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WAGE DYNAMICS NETWORK

WORKING PAPER SERIES
NO 1164 / MARCH 2010

PRICE, WAGE AND EMPLOYMENT RESPONSE TO SHOCKS

EVIDENCE FROM THE WDN SURVEY

by Giuseppe Bertola, Aurelijus Dabusinskas, Marco Hoeberichts, Mario Izquierdo, Claudia Kwapil, Jeremi Montornès and Daniel Radowski

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In 2010 all ECB publications feature a motif taken from the €500 banknote.

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Wage Dynamics Network

This paper contains research conducted within the Wage Dynamics Network (WDN). The WDN is a research network consisting of economists from the European Central Bank (ECB) and the national central banks (NCBs) of the EU countries. The WDN aims at studying in depth the features and sources of wage and labour cost dynamics and their implications for monetary policy. The specific objectives of the network are: 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.

The WDN is chaired by Frank Smets (ECB). Giuseppe Bertola (Università di Torino) and Julián Messina (World Bank and University of Girona) act as external consultants and Ana Lamo (ECB) as Secretary.

The refereeing process of this paper has been co-ordinated by a team composed of Gabriel Fagan (ECB, chairperson), Philip Vermeulen (ECB), Giuseppe Bertola, Julián Messina, Jan Babecký (CNB), Hervé Le Bihan (Banque de France) and Thomas Mathä (Banque centrale du Luxembourg).

The paper is released in order to make the results of WDN research generally available, in preliminary form, to encourage comments and suggestions prior to final publication. The views expressed in the paper are the author's own and do not necessarily reflect those of the ESCB.

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Abstract

This paper analyses information from survey data collected in the framework of the Eurosystem's Wage Dynamics Network (WDN) on patterns of firm-level adjustment to shocks. We document that the relative intensity and the character of price vs. cost and wage vs. employment adjustments in response to cost-push shocks depend – in theoretically sensible ways – on the intensity of competition in firms' product markets, on the importance of collective wage bargaining and on other structural and institutional features of firms and of their environment. Focusing on the pass-through of cost shocks to prices, our results suggest that the pass-through is lower in highly competitive firms. Furthermore, a high degree of employment protection and collective wage agreements tend to make this pass-through stronger.

Keywords: Wage bargaining, Labour-market institutions, Survey data, European Union

JEL code: J31, J38, P50

Non technical summary

In this paper, we analyse how the extensive firm-level information collected in the framework of the Eurosystem's Wage Dynamics Network (WDN) survey can yield novel insights regarding the way in which firm decisions distribute market shocks across prices, wages, and employment. Firm-level reactions to shocks, shaped by structural and institutional features that differ importantly across countries, influence the dynamics of prices and quantities along microeconomic and macroeconomic adjustment processes, with important and controversial welfare and policy implications. While stable wages and stable employment are beneficial for uninsured workers, labour market rigidity constrains labour (re)allocation, reducing productivity and profits, and may increase the extent to which cost-push shocks are passed on to prices. This in turn makes it more difficult for monetary policy to achieve price stability.

We focus on the relationship between structural and institutional features of the firms' environment, and the relevance of price, employment, and wage adjustment in firms' reactions to shocks. The very rich structure of the WDN data makes it possible not only to identify the persistence and commonality of (hypothetical) shocks, but also to relate the stated reaction strategies to self-reported and country-level features of the firm's environment. We analyse specifically the role of the intensity and international character of output market competition, and of the incidence of collective-bargaining constraints on firm-level wages. Our results indicate that these factors are highly heterogeneous across countries and firms, and that they do shape the relevance of price, wage, and employment adjustment: Product market competition reduces the relevance of price reactions to cost shocks. Moreover, these shocks tend to be distributed across wage and employment reactions in ways that depend on the extent of firm-level wage flexibility and on the presence of temporary workers.

Our analysis shows that firms react to shocks in wages and others costs in theoretically sensible and empirically informative ways. A firm in a competitive environment has less control over the price it charges. When prices are sticky, however, a high elasticity of product demand and small margins make it easier for wage and cost shocks to overcome the cost of price changes. In the survey data, firms that report facing strong competition in the product market are less likely to increase prices and more likely to reduce costs after a wage shock (stated in the survey question to be common to all firms in the industry). A higher export share in total sales has a qualitatively similar role, whereas the presence of collective wage agreements at industry or national level makes a price increase more likely. The data also seem to suggest that price increases are more likely in countries with more stringent employment protection legislation.

The second part of the study focuses on cost-cutting strategies and the factors that explain the choice of the strategy. The data indicate that competition and other indications of a high labour-demand elasticity increase the likelihood of cost-cutting strategies via labour costs, either through wage adjustment or employment reduction. We also find that firms covered by collective wage agreements are more likely to look for cost reductions by reducing the number of temporary employees and less likely to reduce wages. Overall, it appears that temporary employment acts as a buffer against fluctuations in permanent employment and against wage fluctuations. EPL insulates permanent employment from cost-push shocks but makes adjustment in temporary employment more likely.

Assessing the extent to which such features imply differences in the behaviour across countries and firms in our sample can help determining the extent to which the wage moderation apparent in recent European experiences is due to stronger product market competition, within and across countries' borders, and how much reflects weaker union power in wage setting, with important implications for inflation transmission mechanisms.

1. Introduction

The way in which firm decisions distribute market shocks across prices, wages, and employment is an essential element of microeconomic and macroeconomic adjustment. Shaped by structural and institutional features that differ importantly across countries, firm-level reactions to shocks shape the allocation and dynamics of wages and employment, with important and controversial welfare and policy implications. While stable wages and stable employment are beneficial for uninsured workers, labour market rigidity constrains labour (re)allocation, reducing productivity and profits, and may increase the extent to which cost-push shocks are passed on to prices. This in turn makes it more difficult for monetary policy to achieve price stability.

At the economy-wide level, the relative importance of various adjustment channels generally depends on institutional and structural features (see e.g. Bertola, 1999). Collective bargaining privileges wage stability. Employment protection legislation aims at stabilising employment. Moreover, more intense product market competition, as implied by international economic integration, makes it more difficult for firms to absorb the resulting loss of production efficiency. At the microeconomic level, administrative and survey data have been analysed from relevant perspectives, e.g. by Guiso et al. (2005), Leonardi and Pica (2007), as well as Cardoso and Portela (2009).

In this paper, we analyse how the extensive firm-level information collected in the framework of the Eurosystem's Wage Dynamics Network (WDN)[1] survey can yield novel insights on these important issues. We focus on the relationship between structural and institutional features of the firms' environment, and the relevance of price, employment, and wage adjustment in firms' reactions to shocks.

The very rich structure of the WDN data makes it possible not only to identify the persistence and commonality of (hypothetical) shocks, but also to relate the stated reaction strategies to self-reported and country-level features of the firm's environment. We focus specifically on the intensity and international character of output market competition, and on the incidence of collective-bargaining constraints on firm-level wages. Our results indicate that these factors are highly heterogeneous across countries and firms, and that they do shape the relevance of price, wage, and employment adjustment in theoretically sensible ways: Product market competition reduces the relevance of price reactions to cost shocks. Moreover, these shocks tend to be distributed across wage and employment reactions in ways that depend on the extent of firm-level wage flexibility and on the presence of temporary workers.

The paper is organised as follows: In Section 2 we document the data set and outline how theoretical considerations motivate the empirical specifications. Section 3 investigates the influence of firms' characteristics on price and cost adjustments, and Section 4 turns to consider different cost-adjustment strategies applied by firms. In each case we report descriptive statistics as well as controlled regressions that provide evidence of a statistically significant role for product market competition and

[1] The WDN connects researchers from 24 European central banks and is coordinated by the European Central Bank (ECB).

wage bargaining frameworks in shaping firms' responses to shocks. Finally, Section 5 concludes the paper.

2. Data and theory

2.1 Available data

Within the WDN a harmonised questionnaire was set up and each participating National Central Bank was responsible for its translation and the conduct of the survey in its own country. Some central banks conducted the survey themselves (often through their branches), others outsourced it to opinion research centres. This approach resulted in a variety of data collection methods ranging from fill-in questionnaires sent by traditional mail and electronically, to interviews by phone and face-to-face interviews. 16 euro area and non-euro area countries[2] participated in the survey. However, our analysis only draws on the information from 14 countries (nine countries from the euro area and five non-euro area countries), as the phrasing of the relevant questions in the German and the Greek questionnaires deviates slightly and thus, results in non-comparable data.

Table 1. Composition of the sample

Country	Number of firms	in %
AT	557	3.7
BE	1,431	9.4
CZ	399	2.6
EE	366	2.4
ES	1,835	12.0
FR	2,029	13.3
HU	2,006	13.2
IE	985	6.5
IT	953	6.3
LT	343	2.3
NL	1,068	7.0
PL	1,161	7.6
PT	1,436	9.4
SI	666	4.4
Total	15,235	100

As shown in Table 1, the total number of observations is 15,235 from seven different sectors (manufacturing, energy, construction, trade, market services, financial intermediation and non-market services).[3] Across countries, the sample size ranges from 343 in Lithuania to 2,029 in France. All firms have more than five employees. As the sampling probabilities and the non-response rates vary across firms, we use ex-post sampling weights that correct for these imperfections. Furthermore, in order to make our results representative for the whole workforce in the sectors covered, we use

[2] The 16 countries are Austria, Belgium, the Czech Republic, Estonia, Spain, France, Germany, Greece, Hungary, Ireland, Italy, Lithuania, the Netherlands, Poland, Portugal and Slovenia. Luxemburg also participated in the survey. However, the data from Luxemburg are not yet available.

