in downward wage rigidity between occupational groups in Luxembourg are wiped out through the effect of full automatic wage indexation.

Figure 3.4 Downward nominal and real wage rigidity across countries.
IWFP Methodology. (*Fraction of workers*)



Source: the figures for Belgium, Denmark, Portugal and Spain are from (Messina *et al* 2009), figures for Hungary are from Katay (2008b), for Luxembourg are from Lünnemann and Wintr (2009b), the rest are IWFP figures from Dickens *et al* (2007). The measures from Dickens *et al* (2007) and the rest are not strictly the same kind of measure. Those from Dickens *et al* (2007) are simple measures from empirical distributions while those from the WDN papers are model based and have been corrected for measurement error.

Evidence on the incidence of DWR based on the original WDN firm survey is presented in Babecký *et al*. (2009a). DNWR is measured by the percentage of firms that have frozen base wages over a period of 5 years previous to the current crisis (the five years period covers 2002 to 2007 for most of the countries surveyed). The survey does not include a measure that directly captures DRWR. However, it is reasonable to expect that this will be closely correlated with the extent to which wages set by the firm are strongly linked to inflation and this is confirmed by empirical evidence comparing the survey and the IWFP measures of DRWR. Thus Babecký *et al.* (2009a) use as a proxy for RWR the percentage of firms for which there is an automatic link between wages and past or expected inflation.

A first key finding from the WDN survey is that nominal wage cuts among European firms, with the exception of Germany, are extremely rare. [13] Excluding the German data, only 2.3% of firms declared that wages were ever cut during the previous five years. Prima facie, this is strongly suggestive of DWR in Europe.

Table 3.4 Downward nominal and real wage rigidity across countries

Country	Wage freezes (downward nominal wage rigidity)	Indexation (downward real wage rigidity)
Austria	13.2	9.8
Belgium	11.8	98.2
*Bulgaria**	*9.9*	*10.4*
Czech Republic	26.5	11.8
*Cyprus**	*15.3*	*40.7*
Estonia	21.7	4.4
Spain	2.4	54.8
France	7.1	9.6
Greece	12.5	20.0
Hungary	5.9	11.2
Ireland	8.7	9.5
Italy	3.9	1.7
Lithuania	19.9	10.8
Luxembourg	8.9	100.0
Netherlands	23.2	na
Poland	10.0	6.9
Portugal	15.0	9.0
Slovenia	2.9	23.5
Slovakia	*20.9*	*21.1*
Total	**9.6**	**17.1**
Euro area	**8.1**	**20.6**
Non euro area	**13.4**	**8.5**

Source: Based on Babecký *et al*. (2009a). Notes: proportion of firms having frozen wages over the past five years and applying an automatic indexation mechanism. Figures are employment-weighted and re-scaled to exclude non-responses. * Bulgaria and Cyprus are not pooled into the cross country data set. Bulgaria, Cyprus and Slovakia are not included in the aggregates as data were collected during the current crises.

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Table 3.4 shows that real wage rigidity (as defined above) is a more widespread phenomenon (17% of firms) than DNWR (only 9.6%), consistently with the IWFP evidence cited above. There are sizeable differences between the EU countries and there is a high correlation across countries between survey-based and IWFP measures. Overall, non euro area countries in the sample are twice as likely to experience

[13] In the case of Germany, Radowski and Bonin (2008) report that 13% and 16% of firms in manufacturing and services, respectively, imposed wage cuts in the previous five years. Similarly, the incidence of wage freezes were is higher than in the other countries. This difference may reflect comparability problems with the survey but also the specific circumstances of the German economy during this period. In this regard, it is notable that aggregate wage and unit labour cost growth in Germany was significantly lower than in other euro area countries during this period. For Luxembourg, a similar finding is obtained on the basis of micro wage data. Lünnemann and Wintr (2009a) report an overall frequency of wage cut of less than 1% per month.

DNWR compared to euro area countries, and the reverse is true for real wage rigidity. DNWR appears stronger than average in the Czech Republic, Estonia, Lithuania, the Netherlands, Portugal and Slovakia.[14] It is considerably smaller than average in Spain, France, Italy and Slovenia. According to the measure adopted, real wage rigidity is especially prevalent in Belgium, Spain, Luxembourg and Slovenia, and less so in Italy, Estonia and Poland.

The survey also allows investigating the importance of various reasons preventing wage cuts. Babecký *et al*. (2009c) find that the two most important causes for avoiding base wage cuts were the resulting reduction in work morale and the possibility that the most productive workers would leave as a consequence. The third reason preventing nominal wage cuts in Europe are institutional restrictions, imposed either in the form of labour regulations or by collective agreements. Whereas earlier research on US data also confirms the relevance of the two first reasons, institutional restrictions do not seem to prevent wage cuts in the US.

Explaining differences in DWR

The evidence from both micro data on the wage changes of individual workers and from the WDN survey point to sizeable differences across countries in the incidence of DWR. Differences in national labour market institutions are a natural explanation. Indeed, the centralisation of wage setting and the degree of collective bargaining coverage have been related in the recent literature to the extent of downward wage rigidity. See, for example, Dickens *et al*. (2008), which investigated this relationship at the country level. Using the IWFP measures of DWR, Messina *et al*. (2009) find that the use of firm-level collective agreements has a negative impact on real wage rigidity, when looking at sector level data for Belgium, Denmark, Spain and Portugal. Bearing in mind that in the four countries under study the dominant level of wage negotiations is outside the firm (at the sector, province or national level), this suggests that some degree of decentralisation within highly centralised countries allows firms to adjust wages downwards, when business conditions turn bad. Babecký *et al*. (2009) instead use the WDN survey information collected before the recent crisis and find that DWR is related to workforce composition at the establishment level in a manner that is consistent with related theoretical models (e.g. efficiency wage theory, insider-outsider theory). They also find that wage rigidity depends on the labour market institutional environment. Collective bargaining coverage is positively related with downward real wage rigidity, measured on the basis of wage indexation. Downward nominal wage rigidity is positively associated with

[14] The Slovakian, Cypriot and Bulgarian surveys were conducted in spring 2009 and therefore the five years reference period may include part of the current crisis period, the 21% of freezes in Slovakia could therefore include reaction to the current economic crisis.

the extent of permanent contracts and this effect is stronger in countries with stricter employment protection regulations.

Alternative means to adjust labour cost

The relevance of downward wage rigidity depends on whether firms have other margins than base wages to adjust labour costs. The WDN firm survey provides unique evidence as it asks firms whether they have ever used other adjustment mechanisms to reduce labour cost. These mechanisms include the possibility to reduce or eliminate bonus payments, reduce or eliminate non-pay benefits, change shift assignments or shift premia, slow or freeze the rate at which promotions are filled, recruit new employees at lower wage level than those who left voluntarily, and encourage early retirement to replace high wage employees with entrants with lower wages. About 63% of the firms have used at least one strategy to reduce labour costs other than reducing base wages in the recent past, and 58% have used at least one of the six margins explicitly identified in the survey. Table 3.5 shows the percentage of firms in each country that reported adopting the various cost reduction strategies. The prevalence of individual strategies varies quite substantially across countries. While in Lithuania all workers have been affected by at least one of the strategies, in Portugal the percentage of affected workers is only 40% and similarly in Bulgaria. The reduction of bonus payments is less likely to be used by euro area than non euro area firms, with the exception of Italy where almost a quarter of firms report resorting to this alternative means of adjustment. Labour turnover instead seems to be an important element in euro area countries. Hiring new employees at lower rates than those who left the company or encouraging early retirement are the most commonly used methods in Belgium, France and Italy. In addition to the variation across countries, the choice of strategies also tends to differ across sectors. The use of cheaper hires to replace workers who leave the firm is the dominant strategy in most sectors. Firms in manufacturing report a relatively even spread across the different strategies. Energy and financial intermediation sectors are the most likely to target bonuses and benefits when trying to reduce cost. The various cost reduction strategies are not mutually exclusive and often firms follow more than one.

When exploring whether firms facing downward nominal wage rigidity can circumvent this constraint using alternative margins to reduce labour costs, Babecký *et al*. (2009) find that indeed such firms are more likely to use any of these strategies. Moreover, they also show that firms operating in a competitive environment are more likely to employ non-base-wage labour cost adjustment strategies. Firms characterised by a higher union coverage are more likely to use non-base wage margins of labour cost adjustment. Any sort of union involvement in wage negotiations (firm level, sectoral/national level or both) results in a higher likelihood of using non-wage adjustment mechanisms with respect to firms that are mainly characterised by individual negotiations. Moreover, they find that firms subject to nominal wage rigidities are much more likely to use

each of the six cost-cutting strategies. This indicates that there is some degree of substitutability between wage flexibility and the flexibility of other labour cost components. This substitutability is not limited by the presence of unions in wage setting.

Table 3.5 Labour cost adjustment strategies - Country-level statistics

Country	Reduce bonuses	Reduce benefits	Change shifts	Slow promotions	Cheaper hires	Early retirement	Use at least one strategy
Belgium	18.4	7.9	7.2	15.0	26.4	18.9	46.0
Bulgaria*	23.9	17.5	12.1	5.2	10.8	1.6	41.4
Czech Republic	32.2	7.5	11.1	1.9	8.7	8.9	67.9
Estonia	40.2	20.5	21.1	6.2	16.2	2.6	93.6
France	14.7	6.1	Na	15.4	39.0	30.3	58.6
Greece	20.4	12.4	Na	na	Na	na	83.5
Hungary	22.7	11.9	38.3	35.1	26.5	10.2	67.2
Ireland	16.9	7.8	16.0	9.4	37.0	9.8	90.9
Italy	25.6	21.8	26.0	34.0	45.6	20.2	71.2
Lithuania	41.0	25.0	19.9	10.6	17.9	2.7	100.0
Luxembourg	16.2	3.8	2.1	6.4	18.1	7.1	52.5
Poland	23.6	16.3	12.4	12.8	23.7	10.9	50.5
Portugal	13.7	8.4	10.7	14.0	16.2	0.0	39.5
Slovenia	13.5	12.8	9.1	18.9	15.8	8.9	57.5
Slovakia	33.2	23.0	13.6	8.4	10.4	na	65.9
Total	**22.8**	**14.8**	**15.7**	**19.7**	**31.8**	**16**	**63.1**
Euro area	**20.8**	**14.7**	**15.4**	**22.9**	**37.7**	**19.3**	**64.4**
Non euro area	**26.7**	**14.9**	**16.3**	**13.4**	**20.7**	**9.7**	**60.4**

Source: Based on Babecký *et al*. (2009) Notes: percentage of firms that use a given strategy, weighted by employment. Data for Austria, Germany, Netherlands and Spain and are not available. In the case of Greece the question was slightly different, in consequence the first column includes the proportion of firms that have reduced bonuses and benefits, as well as overtime hours, number of employees and have engaged in restructuring.* Bulgaria not included in the calculation of the aggregates.

3.1.6. The response of wages to shocks

Although the adjustment of wages is hampered by rigidity, wages are expected to potentially react to different types of shocks faced by the firm. The WDN survey elicits information on how firms would react to hypothetical and unanticipated changes in their business environment, common to all the firms in the industry. It considers two supply shocks, namely an increase in the cost of an intermediate input and a permanent rise in wages, and a slowdown in demand. For each of them, it assesses the relevance of price, margin, output and cost adjustment. Reducing costs is a strategy declared to be relevant or very relevant by 67% of firms in response to an increase in the cost of an intermediate input (cost-push shock), with the reduction in costs slightly more important than the increase in prices (see Table 3.8 in Section 3.2.1). In the case of a slowdown in demand, 78% of firms would try to reduce costs, whereas adjusting the price, margin

or output are relevant strategies for about half of the firms in each case.[15] 50% to 60% of the cost reduction implemented by firms takes the form of a reduction in labour costs (see Table 3.6). Looking more into the details of the policies followed to reduce labour costs, Table 3.6 shows that employment adjustment is substantially more widespread than wage cuts. While 36-39% of the firms would respond to adverse supply shocks by reducing the amount of labour, only about 12% would cut wages. The difference is even more pronounced in the case of demand shocks, as half of the firms would reduce the amount of labour. Only less than 2% would reduce base wages, while a more common but still modest reaction would be the adjustment of flexible wage components (10-12%).

Table 3.6 Cost adjustment after shocks

(percentages)

Cost-cutting strategy	Demand shock	Cost shock	Wage shock
Reduce non-labour costs	39.7	53.9	50.0
Adjust the amount of labour			
Reduce number of temporary/other employees	25.1	17.9	19.9
Reduce number of permanent employees	15.1	10.6	11.1
Reduce hours worked per employee	8.4	6.9	7.4
Adjust wages			
Reduce flexible wage components	10.5	9.5	11.6
Reduce base wages	1.2	1.2	---

Notes: Figures weighted by employment weights, rescaled excluding non-responses. Averages across countries in the harmonized sample with the exception of Germany, Greece Luxembourg and Slovakia. Source Fabiani *et al.* (2009)

Bertola *et al*. (2009) find that the institutional framework affects the cost cutting strategy in response to shocks. Collective wage agreements make wages more rigid and therefore, cost adjustment takes place mainly via laying-off temporary employees. Similarly, stronger employment protection pushes the adjustment to take place through the reduction of temporary employees. Overall, these two forms of labour market regulation tend to promote the duality of the labour force into a protected part and a part acting as a buffer against shocks.

Focusing on the case of Belgium, Druant *et al.* (2008) report that when reducing costs following an adverse shock, 60% of firms reduce employment, while only 14% adjust pay (and only do so through the flexible wage components). This is consistent with the evidence in Fuss (2009), who using individual wage data and firm-level information, finds that employment accounts for most of the wage bill adjustment of Belgian firms. In particular, on average, wage bill contractions result from employment cuts in spite of nominal

[15] However, firms generally adopt combinations of these strategies, the combination of reducing other costs and adjusting prices seems the most popular strategy among European firms. Between 60%-80% of firms, depending on the shock, indicate cost reductions as an important response strategy.

wage increases. Fuss (2009) also reports that labour force cuts are achieved by both reducing entries and increasing exits. Exits are due to more layoffs, especially in smaller firms, and wider use of early retirement, especially in manufacturing. Lastly, overtime hours, temporary unemployment and interim workers play a role but of limited importance in adapting hours worked to economic circumstances. A very small proportion of enterprises actually reduce working time following adverse shocks. Dhyne and Druant (2009) further investigated the large employment reaction to adverse shocks of Belgian firms compared to the average of European firms. They find that the factors underlying this reaction are centralization of wage bargaining, the automatic system of indexation, the limited use of flexible pay, the high share of low skilled blue collar workers, the labour intensive production process and the less stringent legislation against dismissal.

Complementing the evidence on the reaction of firms to common shocks, several studies within the WDN have analysed, using micro data, the reaction of wages to firm-specific shocks to total factor productivity. Katay (2008), Fuss and Wintr (2009a), Carlsson, Messina and Nordström Skans (2009) and Kilponen and Turunen (2009) have studied the reaction of wages to firm-specific total factor productivity in Hungary, Belgium, Sweden and Finland respectively. Overall, some reaction of real wages to productivity is found in all four countries. The elasticities are, however, very low ranging from 0.03 to 0.11 (see Table 3.7). Although the elasticities to firm idiosyncratic shocks are small, the effect on wages may not be that small because the volatility of these idiosyncratic shocks is substantial. Table 3.7 also shows that there is some heterogeneity across countries. While earlier work by Guiso *et al*. (2005) and Cardoso and Portela (2005) for Italy and Portugal respectively finds that wages are insulated with respect to transient idiosyncratic shocks at the firm level, in Hungary the response of wages to permanent shocks is twice as large as the response to transitory shocks and both are significant. Carlsson, Messina and Nordström Skans (2009) also find significant elasticities to permanent shocks, in this case for Swedish workers. Once they control for worker and firm, observed and unobserved, heterogeneity they find that in fact both stayers and newcomers in Sweden are insured against firm shocks. Similarly, Kilponen and Santavirta (2009) find support for the wage setting models with limited commitment, although there seems to be significant variation across industries and educational classes. A feature, observed in Belgian and Swedish data, is that average real labour compensation appears to be substantially more reactive to sector-specific than to firm-specific TFP shocks, probably reflecting the role of sector-specific collective wage bargaining in transmitting cyclical TFP shocks to labour compensation.

Table 3.7 Reaction of wages to firm-level Total Factor Productivity, elasticities.

	wage measure	*permanent*	*transitory*	*current*	*lagged*
HU: Katay	Firm's average net real earnings Full-time workers	**0.11**	**0.05**		
PO: Cardoso and Portela	Individual gross hourly earnings	**0.09**	(0.00)		
IT: Guiso, Pistaferri and Schivardi	Individual earnings full-time stayers	**0.07**	(0.005)		
BE: Fuss and Wintr	Firm's real average labour comp.			(0.02)	(0.01)
	Hourly compensation			**0.03**	(0.00)
FI: Kilponen and Turunen	Plant level average hourly wage			**0.05**	(-0.00)
	Individual level hourly wage			**0.02**	(-0.01)
SE: Carlsson, Messina and Nordström Skans	Individual earnings all	**0.045**			

No significant estimates in brackets

3.2. Price and wages dynamics

Next, we investigate the link between wage and price dynamics. Various pieces of evidence mostly from the WDN survey confirm that wages and prices feed into each other at the micro level and that there is a relationship between wage and price rigidity.

