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Real Wage Flexibility in the European Union: New Evidence from the Labour Cost Data

Jan Babecký and Kamil Dybczak*

Abstract

This paper presents evidence on the extent of real wage flexibility in 24 EU member countries based on the Eurostat labour cost data covering 2000Q1–2010Q2. The term 'wages' refers, for brevity, to total hourly labour costs and its two main components, namely wages and salaries per hour, and non-wage costs. Following the structural VAR approach, real wage flexibility is measured as the responsiveness of real wages to real (permanent) versus nominal (temporary) shocks. The data shows that the impact of the 2008/2009 crisis on real wage adjustment has not been uniform across the sample countries, with some evidence for an increase in real wage rigidity. A strong negative correlation is observed between our aggregate measure of wage flexibility and both the ESCB Wage Dynamics Network firm-level survey estimates of downward real wage rigidity and the International Wage Flexibility Project microeconomic estimates of downward real wage rigidity. Finally, we find that institutional features of labour markets could help explain the variation in the results across countries; for example, stricter employment protection legislation and stronger presence of unions go hand in hand with higher real wage rigidity.

JEL Codes: C22, E24, F02, J30, P20.

Keywords: Labour cost indices, real wage rigidity, structural VAR.

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Nontechnical Summary

The importance of labour market flexibility for the well functioning of labour markets is commonly stressed by economists. In this study we present macroeconomic evidence on the extent of real wage flexibility for a group of 24 EU member countries, based on the newly available Eurostat hourly labour cost data covering the period from 2000Q1 to 2010Q2. The use of the Eurostat harmonised data creates a clear advantage for a cross-country comparison. By 'wages' we refer, for brevity, to total hourly labour costs and their two main components, namely wages and salaries per hour, and non-wage costs.

Real wage flexibility is defined on the basis of the responsiveness of real wages to real shocks based on structural VAR decomposition, as advocated by Moore and Pentecost (2006). Real wages are called flexible if the variation in real wages is explained by real as opposed to nominal shocks. If nominal shocks cause the variation in real wages, such a situation corresponds to rigid real wages. Thus, the indicator of real wage flexibility takes values between zero and one hundred according to the percentage of variance in real wages due to real shocks.

Our contribution to the literature is threefold. First, we present estimates of real wage flexibility for a large set of 24 EU countries. While microeconomic or survey-based estimates of wage flexibility (or reciprocally rigidity) have their own advantages, these estimates are typically available for a few countries only and for a specific point in time, and updates are not always available. We also examine the effect of the 2008–2009 global crisis on the degree of wage flexibility. We find evidence of heterogeneous real wage reactions across the sample countries. In a number of countries the recent crisis has even led to an increase in real wage rigidity. The choice of alternative deflators, e.g. the GDP deflator, the HICP, and the HICP excluding energy prices, affects the measured real wage flexibility, in particular during crisis times. The extent to which real wages react to shocks is also affected by the choice of labour cost component (e.g. wage- versus non-wage costs) and sector (e.g. business economy, services or manufacturing).

Second, we compare our macroeconomic measure of real wage flexibility calculated for the 'pre-crisis' sample ending in 2008Q2 with both (i) a firm-level measure of downward real wage rigidity derived from the ESCB Wage Dynamics Network survey conducted between the second half of 2007 and the beginning of 2008 and (ii) the International Wage Flexibility Project (IWFP) microeconomic estimates of downward real wage rigidity. We find a fairly close match between our macro- and those survey- and IWFP-based measures of downward real wage flexibility.

Finally, we link cross-country differences in real wage flexibility (or reciprocally rigidity) to the institutional features of the national labour markets. We find that the presence of unions is positively correlated with the extent of real wage rigidity. For example, the higher is the share of employees covered by collective bargaining agreements, the higher is the real wage rigidity. Similarly, higher real wage rigidity is observed in countries with a larger proportion of higher-level bargaining agreements as compared to those on the firm level. Last but not least, our results indicate that in countries with stricter employment protection legislation, real wages are more rigid as well.