[3] See Table C1 in Appendix C for details. For more details on the survey data in general see Druant et al. (2009), Babecký et al. (2009a), and Galuscak et al. (2010).

employment adjusted sampling weights. Put differently, our data-set represents around 50 million employees.

The survey was conducted between autumn 2007 and spring 2008. At that time the economic conditions were perceived as being quite favourable. In 2007 real GDP grew by 2.7% in the euro area and the ECB (2007) forecasted it to grow between 1.5 and 2.5% in 2008. Moreover, the inflation rate was 2.1% in 2007 and was forecasted to increase to levels between 2.0 and 3.0% in 2008. Although in retrospect we know that the financial crises already started to spread out, at the time the survey was conducted the consequences of the financial turbulences in the U.S. were underestimated by far. Economic conditions that prevail when a survey is conducted are likely to influence the answers given by firms. Thus, we summarise that the economic conditions at the time the WDN survey was conducted were close to equilibrium conditions. However, firms expected consumer price inflation to increase slightly in the year ahead because of external price pressures stemming from food and energy goods.

This paper focuses its attention on firm-level adjustment strategies in reaction to hypothetical cost shocks. One shock is an unanticipated increase in the cost of an intermediate input, and the other shock represents an unanticipated increase in wages (for example due to contracts bargained at higher levels). Both shocks were supposed common to all firms in the market, and the wage shock was explicitly considered permanent.[4] The respondents were asked to assess the relevance of four different adjustment strategies in response to these shocks: (1) an increase in prices, (2) a reduction in profit margins, (3) a reduction in output and (4) a reduction in costs. Unless they rated 'cost reduction' as completely irrelevant, respondents were in each case additionally asked to indicate how they reduce costs, choosing between reduction of base wages, of flexible wage components, of permanent or temporary employment, of hours worked per employee and of non-labour costs. See Appendix A for the exact wording of the questionnaire.

2.2 Relevant theory

We bring to bear on these data a partial equilibrium perspective on firms' optimal employment strategies, focusing on the interaction between shocks and price, employment, and wage adjustment. We assume a "right to manage" situation, where employment and hours are chosen by firms (possibly subject to hiring and firing costs), while wages may be bargained collectively. In that setting, the relevance of price and cost reactions depends on the shape of the firm's marginal revenues and marginal productivity (hence marginal costs). In turn, these depend on the firm's market power, and on institutional constraints on wage and employment adjustment. Similar insights would also be relevant if employment were an element of collective bargains, or in competitive frameworks where shocks (especially when they are common to the industry) are associated with wage changes along local labour supply curves.

As wages and other costs vary, firms' choices are limited by demand conditions, and possible price adjustment constraints. When prices are flexible, firms move along the product demand curve, and

[4] While firms were also asked to consider reactions to a demand shocks, it is conceptually easier to study whether and how labour-cost adjustment is shaped by the firm's environment in response to the two hypothetical cost-push shocks. Thus, this paper concentrates on the two cost shocks.

employers should choose employment so as to equate the wage to labour's marginal impact on firm's revenues. For a perfectly competitive firm with flexible prices, this is labour's marginal productivity, multiplied by the product's price. For a firm with market power, it is the marginal revenue product. Under flexible prices, margins may be adjusted if the elasticity of demand varies (as in e.g. Gali, 1994). If prices are sticky, however, margins need to be adjusted when costs change. Thus, the relative relevance of the 'increase prices' and 'reduce output' should depend on the extent of price stickiness.

In response to supply shocks that (like those mentioned in the survey questions) are common to all firms, it is more likely that prices rather than costs are the preferred adjustment strategy, when the output market is more competitive and firms have less control over the prices they charge. Under perfect competition, in fact, prices would be equal to marginal costs, and would necessarily change when wages or other input costs are shocked. When prices are sticky, however, a high elasticity of product demand and small margins make it easier for wage and cost shocks to overcome the cost of price changes. Firms that face costs of changing prices (as in menu-cost models) can keep prices fixed in response to cost shocks because their pre-set prices are higher than marginal costs, and the margin can absorb the shock. A lower elasticity of product demand implies larger margins and, for a given cost of changing prices, makes price rigidity a more likely outcome. The survey does not offer quantitative information on the size of desired or actual price changes, which in Calvo models depend on expectations as well as on current marginal cost changes. The survey does, however, offer qualitative information as to the relevance, and perhaps the likelihood, of price adjustment as a response to shocks for each firm.

We find it particularly interesting and insightful to focus on how reaction strategies covary with structural and institutional features of the firms' business environment in which choices are made. As outlined formally in Appendix B, the relevance of employment and wage reactions in a firm's cost-minimisation strategy in response to shocks depends essentially on the elasticity of its demand function, and on institutional constraints. Along its demand curve, wage and employment responses are expected to be larger when labour demand is more elastic. International economic integration is generally expected to increase the elasticity of labour demand as well as labour productivity (see Andersen et al., 2000 and Andersen and Skaksen, 2007). Such firms should also feel intense pressure to reduce costs, and whether they want to and can do so through wage and/or employment adjustment (rather than through a catch-all 'other cost reduction' strategy) should depend on the relevance of labour in their production function. As discussed in e.g. Scheve and Slaughter (2004), when a firm's production and investment choice spans international borders, the elasticity of labour demand is expected to be larger. Substitutability of labour with other factors of production is also obviously relevant, hence accounting for technological features (e.g. by controlling for sectors) is important in our empirical analysis.

Turnover costs may imply that wages and employment are not along the (static) labour demand curve (see e.g. Bertola, 1999). Hence, not only technological conditions, but also institutional features like employment protection legislation, are important determinants of the extent to which that standard first-order condition may be slack in the aftermath of shocks. The ability of wages to respond to firm-level and common shocks depends on institutional features as well as – and in European countries arguably more strongly – on local labour market conditions along the lines of e.g. Topel (1986).

Employment adjustment should be larger when wages are rigid, and smaller when turnover is more costly (Bertola and Rogerson, 1997). Thus, the wage and employment components of cost-reduction responses should be allowed by our empirical specification to depend on firms' institutional environment in terms of both wage-bargaining institutions and employment flexibility. Moreover, it should depend on other relevant structural and institutional features of their environment. In this respect, the survey provides useful information as to the prevalence of temporary work and the level of wage bargaining.

The relevance of each reaction channel is obviously related to that of other possible reactions for each firm. Obviously, a firm's propensity to adjust costs rather than prices depends on how easy it is in practice to do so. This explains why cost-related characteristics are relevant for the choices analysed in Section 3 (between prices and costs). In principle, the character of a firm's product market should determine whether costs rather than prices are adjusted. However, it should not be directly relevant for cost-adjustment strategies. This justifies an explicit two-stage estimation procedure, whereby the predicted probability of cost-adjustment relevance is included in the cost-adjustment specifications to control for sample selection. In practice, however, selection of firms into the sample analysed in Section 4 appears to be driven by the survey's structure rather than by product-market competition indicators. Accordingly, we provide an assessment of the extent to which price, margin, cost, and other strategies covary. However, we do not formally model statistical relationships across the two stages of the firms' survey replies.

3. Adjustment to cost and wage shocks

3.1 Descriptive evidence

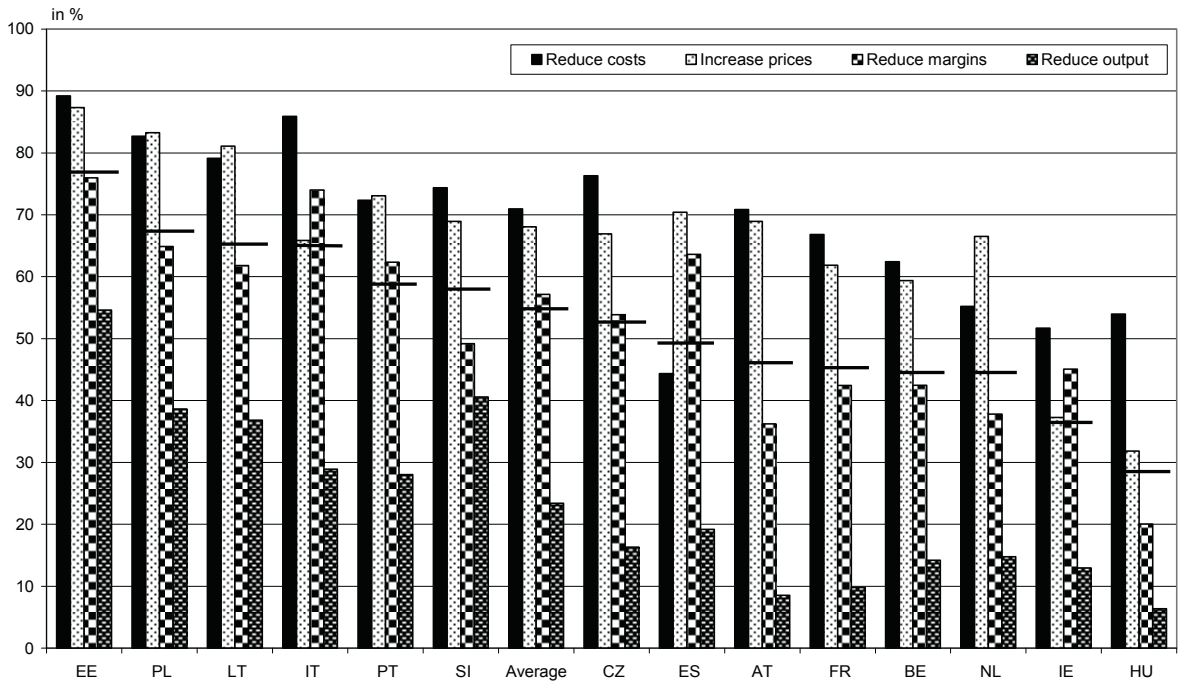
To understand what the survey evidence can contribute to our understanding of the issues of interest, we consider the information available on firm reactions to input-cost shocks in general, and wage shocks in particular. First, respondents were asked to imagine that these kinds of shocks hit their firms. Second, they had to assess how relevant the different adjustment strategies in response to the shocks would be. They could choose among the options "very relevant" (4), "relevant" (3), "of little relevance" (2) and "not relevant" (1). The numbers in brackets give the scores attached to the degree of relevance.