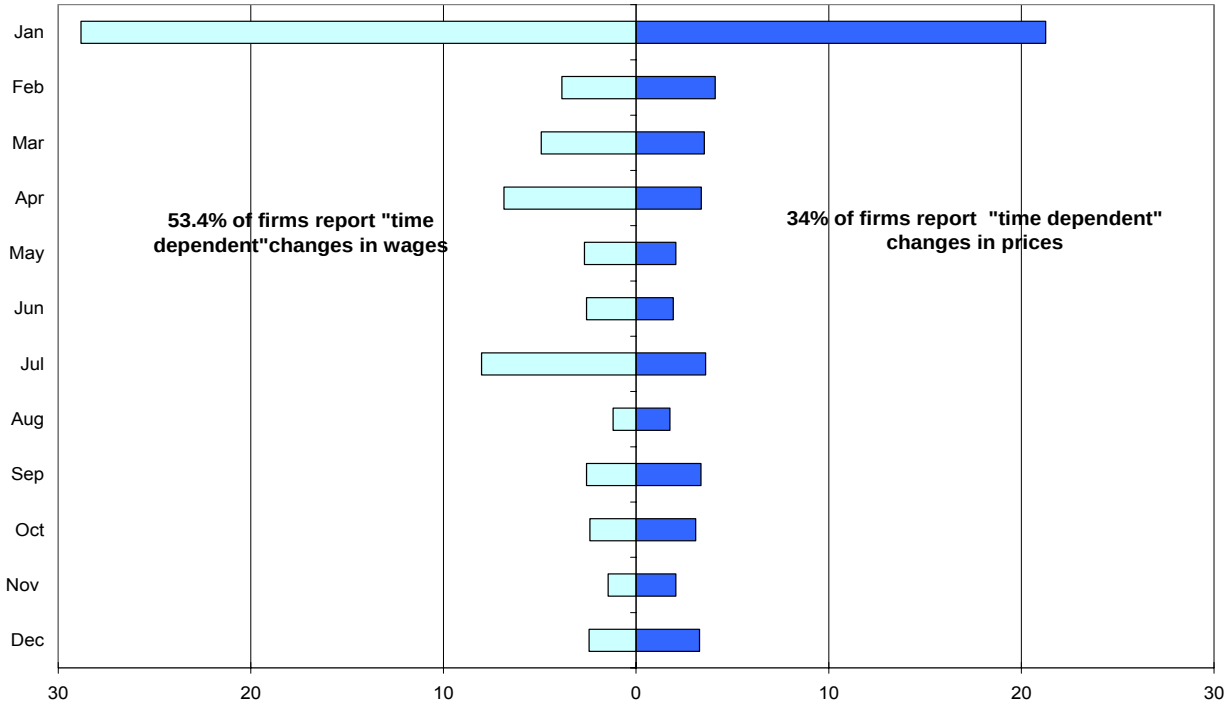
3.2.1. The synchronisation of wage and price changes.

One of the findings stemming from the survey evidence is that there appears to be some synchronisation between the timing of price and wage changes, with peaks in January in both cases (see Figure 3.5). Indeed, when looking at individual firms, it turns out that around half of those that change prices in January also adjust wages in the same month. This evidence is confirmed by the fact that, when explicitly asked about how the timing of price changes relates to that of wage changes within their company, around 40 % of firms acknowledge the existence of some relationship between the two (Figure 5). However, only 15 % state that this relationship is relatively strong. The finding that the majority of firms do not explicitly recognise a direct relationship between the timing of their "typical" price and wage change decisions does not automatically imply that the two policies are not related. Indeed,

other pieces of evidence arising from the WDN survey suggest that wages feed into prices at the micro level.

Figure 3.5 Timing of wage and price changes

Percentage of firms that change wages and prices in (a) particular month(s)



Source: Druant et al (2009) and WDN calculations. Weighted figures (weights based on employment), rescaled excluding non-responses. Germany, Bulgaria and Cyprus not included in the calculations.

3.2.2. How wages feed into prices

The existence and extent of the pass-through of wages into prices can be gauged by analysing the strategies firms declare to implement in reaction to shocks. Indeed, when asked to assess the relevance of different adjustments policies to a common permanent unexpected increase in wages about 60 % of firms reported that they would increase prices (see table 3.8). In a study based also on the WDN survey, Bertola *et al*. (2009) argue that the pass-through of wages into prices is particularly strong in firms with a high labour share, confirming previous evidence from the IPN that prices are stickier in sectors typically characterised by a high incidence of labour costs. The extent to which wages feed into prices is inversely related to the intensity of competitive pressures faced by the firms, their exposure to foreign markets and their size.

Table 3.8 Adjustment strategies to shocks

(firms answering "relevant" or "very relevant", percentages)

	Cost-push shock	Wage shock	Demand shock
Reduce costs	67.6	59.0	78.0
Adjust prices	65.6	59.2	50.5
Reduce margins	53.5	49.8	56.6
Reduce output	21.4	22.5	49.9

Notes: Figures weighted by employment weights, rescaled excluding non-responses. Greece, Slovakia, Cyprus and Luxembourg are non included and in addition Italy and Spain are excluded in the case of a demand shock.

Moreover, the WDN finds that the frequency of price changes varies substantially across sectors and in particular the frequency of price adjustment is lower in firms and sectors with high labour cost share, confirming previous results from the IPN. This suggests that the importance of labour costs and wages has an influence on price adjustments at the firm level. Druant *et al* (2009) investigate, within a multivariate framework, the potential factors that may lie behind the frequency of price and wage changes at the firm level, accounting for the likely simultaneity between price and wage changes. They find a statistically significant relationship from the frequency of wage changes to that of prices, whereas the effect in the opposite direction is not significant (See Table 3.9).

Lünnemann and Mathä (2009a) report for Luxembourg firms that approximately 40% of firms increase their prices after wages have changed due to automatic indexation. This is about twice as much as in the case of wages changes due to collective agreements or wage changes due to other reasons. Furthermore, both the extent and the speed of the pass-through from wages to prices are far from negligible. Up to 40% of the cost increase is passed on to prices and more than 50% of prices are adjusted within one quarter. With regard to the reverse relationship, almost 20% of firms indicated that wages increased after an increase in their prices, which in turn may potentially indicate the presence of second round effects.

Table 3.9 System estimates on price and wage change frequencies

(3 stage least squared)

	(1)		(2)	
	freq. of wage change	freq. of price change	freq. of wage change	freq. of price change
frequency of price change	**0.069**		**0.065**	
frequency of wage change		**0.507****		**0.135***
labour cost share		0.26******		0.284******
competitive pressures		-0.207******		-0.215******
export (% of sales)		-0.092*****		-0.089*****
share of white collars		0.106******		0.106******
share of high skilled workers		0.074******		0.066******
share of bonuses on total wage bill	-0.005		-0.052**	
workforce turnover	-0.08**		-0.073**	
collective agreement at the firm level	-0.051******		-0.031	
coverage of collective agreement	0.085******		0.028	
EPL	-0.126******		0.763******	
internal policy adjusting wages to prices				
country dummies	No	No	Yes	Yes
sector and firm size	Yes	Yes	Yes	Yes
Observations	5217	5217	5217	5217

Notes: (*) and (**) denote statistical significance at 5% and 1%, respectively. Source: Druant *et al*. (2009).

This evidence of a substantial but partial pass-through of wages into prices is more difficult to obtain using micro data. Loupias and Sevestre (2008) analyzed micro data underlying the Banque de France monthly business survey and found that wage changes have a significant impact on the probability and size of a price change, but this impact is low as compared to that of the price of intermediate goods. The elasticity of (desired) prices to wages is significantly smaller than the elasticity of desired prices to intermediate good prices.[16] Rosolia and Venditti (2008) analysed a yearly matched dataset of the Bank of Italy's Survey on Manufacturing Firms and balance sheet data. The elasticity of prices to hourly labour cost is found to be very low, in the order of 0.02-0.03. Carlsson and Nordström Skans (2008) analysed a high-quality matched firm-employee data set for the manufacturing sector in Sweden to study the relationship between prices and marginal costs, the latter being approximated by the unit labour cost. They find a sizeable contemporaneous elasticity of about 0.3. This elasticity still remains small when compared with the theoretical benchmark of elasticity 1 under monopolistic competition with exogenous mark-up. However, introducing expectations of future unit labour cost in the specification, as suggested by staggered contracts models, greatly reduces the gap to the theoretical benchmark.

[16] Due to the qualitative nature of the data, the level of the elasticity cannot be identified. Using CPI data for Luxembourg Lünnemann and Mathä (2009) found asymmetric effects of wage inflation on price. Aggregate cumulated wage inflation increases the probability of price change. Furthermore, automatic wage indexation is found to contribute positively to price changes and price increases and negatively to price decreases. Thus wage inflation and wage indexation have indeed important implications for the inflation process in Luxembourg.

The three studies above focus on manufacturing and there is no available empirical study relating to the services sector as a whole. However Fougère, Gautier and Le Bihan (2008) studied the impact of minimum wages on restaurant prices in France. They find that although restaurant prices are characterized by a substantial degree of nominal rigidity, the long-run pass-through of wages to prices is of the same order of magnitude as the low-wage labour cost share in production. In addition, they explain that due to discrete adjustment at the micro level, the pass-through from wages to prices may be econometrically difficult to detect with standard econometric tools.

Some factors that mitigate the intensity of the pass-through of wages to prices are revealed by the econometric analysis in Bertola *et al* (2009). Other things being equal, large firms and firms that face a larger degree of competition in the products market tend to choose less often to increase prices when faced with wage shocks. In the latter case a relevant explanation is that large firms have other margins of adjustment available. Finally, the data also suggest that price increases as a reaction to a wage shock are more likely in countries with higher employment protection.

4. Macro and policy implications

4.1. Introduction

This section covers the macroeconomic and monetary policy implications of the stylized facts that derive from the microeconomic and survey evidence of the Wage Dynamics Network. The discussion is organized around an estimated New Keynesian model that incorporates the features suitable to represent most of the relevant stylized facts. It also serves as a basis for the discussion of the original research conducted by members of the WDN macro group.

The main microeconomic and survey findings of the WDN this section will focus on are the following:

1. Wage staggering: wage setting is time-dependent. That is wages are typically set for a fixed period of time, typically about one year. Most firms indeed report that they change wages in a particular month once a year, and although wage contracts are largely staggered across firms, there is a noticeable element of synchronization with many wage changes at the beginning of the year.
2. Wage indexation: there are notable differences in the extent of indexation across countries in the euro area. The WDN survey, complementing institutional information, reports that on average one third of the firms have a policy that adapts base wages to inflation. Of these, half have an automatic

indexation mechanism, mostly based on past inflation, while the other half do not employ a formal rule linking wages to inflation. Formal indexation is particularly important in Belgium, Spain, Cyprus and Luxembourg.

3. Wage rigidity for newly hired workers: wages of incumbent workers are typically rigid, but for newly hired workers there are some differences depending on whether quantitative or survey data are considered. Overall, the WDN findings suggest substantial wage rigidity for new hires: almost 80% of the firms surveyed report that new hires' wages are not freely set and internal factors are the most important reason. In contrast, external labour market conditions are relatively more important in non-euro area countries.
4. Downward nominal wage rigidity is prevalent: nominal wages are rarely lowered in reaction to negative shocks. Downward real wage rigidity is less frequent, as real wage decreases are more often observed. But downward real wage rigidity is strong in those countries that have strong formal or informal wage indexation.

In the next subsections, the relevant theoretical concepts and aspects of the macroeconomic general equilibrium model are introduced. Then the stylised facts are discussed in turn. While the first three facts can be represented in one unified framework, downward nominal wage rigidity is introduced in a more substantial variation of the standard model.

4.2. The macroeconomic framework with labour market rigidities

4.2.1. Sticky prices and wages, wage indexation, and labour market frictions

The standard New Keynesian model with sticky prices and wages along the lines of Erceg, Henderson, and Levin (2000) and Smets and Wouters (2003, 2007), and extensions of it, is the relevant starting point for the analysis of the macroeconomic consequences of the labour market features reported above. This is due to the microeconomic details that can directly map the quantitative survey and micro evidence. Since these models are similar to DSGE models used at ESCB central banks, the implications reported here are of general applicability.

Generally, price and wages setters in the model have market power, due to a monopolistically competitive market structure in both product and labour markets. This gives rise to a mark-up of prices over marginal costs and to a mark-up of wages over workers' marginal rate of substitution. In the presence of price and

wage stickiness, these mark-ups endogenously vary in response to cyclical shocks. Furthermore, price and wage setting is forward-looking, as firms and workers need to take future market conditions into account.

Under the assumption of price setting according to Calvo (1983), where prices can only be adjusted infrequently, the familiar New Keynesian Phillips curve delivers the link between inflation and firms' marginal costs:

$$\hat{\pi}_t = \beta \cdot E_t \hat{\pi}_{t+1} + \kappa \cdot \hat{mc}_t$$

where $\hat{\pi}_t$ is the deviation of inflation from steady state, β a discount factor, E_t the expectation operator, and $\hat{mc}_t = \hat{w}_t - \hat{mpl}_t$ is the log-deviation of real marginal cost from steady state. Thus unit labour costs are the driving force of inflation variations around steady state inflation. The parameter κ is a function of the probability of price adjustment and real price rigidity, where the former can be calibrated according to WDN evidence.

A similar equation can be obtained for describing the behavior of wages, additionally allowing for partial indexation of wages to past inflation (following Smets and Wouters, 2003):

$$\hat{\pi}_t^w = \beta \cdot E_t \hat{\pi}_{t+1}^w - \gamma^w \left(\beta \hat{\pi}_t - \hat{\pi}_{t-1}\right) + \kappa^w \left(\hat{mrs}_t - \hat{w}_t \right)$$

where $\pi_t^w = w_{t+1}^n - w_t^n$ is nominal wage inflation (in deviation from steady state), κ^w is a function of relevant parameters (the degree of nominal wage rigidity in particular), and γ^w is the parameter governing indexation of nominal wages. Whenever they are not adjusted in the Calvo-manner, the logarithm of wages changes according to:

$$\hat{w}_t^n = \gamma^w \hat{\pi}_{t-1} + \hat{w}_{t-1}^n$$

Thus, when there is no indexation, i.e., γ^w is zero, those wages that are not adjusted in period t remain constant until the next negotiation. Otherwise, they are partially adjusted to past inflation: there is real wage rigidity. If $\gamma^w = 1$, then contract wages follow inflation perfectly, but are not affected by other economic variables. Estimation of the model below determines the degree of indexation.

In this setup, the ultimate driving force of wage inflation is the difference between workers' disutility of labour and real wages. In terms of the real wage level, this equation becomes

$$\hat{w}_t = \frac{\beta}{1+\beta} E_t \hat{w}_{t+1} + \frac{1}{1+\beta} \hat{w}_{t-1} + \frac{\beta}{1+\beta} E_t \hat{\pi}_{t+1} - \frac{1+\beta\gamma^w}{1+\beta} \hat{\pi}_t + \frac{\gamma^w}{1+\beta} \hat{\pi}_{t-1} + \frac{1}{1+\beta} \kappa^w \left(\hat{mrs}_t - \hat{w}_t \right)$$

Indexation introduces persistence into real wage dynamics, which in turn will make inflation dynamics more persistent. Expected inflation matters here because wage setters anticipate that, given nominal wage stickiness, their real wages fall if prices rise in the future. As for wage rigidity, a larger degree of nominal wage rigidity (translating into a lower κ^w) tends to dampen the impact effect of shocks on real wage changes.

The standard features that close this New Keynesian model are equations describing optimal consumption behavior (with habit formation), the evolution of the capital stock subject to investment adjustment costs, and a monetary policy rule. As mentioned, variants of the model are used at many central banks, and have also been used in contributions to the WDN (e.g., Knell, 2009, and De Walque, Pierrard, Sneessens and Wouters, 2009b).

The crucial extension to also analyse wage differences between newly hired and incumbent workers in the model has been provided by De Walque *et al*. (2009b). Their model introduces involuntary unemployment and hiring frictions in the labour market. After all, the New Keynesian framework features a labour market where all workers are employed and variations in labour input are only due to variations in hours worked per worker. Obviously, newly hired workers are not present in the standard model.

The key implication of the variant with frictional unemployment, and nominal wage rigidities that are allowed to be different for incumbent and new hires is a new equation for the average real wage that evolves according to:

$$w_t = \frac{n_{t-1}}{n_t}(1-\rho)\left[\left(1-\xi_w^o\right)w_t^* + \xi_w^o w_{t-1}\frac{\pi_{t-1}^{\gamma^w}\bar{\pi}^{1-\gamma^w}}{\pi_t}\right] + \frac{m_{t-1}}{n_t}\left[\left(1-\xi_w^n\right)w_t^* + \xi_w^n w_{t-1}\frac{\pi_{t-1}^{\gamma^w}\bar{\pi}^{1-\gamma^w}}{\pi_t}\right] \tag{4.1}$$

where n stands for employment, ρ is an exogenous separation rate, m the number of new hires, w^* the current newly-bargained wage, γ^w the degree of wage indexation to past inflation (as above, but not in logarithms), while ξ_w^n and ξ_w^o stand for the potentially different probabilities of not being able to newly negotiate the wage, for new and incumbent workers, respectively.

Thus aggregate real wages are the weighted average of wage for incumbent workers, who constitute a fraction $(1-\rho)n_{t-1}/n_t$ of the workforce, and wages for newly hired workers, who constitute a fraction m_{t-1}/n_t of workers in period *t*. In the model with labour market frictions, there is then also a wage Phillips curve as above, but with the driving force of the wage being the difference between the actual real wage and the real wage that would obtain absent wage rigidity. This change allows us to disentangle in one model the role of each type of nominal rigidity for the behaviour of the economy.

The recent literature – for example, Pissarides (2009) and Haefke, Sonntag, and van Rhens (2008), Hall (2005), Shimer (2005) and Gertler and Trigari (2006) – has suggested and discussed that it is only wage rigidity of newly-hired workers that is important to generate higher employment volatility. As explicitly shown by Christoffel, Costain, De Walque, Kuester, Linzert, Millard and Pierrard (2009) nominal wage rigidity for the incumbent workers merely dampens real wage volatility but does not alter the hiring decision relative to a model with flexible wages.