1. Introduction

Economists and policymakers are traditionally interested in the assessment of wage flexibility. Wage flexibility is indeed an important aspect of labour market flexibility – see among others Boeri et al. (1998), Blanchflower (2001), Hyclak and Johnes (1992) and European Commission (2003). There are several alternative approaches to measuring wage flexibility, based on microeconomic, survey-based or macroeconomic data, each approach having its advantages and drawbacks. In this study we take the macroeconomic approach due to its advantages, such as cross-country comparability and representativeness of the results of the total economy, while acknowledging its drawbacks (industry or firm composition issues, etc.).

In the microeconomic framework, wage flexibility is typically assessed using the distribution of wages, a lack of wage decreases, for example, being interpreted as an indication of downward rigidity. In (firm-level) surveys, the concept of rigidity is related to the proportion of firms which freeze wages (nominal rigidity) or automatically link wages to inflation (real rigidity). While microeconomic and survey-based estimates of wage flexibility bring valuable evidence on the distributional properties of wages and allow controlling for industry and firm effects, there are important costs involved in data collection and processing, and the resulting estimates of wage flexibility are not readily available for a wider set of countries or over time.

For example, to our knowledge there are no microeconomic estimates of wage flexibility or rigidity for the Czech Republic. Examples of available regional or firm-level measures include wage curve estimates on the level of regions (Galuščák and Münich, 2005) and survey-based estimates of nominal and real wage rigidity for two years: 2007 (Babecký et al., 2010) and 2009 (Box 3 in CNB, 2009).

This paper takes a macroeconomic perspective, the objective of which is to present comparable estimates of wage flexibility for a large group of 24 EU countries. The use of aggregate data allows us to infer about real wage flexibility on the economy-wide level, which is of interest for policy makers. Furthermore, the cross-country dimension allows us to compare our results on real wage flexibility with institutional features of the labour markets, such as collective bargaining coverage and strictness of employment protection legislation.

Wage flexibility can be expressed in nominal or real terms. From the macroeconomic point of view, aggregate real wage flexibility plays the key role in equilibrating supply and demand on the labour market. This paper, therefore, focuses on real wage adjustment.[1]

Real wage flexibility can, in turn, be defined as the responsiveness of real wages to various shocks (e.g. shocks to productivity, unemployment and past wages; see Arpaia and Pichelmann, 2007, for further details). The adjustment of real wages to the unemployment rate (the Phillips curve) is one example of measuring real wage flexibility at the macroeconomic level. Such measurement is regularly performed by the Czech National Bank in its yearly assessments of the degree of

[1] A complementary line of research is to examine the adjusting role played by labour mobility. Fidrmuc (2004) studies the migration of labour in the Czech Republic, Hungary, Poland and Slovakia in comparison with Italy, Spain and Portugal. A detailed assessment of mobility in the Czech Republic is available in Flek (2004). Specific reasons for the restrictions on migration within the EU are discussed in Boeri and Brucker (2005).

economic alignment of the Czech Republic with the euro area (see section 2.2.1 in CNB, 2009, 2010).

The measures of real wage flexibility that are based on the responsiveness of real wages to shocks to real variables such as productivity and unemployment do not allow one to distinguish between the shocks themselves and the reactions to them, since both components are present in the macroeconomic time series. In this study we adopt the structural VAR approach proposed by Blanchard and Quah (1989), which was first used by Moore and Pentecost (2006) in order to assess the responsiveness of real wages to structural shocks. In particular, real wage flexibility is defined in relation to real (permanent) and nominal (transitory) shocks. Real wages are called flexible if the variance in real wages is mainly due to real shocks. On the contrary, if nominal shocks explain most of the variance in real wages, such a situation corresponds to rigid real wages. Thus, the degree of real wage flexibility is given by the percentage of the variance in real wages that can be attributed to real shocks.