There is clearly a lot of heterogeneity across countries as regards not only the character, but also the overall intensity of adjustment. Figure 1 shows for each country the percentage of firms that assign "very relevant" or "relevant" to the possible adjustment strategies. In the Figure, countries are sorted according to the means of the four percentages which, shown by black lines, range from more than 75 percent in EE to less than 30 percent in HU.

Table 2 lists the four different adjustment strategies in question (reduce costs, increase prices, reduce profit margins and reduce output) and the relevance that they have for the respondents. Columns 1 and 3 give the average score across all respondents, whereas columns 2 and 4 give the proportion of respondents indicating that a particular adjustment strategy is "very relevant" or "relevant" for them. Approximately 70 percent of the respondents indicate that the reduction of other costs and the increase

in prices are "very relevant" and "relevant" options in response to a cost shock. Around 57 percent of the firms indicate that a reduction in profit margins is a relevant answer, whereas only approximately 23 percent say that they reduce output after a cost shock.

Figure 1. The percentage of firms assigning "very relevant" or "relevant" to an adjustment strategy after a cost shock, per country



Thus, about two thirds of all firms increase prices in response to an input-cost shock, while one third will keep them constant. Furthermore, our results suggest that the fraction of firms increasing prices after a wage shock is slightly lower. Moreover, after wage shocks reducing costs, increasing prices and reducing profit margins seem on average slightly less important than after other input-cost shocks, probably suggesting that firms experienced on average smaller wage shocks than cost-push shocks in general.

Table 2. Reaction after cost shocks and wage shocks

Adjustment strategy	after a cost shock		after a wage shock	
	Av. Score	Proportion	Av. Score	Proportion
Reduce costs	2.88	70.95%	2.69	62.14%
Increase prices	2.80	68.07%	2.68	61.84%
Reduce margins	2.56	57.14%	2.49	53.26%
Reduce output	1.86	23.41%	1.88	24.25%

To assess the pattern of covariation or substitutability across different survey answers, Table 3 reports the empirical correlations between the various adjustment channels, i.e. answers to the question on cost shocks and the one on wage shocks. All the cross-correlations presented in the table are positive and highly statistically significant. The diagonal elements of the sub-matrix reporting between-shocks correlations (the bottom-left quarter of Table 3) are all above 50 percent and exceed the corresponding off-diagonal elements significantly. This indicates that there is a tendency for firms to use the same adjustment strategies in response to both cost and wage shocks. The highest correlations in the "within-shock" sections of the table correspond to the margin-output pair (approximately 32 and 34 percent in the case of wage shocks and cost shocks, respectively). However, as correlations treat deviations from the mean in a symmetric way, these numbers indicate that reducing profit margins and output tend to go hand in hand in not being used. Put differently, both answers categories are often chosen to be "of little relevance" or "not relevant", respectively.

Table 3. Correlations across the relevance of different adjustment strategies

		Cost shock				Wage shock			
	Adjustment strategy	Price	Margin	Output	Costs	Price	Margin	Output	Costs
Cost shock	Price	1.0							
	Margin	0.19	1.0						
	Output	0.23	0.34	1.0					
	Costs	0.14	0.28	0.30	1.0				
Wage shock	Price	0.57	0.14	0.21	0.13	1.0			
	Margin	0.16	0.63	0.27	0.17	0.20	1.0		
	Output	0.21	0.25	0.58	0.24	0.27	0.32	1.0	
	Costs	0.13	0.25	0.27	0.60	0.16	0.26	0.14	1.0

Notes: Responses weighted by employment and rescaled excluding non-responses. All correlations are statistically significant at the 1% level. The sample size is kept fixed so that it contains only non-missings for survey questions 23 (on cost-shocks) and 25 (on wage shocks).

This prompts us to group firm responses according to "packages" of adjustment responses. Table 4 gives the percentage of respondents that indicate that the respective combination of measures is "very relevant" and "relevant" for them. As Table 4 also includes respondents that prefer none of the adjustment strategies suggested by the questionnaire (see row seven) – this might be because they do not react at all or because they use other channels of adjustment – the columns add up to 100 percent

of all respondents. The first three rows in Table 4 show that approximately 50 percent of the respondents increase prices and reduce other costs at the same time. Some of them additionally adjust the profit margin and reduce output. Thus, the combination of increasing prices and reducing costs seems one of the most popular among the respondents. This combination is slightly less favoured after wage shocks (only around 40 percent).

Summing up, WDN survey data suggest that about two thirds of the firms increase prices after an input-cost shock, while one third tries to deal with higher costs in a different way and will keep prices constant. Furthermore, price increases are more likely to be part of a whole package of measures instead of the only response to cost-push shocks. The most popular combination seems to be increasing prices and reducing costs. This gives evidence that cost-push shocks are not passed through 1:1 in the production chain but smoothed by firms. Finally, these results seem to challenge the assumption that firms always operate at minimal costs. 60 to 70 percent of the firms (depending on the kind of shock) indicate that they try to reduce other costs after a cost-push shock. However, it might well be that the occurrence of a shock itself opens up some room for manoeuvre. It is possible that a shock, like an oil price shock, can be used to negotiate with suppliers on new conditions – probably only temporary in nature. This way of dealing with cost-push shocks would then constitute – at least to some extent – a shock-absorbing mechanism in the economy, as prices have to be raised and output reduced by less than without these cost reductions.

Table 4. Share of firms choosing different adjustment strategies

Adjustment strategy	after a cost shock	after a wage shock
Price/Margin/Costs	18.33%	14.80%
Price/Margin/Output/Costs	15.11%	12.33%
Price/Costs	14.49%	11.80%
Margin/Costs	9.64%	9.21%
Increase price	9.32%	9.58%
Reduce costs	7.32%	9.32%
None	7.04%	9.13%
Price/Margin	6.84%	6.46%
Reduce margin	3.60%	5.45%
Price/Output/Costs	2.46%	2.30%
Margin/Output/Costs	2.35%	1.49%
Output/Costs	1.24%	0.88%
Price/Margin/Output	1.05%	2.25%
Reduce Output	0.52%	1.40%
Price/Output	0.46%	2.32%
Margin/Output	0.21%	1.27%

Notes: Responses weighted by employment and rescaled excluding non-responses. The sample size is kept fixed so that it contains only non-missings for survey questions 23 (on cost-shocks) and 25 (on wage shocks).

3.2 Firms adjustment strategies and some relevant covariates

In what follows, we focus on the two most popular adjustment strategies, namely reducing costs and increasing prices (see Table 2). In theory, the choice of adjustment strategy is dictated by firms' marginal revenue and cost considerations. Though these are not observed, some of the variables available in the WDN survey dataset can be used to capture certain characteristics of firms' marginal revenue and cost schedules indirectly.

In particular, we analyse whether cost reduction is a more relevant adjustment strategy than price adjustment for firms that behave as price takers rather than price makers. The variable *competition* is a dummy variable coded as unity if the firm replies that it would be "very likely" to decrease the price of its product if the firm's main competitor reduced its price (and as zero if "likely", "not likely", "not at all", and "do not know/does not apply" was indicated by the firm).[5] The *share of foreign sales* in a firm's revenues can also proxy for the intensity of price competition, since (controlling for sector and size) market power should be smaller for firms that are more exposed to large international markets.

To account for differences in production technologies and labour intensities across firms, our specifications also include: *labour share* – the share of labour costs in total costs; the *sector* in which

[5] A slightly different question was asked in the Dutch survey, and is recoded to recover analogous information.

the firm operates – seven NACE-based sector dummies (manufacturing, energy, construction, trade, market services, financial intermediation and non-market services); and *firm size* – a set of four dummy variables indicating firm size category in terms of employment (5-19, 20-49, 50-199 and 200 and more employees).