4.2.2. Estimation of the model with wage stickiness, staggering, and newly hired workers

The model presented in De Walque *et al.* (2009b)[17] is estimated with Bayesian techniques using as observable variables seven key macroeconomic quarterly time series from the European AWM database for the period 1990Q2-2008Q4: the log difference of real GDP, real consumption, real investment, the real wage, hours worked[18], GDP deflator, and the nominal interest rate. Some parameters are calibrated as follows. The separation rate and job finding rates are respectively set to 2.93% and to 25% on a quarterly basis, based on Elsby, Hobijn and Sahin (2008). The unemployment rate resulting from these flows is equal to 9%.[19] Otherwise, we adopt the same priors as Smets and Wouters (2007). The only additional estimated parameters are the worker bargaining power and the replacement ratio, i.e., the ratio of the unemployment benefits and utility of leisure to the steady state wage. The values estimated for some relevant parameters are displayed in Table 4.1, along with the prior distribution assumed.

[17] Importantly, hours worked are considered to be constant. As such the estimation is a replication of the Gertler, Sala and Trigari (2008) exercise for the US.

[18] The series for hours worked is that of Joachim Schroth and consists of hours worked in the five larger economies of the euro zone. This data is only available from 1990 Q1 onwards.

[19] A correction is made for the fact that not all workers who lose a job can search for a new job in the current period.

Table 4.1 Estimated values for some relevant parameters

	Prior distribution			Mode	s.d.
Calvo existing jobs	Beta	0.5	0.1	0.633	0.059
Calvo new jobs	Beta	0.5	0.1	0.630	0.080
Wage indexation	Beta	0.5	0.15	0.364	0.101
Worker barg. power	Beta	0.5	0.15	0.912	0.029
Replacement ratio	Beta	0.5	0.15	0.852	0.047

The degree of wage indexation γ^w is found to be 35%. This means that between wage negotiations, nominal wages follow aggregate price level changes only by about a third on average. This result is broadly in accordance with the survey evidence of section 3 of this report. The nominal wage rigidity parameters, ξ_w^n and ξ_w^o, are both estimated to be equal to 0.63. Interestingly, a Calvo parameter of 0.63 for incumbent workers corresponds to an average length of the wage contract of (1+0.63)/(1-0.63) = 4.4 quarters,[20] which is in line with the survey evidence. Furthermore, the estimated large proportion of newly hired workers receiving the same wages as the previous average can be interpreted as workers being constrained to receive the same wage as workers in the firm they enter. This matches the observation from the WDN survey that firms tend to apply internal pay scales, linking the wage of new hires to those of existing workers. The replacement ratio and the worker bargaining power are both estimated to be relatively high, as it is the case in the exercise run for the U.S. by Gertler *et al.* (2008). The steady-state wage is actually increasing in both these parameters, and high values for the steady-state wage helps to reduce the percentage deviations around it, bringing some real wage rigidity. We now turn to the discussion of the macroeconomic implications of the stylized facts found by the WDN, using this estimated model as a reference point.

4.3. The implications

4.3.1. Staggering and synchronization of wage changes

This section assesses the WDN findings regarding the way wages are staggered, the duration of wage contracts, the clustering of wages at the beginning of the year, and other forms of real wage rigidity. Particular attention is paid to the Calvo (1983) and Taylor (1980) models of price rigidity, which are

[20] Here we follow the suggestion by Dixon and Kara (2006) to compare random duration (Calvo) and fixed duration (Taylor) contracts by matching the average age of contracts in a cross-section rather than the average duration.

typically used in macroeconomic models. The former assumes that wage (or price) setters face only a constant probability to adjust their wage, inducing the necessity to incorporate future market conditions at which the currently chosen wage may still prevail. In contrast, the latter wage setting model specifies explicit, fixed and non-stochastic durations of contracts, which is a more accurate description of wage setting behaviour.

There is one clear model implication of the WDN finding that wages are typically set for one year: the standard Calvo-model of wage stickiness does not provide an accurate description of the distribution of contract durations, since at each point in time all wage setters face the same distribution. The clustering of wages at the beginning of the year can also not easily be accounted for. Instead, with Taylor's (1980) model of time-dependent price setting this can more readily be achieved. It can be formulated to imply one year contract durations as well as to have the wages changes clustered at a particular month.

The introduction of these features in the standard macroeconomic model described above, as done by De Walque, Jimeno, LeBihan, Krause, Millard and Smets (2009a) shows on the one hand that the impulse responses of interest rates, output, and employment to a monetary policy shock are not markedly different whether wages are set according to the Taylor or the Calvo model. On the other hand, the responses of prices and wages themselves are larger under Calvo-style contracts, and price inflation responds more persistently. This echoes earlier findings by Kiley (2002) and corresponds to results in the contribution to the WDN by Knell (2009): due to a tail of very long durations, nominal wages respond more persistently in the random duration set-up.

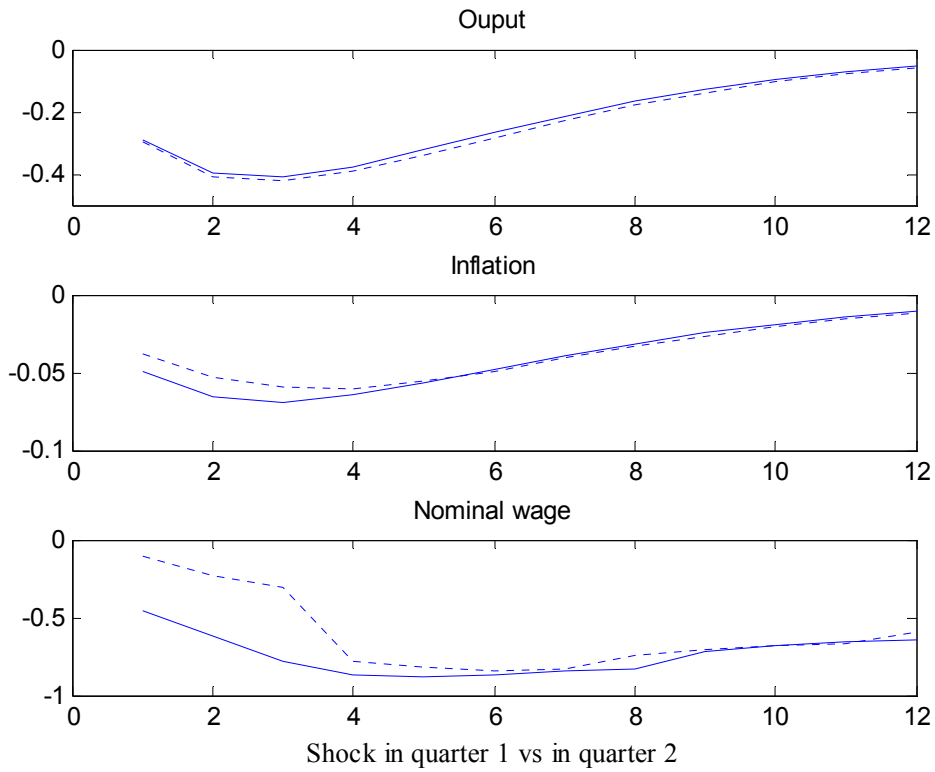
This finding mainly raises the issue of the correct calibration of New Keynesian macro models used for policy analysis. Dixon and Kara (2006) showed that the more relevant metric to set realistic contract durations in the Calvo model is to make sure that it predicts the right average age of contracts at a point in time (i.e., the average experienced duration up to that point), rather than the average expected duration of all contracts in place. Under this metric, De Walque, Smets, and Wouters (2006) also show that the Calvo contract has similar implications to the more realistic Taylor contract model. Therefore, New Keynesian models should aim at matching a frequency of wage changes of about 40% per quarter, which is consistent with the findings above.

For the clustering of wage changes at the beginning of the year ("January effect"), De Walque *et al*. (2009a) and Knell (2009) find that uneven staggering reduces real wage rigidity. Another important implication is that the impact of shocks varies according to the period – here, a quarter – in which the shock takes place. For example, the response of inflation is faster and larger if an interest rate change takes place in the quarter

when most workers actually renegotiate their wage. Similar mechanisms were pointed out for the U.S. by Olivei and Teynrero (2007).

These effects are illustrated in Figure 4.1, which compares the effects of a monetary policy shock in the first quarter (where wage changes are clustered), with those of a shock in the second quarter, calibrated to match the WDN finding for this pattern.

Figure 4.1 Impact of monetary policy shock under uneven staggering



Note: Dotted line: shock in second quarter

The aggregate wage reacts very differently in the two cases: when the shock occurs in the second quarter, it takes one year for the shock to be fully reflected in the nominal wages. The quantitative importance for inflation and output responses seems limited however, due to the forward-looking behaviour of agents. In particular, since prices are set on the basis of expected marginal costs, the jump in wages three quarters hence is already incorporated in the inflation response at the time of the shock.

In some countries where collective bargaining is important, the staggering of wages as observed in the micro data reflects that sectors negotiate sequentially over the year. The notion of "reference norms" in this context relates to the fact that each bargaining sector uses the wages set by other sectors in their negotiation as a benchmark. The WDN contribution of Knell and Stiglbauer (2009) shows the relevance of these patterns for Austria, and analyses its implications for inflation.

Knell and Stiglbauer (2009) show analytically that the effect of reference norms is to increase persistence of inflation following shocks. This effect is somewhat dampened when there is additional asymmetry in reference norms across sectors. In the case of 'wage leadership' one sector act as the benchmark sector, itself ignoring wage settlements of the previous wage round (which themselves used the previous settlement of the wage leader). This breaks the chain of wage staggering and helps rationalizing why countries such as Austria, where one sector ('metals') acts as a wage leader, exhibit lower inflation persistence than other countries.

Real wage rigidity is the sluggish response of the real wage to changes in the notional flexible real wage, i.e., that would obtain absent rigidity. This can be purely the consequence of the combination of nominal rigidity in both prices and wages, as could be seen in real wage equation above.[21] Real wage rigidity would vanish if either wages or prices are flexible. Knell (2009) uses a framework similar to that outlined in Section 4.1., without search and matching frictions, and finds that real wage rigidity is very closely correlated to the degree of inflation persistence. Real wage rigidity is also found to be lower if wage setting is clustered in particular months, if there is less wage indexation, or if there is a significant share of flexible wages in the economy.

Duarte and Marques (2008) uses as a starting point the Layard-Nickell framework of collective wage bargaining and monopolistic price setting to identify the responses to aggregate demand and supply shocks, and price and wage shocks. The study compares wage dynamics in the euro area with that in the United States. The main findings are that wage dynamics in both the euro area and the US are mainly driven by shocks to unemployment, i.e. aggregate demand shocks. In contrast, productivity improvements play a more prominent role in the US, while the euro area is to a much larger extent affected by import price shocks. This reflects the higher openness of the euro area. The same is true for price dynamics. Furthermore, the growth of real and nominal wages as well as price inflation are more persistent in the euro area than in the US following unemployment and technology shocks. Overall, this points to a lower degree of flexibility in European economies. This is also borne out by a comparison of the long-run estimate of the semi-elasticity

[21] This contrasts with real rigidity in the driving term of the real wage equation itself.

of wages with respect to unemployment in the euro area (0.15), which is about half that in the United States.[22]

Cross-country implications of the results have been investigated by Knell (2009), using the survey results presented in section 3 of the present report. Based on country data for duration and indexation of wages, measures of real wage rigidity can be computed. These are indeed successful in replicating the ranking of countries by real wage rigidity, as found in other studies. However, a larger part of the magnitude of cross-country dispersion fails to be captured. To rationalize these differences, more detailed institutional specificities of countries need to be accounted for.

Policy implications

Overall, incorporating the WDN micro findings on wage staggering into the wage staggering framework used in current monetary policy models (like Smets and Wouters, 2007) does not lead to a major alteration in the transmission of shocks to output and inflation. However, there are two implications concerning policy.

First of all, a result in Benigno (2004) suggests that in a monetary union, under heterogeneity in nominal rigidity, the central bank should put more emphasis on countries for which the degree of nominal rigidity is larger. However, the cross-country heterogeneity in the duration of wage contracts is found to be rather low in the Euro Area, and therefore such a concern is not warranted.

The Taylor type, time-dependent staggering of wage contracts found in micro data is in clear discrepancy to the conventional assumptions made in standard models. Levin, Onatski, Williams, and Williams (2006) find that, under Calvo-style wage setting, a wage inflation targeting rule performs well compared to a price inflation targeting rule. It turns out that when contracts are described by a Taylor pattern, the case for using a wage inflation targeting rule is more limited. This is due to the reduced inefficient dispersion of wages that arises for contracts of limited duration.

[22] In a related country study, Marques (2008) uses the above mentioned methodology to analyse wage and price dynamics in Portugal. Both real wages and wage inflation are particularly persistent after import price shocks. Most variation in wages is due to unemployment (demand) shocks, while inflation is mainly driven by import price shocks. Productivity improvements play only a minor role. Papageorghiou (2008) sheds light on the role of wage indexation by estimating a wage-price equation for Cyprus, a country where indexation is automatic and occurs twice a year. The main result of the study is the inability to detect in the specific sample period any inflationary spiral (second or higher round effects) between wages and prices despite the automatic price indexation.

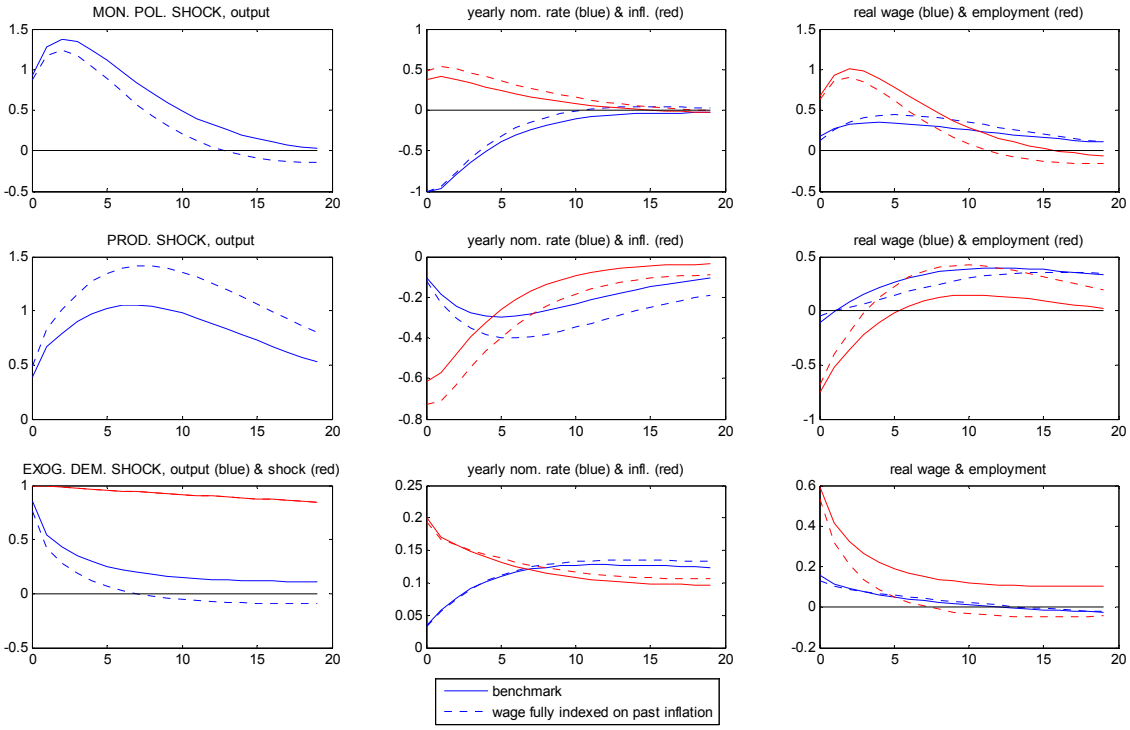
Finally, uneven staggering, according to the results mentioned above, does not turn out to quantitatively alter much the transmission mechanism.

4.3.2. Wage indexation

Wage indexation refers to nominal wage growth in line with aggregate inflation, even between wage negotiations. It is thus a form of real wage rigidity. Since indexation is usually based on a backward looking measure of inflation, an unexpected rise of inflation will temporarily lower real wages, while a decrease in inflation tends to raise real wages.

To assess the impact of indexation for the macroeconomy, the simulations in Figure 4.2 below compare the benchmark model estimated in section 4.2.2 with an economy in which non-bargained wages are fully indexed to past inflation. The figure displays impulse responses for three shocks: a monetary policy shock, a productivity shock and an exogenous demand shock. As expected, for all kind of shocks, full wage indexation has the effect of increasing inflation volatility and its persistence. Second-round effects are at work: the transmission of inflation to wages via indexation affects marginal cost, which in turn feeds back to inflation.

Figure 4.2 Wage indexation



The impact of this increased volatility of inflation on employment depends on the response of the real wage of the newly-hired workers to inflation. For the estimated model, given that the two nominal wage rigidity parameters ξ_w^n and ξ_w^o are estimated to be equal, the new hires and incumbent workers share the same wage. For the shocks to which real wages and inflation react in the same direction (typically monetary policy shocks and exogenous demand shocks), more wage indexation feeds real wage volatility, decreasing firms' incentive to hire. For such shocks, wage indexation has the effect of amplifying the volatility of real wages, dampening the volatility of employment and output.

The opposite effect is observed for a productivity shock which practically acts as a cost push shock in a model with real wage rigidities, and to which the real wage and prices react in opposite direction: the initial decrease in inflation leads to more real wage rigidity and amplifies the hiring incentives of firms, thus amplifying employment and output.[23]

Table 4.2 compares second-moment statistics computed for simulations of the benchmark model, and one in which wages are fully indexed to past inflation, with the data. It suggests that on aggregate more indexation leads to greater volatility in inflation, hours worked and less volatility in real wages, implying that the effects of supply and cost push shocks are slightly dominating those of demand-type shocks. This reflects that in this kind of estimated New-Keynesian models, price mark-up shocks are the main driver of inflation (as is the case in Smets and Wouters, 2007).