Moore and Pentecost (2006) use this concept of real wage flexibility to assess the suitability of the Czech Republic, Hungary, Poland and Slovakia for membership in the euro area, considering France and Italy as benchmarks. (Although wage flexibility is important, it is obviously not a sufficient condition for a country to join the monetary union.) If real wages in, for example, Hungary are as responsive to real shocks as those in, say, Italy, then Hungary is said to be 'suitable' for EMU membership. Based on wage flexibility alone, the Czech Republic and Hungary are found to be good candidates for the EMU, while euro adoption is not advisable for Poland and Slovakia. The reality, however, has been different. Out of these four countries, Slovakia was the first to join the EMU, on 1 January 2009, while in the Czech Republic, Hungary and Poland euro adoption is not on the immediate agenda yet.

Babecký and Dybczak (2008) extend the analysis of Moore and Pentecost (2006) in three aspects. First, instead of aggregate wages, they employ a newly available harmonised labour cost data set provided by the Eurostat from 1996Q1 to 2007Q3. Second, they use a larger sample covering 24 EU member countries. Finally, they assess the sensitivity of the results to the sample length. They find evidence of heterogeneous real wage adjustment across twelve so-called new EU Member States (NMS-12) as well as twelve countries of the euro area (EA-12). Overall, the degree of real wage flexibility in the NMS-12 is found to be within the bounds of the corresponding values for the euro area 'core' and 'peripheral' member countries. Also, there is evidence of rising real wage flexibility in the NMS-12 group over time.

However, it still remains an open question as to which factors account for the differences in the degree of real wage flexibility (or reciprocally rigidity) across countries. The main contributions of this study lie in (i) presenting updated evidence on real wage flexibility, in particular assessing the effect of the 2008–2009 crisis; (ii) comparing the macroeconomic indicator of real wage flexibility with the measure of real wage rigidity derived from the European Wage Dynamics Network (WDN) survey of wage formation[2] and with the International Wage Flexibility Project

[2] The firm-level survey on price and wage setting was conducted in the second half of 2007 within the framework of the Wage Dynamics Network, a research network sponsored by a consortium of the EU central banks and coordinated by the European Central Bank. A follow-up survey, albeit on a smaller scale, was conducted in the middle of 2009 with the objective of investigating how European firms were adjusting during the crisis. Detailed information about the network, the survey and output publications is available on the WDN web site: http://www.ecb.int/home/html/researcher_wdn.en.html.

(IWFP)-based microeconomic estimates of downward real wage rigidity; and (iii) examining the role of institutional features of labour markets in explaining the cross-country variation in real wage flexibility. We also examine the role of measurement issues, e.g. the choice of deflators, in real wage dynamics.

The paper is organised as follows. After this introduction, Section 2 discusses the methodological aspects of measuring real wage flexibility. Section 3 describes the data set. Section 4 presents the real wage flexibility estimation results. Section 5 compares these macroeconomic estimates of real wage flexibility with the WDN and IWFP firm-level indicators of rigidity and with labour market institutions. The last section concludes.

2. Empirical Framework

Since wage flexibility is measured as the responsiveness of real wages to structural shocks, in the first step we need to identify such shocks. In order to identify structural shocks from the observed fluctuations in nominal and real wages, Moore and Pentecost (2006) propose a bi-variate structural vector autoregressive (SVAR) procedure. This identification strategy in turn is based on bi-variate SVAR decomposition as advocated by Blanchard and Quah (1989), in the way that Bayoumi and Eichengreen (1996) apply this decomposition to extract real (supply) and nominal (demand) shocks from the observed series of real output and prices. Such an approach is quite popular in studies on business cycle convergence, particular in the European Union context.[3] In our case, structural shocks are defined according to their short- and long-term effects on nominal and real wages. By definition, one type of shock (labelled as 'nominal') has only a transitory impact on the level of real wages, while another type of shock (labelled as 'real') might have a long-term impact on the level of real wages. Naturally, there are both advantages and disadvantages of describing real wage dynamics in terms of a limited number (two in our case) of structural shocks. Basically, all the discussion that has taken place since Blanchard and Quah's (1989) seminal contribution to the business cycle literature is relevant to our application of this decomposition for the purpose of examining the reactions of real wages to structural shocks.