While the choice of price adjustment as a shock-reaction strategy is shaped importantly by product market characteristics, the relevance of cost adjustment depends in theory on how easy it would be to do so. This depends on rigidities and adjustment costs in the labour market. In this respect, the WDN survey dataset offers a number of variables that can be regarded as indirect measures of rigidities and adjustment costs associated with the labour input. To account for wage rigidities, our set of explanatory variables includes *collective agreement, higher level* – a dummy variable showing whether a given firm adopts a collective agreement concluded at national, regional, sectoral or occupational level, and *collective agreement, firm level* – a dummy variable indicating the presence of collective bargaining at the level of the firm.

Finally, our estimations include a set of *country-specific dummies* to account for unobserved national effects, such as those that might arise from country-specific employment protection legislation. Table C1 reports some basic summary statistics for the covariates used in the analysis and is provided in Appendix C. As can be seen from Table C1, not all information was provided by all responding firms. While in total 15,235 firms replied to our questionnaire, e.g. only 13,615 firms provided information on their share of labour costs in total costs. Thus, the available number of observations that can be used in the following regression analysis drops accordingly. As already mentioned in Section 2, our estimations include information from 14 countries. However, information on Ireland is only included for cost shocks, as the Irish questionnaire does not contain a question on wage shocks.

3.3 Explaining the response to shocks

We explore the determinants of firms' choice to increase prices and/or lower costs in response to cost-push shocks by focusing on one of these adjustment strategies at a time. As already described in Section 3.1, firms could indicate the importance of each strategy in their packages of measures by telling us whether a given margin of adjustment is "very relevant", "relevant", "of little relevance" or "not relevant". On the basis of this information, we define the endogenous variables as dummies, which are equal to unity if the adjustment strategy in question is "very relevant" or "relevant", and zero otherwise. Thus, we model the determinants of price increase and cost-cutting decisions by estimating probit models of the following form

$$\text{Prob}(Y = 1) = \Phi(\beta' x), \tag{1}$$

where β is a vector of coefficients, x is a vector of explanatory variables, and $\Phi(.)$ denotes the cumulative normal distribution function.

As shown in Figure 1, the sample is very heterogeneous across countries. Thus, we use regressions with country dummies. It may be of particular interest, however, to additionally assess whether slope coefficients differ across two groups of countries that may be heterogeneous across sensible and policy-relevant dimensions: the older members of the EU, which in our sample have all adopted the

single currency, and the new Central and Eastern European members that have not yet entered the euro area. Thus, we report the coefficient of interactions with a non-euro area (Non-EA) dummy, that equals unity for firms that are located in the Czech Republic, Estonia, Hungary, Lithuania and Poland. We are mainly interested in the interaction with two variables: the share of labour costs in total costs, representing an important feature of firms' production functions, and the share of foreign sales, an important feature of firms' market conditions. The latter variable's association with firms' reaction strategies may reasonably differ between euro area and non euro-area countries. Firms in non-euro area countries are exposed to potentially floating exchange rates and, in light of the countries' recent accession to the EU and less advanced economic development, may specialise in production stages where international markets are more competitive.

The estimation results characterising firms' adjustment to cost and wage shocks are presented in Table 5. This table shows average probit marginal effects for price increase and cost reduction decisions. It gives the average over the marginal effects computed for all firms in the sample. The size of the average marginal effect and its significance, however, do not differ substantially from those computed for a (hypothetical) firm for which all model covariates are set at their average values. These average marginal effects give an indication by how much the probability that a price increase or a cost reduction is a "very relevant" or "relevant" strategy changes, if one of the covariates changes by one unit (or change from zero to one if the covariate is a dummy variable). The bottom row of the table reports the predicted probability for a hypothetical benchmark firm to report that the response to a shock is "relevant" or "very relevant". To economise on space, some of the less relevant estimates are not reported in Table 5.

Competition

Our empirical results show that stronger competition is associated with more intensive adjustment in (other) costs in the aftermath of supply shocks. A firm in a very competitive environment is 3.8 p.p. more likely to reduce costs after a cost shock and 2.9 p.p. after a wage shock. Reciprocally, price increases are less likely when competition in the product market is strong, though this effect is statistically significant only for the wage shock. Qualitatively, however, competition has the same effect on firms' adjustment to both shocks: it makes firms more likely to reduce costs, but less likely to increase prices, as suggested by our theoretical considerations in Section 2.2.

Foreign sales

Our complementary indicator of competitive pressure, the share of foreign sales in total sales, appears to matter for the way firms react to cost-push shocks as well. Specifically, we find that firms with a higher exposure to foreign product markets are more likely to respond to cost shocks by lowering other costs. In this regard, exposure to foreign markets implies a qualitatively similar effect to that of our more direct measure of price competition. We also find that a higher share of foreign sales in total sales reduces the degree to which a wage shock is passed-through to output prices. Foreign competitors are unlikely to be hit by the same wage shock, which makes it difficult for a firm with a large share of foreign sales to increase prices after a wage shock. This mitigation effect on the pass-through to prices is generally stronger in the case of non-euro area countries (new EU member states).

Table 5. Adjustment of prices and (other) costs in response to cost shocks and wage shocks, probit, average marginal effects

	Cost shock		Wage shock	
	Increase price	Reduce costs	Increase price	Reduce costs
Competition (dummy)	-0.0182 (0.0119)	0.0375*** (0.0113)	-0.0296** (0.0125)	0.0292** (0.0118)
Share of foreign sales	-0.0048 (0.0181)	0.0550*** (0.0186)	-0.0609*** (0.0194)	0.0458** (0.0193)
Labour share	-0.103*** (0.0266)	-0.0747*** (0.0271)	0.117*** (0.0294)	-0.0492* (0.0290)
Collective agreement, higher level (dummy)	0.0247* (0.0138)	0.0136 (0.0139)	0.0390** (0.0155)	0.0066 (0.0151)
Collective agreement, firm level (dummy)	-0.0046 (0.0116)	0.0128 (0.0119)	-0.0217* (0.0126)	0.0210 (0.0130)
Share of foreign sales X Non-EA	-0.0632** (0.0315)	-0.0458 (0.0311)	-0.0655** (0.0329)	-0.0453 (0.0308)
Labour share X Non-EA	0.0229 (0.0507)	0.0633 (0.0497)	0.0412 (0.0497)	0.1140** (0.050)
Observations	11123	11004	10336	10010
Pseudo-R2[6]	0.088	0.080	0.097	0.149
Log-likelihood	-6572.1	-6482.3	-6309.4	-5808.3
Observed frequency	0.650	0.661	0.592	0.574
Predicted frequency	0.660	0.676	0.598	0.578

Notes: Robust standard errors in parentheses; ***, **, * denote significance at the 1%, 5% and 10% significance level, respectively. Not reported: country, sector and firms' size effects. EA abbreviates euro area. The marginal effects of interaction terms are averages across all observations of the Ai and Norton (2003) expressions.

Collective agreement

Firms covered by collective bargaining at the national, regional or sectoral level are more likely to respond to shocks by increasing prices, whereas collective agreements at the firm level do not seem to have strong independent effects on price and cost adjustment. Thus, rigidities in marginal cost stemming from the presence of higher level collective agreements increase the likelihood that cost shocks and wage shocks will be passed-through to product prices by 2.5 p.p. and 3.9 p.p., respectively. Overall, the presence of collective agreements makes it more likely that adjustments are taking place by raising prices.

Labour intensity

[6] McFadden's Pseudo R^2 compares the likelihood of a model with independent variables to the likelihood of a model without independent variables. The ratio is indicative of the degree to which the model parameters improve upon the prediction of the null model.

A firm's production technology also affects the way it reacts to shocks. According to Table 5, a higher labour cost share lowers the likelihood of price adjustment after a cost shock (a 10 p.p. rise in the labour share lowers the incidence of price adjustment by about 1 p.p.). The marginal costs of firms using labour input more intensively are bound to be less sensitive to changes in the cost of intermediate inputs, reducing the need to adjust product prices in response to the input-cost shock. Since a higher labour share implies that marginal costs are more sensitive to labour costs, prices are more likely to be raised in response to a general wage increase. This is also consistent with the results obtained focusing on price determinants within the Inflation Persistence Network (see Fabiani et al., 2006).

Country, sector and size effects

Summarising the results from above, we find only small differences between EU countries in the euro area and those that, in our sample, are both outside of the euro area and recent new members. The most relevant difference seems to be that the new EU-countries are less likely to increase prices after a supply shock when they have a high exposure to foreign markets. As mentioned, this may be explained by the overall more competitive character of these firms' market environment.

Country dummies are not reported in Table 5, however, we estimate sizeable and significant country effects. For instance, the contribution of the Estonian dummy to the probability of price adjustment in the case of a wage shock is estimated to be +17.8 p.p. (reference country for these dummies is Austria; the dummy effect is evaluated at mean values of other determinants). Moreover, a -41.7 p.p. effect is associated with the Hungarian dummy for a price adjustment in response to the wage shock. In both cases, the country effect is huge. Thus, we conclude that in spite of taking into account a rather extensive set of firm-specific characteristics, an important part of variation in firms' adjustment to shocks remains attributed to national factors. Looking at linear regression analysis instead of probit estimates, sheds even more light on the relative explanatory power of our covariates. Using the partitioning of the sum of squares from a linear regression shows that the bulk share of the explanatory power (85-95 percent) comes from country dummies.