Table 4.2 Standard deviations and autocorrelations

		Data	Benchmark	Full wage indexation	Flexible wage for new hires
Total hours worked	rel. std. dev.	0.721	0.742	0.787	0.637
	ser. corr.	*0.785*	*0.837*	*0.812*	*0.862*
Real wage	rel. std. dev.	0.624	0.590	0.542	1.566
	ser. corr.	*0.826*	*0.759*	*0.708*	*0.728*
Inflation	rel. std. dev.	0.175	0.192	0.276	0.441
	ser. corr.	*0.125*	*0.274*	*0.395*	*0.491*

Data source: AWM16 database and hours data by Joachim Schroth for the largest 5 economies of the EA.

[23] This observation has been emphasized by Blanchard and Gali (2008). With real wage rigidity, even productivity shocks create a trade-off because unit labour costs do not fall quick enough after productivity increases, thus pushing up inflation.

Policy implications

The presence of substantial indexation in some Euro Area economies makes the adjustment to aggregate shocks more costly, and monetary policy less effective, when adjustment of real wages is called for to stabilize the economy. Inflation becomes more persistent. The simultaneous presence of nominal price and wage rigidities complicates monetary policy by implying rigid real wages, generating policy trade-off between output and inflation stabilization. In the model by Erceg, Henderson, and Levin (2000), optimal monetary policy then needs to take account of wage inflation in addition to price inflation. With indexation, real wage rigidity becomes even more prevalent.

4.3.3. Rigidity of wages for newly hired workers

As seen in section 4.2, the dynamics of aggregate wages is the result of the behaviour of the wages of incumbent workers and of newly-hired workers. Wage equation (4.1) shows clearly the composition effect at work. But while the wages of incumbent workers are typically set by long-term contracts, with indexation clauses in some cases, the wages of newly-hired workers could potentially be more flexible. In particular, external labour market conditions are likely to have a direct effect on wage determination.

The estimation of the structural model described in section 4.1 indicates an average duration of wage contracts of about one year in Europe, and furthermore that new hires negotiate their wage in the same proportion as incumbents. Both findings are in line with the WDN survey evidence. The last column of Table 4.2 shows a counterfactual scenario with perfectly flexible wage for new hires. Wages and inflation become more volatile, while hours worked are less volatile. Thus, by enhancing firms' incentive to hire, wage stickiness in new hires makes firms more inclined to respond to shocks by adjusting employment.

Even though the parameter value $\xi_w^n > 0$ is important for matching the empirical volatility of labour in a theoretical model, it is even more important for matching observed real wage volatility. Indeed, the most striking feature in the last column of Table 4.2 is the huge increase in real wage volatility, and to a lower degree, in inflation, when new wages are fully flexible. Thus, linking wages of the new hires to the wages of the incumbents is crucial in explaining aggregate real wage rigidity. It cannot be explained mechanically through equation (4.1) by the decrease in the ξ_w^n parameter itself since newly-hired workers contribute only marginally to the average wage itself, especially in a sclerotic labour market.

The reason why the new workers' nominal wage rigidity generates such strong real wage rigidity comes from its interaction with inflation. As discussed in Christoffel *et al*. (2009), in models with frictional

unemployment and Nash wage bargaining, the marginal cost is mainly driven by the labour demand. As such, it is independent of the average wage in existing jobs and wage stickiness affects inflation dynamics only if it modifies the wages of prospective new hires. Setting the parameter ξ_w^n at a positive, relatively large, value, has exactly this role in the benchmark model here. Therefore, wage stickiness of the new hires induces a lower reaction of inflation relative to the counterfactual economy. Decreased inflation expectations translate rapidly into more real wage rigidity since every period about 37% of the incumbent workers renegotiate their wage contract taking inflation expectations into account.

The conclusion is that the connection between the wage of the new hires and that of the incumbents plays a crucial role in generating real wage rigidity, much more important, in fact, than the role played by indexation.[24] Indirectly, this lends support to efficiency wage considerations such as fairness (Akerlof and Yellen, 1988) and morale (Bewley, 1999), and also the related idea of Lindbeck and Snower (1984) that incumbent workers resent new workers being paid differently and threaten harassment.

Thus the estimated model, and the WDN survey evidence clearly contradict the views of Pissarides (2009) and Haefke *et al*. (2008) that newly hired wages are perfectly flexible, and thus unemployment volatility cannot be explained by wage rigidity in search and matching models. The study by Konya and Krause (2009) for the WDN also finds no rigidity in newly hired workers' wages. Part of the reason for this discrepancy is that these authors analyse real models, thus excluding other factors that may drive employment adjustment and wages. The benchmark model used here features sticky prices and a variety of shocks.

Policy implications

Both the model analysis and survey evidence produced by the WDN indicate a high degree of real wage rigidity also for newly hired workers in Europe. Therefore, in general, the assumed general wage rigidity applied to all workers in macroeconomic models used for policy analysis in the ESCB appears warranted. To the extent that real wages (of prospective new hires) determine real marginal costs, which drive inflation, it seems that real wage dynamics are a reasonable indicator for assessing inflationary pressures.

There are however some structural issues that need to be considered. Even though a high degree of real wage rigidity makes labour markets in principle more volatile, it is not clear whether this would indicate general labour market efficiency. After all, an adjustment mechanism is closed down, which mutes the price

[24] However, as noticed by Christoffel *et al.* (2009) the introduction of an intensive (hours) margin in the model would attenuate this strong effect of new hires wage rigidity on inflation and aggregate real wages but would enhance the effect on employment.

signals that should induce workers to reallocate to more profitable jobs that become available. So while firms on the one hand may find it more profitable to hire unemployed workers at a rigid wage, they may be constrained in their ability to attract workers from other firms, by offering them a wage premium.[25]

Reforming labour markets to facilitate wage adjustments would thus both make incumbent worker's and new hires' wages more flexible, since the latter appear closely tied to the former in the aggregate European labour markets. It may also help relative wages between sectors and countries to adjust faster to demand imbalances, which is particularly relevant in a monetary union.

4.3.4. Downward wage rigidity

Macroeconomic evidence on downward wage rigidities

As documented in Section 3, there is considerable evidence at the micro level for the presence of DWR in EU countries. This is confirmed both by survey evidence and by the analysis of changes in individual wages in micro datasets. To be sure, there are differences across countries in both the nature (real versus nominal) and the extent of the downward rigidities. At the macro level, however, it is difficult to arrive at clear cut evidence for or against downward rigidities. The usual approach to testing this issue, pioneered by Debelle and Laxton (1997), is to estimate Phillips curve equations which allow for non-linearities in the response of wages to cyclical conditions. If downward nominal or real wage rigidity were prevalent, one would expect an asymmetric response of aggregate wages to labour market conditions. In tight labour markets, wages would be expected to respond strongly to labour market slack since there are no impediments to increasing wages. In contrast, in weak labour market conditions, the response of wages to unemployment would be muted, reflecting the difficulty in reducing wages. This approach is followed by Lodge (2009) who estimates a quarterly wage equation for a panel of 17 OECD countries (including most Euro Area countries) with data starting from the 1970s. His results suggest asymmetry in the estimate wage equations as the coefficients on the unemployment gap measures are systematically zero in recession or crisis episodes and negative otherwise. Nevertheless, these results are not unambiguous as statistically it cannot be rejected that the coefficient are not the same during recession/crisis and outside these periods. This ambiguity should not be surprising. In a sample period characterised by positive productivity growth and positive (and sometimes high) inflation it is difficult to identify such nonlinearities with aggregate wage data. This is confirmed by Monte-Carlo studies by Laxton et al (2000). Moreover, the panel approach imposes a

[25] The possibility of on-the-job search and the resulting job-to-job transitions has not yet entered the discussions on the flexibility of new hires wages in search and matching models.

common set of parameters across countries: however, we know from the micro results, that the pattern of downward rigidity differs markedly across countries.

Implications of downward rigidity on the central bank's inflation objective

The recent monetary economics literature suggests that the optimal rate of inflation is either zero or negative. In practice, however, central banks do not aim for zero or negative inflation. In fact, the longer term inflation targets/objectives of central banks typically involve positive (albeit small) rates of inflation. This gap between theory and practice is striking and a number of reasons – most prominently the desire to avoid hitting the zero bound on interest rates - have been put forward to explain it (a good survey is provided by Palenzuela *et al* (2003).

One of the most prominent arguments in favour of the optimality of a positive rate of inflation is that this will allow easier adjustment of relative (real) wages and will therefore "grease the wheels of the economy". This line of thinking goes back at least to Tobin (1972) and has been formalized by Akerlof, Dickens and Perry (1996). They show that in the presence of downward nominal wage rigidity, a central bank which aims at an inflation rate which is too low will lead to higher steady state unemployment, thereby reducing welfare. In the European context, a similar claim is put forward by Wyplosz (2001) who, in fact, argues on this basis for an inflation objective for the ECB of around 4% per annum.

If downward wage rigidities can justify an inflation objective greater than zero, the key question is; how large should the optimal inflation rate be? A recent study by Fagan and Messina (2009) addresses this question in a quantitative macroeconomic model that is able to match the observed individual wage change distributions in countries showing different degrees of nominal and real rigidities. Asymmetries in these distributions are used to estimate the key wage setting parameters in the model. The optimal inflation rate for the United States lies in the range of 2%-5%, depending on the dataset used. This is due to a high degree of DNWR. Interestingly, the paper finds that the optimal inflation rate for selected European countries (characterised by high DRWR and low DNWR) lies between 0% and 2% – hence consistent with the definition of price stability articulated by the ECB. A number of factors can explain this difference. First, to the extent that wage rigidities are real because of indexation, a feature that is quite prevalent in Europe, inflation will not be able to bring about the necessary real adjustment. Second, a higher degree of price stickiness in the euro area relative to the United States increases the costs of inflation and, everything else equal, reduces the optimal target rate of inflation. Finally, the variance of the shocks hitting the economy may be smaller in the Europe relative to the United States.

Downward wage rigidity and dynamic adjustment

Flexible labour markets are essential for the well-functioning of the European Monetary Union. In the absence of the possibility to adjust the nominal exchange rate, a flexible response of wages to both symmetric and asymmetric shocks is important to ensure a smooth and efficient economic adjustment within a monetary union. The evidence presented above shows that in spite of ongoing labour market reform, there are still large differences in labour market institutions, including in the incidence of DWR. What are the implications for the transmission of shocks in national labour markets and for the optimal monetary policy response?

Fahr and Smets (2008) address this question in a general equilibrium model of a monetary union that incorporates DWR. Two results are worth highlighting here. First, in response to shocks that require a negative real wage adjustment (such as a negative productivity shock), DWR shifts the burden of adjustment towards employment and consumption. In particular DRWR leads to a very sluggish adjustment of the real wage and large negative effects on employment and consumption. In this case, the optimal policy response consists of a stronger and more protracted tightening of the real interest rate. Second, the region which exhibits DRWR will suffer from a loss of competitiveness relative to the region that has more flexible labour markets.

4.4. Summary and Conclusions

The macroeconomic analyses in the Wage Dynamics Network can be summarized as follows:

1. The staggering of wages with duration of about a year, and the clustering of wage changes at the beginning of the calendar year have effects on the adjustment of wages to shocks, but appear to change output and inflation dynamics only to a limited extent.
2. Wage indexation makes inflation more persistent. There is substantial heterogeneity in the prevalence of indexation across Euro Area economies. As a form of real wage rigidity, indexation complicates monetary policy by generating trade-offs between output and inflation stabilization, even in the presence of shocks typically not regarded as cost push shocks (see Blanchard and Gali, 2007).
3. Wages of new hires appear rigid in European data: microeconomic studies, the survey evidence and estimation of a macroeconomic model with search frictions all indicate rigidity in new hires wages, in contrast to evidence from U.S. micro data. This suggests that efficiency wage considerations relating to fairness and morale within firms are an important factor.

4. Downward wage rigidity prevails, in particular in terms of nominal wage rigidity. Some form of money illusion appears at work.

Overall, the results support policy recommendations asking for increased wage flexibility and an abolishment of automatic wage indexation schemes to improve the performance of labour markets. Such measures would support the smooth functioning of monetary union and contribute to an efficient allocation of resources across sectors. At the same time, an important caveat of the analysis presented so far is, that it does not contain a fully fledged welfare analysis. In particular, most models abstract from insurance motives and other factors such as fairness and efficiency wage considerations that some of the labour market institutions may address.[26] Enhancing labour market flexibility may remove a macroeconomic coordination failure, but may not provide a substitute that resolves the microeconomic need for insurance. The same is true for state-provided insurance schemes (firing restrictions or unemployment benefits) which are making labour markets more rigid, but for which no market-based equivalent exists. Thus, institutions need to be carefully designed, so as to improve the productive capacity of the economy without leading to a deterioration in overall welfare. These are normative issues that the WDN has not investigated and future research may resolve.

5. Concluding remarks: Institutions and the labour market response to the current crisis

One of the main achievements of the WDN has been to document noticeable cross-country differences regarding many features of wage dynamics such as the frequency of wage changes, nominal and real wage rigidities, firms' responses to shocks, wages adjustments to inflation, determinants of entry wages, the elasticity of wages with respect to productivity, wages pass through into process, etc. A number of WDN studies, using firm-level data, have been able to provide quantitative information on these features and by doing that, these studies have shed light on the relative importance of institutional factors as determinants of the dynamics of wages. In principle, international differences on the features above, once they are "cleaned out" from sectoral and other composition, effects can be attributed to the impact that institutions may have on wage and price determination and adjustment.

To conclude this report, the current section summarises the main WDN findings discussed in previous sections on the role that institutions play at shaping wage dynamics and explaining its cross country

[26] See Ellingson and Holden (1998) and Postlewaite, Samuelson, and Silverman (2008), are two references that formalize the idea that consumption commitments, such as house mortgage payments reduce discretionary net income, and thus makes workers willing to accept rigid wage contracts with predictable income, even if they come with unemployment risk.

heterogeneity. Then the second part of this section looks at how the institutions are conditioning the adjustment to the current crisis. It first reports on how labour market variables and in particular wages are adjusting during the current crises and then provides some evidence on how cross-country differences in labour market institutions (mostly, collective bargaining and EPL) are related to wage adjustments.

5.1. Institutions and wage dynamics before the current crisis

Collective bargaining

Among the various labour market regulations, those configuring the scope and contents of collective bargaining have the most direct impact on wage determination. The coverage of collective bargaining, the level at which it takes place and the degree of coordination and synchronisation of the agreements affect not only the average wage level, but also its dispersion, the frequency of wage adjustment and the extent and timing of the response of wages to economic shocks.

The WDN NCB questionnaire on national collective wage bargaining institutions (see Du Caju *et al*. 2008) and the WDN survey on firms wage and price setting provide a new set of quantitative and qualitative information on wage setting systems in European countries that, as seen in Section 2.1, update, extend (mostly in the sectoral dimensions) and complement other existing data sets on labour market structural indicators (see for example Elmeskov, Martin and Scarpetta 1998, European Industrial Relations Observatory (EIRO) and the OECD Employment Outlooks). Both the NCBs questionnaire and the WDN survey indicate that cross-country differences in wage setting are important. Regarding recent trends, the decline in trade union density since mid nineties has not been accompanied by a decline in the coverage of collective bargaining agreements. There is also a trend towards a higher degree of decentralisation in bargaining, from sectoral to firm level.

The WDN has taken advantage of the wealth of this institutional information to account for the different behaviour of wages in several dimensions. As seen in Section 3.2, Druant *et al.* (2009) show that wages tend to be more flexible in the presence of firm-level collective wage agreements than when sectoral or national level agreements are prevalent, while Messina *et al* (2009), Du Caju *et al*. (2009); Babecky *et al*. (2009a) show that the higher the coverage of collective bargaining agreements, the higher the degree of downward real wage rigidity. Messina *et al* (2009) also finds that the use of firm level bargaining counter acts this favouring more downward flexibility. Collective bargaining also influences the reaction of firms to shocks, Bertola *et al. (*2009) find that firms covered by collective wage agreements are more likely look for cost reduction by reducing the number of temporary employees and less likely to reduces wages. It also

shapes the way and the extent in which different margins of adjustment are used by firms to reduce cost (see Babecký *et al* 2009b and Babecký *et al* 2008). In the case of newly hired workers, Galuscak *et al.* (2009) find that in countries where collective agreements are more widespread and coverage is higher, the importance of internal pay structures as a determinant of hiring pay is higher. Bargaining institutions also influence the evolution of the wage structure and relative wages across sectors (see Christopoulou *et al* 2009, Du Caju *et al* 2009). In addition, as we will discuss in subsection 5.2.2, according to the latest WDN evidence, wage bargaining institutions are being very relevant for the response of firms to the current economic and financial crisis.

Employment Protection Legislation

Employment Protection Legislation (EPL), by defining the conditions under which hirings and layoffs can take place, also impinges upon firm's decisions regarding wage determination (both for incumbent and new workers) and regarding adjustment to shocks. As in the case of collective bargaining, there are remarkable cross-country differences in hiring and firing legal procedures and costs (see, for instance, OECD Labour Market Indicators, summarised in table A5.1, Annex 5). Over the recent years many European countries have introduced a dual structure in employment contracts. This occurred mainly through the liberalisation of "atypical contracts" for new hirings (part-time, temporary, seasonal contracts), which accounted in some countries (e.g. Spain, Portugal) for more than 20% of total employees.

Although the WDN does not directly measure cross-country differences in EPL, the influence of EPL on firms decisions regarding wage setting and adjustment to shocks has been largely studied within the WDN. Using the survey data, Babecký *et al*. (2009b) and Bertola *et al*. (2009) document that, when EPL is very strict for incumbents, but temporary contracts are widespread among new hires, adjustment to shocks takes place mostly through employment; moreover, price increases as a reaction to a wage shock are more likely in countries with higher employment protection. Druant *et al*. (2009) find that the more stringent EPL, the higher wage rigidity. On the other hand, using data on labour market flows, Rumler and Scharler (2009) find no influence of EPL on employment volatility, which may be due to the counteracting effects of temporary contracts and collective bargaining on these flows, as temporary contracts seem to be more prevalent and collective bargaining more widespread in countries with stricter EPL.