To look into the possibility that these country-specific effects may be related to the extent of labour protection legislation (EPL), we calculated correlation coefficients between the probit coefficients associated with the country dummies in the estimations of Table 5 and the OECD EPL index.[7] As shown in Table 6 in the case of a cost shock, this correlation is positive and quite strong (0.46) for price increases, but nearly zero for cost reductions. For the wage shock scenario the correlations are not significantly different from zero. Though only suggestive, this evidence implies that EPL is likely to be positively related to price adjustment in response to cost shocks. Put differently, price increases seem to be more likely in countries with higher employment protection.

[7] The EPL index is originally available only for OECD members. In the case of new member states, equivalent (for the members of OECD - updated) indicators of EPL are taken from Tonin (2005).

Table 6. Correlation between the probit coefficients of country dummies and EPL, all countries

	Cost shock	Wage shock
Increase price	0.461*	0.269
	(0.259)	(0.363)
Reduce costs	0.056	-0.208
	(0.255)	(0.274)

Notes: Bootstrap standard errors in parentheses. * denote significance at the 10% significance level according to asymptotic and bootstrap standard errors. The country effects (coefficients associated with the country dummies) are obtained from the estimations described in Table 5.

Our estimations suggest two additional results (also not reported in Table 5). First, there is a clear sectoral effect indicating that compared to the manufacturing sector, firms operating in the market services sector are less likely to respond to the input-cost shock. The same applies to the wage shock. However, with a notable exception: the degree to which services firms raise prices in the aftermath of a permanent increase in wages is equivalent to that of manufacturing firms. Second, we find that larger firms are more likely to emphasise the importance of the "cutting other costs" adjustment strategy.

3.4 A counterfactual exercise

Previous results may be used to assess how the aggregate response of prices and costs to cost-push shocks may be influenced by convergence within the euro area and other integrating economies. For this purpose, we compare aggregate results from our regression analysis with their hypothetical counterparts in the aftermath of a structural change. Needless to say, in the absence of a complete structural interpretation of our regression results, these counterfactuals have to be interpreted with caution.

We assess how our results bear on the extent of wage/cost pass-through into prices, as an important component of the inflation transmission mechanism. Our data and estimates offer interesting information as to the relevance and heterogeneity of relevant factors in different settings. The survey weights available in the data make it possible to compute aggregate statistics and regression estimates may be used to infer how the aggregates would change if covariates changed.

We carry out a counterfactual exercise using regression results reported in Table 5 about the determinants of price versus cost adjustment after a shock. In particular, we show how the predicted probability to use some specific way of adjustment changes once we set the variable competition at the highest observed level, which is nearly 50 percent in the case of the Belgian financial intermediaries sector.

Table 7. Change in the probability to adjust prices or costs after a cost shock if competition is set to the highest observed level (the effect after a wage shock is given in parenthesis)

	Competition		Price increase				Cost reduction			
	Actual	Hypo-thetical	Predicted probability with max. competition		Change in p.p.		Predicted probability with max. competition		Change in p.p.	
AT	0.14	0.50	0.66	(0.68)	-0.7	(-1.0)	0.72	(0.70)	1.4	(1.1)
BE	0.10	0.50	0.69	(0.71)	-0.8	(-1.2)	0.65	(0.69)	1.8	(1.3)
CZ	0.23	0.50	0.66	(0.54)	-0.5	(-0.8)	0.81	(0.82)	0.9	(0.6)
EE	0.14	0.50	0.87	(0.82)	-0.4	(-0.8)	0.92	(0.91)	0.7	(0.5)
ES	0.13	0.50	0.69	(0.55)	-0.6	(-1.1)	0.49	(0.48)	1.6	(1.2)
FR	0.12	0.50	0.63	(0.58)	-0.8	(-1.3)	0.76	(0.15)	1.4	(0.8)
HU	0.14	0.50	0.31	(0.23)	-0.6	(-0.9)	0.62	(0.55)	1.5	(1.2)
IE	0.13	0.50	0.44	(-----)	-0.7	(-----)	0.59	(-----)	1.5	(-----)
IT	0.17	0.50	0.65	(0.63)	-0.6	(-1.0)	0.87	(0.81)	0.8	(0.8)
LT	0.17	0.50	0.80	(0.68)	-0.5	(-0.9)	0.74	(0.74)	1.2	(0.9)
NL	0.25	0.50	0.68	(0.57)	-0.5	(-0.8)	0.56	(0.57)	1.1	(0.9)
PL	0.15	0.50	0.85	(0.81)	-0.4	(-0.8)	0.85	(0.80)	1.0	(0.9)
PT	0.23	0.50	0.73	(0.71)	-0.4	(-0.7)	0.74	(0.73)	0.9	(0.7)
SI	0.25	0.50	0.68	(0.53)	-0.4	(-0.8)	0.76	(0.76)	0.8	(0.7)
Total	**0.16**	**0.50**	**0.68**	**(0.63)**	**-0.6**	**(-1.0)**	**0.74**	**(0.65)**	**1.1**	**(0.9)**

Notes: Ireland's questionnaire does not contain a question on wage shocks. Column "Competition, actual" shows the share of firms reporting strong competition in the survey data (the mean of the competition dummy for the estimation sample of column 2 in Table 5). "Competition, hypothetical" indicates the assumed counterfactual level of competition, which corresponds to the actual share of firms reporting strong competition in the Belgian financial sector.

Considering an increase in competition throughout all countries to the highest level, Table 7 shows the change in the probability of adjusting prices and costs after an intermediary input-cost shock. Column 4 in Table 7 indicates that an increase in competition will lead to a 0.6 p.p. smaller probability that a cost-push shock is passed-through to prices, while the probability of cost reductions will increase by 1.1 p.p. Put differently, more competition will reduce the probability that cost shocks are passed through to prices. Moreover, the change in the pass-through of a cost shock to prices is predicted to be stronger in countries (euro area countries) where our measure of competition is low on average. Finally, Table 7 also gives the results after a wage shock in parenthesis. The results for a wage shock show the same direction and are of comparable size as the results for a cost shock. Overall, however, the effects of this counterfactual exercise are rather small.

4. Cost-cutting strategies

The rich information provided by the WDN survey also allows for a deeper analysis with regard to the most popular adjustment strategy after cost-push shocks (see Table 2), namely reducing other costs. Thus, we proceed to analyse the different cost-cutting strategies reported by firms. The respondents were asked to report their most important strategy of cutting costs. They could choose among six different options: (a) reduce base wages, (b) reduce flexible wage components, (c) reduce the number of permanent employees, (d) reduce the number of temporary employees, (e) reduce hours worked per employee and (f) reduce non-labour costs. Our aim is to measure the extent to which wage rigidity implies larger employment responses to shocks when labour demand is more elastic and employment protection is less stringent.

4.1 Descriptive evidence

The answers are summarised in Table 8, which shows that about half of the firms prefer to reduce labour costs, while the other half prefers to reduce non-labour costs. These non-labour costs include for instance negotiating with suppliers about prices, reducing administrative costs and reducing advertising costs. The first three categories in Table 8 imply an employment response to a shock. In reaction to a shock, and without conditioning on any other variable, some 35-40 percent of the responding firms plan to implement their cost reductions by reducing employment. Only around 10 percent of the firms indicate that they are likely to reduce costs by cutting flexible wage components, and only about 2 percent would cut base wages. Finding that firms are more likely to cut employment than wages is of course common in the literature (e.g. Bewley, 1999). We will analyse below how these differences are related to features of the firms' environment.

Table 8. Acceptance of different ways of cost adjustment (share of firms)

Cost-cutting strategy	after a cost shock	after a wage shock
Reduce number of temporary/other employees	17.56%	19.45%
Reduce number of permanent employees	10.89%	11.39%
Reduce hours worked per employee	7.08%	7.79%
Reduce flexible wage components	9.39%	11.58%
Reduce base wages	1.64%	---
Reduce non-labour costs	53.44%	49.79%

Notes: Responses weighted by employment and rescaled excluding non-responses; figures are based on survey questions 24 and 26.

On the basis of the simple theoretical considerations outlined above, wage and employment responses are expected to be larger when firms are subject to strong product market competition. Moreover, they should be smaller when collective agreements reduce wage flexibility, and employment protection legislation (or non-availability of temporary contracts, or technological features) reduces employment flexibility. The following empirical analysis brings this reasoning to bear on the data, combining information from the firm-level and the country-level.

4.2 Adjustment channels and some relevant covariates

To determine factors explaining the choice of the most important cost-cutting strategy, we run a set of probit regressions relating each adjustment choice to theoretically relevant covariates. In particular, we focus on indicators of product market structure and labour market institutions. The dependent variable in the probit regression equals one if the firm indicates that the respective cost-cutting strategy is the most important one, and zero otherwise. Additional to the covariates already described in Section 3 (*competition, share of foreign sales, labour share, collective agreement (higher level and firm-level)*

as well as *country, industry* and *size*), we include more variables on characteristics of the labour market, as we are especially interested in their influence on labour-cost cutting strategies.

Table 9. Cost adjustment strategies and some relevant covariates, probit, average marginal effects

	Cost shock			Wage shock		
	Permanent employment	Temporary employment	Wages	Permanent employment	Temporary employment	Wages
Competition (dummy)	0.0209**	0.0158	0.0231**	0.0275***	0.0268**	0.0221**
	(0.0089)	(0.0114)	(0.0098)	(0.0101)	(0.0125)	(0.0103)
Share of foreign sales	-0.0182	0.0146	-0.0163	-0.0123	0.0345*	-0.0164
	(0.0135)	(0.0166)	(0.0146)	(0.0151)	(0.0179)	(0.0161)
Labour share	0.0279	-0.0179	0.0891***	0.0419*	0.0308	0.0790***
	(0.0190)	(0.0253)	(0.0220)	(0.0221)	(0.0271)	(0.0232)
Coll. agreement higher level (dummy)	0.0116	0.0398***	-0.0186*	-0.0036	0.0352**	-0.0268**
	(0.0110)	(0.0148)	(0.0111)	(0.0125)	(0.0159)	(0.0122)
Coll. agreement firm level (dummy)	0.0055	-0.0055	-0.0004	0.0120	0.0109	-0.0167*
	(0.0076)	(0.0103)	(0.0090)	(0.0092)	(0.0116)	(0.0090)
Share of temp. employment	-0.0725***	0.135***	-0.0299	-0.0503**	0.137***	-0.0417**
	(0.0212)	(0.0234)	(0.0194)	(0.0220)	(0.0245)	(0.0207)
Share of part-time empl.	0.0129	-0.0133	-0.0448**	0.0066	-0.0107	-0.0371
	(0.0190)	(0.0280)	(0.0228)	(0.0226)	(0.0308)	(0.0238)
Share of variable wages	-0.0002	-0.0004*	0.0010***	-0.00058**	-0.0004	0.0012***
	(0.0002)	(0.0002)	(0.0002)	(0.00023)	(0.0003)	(0.0002)
Share of foreign sales X Non-EA	0.0272	0.0125	0.0155	0.0183	0.0107	0.0099
	(0.0208)	(0.0304)	(0.0224)	(0.0234)	(0.0330)	(0.0242)
Labour share X Non-EA	0.0894***	-0.0079	-0.0387	0.0790*	-0.0789	-0.0113
	(0.0440)	(0.0495)	(0.0415)	(0.0469)	(0.0529)	(0.0441)
Observations	8037	8037	8037	7415	7415	7415
Log-Likelihood	-2042.6	-3461.0	-2520.7	-2194.3	-3360.7	-2441.0
Pseudo-R2	0.0473	0.0649	0.0657	0.0363	0.0742	0.0601
Observed frequency	0.0791	0.1731	0.1106	0.0957	0.1926	0.1159
Predicted frequency	0.0684	0.1552	0.0938	0.0866	0.1704	0.1019

Notes: Robust standard errors in parentheses; ***, **, * denote significance at the 1%, 5% and 10% significance level, respectively. Not reported: country, sector and firms' size effects. EA abbreviates euro area. The marginal effects of interaction terms are averages across all observations of the Ai and Norton (2003) expressions.

Hence, we introduce the *share of temporary employment,* as a continuous variable giving the percentage share of employees with a temporary contract. The *share of part-time employment* gives the percentage share of employees with a permanent contract, but working part-time. Finally, the *share of variable wages* is also a continuous variable and gives the percentage share of the total wage bill that is related to individual or company performance related bonuses and benefits. Moreover, theoretically employment protection legislation (*EPL*) should be associated with the decision of either adjusting employment or wages after a cost-push shock. However, our regressions include country dummies in order to control for national differences in general. Thus, we cannot include EPL

indicators, without variation within countries. Following the regression analysis, however, we will investigate the association between country dummies and the EPL indexes.

Table 9 presents results on cost reductions due to employment (permanent and temporary) and wage adjustments; results on hours and non-labour-cost adjustment are reported only in Appendix C (see Table C2). We analyse the impact of product market competition (*competition* and *share of foreign sales*), the firm's technology (*labour share*), the structure of the workforce and its remuneration (*share of temporary and part-time employment* as well as *share of variable wages*) and labour market institutions *(collective agreement, firm level; collective agreement, higher level*) on each type of cost-adjustment strategy separately. Moreover, as previously mentioned, we consider country dummies as well as industry and size dummies in order to control for all kinds of national differences and differences in technology.

Consider, to begin with, the results for the impact of competition on the choice of the preferred cost-adjustment channel. Product market competition appears to be positively associated with the relevance of employment and wage adjustment after both types of shocks. For a given degree of wage rigidity, this is consistent with standard labour demand theory, in that, for a given labour share, a more elastic product demand function implies a more elastic labour demand and a more pressing need for firms to reduce employment. This result is similar for permanent and temporary employment. Also wage adjustment is more likely in a highly competitive environment. As shown in Table C2, the main impact of competition is on the choice between labour and non-labour costs. These costs could include, for instance, advertising, marketing and other costs that in a competitive environment should be minimised even without a negative shock.[8] Firms operating in a highly competitive environment are thus less likely to reduce non-labour costs and more likely to reduce labour costs, regardless which type of labour costs.

Regarding wage-setting institutions, we find that collective agreements outside the firm, that is collective agreements signed at the national, regional, sectoral or occupational level, make an adjustment of temporary employment more likely. Imposing a wage agreement negotiated at a higher than the firm level to a firm increases the probability of laying-off temporary workers by approximately 4 p.p. Furthermore, there is a tendency for wages to be more sticky when there are collective wage agreements present. Thus, firms covered by collective wage agreements appear to reduce the number of temporary employees (and not the number of permanent employees) due to wage rigidity. It should be noted that country dummies are included in our regressions, already capturing national-specific characteristics of collective bargaining institutions.

The share of temporary workers features a relatively strong association with the character of cost-cutting strategies. Firms with a high share of temporary employment are more likely to indicate layoffs of temporary employees as the preferred adjustment strategy, and less likely to reduce the number of permanent employees and wages (as well as to try and decrease non-labour costs). An increase in the

[8] A multinomial model was estimated for a robustness check. The results are qualitatively similar to the ones described above. Competition variables, which are perceived competition and the share of foreign sales, tend to affect more the decision between non-labour cost and labour cost adjustment, rather than the decision between the different types of labour costs.

share of temporary workers by 10 percentage points increases the probability of cutting temporary employment by 1.4 p.p. Thus, temporary employment acts as a buffer against employment fluctuations for permanent workers and against wage fluctuations.

Figure 2. Adjustment of permanent employment: Correlation between EPL (for permanent employment, vertical axis) and country dummies

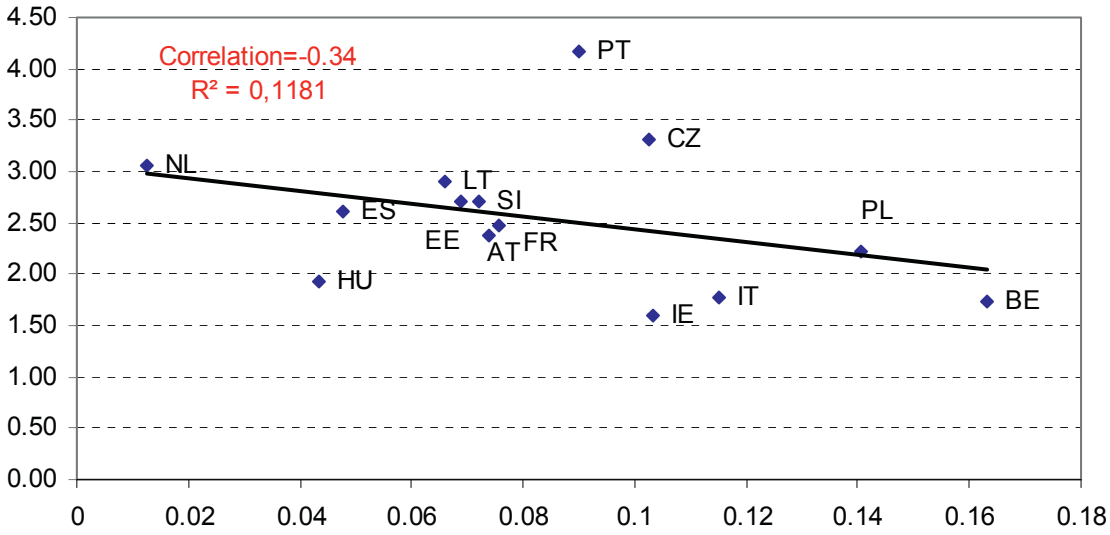
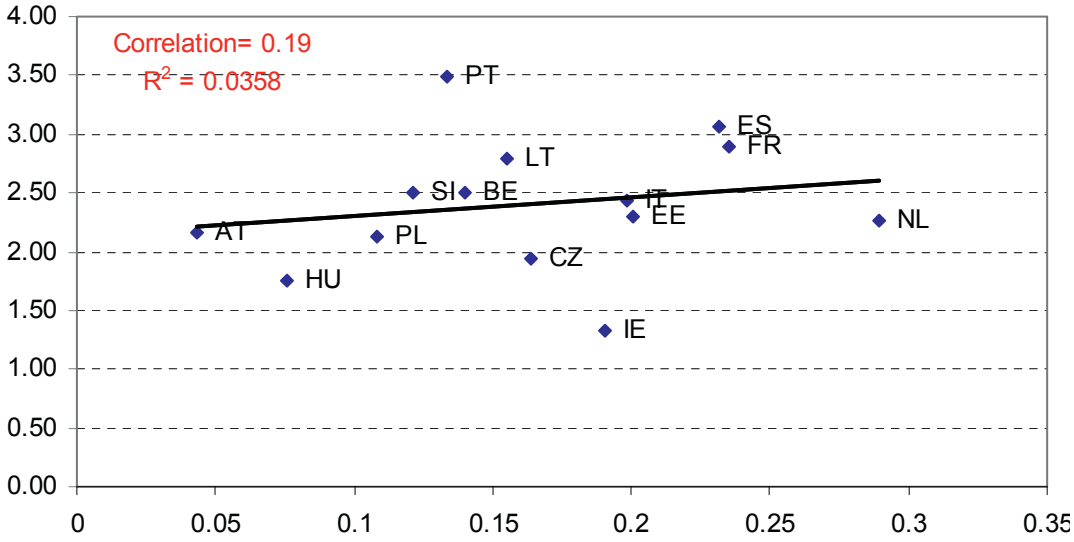