Product market regulation

Product market regulation, by affecting the degree of competition across firms and therefore their ability to adjust prices in response to firm-specific shocks, is another important factor influencing wage setting and in particular the link between wages and prices, as well as firms' reactions to shocks. Indeed, a number of WDN studies highlighted several consequences of product market competition on wage dynamics.

Multivariate analysis of the determinants of price and wage rigidity in Druant *et al.* (2009) using firm level survey data confirms that more frequent price adjustments are associated with higher competitive pressures and exposure to foreign markets. Messina *et al.* (2009) relate IWFP measures of downwards nominal and real wage rigidity to product market competition for several countries, they find that higher competition leads to lower downwards nominal wage rigidity, but it has no impact on downwards real wage rigidity. In contrast to this, Du Caju, Fuss and Wintr (2009) find that, in Belgium, DRWR is larger in sectors with more intense competition on the product market. Babecký *et al*. (2009b) find that firms that operate in a more competitive environment are more likely to use benefits adjustment, replacement of voluntary leavers with new employees at lower wages and changes in shift assignments as cost cutting strategies, Bertola *et al*. (2009) conclude, consistently with these results, that the pass-through of cost shocks to prices is lower in highly competitive firms. The degree of product market competition also increases the importance of external factors in determining the wage of newly hired workers (Galuscak *et al.* 2009). Finally, Du Caju *et al* (2009) find a negative relationship between sectoral competition and industry wage differentials across sectors, supporting rent sharing theories of wage determination.

5.2. Institutions and adjustments during the current crisis

The WDN evidence described in previous sections largely refers to wage features during a period of relatively stable growth and moderate levels of inflation in many of the countries examined (this is particularly the case for the survey evidence). The robustness of the WDN results might then be challenged by the current economic crisis, which is exceptional for its depth and synchronization across countries and is characterized by a strong fall in demand and rising unemployment levels. In particular, this crisis can be viewed as an "experiment" to test the above findings on the role of institutions on wage dynamics and wage adjustments. Despite the global nature of the crisis, countries responded (and are still responding) to the labour market consequences of broadly similar aggregate and sectoral shocks with different policies. One noticeable difference is between those economies that have heavily relied on wage subsidies and working hours adjustment (e.g. Germany and Italy) and those that have put more weight on income support by extending unemployment protection schemes (e.g. Spain). In this regard, a recent document by the OECD ("Addressing the labour market challenges of the economic downturn: A summary of country responses to the OECD-EC questionnaire) provides a good account of international differences in the measures put recently in place to fight the labour market consequences of the crisis.

During its final months of operations the WDN has aimed at providing evidence on wage adjustments during the current crisis. For that it has undertaken a number of projects including launching a follow-up survey conducted during summer 2009 in a sample of ten countries (Austria, Belgium, Czech Republic,

Estonia, France, Italy, Luxembourg, the Netherlands, Poland, and Spain) and specifically designed to assess the response of wages and labour costs during this crisis period. This follow-up survey, more limited that the original one, collects data on firms' perceptions of the crisis and their actual response to it, yielding interesting insights on the constraints firms face when adjusting to the demand shocks brought up by the crisis, and also allowing us to test the robustness of some of the findings of the original survey.[27]

This Section first documents the effects of the current financial and economic labour markets using both macroeconomic series and the firm level evidence from the follow up survey. Then, it explores to what extent these facts can be explained by some of the labour market institutions regarded as relevant by previous WDN studies.

5.2.1. Wage adjustments

Macro evidence

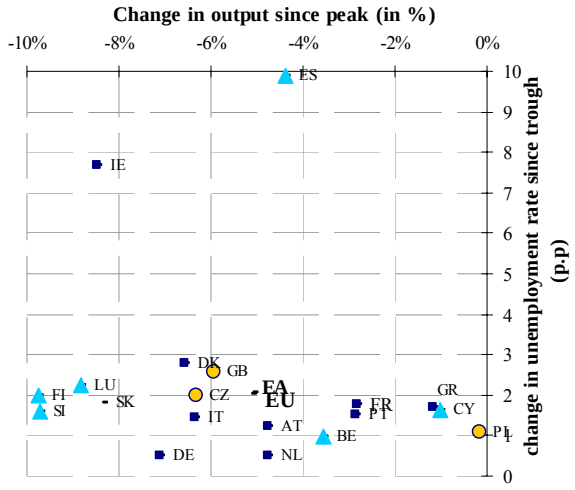
Unemployment rates in EU countries increased on average 2.4pp from 2008Q1 to 2009Q3, when they reached levels of 9.1% and 9.6% in the EU and the euro area, respectively. The increase varies substantially across countries: it was particularly high in the Baltic States (Latvia 13.2pp, Lithuania 9.7pp and Estonia 9.3pp), Ireland and Spain, while it was very contained, below 1pp, in Germany, Romania, the Netherlands and Belgium.

Part of the cross-country heterogeneity in the development of the unemployment rate is obviously related to the difference in the magnitude of the GDP contraction but, as Figures 5.1 and 5.2 show, there is also large heterogeneity across countries in terms of the unemployment elasticity to GDP, which varies from more than 2.2 for Spain to less than 0.1 for Germany, Romania and the Netherlands.

Within countries, the response of unemployment rates has been heterogeneous across groups of workers (see Figure 5.3), with young, male, and low-educated workers experiencing the strongest increases. The difference in unemployment rates between the young and those aged 25 to 74 increased by more than 5pp in Spain, Ireland, Slovenia, Slovakia and Belgium during the crisis. The decline in manufacturing activity affected mostly male workers, while sectors dominated by female employment are much less affected.

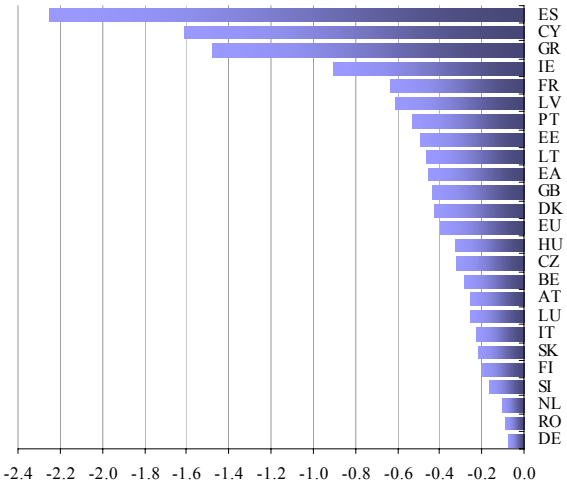
[27] See Annex 3 for details on the follow-up survey.

Figure 5.1 Unemployment rate vs. GDP



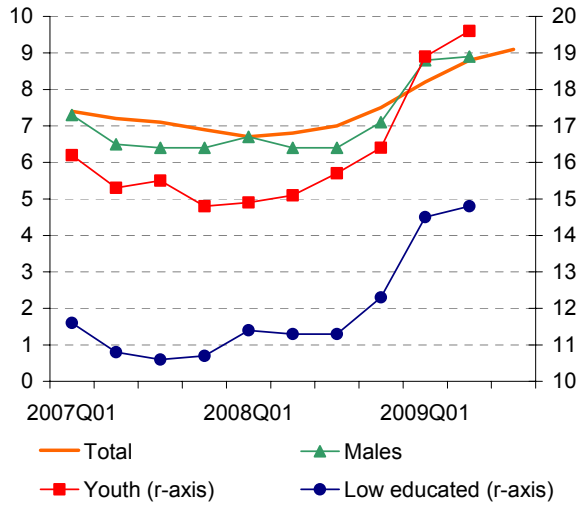
Source: Eurostat and Author's calculations
Note: LT, LV and EE have been excluded from the Figures as GDP contractions are 17% or larger. Countries with
■ *group 1, highly regulated, high coverage, sectoral negotiations*
▲ *group 2, important role of gov., indexation, intersect. neg.*
● *group 3, relatively deregulated*

Figure 5.2 Unemployment rate elasticities w.r.t GDP growth



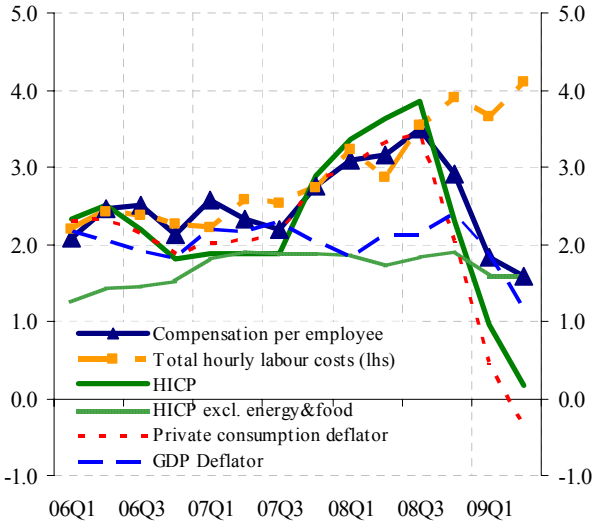
Source: Eurostat and Author's calculations
Note: Elasticities are computed by dividing the decline in GDP and employment since the variable and country-specific peak.
PL is excluded due to the only small GDP contraction

Figure 5. 3 Evolution of unemployment (in %)



Source: Eurostat LFS.

Figure 5.4 Compensation per employee compared to price deflators in the euro area



Source: Eurostat and ECB

Regarding *employment* adjustment, overall employment in the EU has declined by 1.4%, to 214.3 million people since its peak in 2007Q3. The sectors that suffered the largest losses are construction and industry. It

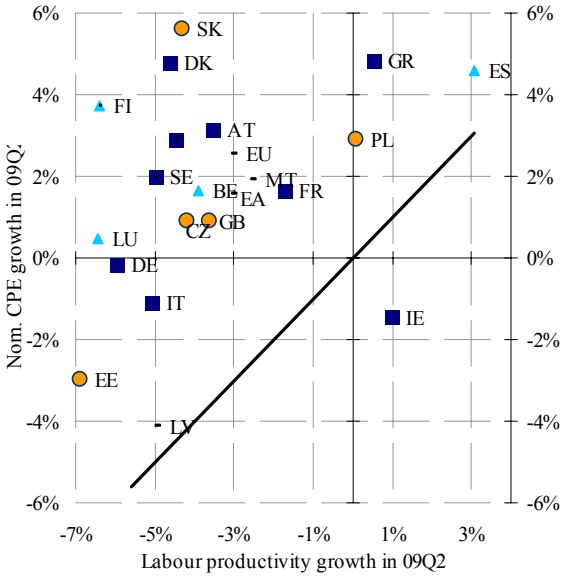
is remarkable that while full-time employment decreased, part-time employment kept increasing, underlining the importance of the intensive margins of adjustment. This is related to policy measures by Governments and firms in some countries, particularly in Germany and Italy where the reduction in hours worked is subsidized to avoid lay-offs in the short-run (Cassa Integrazione Guadagni in Italy and Kurzarbeit in Germany). In addition, workers with temporary contracts were hit harder than those with a permanent contract. This pattern, observed for all EU countries, was particularly relevant in Spain, which has the highest share of flexible workers: in 2009Q2 the percentage of temporary workers in Spain was 25.2%, 9.4pp lower than in 2006Q3.

Concerning the adjustment of *wages* (see Figure 5.4), while nominal compensation per employee in the euro area declined more than the GDP deflator, implying pro-cyclical real compensation per employee since the peak in 2008Q3[28], both nominal and real hourly labour costs have been increasing steadily since 2008Q3, being therefore countercyclical during this recession.

Nominal compensation per employee has declined only in the three Baltic States, Germany, Italy and Ireland. In the case of Germany and Italy this was mostly due to the strong reduction in hours per employee related to Government subsidised schemes, which has been accompanied by strong increases in hourly wages. In real terms, compensation per employee has declined in the three Baltic States, Germany, Italy, the Czech Republic and the United Kingdom.

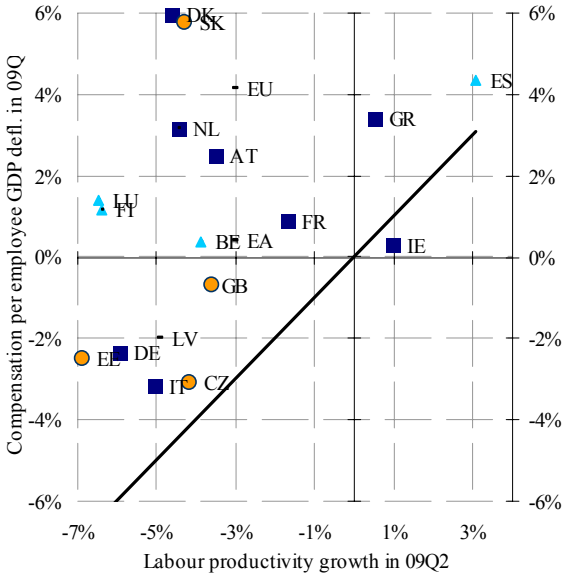
[28] Real compensation per employee calculated using the HICP or a private consumption deflator has increased.

Figure 5.5 Nominal compensation per employee (CPE) vs. labour productivity growth



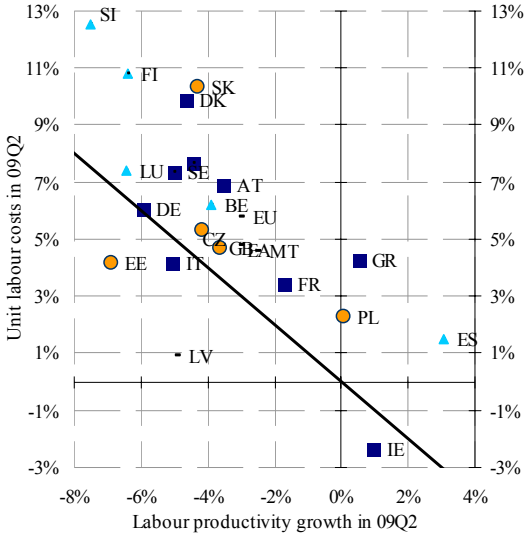
Source: Eurostat, Note: Country markings follow the institutional groupings in the WDN, with ■ group 1, highly regulated, high coverage, sectoral negotiations
▲ group 2, important role of gov., indexation, intersect. neg.
● group 3, relatively deregulated

Figure 5.6 Real compensation per employee (GDP defl.) vs. labour productivity growth



Source: Eurostat and author's calculations
Note: Elasticities are computed by dividing decline in GDP and employment since variable and country-specific peak.
PL is excluded due to the only small GDP contraction

Figure 5.7 Unit Labour cost vs. labour productivity growth



Source: Eurostat, Note: Country markings follow the institutional groupings in the WDN, with
■ group 1, highly regulated, high coverage, sectoral negotiations
▲ group 2, important role of gov., indexation, intersect. neg.
● group 3, relatively deregulated

In a monetary union the evolution of the relative competitiveness of different countries is important as exchange rate adjustments do not take place. Labour productivity (output per head) has increased between 2008Q2 and 2009Q2 only in the case of Spain, Ireland, Greece and slightly for Poland (see Figure 5.7), while all the other countries suffered a reduction. At the same time, all countries except Ireland have experienced an increase in unit labour costs. Furthermore, it seems that stronger productivity declines are accompanied with stronger unit labour cost growth (see Figure 5.7). This suggests that compensation per employee has reacted much more sluggishly compared to the evolution in productivity. Ireland is the only country where growth in compensation per employee has been slower than that of labour productivity between 2008Q2 and 2009Q2, both in nominal terms as well as in real terms (GDP deflated, see Figure 5.5 and 5.7) and the only one where unit labour cost has declined.

Micro Evidence: The current crisis through the lens of the follow-up survey

The WDN follow-up survey contains questions that aim at understanding how firms perceived the intensity of the current economic downturn, as well as the ways in which it has manifested. Table 5.1 summarises this information, the first block of the table gives an overview across countries of how firms perceive the intensity of the negative demand shock. The figures presented indicate that this shock was strongest in Estonia, where 81% of firms experienced a strong or exceptionally strong decline in demand, followed by Czech firms, of which 52% declared that their demand declined strongly or exceptionally strongly.