Figure 3. Adjustment of temporary employment: Correlation between EPL (for permanent employment, vertical axis) and country dummies



Moreover, EPL might have an effect on the firm's decision on which type of costs to adjust after a shock. As already mentioned, our regression analysis captures the differences in EPL across countries by country dummies. Although, they capture also other national specificities, we investigate whether EPL is playing a role in explaining country-level differences in the strategies to adjust costs. Figure 2,

for instance, shows that in the permanent employment adjustment regression, country dummies are negatively correlated with the degree of EPL strictness for regular workers (-0.34). EPL explains almost 12 percent of the country dummies variance. This suggests that firms in countries with a high degree of employment protection are less likely to reduce permanent employment after a shock. Thus, EPL works as intended – it protects permanent employees. In the case of temporary employment it is, however, the other way around. The relationship between EPL and the country dummies is positive. Here, EPL explains only about 4 percent of country variance. In the temporary employment adjustment regression the correlation between the EPL index and country dummies is approximately 0.2, suggesting that firms in countries with a high EPL index tend to be more likely to reduce costs via laying-off temporary workers.

Now we turn to some more variables included in our regressions. The results presented in Table 9 suggest that firms using a labour intensive technology are more likely to cut wages. Furthermore, as shown in Table C2 in the Appendix, a high labour share is also associated with a higher likelihood of non-labour costs reduction. Moreover, a larger *share of variable wages* is also associated with easier wage adjustment in reaction to shocks. Babecký et al. (2009b), who focus on alternative margins of adjustment in labour costs than base wages, find that these alternative margins, like bonus payments, are more commonly used by firms subject to (nominal) base wage rigidities. In our regressions, the base-wage rigidity implied by higher-level wage agreements implies that temporary employment bears the brunt of adjustment. However, a larger share of variable wage costs tends to stabilise both temporary and permanent employment, privileging wage adjustment for all types of cost-push shocks.

In order to analyse the differences between euro area and non-euro area countries, we again estimate the average marginal effect of the interaction between a non-euro area dummy and two important continuous variables: the share of labour costs in total costs, and that of foreign sales in revenues. For firms in non-euro area countries, labour intensity is associated with a significantly higher incidence of permanent employment reactions to cost-push shocks. This may well reflect the more flexible lay-off arrangements of less heavily regulated markets.

Overall, our results suggest that product market competition is an important determinant in the firm's decision to adjust labour costs instead of non-labour costs. Firms operating in a highly competitive environment are less likely to reduce non-labour costs and more likely to reduce labour costs via cutting the number of employees as well as wages. Moreover, the decision between different kinds of labour costs (wages versus employment) is mainly driven by the framework of the labour market. In this respect, wage setting institutions, in particular, wage agreements signed outside the firm, tend to make wages more sticky and force adjustment via temporary employees. A high degree of employment protection (EPL) affects temporary employment in the same way. While EPL works as intended and protects jobs of permanent employees after a cost-push shock, the cost adjustment takes again place via the adjustment of temporary employees.

4.3 A counterfactual exercise

We carry out two counterfactual exercises using regression results reported in the previous section about the determinants of different margins of adjustment after a shock. In particular, we show how the predicted probability to use some specific way of adjustment changes once we modify variables as competition and the share of firms affected by collective bargaining at higher level than the firm.

Table 10. Change in the probability to adjust permanent employment and non-labour costs after a wage shock if competition is set to the highest observed level

	Competition		Permanent employment adjustment		Non-labour cost adjustment	
	Actual	Hypo-thetical	Predicted probability with max. competition	Change in p.p.	Predicted probability with max. competition	Change in p.p.
AT	0.14	0.50	0.10	0.01	0.57	-0.02
BE	0.10	0.50	0.11	0.01	0.49	-0.04
CZ	0.23	0.50	0.16	0.01	0.50	-0.02
EE	0.14	0.50	0.17	0.01	0.47	-0.03
ES	0.13	0.50	0.09	0.01	0.38	-0.03
FR	0.12	0.50	0.09	0.01	0.43	-0.03
HU	0.14	0.50	0.07	0.01	0.69	-0.02
IT	0.17	0.50	0.13	0.01	0.42	-0.02
LT	0.17	0.50	0.11	0.01	0.61	-0.02
NL	0.25	0.50	0.03	0.00	0.45	-0.02
PL	0.15	0.50	0.17	0.01	0.56	-0.03
PT	0.23	0.50	0.09	0.01	0.41	-0.02
SI	0.25	0.50	0.08	0.00	0.61	-0.02
Total	**0.16**	**0.50**	0.12	0.01	0.47	-0.02

Table 10 shows the potential impact of a structural reform increasing competition in product markets in European countries (for instance in the context of the Lisbon strategy). In particular, we simulate an increase in competition to the level observed in the financial intermediation sector in Belgium, the maximum in our sample. As discussed in the previous section, competition increases the probability to adjust employment after a shock. Thus, an increase in competition will lead to more employment adjustment. However, the impact on predicted probabilities is quite small, around 1 pp. in each country, despite the simulated change in the competition environment is not trivial. In this respect, we should be aware that our simulations do no capture aggregate effects in the sense that firms are confronted with a higher competitive scenario but their reaction do not take into account that all other firms are now changing their cost-cutting strategies. In addition, more competition would reduce the adjustment of non-labour costs.

Table 11 reports the simulated impact of more rigid wages at the firm level associated with a higher incidence of collective agreements signed outside the firm. If the share of collective bargaining at higher level is set to unity (as in LT, and not very different from 0.98-0.99 shares recorded in FR and BE), the fraction of firms adjusting temporary employment is slightly higher, while that of firms adjusting wages symmetrically declines. Both effects are, however, quite small.

Table 11. Change in the probability to adjust temporary employment and wages after a cost shock if the incidence of collective bargaining at higher level than the firm is set to 1

	Incidence of collective bargaining at higher level than the firm		Temporary employment adjustment		Wage adjustment	
	Actual	Hypo-thetical	Predicted probability with higher collective bargaining	Change in p.p.	Predicted probability higher collective bargaining	Change in p.p.
AT	0.96	1	0.05	0.00	0.09	0.00
BE	0.98	1	0.18	0.00	0.04	0.00
CZ	0.17	1	0.20	0.04	0.08	-0.01
EE	0.03	1	0.19	0.04	0.13	-0.02
ES	0.83	1	0.26	0.01	0.12	0.00
FR	0.99	1	0.27	0.00	0.08	0.00
HU	0.00	1	0.09	0.02	0.08	-0.02
IT	0.68	1	0.20	0.01	0.04	0.00
LT	1.00	1	0.22	0.00	0.08	0.00
NL	0.01	1	0.14	0.03	0.10	-0.02
PL	0.45	1	0.32	0.03	0.02	0.00
PT	0.04	1	0.12	0.03	0.13	-0.02
SI	0.59	1	0.16	0.01	0.26	-0.01
Total	0.74	**1**	0.15	0.01	0.11	-0.01

5. Conclusions

Empirical evidence from the WDN survey highlights several characteristics of price, wage and employment reactions to changes in the economic environment for numerous European countries.

Our analysis shows that firms react to shocks in wages and others costs in theoretically sensible ways. In a simple theoretical framework, a firm in a competitive environment with a high elasticity of product demand and a small margin would be more likely to change its price in reaction to a wage shock or a cost shock that is common to all firms in the industry. When prices are sticky, however, a high elasticity of product demand and small margins make it easier for wage and cost shocks to overcome the cost of price changes. In the survey data, firms that report facing strong competition in the product market are less likely to increase prices and more likely to reduce costs after a wage shock (stated in the survey question to be common to all firms in the industry). A higher export share in total sales has a qualitatively similar role, whereas the presence of collective wage agreements at industry or national level makes a price increase more likely. The data also seem to suggest that price increases are more likely in countries with more stringent employment protection legislation.