Table 5.1 Intensity of the crisis. Different channels through which the crisis affected firms' activity

	Country														
	AT	**BE**	**BG***	**CY***	**ES**	**FR**	**IT**	**LU**	**NL**	**CZ**	**EE**	**PL**	**Euro area**	**Non euro area**	**Total**
								Demand fall							
None / marginal	26.2	21.7	12.3	25.1	19	19.1	14.8	15.2	34.5	6.9	1.9	16.9	19.3	13.7	**18**
Moderate	45.5	36.2	34	39.6	40.6	43.9	41.9	47.8	29.3	40.3	16.8	59.6	40.3	53.1	**43.4**
Strong	18.5	23.7	32	23.3	28	24.8	35.5	29.7	22.8	41.2	41.5	18.7	29.5	25.3	**28.5**
Exceptionally strong	9.7	18.3	20.1	11.4	12.4	11.5	7.3	7.14	12.8	11.7	39.4	4	10.5	7.2	**9.7**
Don't know	0.2	0.2	1.6	0.6	0	0.7	0.5	0.1	0.6	0	0.4	0.8	0.4	0.6	**0.5**
								Financial constraints							
None / marginal	55.4	54.8	22.9	47.0	52	64.5	45.8	62.1	55.5	34.6	28.9	43.7	52.9	40.8	**50**
Moderate	24.5	23.1	34.9	26.4	20.2	18.3	29.7	18.2	18.3	35.5	25.6	37.6	23.5	36.7	**26.7**
Strong	11.3	12.7	25.3	11.6	16.2	6.6	16	14.3	14.9	21.4	24.3	11.2	13.6	14.3	**13.8**
Exceptionally strong	3.8	5.3	11.6	13.5	11.2	3	4.7	4.3	5	6.8	13.8	4.5	5.6	5.5	**5.6**
Don't know	5.0	4.1	5.2	1.5	0.5	7.6	3.9	1.3	6.2	1.7	7.4	2.9	4.4	2.8	**4**
								Difficulty in being paid							
None / marginal	24.7	27.2	14.6	18.1	39.5	35.5	15.8	32.3	46.1	21.5	11	24.1	29	23	**27.5**
Moderate	56.2	41.1	23.6	36.0	35	46.9	40.4	41.7	29.4	41.1	34.5	47.4	39.5	45.4	**41**
Strong	15.2	24.4	34.6	23.7	16.1	14.3	31.4	20.2	14.3	30.8	31.1	21.4	22.2	24.1	**22.7**
Exceptionally strong	2.5	3.1	25	21.3	8.9	1.8	10.6	5.9	3.8	5.2	21.8	5.3	7	5.9	**6.8**
Don't know	1.4	4.2	2.2	0.9	0.4	1.5	1.9	-	6.4	1.3	1.7	1.8	2.2	1.6	**2.1**

Notes: The table presents the percentage of firm managers who state that demand has fallen/have faced financial constraints/difficulties in being paid by customers "not at all/marginally", "moderately", "strongly" or "exceptionally strongly". All figures are employment-weighted. * no harmonised and not included in the aggregates. Note: The construction sector is not covered by Spain, France and Italy. The financial intermediation sector is not covered by the Czech Republic, Estonia, Spain, and France

The relative size of the demand decline was smallest in Poland, followed by Austria, where 23% and 28% of companies, respectively, responded that the fall in demand was strong or exceptionally strong .The share of firms which were not, or only marginally, affected by the crisis was largest in the Netherlands (35 %).

This firm level information is in line with the data on aggregate GDP during this period (see table A6.1 in annex 6). For example, in Estonia GDP fell 18% between the first quarter of 2008 and the second quarter of 2009 on a seasonally adjusted basis and in the Czech Republic there was a sharp GDP decline during the time period preceding the survey, i.e. in the first quarter of 2009, when the economy contracted by 4.8%, while in Poland GDP increased by 3.4% within the same period. Finally, according to the WDN follow-up survey firms were mainly affected by a fall in demand and, secondly, by difficulties in being paid by customers. This holds for all size classes and across countries. In contrast, financial constraints are less important.

The evidence from the original WDN survey data, collected before the current crisis, showed that wages of workers were rarely cut during the five years period preceding the launching of the survey and that downward wage rigidity (DWR) was prevalent in most EU countries.[29] The follow-up survey re-visits these facts in the context of the current financial and economic crisis. On average, approximately 3.2% of firms in the countries sampled in the follow-up survey have experienced wage cuts in the period since the crisis began and the summer of 2009. This compares with an average share of 2.6% for the same sample of firms according to the previous survey (see Table 5.2). The incidence of wage freezes, on the other hand, has increased very significantly, from only 9% in the original survey to 34.5% in the follow-up survey. Overall, this implies that downward wage rigidity was still prevalent in the summer of 2009 – firms are freezing wages instead of cutting them even in an environment of economic downturn associated with near zero inflation.

One notable exception among the sampled countries is Estonia, which has a high incidence of both wage cuts and wage freezes. Approximately 44% of firms did cut wages and 38% plan to do so in relation to the crisis. Estonia indeed suffered a sharper downturn than the other countries covered by the survey, but also its institutional environment for wage setting is rather flexible. In addition, the country implemented a reform of labour regulations in 2009, which imposed more flexible employment protection legislation (EPL) and considerably lowered the layoff costs for employers. In general, the frequency of wage cuts is lower in the euro area countries, which also have higher trade union penetration. [30]

Four of the countries participating in the follow-up survey (France, Italy, Luxembourg and Poland) also collected information on the reasons why firms avoid wage cuts. When comparing the answers with those provided by the same firms to the earlier WDN survey, it turns out that the importance of all reasons declines in the follow-up survey. The decline is the strongest for those reasons that are more related to the slack in the labour market, such as the possibility that the most productive employees leave after a wage reduction, whereas the importance of institutional restrictions declines less.

[29] In the original WDN survey the questions on wage cuts and freezes referred to the time period covering five years prior to the implementation of the earlier survey.

[30] A survey conducted by the Employment Research Institute (IAB) in Germany that covered 8,000 businesses finds that about 40% of businesses and administrations have been affected by the economic crisis of which 12% have cut hourly wages or plan to do so. Among the 7% that declared being at existential risk due to the crisis wage cuts go up to 29% .

Table 5.2 Incidence of wage cuts and freezes during the crisis: follow-up survey.

	Share of firms cutting wages (%)			Share of firms freezing wages (%)		
	Original survey	follow-up survey		Original survey	follow-up survey	
		did cut	will cut		did freeze	will freeze
Countries						
Austria	1.5	1.7	1.5	9.3	1.8	8.4
Belgium	2.9	1.0	1.8	15.9	23.7	4.4
Czech Republic	9.3	9.0	3.2	31.4	54.6	11.7
Cyprus****	3.4	1.8	2.0	15.3	20.6	5.9
Estonia	3.7	44.1	38.6	21.3	61.5	64.6
Spain	0.1	2.6	0.5	1.5	26.7	3.7
France	2.5	1.9	4.7	7.7	86.0	83.8
Italy	0.7	2.0	4.3	3.8	31.7	62.8
Luxembourg***	7.3	0.3	0.3	8.0	46.8	44.5
Netherlands	1.6	2.6	3.8	25.8	15.2	8.7
Poland	5.7	4.2	1.6	9.7	18.0	8.1
Total	**2.6**	**3.2**	**3.1**	**9.5**	**34.5**	**34.5**
Euro area	**1.3**	**2.1**	**3.3**	**7.6**	**37.1**	**43.1**
Non-euro area	**6.4**	**6.5**	**2.7**	**14.8**	**27.4**	**10.3**
Sectors						
Manufacturing	3.1	3.9	2.9	8.2	35.5	39.0
Construction*	4.0	5.9	3.6	13.6	13.8	9.5
Trade	1.3	2.8	2.3	7.0	26.4	26.2
Market services	2.8	2.4	4.2	12.2	42.0	39.4
Financial intermed.**	1.6	0.1	0.5	11.9	26.0	7.2

Notes: Source: Messina and Rõõm (2009). Figures for the original survey have been calculated including only the firms that are in the 2009 sample. Figures are employment-weighted and rescaled excluding "do not know" answers. *Construction sector is not covered by Spain, France and Italy. ** Financial intermediation is not covered by the Czech Republic, Estonia, Spain, and France. In LU the share of workers affected by wage cuts is about 0.5% in both surveys. ****CY is not included in the aggregates

The WDN follow-up survey was also targeted at comparing the reaction to the current demand shock with the replies provided (by the same firms) in the original survey to a hypothetical demand shock. Table 5.3 shows that cost reduction is the most relevant adjustment strategy to the current fall in demand, more than reducing price, margins or output. Compared to the original survey, all adjustment margins are less relevant, although the difference in the case of the cost cutting strategy is very small. In all cases the difference with the original survey diminishes with the intensity of the negative shock.

Table 5.3 Adjustment strategies to demand shocks

(Percentage of firms replying relevant or very relevant)

	reduce prices		reduce margins		reduce output		reduce cost	
	Original survey	follow-up survey	Original survey	follow-up survey	Original survey	follow-up survey	Original survey	follow-up survey
All firms	**56.3**	**37**	**63.1**	**43.2**	**51.8**	**39.5**	**84.7**	**73.4**
Country								
AT	37.7	30.2	57.3	44.6	54.3	43.8	82.9	84.3
BE	42.5	36.1	55.1	52.3	60.1	55.9	80.6	81.7
CZ	51.3	34	54.4	40	52.2	48.5	86.7	88.3
EE	76.4	72	82.4	77.6	66.9	64.2	93.8	98.3
FR	41	14.9	56.6	24	54.2	29.4	78.8	42.8
LU	48.2	26.5	64.1	32.1	43.8	24.5	89.8	88.3
IT	58.3	41.5	na	na	46	37.3	91	78.8
NL	39.9	23.7	50.7	35.6	40.6	33.9	71.9	63.6
PL	79.4	60.8	78.3	64.3	60.4	47.6	85.3	87.1
Sector								
Manufacturing	56.3	37.8	60.4	43.9	66.5	57.9	86.3	76.5
Construction *	70.7	58.7	80.3	60.6	52.3	45.2	82.5	71.5
Trade	65.2	41.6	71.2	50.2	37.6	25.4	87.9	81.3
Market Services	48.1	31.6	57.3	36.5	40.2	21	80.8	64.5
Financial Intermediation**	64.8	10.6	79.6	32.1	30.6	27.3	88.2	88.5
Size								
5-19	65.4	40.5	71.2	45.1	45.1	32.1	80.2	69.7
20-49	60.7	43.1	63.1	46.5	48.2	41.2	85.5	70.4
50-199	60.8	40.8	67.6	42.4	55	39.6	85.8	73.1
200+	48.8	30.9	56.7	41.5	54.1	40.6	85.1	76.3
Intensity of negative impact of the crisis								
not at all marginally	60.7	27.7	62.6	29.5	47.2	15.7	83.7	55.6
Moderately	58.3	37	68.5	47.9	49.6	31	83.6	75.1
Strongly	52.2	45	56	50.2	53.6	60.1	86.7	83.4
exceptionally strongly	**47.2**	**40.6**	**61.9**	**49.1**	**76.6**	**79.5**	**86.1**	**85.9**
Intensity of negative impact of the crisis								
not at all, marginally, moderately	59.3	33.6	65.7	41	48.5	25.4	83.6	68.1
strongly, except. Strongly	51.2	44.1	57.5	49.9	58.4	64.1	86.6	83.9

Notes: Figures weighted by employment weights, rescaled excluding non-responses. Spain not included as the replies to this question in the Spanish survey are not fully harmonised with the rest. Construction sector is not covered by Spain, France and Italy.
** Financial intermediation is not covered by the Czech Republic, Estonia, Spain, and France.

When looking in detail to the cost cutting strategies that have actually been implemented during the crisis, Table 5.4 shows that costs were mainly contained by reducing the quantity of labour. The percentage of firms that chose to reduce temporary employment as the main channel to adjust cost is highest in Spain, Belgium and Netherlands (over 40%), while in the Czech Republic and Poland it only amounts to 10%. Confirming the results on wage rigidity, cuts in base wages have been very scarce, with the exception of

Estonia, but adjustment through flexible wage components has been more common than in the original survey. The stronger the impact of the crisis, the more firms recurr to a reduction in hours worked, temporary and permanent workers, as opposed to resorting mainly to an adjustment in non labour costs. The table also suggests that the larger the firms, the more layoffs of temporary workers and the less the reduction of non labour costs.

Table 5.4 Cost-cutting strategies during te current crisis *(percentages)*

	Base wages		**Flexible wages**		**Perm. Empl.**		**Temp. Empl.**		**Hours**		**Non labour cost**	
	Original survey	follow-up survey	Original survey	follow-up survey	Original survey	follow-up survey	Original survey	follow-up survey	Original survey	follow-up survey	Original survey	follow-up survey
All firms	**1.5**	**1.7**	**8.6**	**11.8**	**17.1**	**19.1**	**27.4**	**25.6**	**7.7**	**14.1**	**38.3**	**36**
Country												
AT	0	0.4	10.9	15.8	11	11.2	6.5	10.1	20.4	34.2	51.2	28.2
BE	0.3	3.4	10.3	16.7	29.3	35.7	29	45.6	5.1	32.5	26	40.6
CZ	0	3.9	18.6	24.3	19	42.7	27	34.2	3.5	10.8	41.5	52.8
EE	0.5	15.7	17.3	23.9	17.2	24.4	15.7	3.3	4.9	9.1	44.5	23.6
ES	4.8	1.1	5.8	5.9	11.7	25.8	57.5	42.4	5.6	5.7	14.6	19.2
FR	0	0.1	7.5	9.9	10.9	17.1	28.4	33.9	10	12.4	43.2	26.2
IT	1	1.3	9.3	8.8	16	17.1	28.9	20.8	9.8	18.2	35	33.8
NL	0.3	1.2	3	4.6	3.2	8.4	37.7	40.1	2.1	5.8	53.7	39.9
PL	3.5	2.2	8	17	31.4	15.3	8.7	10	5.2	6.4	43.3	47
Sector												
Manufacturing	1.8	2.1	6.3	10.4	15.2	20.9	31.3	29.4	8.4	17.2	37.8	29.5
Construction*	0.1	3.5	7.5	17	27.6	14.5	15.7	20.5	10.5	5.7	38.6	44.8
Trade	2	1.8	9.8	10.2	21.2	20	24.7	23.2	6.9	11.1	36.8	42.1
Market Services	0.9	0.8	11.3	13.1	15.5	16	25.3	22.9	7.3	13.3	39.7	40.3
Financial Interm**	0	0	9.7	32.6	23.7	27.5	26.4	17.3	0.4	2.6	39.8	34.3
Size												
5-19	1.8	1.3	7.7	11.8	20.1	17.6	21.9	14.2	8.7	8	39.7	48.1
20-49	0.7	2.3	9.3	11.2	15.7	17.4	23.4	17.5	7.8	15.6	43.8	38.7
50-199	1.7	1.1	10.4	14.5	18.3	19.6	25.5	26.2	8.4	14.1	36.2	35.3
200+	1.6	1.7	7.7	10.8	16.3	20.1	32.3	33	6.9	15.1	35.9	31.2
Intensity of negative impact of the crisis												
not at all, marginal	0.6	0.5	8.8	12.8	19.9	5.5	24	20	5.7	12	41	49.5
Moderately	2.9	1.9	9.5	11.5	17.5	17.5	24.2	25.6	9.2	10.2	37.9	39.8
Strongly	0.7	2.1	8.2	12.3	15.3	25.5	30	27.9	8.4	18.6	38	27.7
Exceptionally strong	1.2	1	5.7	10.6	14.9	37.9	40.7	29.7	5.4	22.8	32.1	13.7

Notes: Figures weighted by employment weights, rescaled excluding non-responses Construction sector is not covered by Spain, France and Italy. ** Financial intermediation is not covered by the Czech Republic, Estonia, Spain, and France.

5.2.2. Institutions and wage adjustment

The facts documented above suggest that, in addition to the extent of the economic decline in each country, other factors such as sectoral specialisation, the institutional features prevailing in each country and the active policies adopted could be playing a relevant role to explain the cross country heterogeneity in adjustment to the current crisis. Some preliminary macro evidence (Fahr *et al.*, *ongoing*) on how cross-country differences in labour market institutions are related to the performance of the labour market in the current crisis is not very conclusive. This is not surprising given the lagged reaction of wages and employment and the fact that the adjustment is still going on. In contrast, the preliminary results from the WDN follow-up survey provide relevant evidence on the role of institutions. The survey shows a great deal of cross-country variation in the likelihood of wage cuts (either already implemented by firms or expected to be implemented in the near future), of adjustment through flexible wage components, and of using the different margins of employment adjustment (temporary or permanent employment and hours of worked).

Messina and Rõõm (2009) investigate the impact of labour market institutions, among other factors, on downward wage rigidity during the current crises. Using the follow-up survey data they perform regression analysis where they control for the intensity of the fall in demand and country-fixed effects and find that collective agreements hinder wage cuts, especially in the case of collective bargaining agreements negotiated outside the firm. Moreover, EPL is negatively associated with the propensity of wage cuts, and strict EPL in combination with collective bargaining has a strong negative impact on downward wage flexibility. Differences in the magnitude of the crisis play of course also a role in explaining variation in the cross-country incidence of wage cuts and freezes. Moreover, Messina and Rõõm (2009) find that the larger is the fall in demand, the more (in relative terms) institutional features matter to prevent wage cuts.

Regression analysis (Fabiani and Lamo*, ongoing*) on the cost cutting strategies adopted by firms in response to the fall-out in demand confirms the relevance of institutions. For instance, the presence of centralised collective wage agreements hinders the adjustment of wages, even the flexible components, and induces firms to reduce labour costs through the intensive margin, that is hours worked. Strong EPL is associated with a higher recourse to temporary employee's layoffs and lower reduction of hours worked.

BOX 2 Labour markets and financial crises[31]

A) Labour market patterns

Historically, systemic financial crisis have tended to throw a long shadow on labour markets even after output has recovered. The typical recession in industrialized OECD countries[32] has tended to involve a decline in activity and then a sharp recovery – a 'V' shape – recession. Those associated with systemic financial crises[33] have been much more severe, with a more protracted 'U'-shaped recession, and a permanent loss in output (Figure B2.1). Mirroring the activity declines, employment has fallen much more rapidly during periods of financial turmoil than in other recessions. The employment response also appears to have been much more protracted: during the systemic crises, employment fell and then stagnated for a substantial period, with a sustained recovery coming only after about seven to eight years after the peak (Figure B2.2). Concomitantly, unemployment rates rose persistently and real wage growth declined and even turned negative in line with low labour demand (Figures B2.3 and B2.4).

Figure B2.1 GDP growth

(year-on-year growth, T = peak)

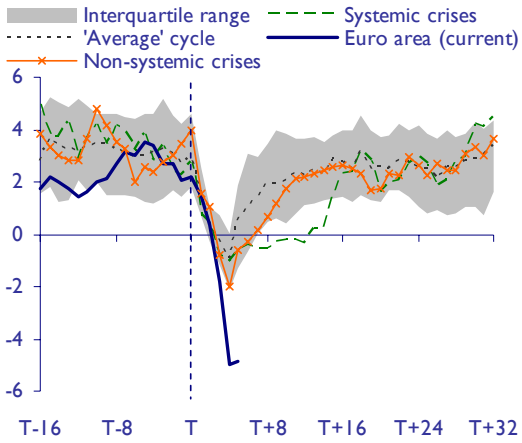
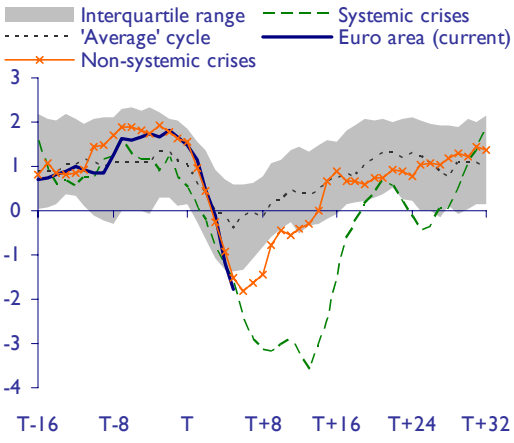


Figure B2.2 Employment growth

(year-on-year growth, T = peak)



[31] By Juha Kilponen, David Lodge, Rolf Strauch and Juuso Vanhala. Data assistance was provided by Agniezka Mazany, Magdalena Komzakova, Liisa Väisänen and Tarja Yrjölä.

[32] The full sample of countries includes: Belgium, Germany, Ireland, Greece, Spain, France, Italy, Luxembourg, Netherlands, New Zealand, Finland, Denmark, Sweden, Portugal, Norway, Switzerland, United Kingdom, Australia, Canada, Japan and United States.

[33] The definition of systemic and non-systemic financial crises follows IMF (2008), "What happens during recessions, crunches and busts?", Working paper 08/274 and IMF WEO, April 2009. Systemic crises are identified on the basis of the literature capturing economic downturns associated severe banking crises (Spain in the late 1970s, Norway in the late 1980s and Sweden, Finland and Japan in the early 1990s) - see Laeven, L and Valencia, F (2008), "Systemic banking crises: a new database", IMF working paper 08/224. Broadly a systemic crisis is one in which the volume of non-reforming loans was high and most or all bank capital exhausted. A further 13 non-systemic financial crisis episodes, where economic downturns can also be related to (less severe) banking problems.

Figure B2.3 Unemployment levels

(percent of labour force, T = peak)

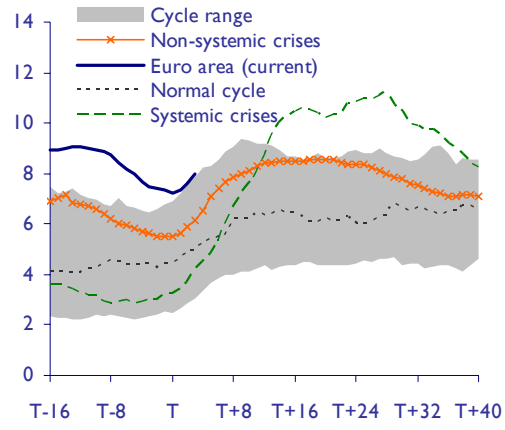
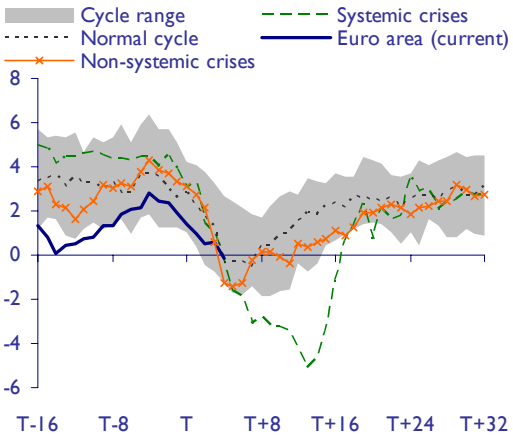


Figure B2. 4 Real compensation

(year-on-year growth, deflated using CPI, T = peak)



Sources: ECB computations based on Eurostat and OECD data.
Notes: the figures show developments preceding and following the recessions in a sample of 20 OECD countries. In each figure, quarter T represents the peak in the output level before a recession. The dotted line shows the average cyclical path across countries in the sample. The grey shaded area around that shows the range of experience across countries and cycles – summarised by the inter-quartile range. The crossed and dashed lines identify the average path in recessions following systemic and non-systemic financial crises. The blue line shows the current path for the euro area, with the peak in 2008 Q1. For more detail, see ECB (2009), "The latest euro area recession in historical context", Monthly Bulletin, November.

When looking at these variables, three key questions emerge: First, why is the impact on labour markets so protracted? Second, is the wage reaction to the economic downturn asymmetric and marked by nominal or real rigidities? Third, did wage dynamics contribute to employment and output losses? These three questions will be addressed in turn.

B) Unemployment dynamics and labour market flows[34]

Unemployment and long-term unemployment (LTU) generally display a positive relationship and tend to be subject to large structural shifts in Continental and Nordic countries following systemic crises. One can roughly distinguish between three groups of countries: Anglo-Saxon, North European and Continental European. In Anglo-Saxon countries unemployment and LTU have been low in recent decades. The rise of unemployment and the proportion of LTU in downturns have remained relatively modest, and both variables have typically returned relatively rapidly close to the pre-crisis level. Continental European countries have displayed markedly higher unemployment rates and in particular a higher proportion of LTU (see Table B2.1). The persistence in these variables has also been high. Once a rise in these variables has taken place recovery the proportion of LTU remains has remained at a higher level. This is evident especially in Finland and Sweden (but also for Spain and Japan), where the systemic crises led to a very large increase in the unemployment rate followed by a substantial increase in the proportion of LTU. Thus, employment losses during crises became encrusted in higher long-term unemployment, which caused human capital losses and reduced potential output growth.

[34] A more detailed analysis is provided in Vanhala, J. (2009): Labour Market Transitions During Severe Recessions, Bank of Finland, mimeo.

Table B2.1 Labour markets in selected countries, summary statistics

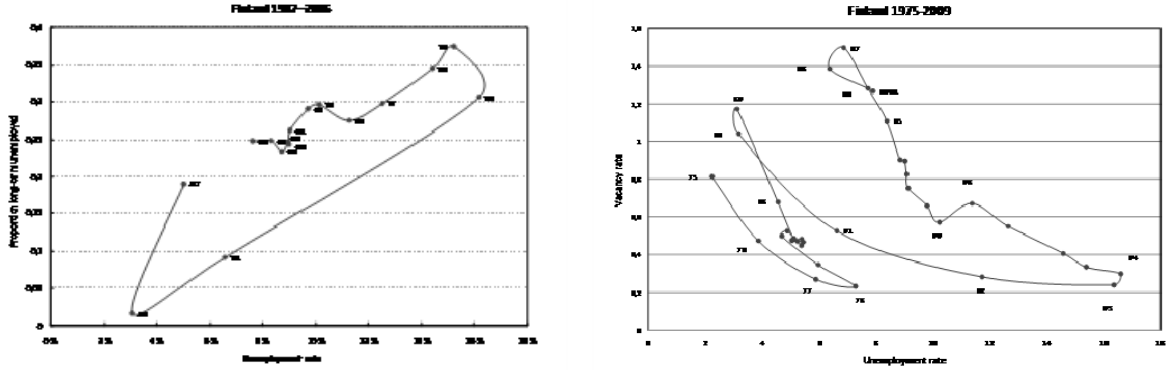
	Unemployment rate	Proportion long-term unemployed	Labour force, % of population 15-64	Unemployment inflow rate	Unemployment outflow rate	Worker inflow	Worker outflow
Finland	8.4; 0.172	22.9; 0.338	75.8; 0.006	-	-	-	-
France	8.3; 0.054	37.8; 0.053	67.2; 0.002	0.078; 0.051	0.008; 0.049	0.081; 0.047	0.083;0.048
Italy	10.3; 0.040	61.6; 0.040	61.1; 0.008	0.042; 0.092	0.004; 0.076	0.049; 0.093	0.048; 0.076
Japan	3.2; 0.060	20.7; 0.073	75.2; 0.004	0.193; 0.104	0.006; 0.101	0.069; 0.095	0.070; 0.101
Norway	4.6; 0.141	13.1; 0.151	78.8; 0.009	0.383; 0.087	0.016; 0.100	0.181; 0.088	0.181; 0.098
Spain	15.5; 0.073	46.1; 0.034	62.1; 0.006	0.062; 0.109	0.010;0.070	0.101; 0.083	0.102; 0.065
Sweden	4.7; 0.148	16.1; 0.146	79.8; 0.006	0.289; 0.093	0.012; 0.098	0.136; 0.094	0.138; 0.092
United Kingdom	7.7; 0.119	35.3; 0.070	74.8; 0.004	0.133; 0.078	0.01; 0.069	0.113; 0.076	0.111; 0.066
United States	6.2; 0.102	7.5; 0.207	74.0; 0.003	0.570; 0.096	0.036; 0.022	0.409; 0.019	0.409; 0.020

Sources: Bank of Finland computations based on OECD data and data from Elsby et al. (2008).
Notes: The mean has been calculated from raw annual data and the std. deviations have been calculated from annual log data that is hp (6,25) filtered. All variables were calculated from year 1970 or latter period depending on data availability. Country notes: Finland: missing values for variable LTU in 1981,1988, 1990, 1992 and 1994. Sweden LTU: Fata 1976-2003. Italy: Missing values for f,s, F,Sflows 1993. Missing values for t were interpolated as an average of t-1 and t+1.

Unemployment and LTU dynamics after crises emerge from limited matching efficiency of labour markets. This can be illustrated by looking at the unemployment inflow and outflow dynamics during the crises. The countries, where unemployment and LTU tends to remain relatively low over business cycles and an increase in unemployment and the proportion of LTU tends to be reversed rapidly, are roughly the same countries (Anglo-Saxon) as those with high reallocation rates. In countries with low reallocation rates (Continental Europe) unemployment and LTU tend to increase more in downturns and the recovery is more sluggish.[35] In these cases, the gap between inflow and outflow rates emerging in the crisis is not closed afterwards. Restructuring is an element explaining this breach between inflow and outflow rates. A prime example of this was the Finnish crisis in the 1990s. The post recession increase in employment occurred in different sectors than the ones from which jobs had been destroyed. The outward shift of the Beveridge curve (see Figure B.25) coincided with the increase in unemployment and LTU.

[35] The rates of inflow to and outflow from unemployment are estimates presented in Elsby *et al*. (2008)

Figure B2.5 Long term unemployment and structural change in Finland



C) Wage asymmetries[36]

Evidence from standard wage models suggest that wages reacted less systematically to unemployment increases during crises than at normal times. Table B2.2 presents the results of an analysis using a standard wage equation for a panel of OECD countries, regressing nominal compensation growth against changes in the GDP deflator, productivity and a measure of labour market slack.[37] As expected, the estimates suggest that real wages respond to changes in labour market conditions: a widening of the unemployment gap – i.e. a rise in unemployment relative to the estimated NAIRU – causes wages growth to slow (Column 2). However, this wage flexibility does not apply systematically during crisis episodes (Columns 3 and 4), which can be read as one indication of nominal or real wage rigidity.[38]

[36] For a more detailed analysis see David Lodge (2009) Wage flexibility during recessions and crises – Is there evidence of asymmetries? ECB, mimeo.

[37] The precise form of the equation is: $\Delta w_{it} = \delta_1 + \delta_2^{'}(\widetilde{u}_{it}) + \delta_2^{''}(\widetilde{u}_{it}) * dummy_{it} + \delta_3 \Delta p_{it-1} + \delta_4 \Delta wedge_{it-1} + \delta_5 \Delta q_{it} + \delta_6 \Delta z_{it} + \varepsilon_{it}$ where in quarter *t*, for country *i*, Δw_{it} is change in (log) nominal compensation per employee; Δp_{it} is change in (log) GDP deflator; $\Delta wedge_{it}$ is the wedge between the GDP and consumer price deflator growth; Δq_{it} is change in productivity; and Δz_{it} a set of other variables including the oil price and euro-dollar exchange rate. The variable $\widetilde{u}_{it-4}$ represents a (lagged) measure of labour market slack, measured as the unemployment rate less an estimated NAIRU measure, derived by applying an HP filter to the unemployment rate. The coefficient $\delta_2^{'}$ represents the average responsiveness of compensation to changes in labour market pressure. The dummy variable isolates periods of recession or financial crisis across countries so that the coefficient $\delta_2^{''}$ captures the possibly different response of wages to labour market conditions during crisis periods.

[38] F-tests cannot reject the hypothesis that the coefficients on the unemployment gap measures (during a recession / crisis or not) are the same.

Table B2.2 Asymmetries in wage behaviour

	(1)	(2)	(3)	(4)
GDP deflator	0.700 ***	0.701 ***	0.700 ***	0.700 ***
Consumption-GDP deflator wedge	0.362 ***	0.361 ***	0.361 ***	0.362 ***
Productivity	0.175 ***	0.175 ***	0.175 ***	0.175 ***
Oil	0.004 ***	0.004 ***	0.004 ***	0.004 ***
US-dollar exchange rate	-0.008 *	-0.008 *	-0.008 *	-0.008 *
Unemployment gap	-0.001 ***			
Unempl. gap negative		0.000		
Unempl. gap positive		-0.002 ***		
Unempl. gap - no recession			-0.001 ***	
Unempl. gap - recession			0.000	
Unempl. gap - no crisis				-0.001 ***
Unempl. gap - crisis				0.000
Constant	0.005 ***	0.006 ***	0.005 ***	0.005 ***
Number of observations	2312	2312	2312	2312
Periods of positive unempl. gap		1249		
Recession / crisis periods			249	74
R-Squared	0.411	0.412	0.412	0.411

Notes: Stars denote p-values for significance of coefficients: * p<0.1; ** p<0.05; *** p<0.01. See footnote 38 for estimation details.

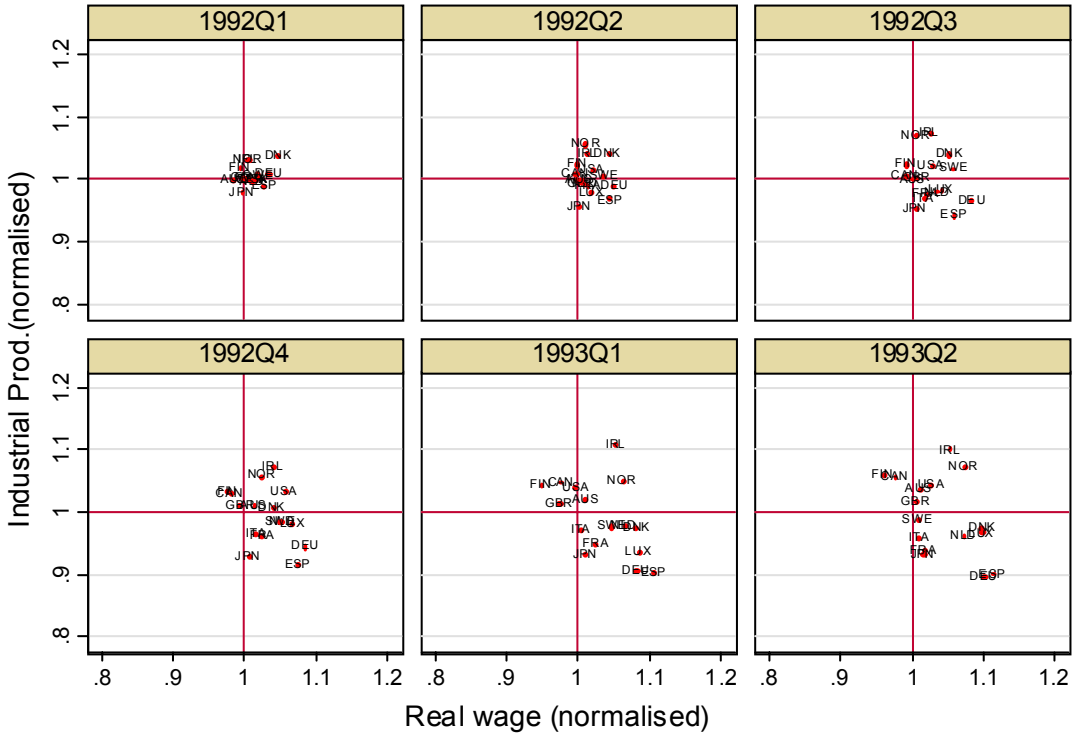
D) Wage adjustment aggregate supply[39]

Moreover, evidence points to real wage rigidities during crises being associated with a disproportionate reaction of employment compared to normal recessions. Using a panel VAR approach, which distinguishes between crisis and non-crisis episodes, a further indication of wage rigidity can be found in the direction of Granger causality going from compensation per employee to employment, but not vice versa. In addition, the initial pattern of prices and compensation per employee following a financial crisis related demand shock does not differ substantially from normal times. This implies some downward real wage rigidity, which is associated with a large drop of employment growth. The wage drift apparently did not play a systematic role for the labour market impact of labour costs during past financial crises since a similar pattern can be found for wage rates. In turn, impulse-response functions for unemployment rates point to a drastic increase indicating that the employment reaction is not absorbed by lower participation rates. The evidence for downward wage rigidity and the impact on labour demand is much less pronounced when normal business cycle fluctuations are taken into account.

The broad picture of negative supply side effects of wage rigidity is confirmed when looking more specifically at the ERM II crisis. Figure B3.6 looks at the relationship between output (measured by industrial production) and the real product wage in the sample of OECD countries during the ERM II crisis (1992-1993). A distinct feature of this Figure is that in particular towards the end of the sample, countries with high real wages had also typically low output. This illustrative evidence on a downward output-real wage curve is confirmed by formal econometric evidence. When analysing wage developments during the ERM II crisis more closely, the existence of nominal wage rigidities in terms of a high degree of wage inertia becomes indeed also apparent.

[39] More detailed analysis and discussion is provided in Kilponen, J. (2009): Aggregate Supply and Nominal Wage Adjustment in the Recent Financial Crises, European Central Bank, mimeo; and Rolf Strauch (2009) Labour markets during financial crises – a panel VAR analysis. The study is based on the approach by C. Goodhart and B. Hofmann (2008) House price, money, credit and the macroeconomy, ECB Working Paper No. 888. We would like to thank Boris Hofmann for useful discussions and for making his codes available.