The second part of the study focuses on cost-cutting strategies and the factors that explain the choice of the strategy. The data indicate that competition and other indications of a high labour-demand elasticity increase the likelihood of cost-cutting strategies via labour costs, either through wage adjustment or employment reduction. We also find that firms covered by collective wage agreements are more likely to look for cost reductions by reducing the number of temporary employees and less

likely to reduce wages. Overall, it appears that temporary employment acts as a buffer against fluctuations in permanent employment and against wage fluctuations. EPL insulates permanent employment from cost-push shocks but makes adjustment in temporary employment more likely.

Assessing the extent to which such features imply differences in the behaviour across countries and firms in our sample can help determining the extent to which the wage moderation apparent in recent European experiences is due to stronger product market competition, within and across countries' borders, and how much reflects weaker union power in wage setting, with important implications for inflation transmission mechanisms.

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Appendix A: Survey questions

In questions 23 and 25, the relevance of each adjustment variable was assessed on a categorical scale: 1 - "not relevant"; 2 - "of little relevance"; 3 - "relevant"; 4 - "very relevant."
In questions 24 and 26, respondents had to choose a single option, namely the most important adjustment channel.

23. How relevant is each one of the following strategies when your firm faces an unanticipated increase in the cost of an intermediate input (e.g. an oil price increase) affecting all firms in the market? Please tick an option for each line.
Increase prices.
Reduce margins.
Reduce output.
Reduce other costs.

24. If the reduction of other costs is of any relevance in your answer to question 23, please indicate the main channel through which this goal is achieved: Please choose a single option, the most important factor.
1=Reduce base wages
2=Reduce flexible wage components (for example bonuses, benefits, etc)
3=Reduce the number of permanent employees
4=Reduce the number of temporary employees / other type of workers
5=Adjust the number of hours worked per employee
6=Reduce other non-labour costs

25. How relevant is each one of the following strategies when your firm faces an unanticipated permanent increase in wages (e.g. due to the renewal of the national contract) affecting all firms in the market? Please tick an option for each line.
Increase prices.
Reduce margins.
Reduce output.
Reduce other costs.

26. If the reduction of other costs is of any relevance in your answer to question 25, please indicate the main channel through which this goal is achieved: Please choose a single option, the most important factor.
1=Reduce flexible wage components (for example bonuses, benefits, etc)
2=Reduce the number of permanent employees
3=Reduce the number of temporary employees / other type of workers
4=Adjust the number of hours worked per employee
5=Reduce non-labour costs

Appendix B: Theoretical impact of shocks on wages and employment

To maximise profits in a 'right to manage' setting employers should choose employment so as to equate the wage, which they take as given, to labour's marginal impact on firm's revenues, *mrp*(*l*). Formally, consider a log-linear schedule

$$w_i = -\eta_i l_i + a_i$$

where w is the log of employer labour cost, l_i is employment, a indexes marginal revenue, and $\eta_i<1$ is the elasticity of the inverse labour demand schedule. Symmetrically, let ε_i denote the elasticity of wages to employment:

$$w_i = \varepsilon_i l_i + s_i \ ,$$

where changes of the s_i shifter may represent a wage shock. Solving for wages and employment, we have

$$w_i = [\eta_i/(\varepsilon_i+\eta_i)]s_i + [\varepsilon_i/(\varepsilon_i+\eta_i)]a_i,$$

$$l_i = (a_i - s_i)/(\varepsilon_i+\eta_i).$$

Wage shocks can be represented by Δs in this simple framework. In equilibrium,

$$\Delta w_i = [\eta_i/(\varepsilon_i+\eta_i)]\ \Delta s_i \ ,$$

$$\Delta l_i = \Delta s_i/(\varepsilon_i+\eta_i),$$

so the employment impact is larger when η is small, i.e., when labour demand is more sensitive to cost conditions.

In turn, labour demand elasticity depends on the degree of decreasing returns to labour (as indexed by the share of labour in minimised total costs) and, more interestingly, on the elasticity of product demand and labour's substitutability with other factors of production (by the "Marshall-Hicks" conditions, see e.g. Burda, 2000): η is the weighted average of the constant-output elasticity of substitution, σ, and the elasticity of revenues to output. The cost share of labour is the weighting factor applied to these substitution and scale effects into the total elasticity of labour demand. In response to other factor price shocks, factor substitutability is similarly relevant.

As to the role of supply elasticity, the employment response to shocks is small when ε is large: wages then bear the brunt of adjustment according to

$$l_i = \Delta a_i/(\varepsilon_i+\eta_i). \qquad (4)$$

Conversely, if wages do not change (possibly because they are set by binding agreements at more aggregate levels), then employment responds strongly to other cost shocks.

Appendix C: Details on empirical results

Table C1. Covariates used in the analysis of Section 3 and 4

Variable		Type	Mean	Std. Dev.	Min	Max	Number of obs.
Country:	AT	Dummy	0.037		0	1	15235
	BE	Dummy	0.094		0	1	15235
	CZ	Dummy	0.026		0	1	15235
	EE	Dummy	0.024		0	1	15235
	ES	Dummy	0.120		0	1	15235
	FR	Dummy	0.133		0	1	15235
	HU	Dummy	0.132		0	1	15235
	IE	Dummy	0.065		0	1	15235
	IT	Dummy	0.063		0	1	15235
	LT	Dummy	0.023		0	1	15235
	NL	Dummy	0.070		0	1	15235
	PL	Dummy	0.076		0	1	15235
	PT	Dummy	0.094		0	1	15235
	SI	Dummy	0.044		0	1	15235
Sector:	Manufacturing	Dummy	0.399		0	1	15171
	Energy	Dummy	0.012		0	1	15171
	Construction	Dummy	0.076		0	1	15171
	Trade	Dummy	0.204		0	1	15171
	Market services	Dummy	0.272		0	1	15171
	Financial intermediaries	Dummy	0.024		0	1	15171
	Non-market services	Dummy	0.013		0	1	15171
Size:	5-19	Dummy	0.260		0	1	14972
	20-49	Dummy	0.224		0	1	14972
	50-199	Dummy	0.304		0	1	14972
	200+	Dummy	0.212		0	1	14972
Competition		Dummy	0.164		0	1	14139
Share of foreign sales		Fraction	0.193	0.308	0	1	13810
Labour share		Fraction	0.339	0.201	0.001	1	13615
Collective agreement, higher level		Dummy	0.597		0	1	15099
Collective agreement, firm level		Dummy	0.243		0	1	15026
EPL for permanent workers		Index	2.442	0.734	1.603	4.167	13860
Share of part-time employment		Fraction	0.094	0.180	0	1	15021
Share of temporary employment		Fraction	0.094	0.184	0	1	14991
Share of variable wages		Fraction	0.120	0.191	0	1	13277

Notes: EPL is an index ranging from 0 (low strictness) to 5 (high strictness).

Table C2. Cost adjustment strategies and some relevant covariates, probit, average marginal effects

	Cost shock		Wage shock	
	Hours	Non-labour cost	Hours	Non-labour cost
Competition (dummy)	-0.0008	-0.0593***	-0.0078	-0.0734***
	(0.0071)	(0.0149)	(0.0072)	(0.0153)
Share of foreign sales	-0.0138	0.0321	-0.0169	-0.0022
	(0.0103)	(0.0229)	(0.0112)	(0.0244)
Labour share	0.0174	-0.116***	0.0018	-0.142***
	(0.0153)	(0.0349)	(0.0169)	(0.0372)
Collective agreement higher level (dummy)	-0.0004	-0.0217	-0.0142	-0.0012
	(0.0095)	(0.0188)	(0.0109)	(0.0205)
Collective agreement firm level (dummy)	-0.0031	-0.0014	-0.0016	-0.0078
	(0.0064)	(0.0142)	(0.0072)	(0.0151)
Share of temporary employment	0.0183	-0.0598*	0.0382**	-0.0884***
	(0.0147)	(0.0332)	(0.0155)	(0.0338)
Share of part-time employment	0.0573***	0.0014	0.0620***	0.00876
	(0.0149)	(0.0355)	(0.0170)	(0.0379)
Share of variable wages	-0.0001	-0.0003	-0.0001	-0.0003
	(0.0001)	(0.0003)	(0.0002)	(0.0003)
Share of foreign sales X non-euro area	0.0161	-0.0395	0.0049	-0.0001
	(0.0215)	(0.0378)	(0.0213)	(0.0397)
Labour share X non-euro area	-0.0175	-0.0904	-0.0016	-0.0752
	(0.030)	(0.0621)	(0.0315)	(0.0631)
Observations	8037	8037	7415	7415
Log-Likelihood	-1689.0	-5276.1	-1651.8	-4942.0
Pseudo-R2	0.0522	0.0326	0.0524	0.0371
Observed frequency	0.0626	0.5762	0.0672	0.5154
Predicted frequency	0.0519	0.5763	0.0564	0.5149

Notes: Robust standard errors in parentheses; ***, **, * denote significance at the 1%, 5% and 10% significance level, respectively. Not reported: country, sector and firms' size effects. EA abbreviates euro area. Changes to the marginal effects of interaction terms are averages across all observations of the Ai and Norton (2003) expressions.