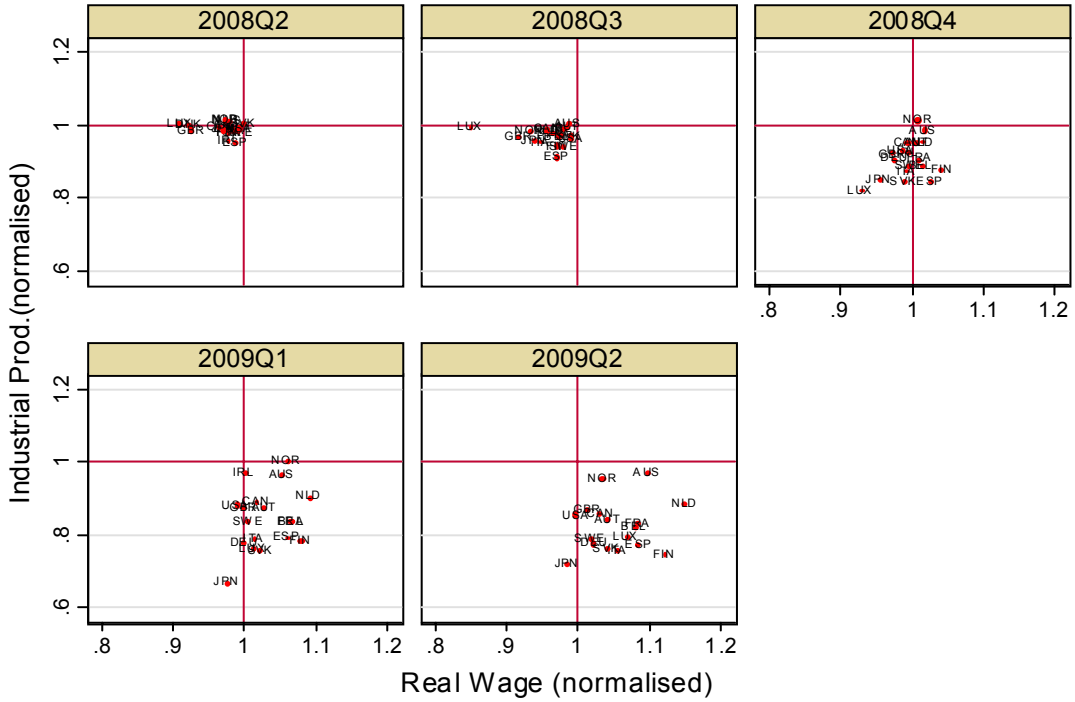
Figure B2.6.Industrial Production and Real Wage in the Sample of OECD Countries, 1992Q1-1993Q2.



Note: Industrial production and real wage has been normalized to one in 1991q4. The real wage has been computed deflating the nominal wages by the producer price index.

The current crisis however is different so far. Figure B2.7 shows the evolution of output and the real product wage between 2008Q2 and 2009Q2. There does not seem to be any evidence on the downward sloping supply curve. Note also that there are several countries where the real wage had fallen below 2008Q1 level already prior to 2009Q1. This difference to the ERM II crisis reflects some variation in the nominal wage inertia between the two crisis episodes. Both results are affected by government measures; since massive public spending increases has helped to cushion the output and employment effect of the crisis, and measures supporting the adjustment in hours worked amplify the reaction of wage rates.

Figure B2.7 Industrial Production and Real Wage in the Sample of OECD Countries, 2008Q2 - 2009Q2.



Note: Industrial production and real wage has been normalized to one in 2008Q1. The real wage has been computed by deflating the nominal wage by the producer price index.

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ANNEX 1: WDN participants

CHAIRPERSON: **Frank Smets (ECB)**				
SECRETARY: **Ana Lamo (ECB)**				
GROUPS	MACRO GROUP	MICRO GROUP	SURVEY GROUP	META GROUP
CONTACT PERSON	**Frank Smets (ECB)**	**Juan F. Jimeno (Banco de España)**	**Silvia Fabiani (Banca d'Italia)**	**Frank Smets (ECB)**
Austria	Markus Knell Alfred Stiglbauer	Wolfgang Pointner Alfred Stiglbauer	Claudia Kwapil	Alfred Stiglbauer
Belgium	Grégory De Walque Raf Wouters	Philip Du Caju Catherine Fuss	Martine Druant Philip Du Caju	Raf Wouters
Bulgaria			Ivan Lozev	
Cyprus	Maria Papageorghiou		Mikalis V. Ktoris	
Czech Republic	Jan Babecký	Kamil Galuščák	Kamil Galuščák Jan Babecký	Jan Babecký
Denmark	Peter Storgaard	Niels Lynggård Hansen		
Estonia			Aurelijus Dabusinskas Tairi Room	
Finland	Juha Kilponen Juuso Vanhala	Juha Kilponen		
France	Hervé Le Bihan Erwan Gautier	Patrick Sevestre Thomas Heckel	Jeremi Montornès Guillaume Horny	Hervé Le Bihan
Germany	Michael Krause	Daniel Radowski	Daniel Radowski	Michael Krause
Greece	Daphne Nicolitsas	Daphne Nicolitsas Dora Kosma	Daphne Nicolitsas Dora Kosma	Daphne Nicolitsas
Hungary	István Kónya	Gábor Kátay	István Kónya Gabor Kezdi	
Ireland	Karl Whelan	Martina Lawless	Martina Lawless Mary J. Keeney	
Italy	Fabrizio Venditti	Alfonso Rosolia Fabrizio Venditti	Silvia Fabiani Roberto Sabbatini	Silvia Fabiani
Lithuania			Ernestas Virbickas	
Luxembourg	Olivier Pierrard	Patrick Lünnemann Ladislav Wintr	Patrick Lünnemann Thomas Mathä	

The Netherlands		Steven Poelhekke	Marco Hoeberichts Ad C.J. Stokman	
Poland	Michał Gradzewicz	Jacek Socha	Pawel Strzelecki Jacek Socha	
Portugal	Carlos Robalo Marques	Pedro Portugal	Carlos Robalo Marques Fernando Martins	
Slovenia	*Klara Stovicek*		Jan Grobovsek	
Slovakia			Pavel Gertler	
Spain	James Constain	Juan F. Jimeno Mario Izquierdo	Mario Izquierdo	Juan F. Jimeno
Sweden		Mikael Carlsson		
UK	Stephen Millard			
ECB-DGR	Frank Smets Kai Christoffel Gabriel Fagan	Ana Lamo	Frank Smets Ana Lamo	Frank Smets Ana Lamo
ECB-DGE	Tobias Linzert Boris Hofmann Daphne Momferatou Melanie Ward-Warmedinger Keith Kuester Stephan Fahr	Jarkko Turunen Philip Vermeulen		Philip Vermeulen
Uni.Di Torino	Giuseppe Bertola		Giuseppe Bertola	Giuseppe Bertola
World Bank		Julian Messina	Julian Messina	Julian Messina

ANNEX 2: WDN Survey

Table A2.1: WDN survey – The main characteristics of the national surveys

Country	Sectoral coverage	Firms' size	Sample size	Number of respondents *(reponse rate)*	Geographical breakdown	Who carried out the survey	How was the survey carried out
Austria	Manufacturing Energy Construction Trade Bus. services Fin. intermed.	≥ 5	~ 3,500	557 *(16%)*	No	External Company (WIFO)	Traditional mail and Internet
Belgium	Manufacturing Energy Construction Trade Bus. services Fin. intermed.	≥ 5	~ 4,100	1,431 *(35%)*	No	NBB On the business survey sample	Traditional mail
Cyprus	Manufacturing, Construction, Trade, Bus. Services	≥5	600	208 (35%)	No	External company	Phone, Mail, face-to-face
Bulgaria	Manufacturing Trade Bus. services	>=20 manufacturing >=5 trade >=5 bus.services	1,292	"504 (39%)"	Yes	External company (ESTAT)	Main: Face-to-face interview; Supplementary: email or traditional mail
Czech Rep.	Manufacturing Construction Trade Bus. services	≥ 20	1,591	399 *(25%)*	No	CNB branches	Internet
Estonia	Manufacturing Construction Trade Bus. services	≥ 5	~ 1,400	366 *(26%)*	Yes (Tallinn–non-Tallinn)	External company	Internet
France	Manufacturing Trade Bus. services Non-market serv.	≥20 industry ≥ 5 services	~ 6,550	2,029 *(31%)*	Yes	Local branches	Phone, mail, and face to face
Germany	Manufacturing Bus. services	All (56 firms with <5)	4,600	1,832 *(40%)*	East-West	IFO, attached to IFO business survey	Traditional mail
Greece	Manufacturing Trade Bus. services	≥ 5	5,000	429 *(9%)*	All regions	External company	Traditional mail
Hungary	Manufacturing Energy Construction Trade Bus. services Fin. intermed.	≥ 5	3,785	2,006 *(53%)*	All regions, stratified by NUTS1 regions	External company	Face-to-face interview
Ireland	Manufacturing Energy Construction Trade Bus. services Fin. intermed.	≥ 5	~ 4,000	985 *(25%)*	No	External company	Traditional mail, phone
Italy	Manufacturing Trade Bus. services Fin. intermed.	≥ 20	~ 4,000	953 *(24%)*	Yes	External company	Internet

Lithuania	Manufacturing Energy Construction Trade Bus. services Fin. intermed.	≥5	2,810	500 *(18%)*	No	External company	Phone, mail, face-to-face
Luxembourg	Manufacturing Construction Trade Bus. services Fin. intermed Non-market services	□1	>7,000	701	No	BCL	Email
Netherlands	Manufacturing Construction Trade Bus. services Fin. intermed.	≥ 5	2,116	1,068 *(50%)*	No	External company	Internet
Poland	Manufacturing Energy Construction Trade Bus. services Fin. intermed.	All	~1,600	1,161 *(73%)*	All regions	National Bank of Poland (branches) Attached to the LFS	Traditional mail
Portugal	Manufacturing Energy Construction Trade Bus. services Fin. intermed.	≥ 10	~5,000	1,436 *(29%)*	No	Banco de Portugal	Traditional mail and internet
Slovenia	Manufacturing Energy Construction Trade Bus. services Fin. intermed.	≥ 5	~ 3,000	658 *(22%)*	No	Banka Slovenije	Traditional mail and internet
Slovakia	Manufacturing Energy Construction Trade Bus. services Fin. intermed.	≥ 10	1416	802 (57%)	All regions (NUTS3)	External company	Face-to-face interview.
Spain	Manufacturing Energy Trade Bus. services	≥ 5	3,000	1,835 *(61%)*	No	External company	Mail, phone, fax or internet

ANNEX 3 Follow-up WDN Survey

Table A3.1 Follow–up WDN Survey – The main characteristics of national surveys

Country	Sectoral coverage	Firms' size	Sample Size	Number of respondents *response rate*	Same as for initial survey?	Who conducted the survey	How was the survey conducted
Austria	Manufacturing Energy Construction Market Services Financial Intermediation	>=10	1538	731 (48%) (322 firms from the old sample and 409 new respondents)	Bigger sample including the old sample	WIFO	Traditional mail
Belgium	Manufacturing Energy Construction Trade Market services Financial intermediation	>=5	1431	997 (70%)	Respondents to initial survey	NBB	Traditional mail
Cyprus	Manufacturing, Construction,Trade, Market services	≥5	600	208 (35%)	The follow up survey for the case of Cyprus was conducted at the same time as the initial survey	External company	Phone, Mail, face-to-face
Czech Republic	Manufacturing Construction Trade Market services	>=20	399	241 (60%)	Respondents to initial survey	CNB	Traditional mail
Estonia	Manufacturing Construction Trade Market services	>=5	366	163 (45%)	Respondents to initial survey	TNS Emor	Internet
France	Manufacturing Market services Trade	>=5	2029	813 (40%)	Respondents to the initial survey	BdF	Mail (traditional + electronic)
Italy	Manufacturing Trade Market services Financial intermediation	>=5	953	677 (71%)	Respondents to initial survey	external company	Internet
Luxemburg	Manufacturing Construction Trade Market services Non-market services	>1	701	432 (62%)	Respondents to initial survey	BCL	Email
The Netherlands	Manufacturing Construction Trade Market services Financial intermediation	>=5	1060	670 (63%)	Respondents to initial survey	TNS NIPO	Internet

Poland	Manufacturing Energy Construction Trade Market services Financial intermediation	>=1	?	381 (?)	Part of new wave of NBP survey (1600 responses). Only firms that overlaped previous WDN survey included in the dataset	NBP	Annonymus questionnaires, sent by e-mail or collected by NBP representatives

ANNEX 4. The Structure of Earnings Survey

The Structure of Earnings Survey (SES henceforth) is a standardised survey conducted by the national statistical offices of 20 European countries. It involves interviewing a large sample of firms/plants randomly selected from the Social Security General Register records or similar firm registers in each country, and obtaining information on both the firm/plant as such, and a random sample (ca. 20%) of their employees. It was conducted for the first time in 1995. In 2002, the survey was repeated and it was then decided that it will be conducted every 4 years, starting from 2002, at the moment only two waves are available, although a few countries (Spain and Germany) are currently starting to release the 2006 wave.

The SES contains information on several measures of pay and hours of work, age, gender, and educational attainment among other workers characteristics, and some characteristics that are job specific as type of contract, sector, occupation, etc. Information obtained about the firm includes number of employees, whether the firm is privately owned, the nature of wage bargaining, etc. It is uniquely suited for the WDN studies on wage structure and wage differentials as (i) is comparable across countries. (ii) It is a matched employer employee dataset and, therefore, allows controlling for individual, job-specific and firm-specific features when estimating a comparable measure of wages. (iii) The data is collected at the firm level, which gives accurate information on pay and earnings, variables that are usually very noisy in household surveys.

The access to SES data for research is limited. So far, the WDN has had access to data for ten countries (Austria, Belgium, Czech Republic, Germany, Greece, Hungary, Ireland, Italy, the Netherlands, and Spain). This access has been granted by different channels: ECB access at the Safe Center in Eurostat premises, remote access by the ECB, and access via NCB. [40] The Table A4.1 below shows some features of the sample size available in each country.

Table A4.1. SES data. Sample size by country and wave

Country	Sample size wave 1	Sample size wave 2
Austria (1996 for wave 1)	93,941	85,481
Czech Republic (2002 & 2006 for wave 1 & 2)	541,156	957,279
Belgium (1999 for wave 1)	101,302	102,941
Germany (2001 for wave 2)	652,676	467,932
Spain	170,697	173,487
Greece	38,071	41,449
Hungary (1996 for wave 1)	91,578	119,019
Ireland	36,727	16,359
Italy	79,501	73,692
The Netherlands	66,196	37,860

Except when indicated wave 1 refers to 1995 and wave 2 to 2002. In case of the Czech Republic is not strictly SES data but a similar national source: MEE

[40] DGS at the ECB provided very valuable help in the process of getting access to these data.

ANNEX 5

Table A5.1 Employment protection in OECD and selected non-OECD countries

Scale from 0 (least restrictions) to 6 (most restrictions)

Country	1998	2000	2005	2008
Austria	2.38	2.38	2.15	2.15
Belgium	2.48	2.50	2.50	2.50
Bulgaria	na	na	na	na
Cyprus	na	na	na	na
Czech Republic	1.94	1.94	2.10	1.99
Denmark	1.90	1.90	1.90	1.77
Estonia	na	na	na	2.29
Finland	2.18	2.18	2.12	2.03
France	2.84	2.84	2.89	2.89
Germany	2.57	2.57	2.39	2.39
Greece	3.46	3.46	2.81	2.81
Hungary	1.54	1.54	1.75	1.85
Ireland	1.17	1.17	1.32	1.32
Italy	3.06	2.91	2.33	2.38
Japan	1.60	1.45	1.45	1.45
Lithuania	na	na	na	na
Luxemburg	na	na	na	3.35
Netherlands	2.77	2.27	2.27	2.13
Poland	1.86	1.86	2.19	2.19
Portugal	3.53	3.53	3.36	2.93
Slovakia	2.17	2.17	1.74	1.82
Slovenia	na	na	na	2.57
Spain	2.96	2.96	3.01	3.01
Sweden	2.49	2.49	2.49	2.18
United Kingdom	0.98	1.05	1.10	1.10
United States	0.65	0.65	0.65	0.65

Source: OECD. For details about the OECD methodology to calculate EPL indicators see www.oecd.org/employment/protection.

ANNEX 6

Table 6.1 GDP decline (%)

(quarter-on-quarter growth rates, seasonally adjusted data)

	2008Q1	2008Q2	2008Q3	2008Q4	2009Q1	2009Q2	Cumulative decline
Austria	1.05	0.26	-0.40	-0.96	-2.70	-0.53	3.3
Belgium	0.39	0.34	0.00	-1.74	-1.71	-0.26	3.0
Czech Republic	0.13	1.22	0.46	-1.28	-4.82	0.11	4.2
Estonia	-1.12	-1.51	-2.99	-4.48	-5.98	-3.38	18.0
Spain	0.42	-0.02	-0.55	-1.08	-1.58	-1.06	3.8
France	0.46	-0.47	-0.22	-1.42	-1.35	0.34	2.6
Italy	0.52	-0.59	-0.78	-2.08	-2.71	-0.50	6.0
Luxembourg	0.39	-1.03	-0.43	-2.85	-1.74	-1.34	4.3
Netherlands	0.74	-0.19	-0.36	-1.04	-2.69	-0.87	4.4
Poland	1.11	0.85	0.63	-0.06	0.28	0.52	-3.4*
Weighted average	0.54	-0.21	-0.37	-1.41	-1.93	-0.30	3.6

Source: EC. Notes: GDP in volume. The last column of the table presents cumulative decline from 2008Q1 to 2009Q2 (seasonally adjusted). * Cumulative increase in GDP was 3.4% in Poland.