According to the stylised bi-variate framework, real shocks can affect real wages in either positive or negative directions. A positive effect can be associated, for example, with a rise in productivity, followed by a permanent increase in real wages and employment. This leads to an outward shift of the aggregate labour demand curve. A negative impact of the real shock on real wages can be interpreted as being due to an increase in labour supply, followed by a decrease in real wages.

Although nominal shocks cannot have long-lasting effects on real wages, no restrictions are imposed on the short-run effects and their sign and magnitude depend on relative price/wage stickiness. If real wages WR = W/P decrease following a positive nominal shock, such a situation corresponds to sticky nominal wages W. Under the sticky price assumption, real wages increase in response to a positive nominal shock. Lastly, if nominal wages W and prices P move simultaneously, real wages do not change.

[3] See, among others, Babetskii et al. (2004) for an assessment of supply and demand shock asymmetry in the EU accession countries. Furthermore, in the meta-analysis of studies on business cycle correlation by Fidrmuc and Korhonen (2006) about half of the 35 studies reviewed apply such decomposition.

Economic theory proposes alternative explanations as to why markets do not clear immediately after an unexpected shock hits the economy. Abraham and Haltiwanger (1995) present an overview of competing models that have been put forward to explain procyclical as well as countercyclical behaviour of real wages. Particularly, New Keynesians claim that rigidity of wages and prices is one of the most relevant causes of economic fluctuations, i.e. the sticky wages and sticky prices assumptions (Mankiw and Romer, 1991). On the one hand, the sticky wages assumption imposes rigidity on the short-run adjustment of wages to demand shocks, thanks to implicit or explicit agreements in the labour market. On the other hand, the sticky price assumption imposes rigidity on the short-run price adjustment to demand shocks, mainly due to menu costs. Although the two assumptions appear quite similar, their real economic implications are in sharp contrast. As discussed, for example, by Kandil (1996), the real wage can develop procyclically or countercyclically depending on the adjustment of nominal wages and prices. Under the assumption of sticky wages a temporary demand shock translates into higher prices and lower real wage rates, i.e. real wages move countercyclically. In contrast, under sticky prices a positive demand shock tends to increase real wages. Thus, under the sticky prices assumption real wages and other real economic variables move procyclically.

A structural bi-variate VAR decomposition makes it possible to identify real (permanent) and nominal (transitory) shocks from the observable movements of real and nominal wages.[4] Formally, let us consider wr_t and w_t, real and nominal wages expressed in logarithms (for brevity we will use the term 'wages', meaning overall total labour costs or a particular labour cost component). These variables are assumed to be first difference stationary. The following VAR representation will be estimated:

$$\Delta wr_t = b_{01} + \sum_{k=1}^{K} b_{11k} \Delta wr_{t-k} + \sum_{k=1}^{K} b_{12k} \Delta w_{t-k} + e_t^{wr} \tag{1}$$

$$\Delta w_t = b_{02} + \sum_{k=1}^{K} b_{21k} \Delta wr_{t-k} + \sum_{k=1}^{K} b_{22k} \Delta w_{t-k} + e_t^{w} \tag{2}$$

where e_t^{wr} and e_t^{w} are white-noise disturbances, b_{ijk} are coefficients and K is the lag length, chosen so that e_t^{wr} and e_t^{w} are serially uncorrelated.[5] Disturbances e_t^{wr} and e_t^{w} are not structural, they simply represent unexplained components in real and nominal wage growth movements. In order to recover structural disturbances, i.e. those having an economic interpretation of real and nominal shocks, the following two relationships are proposed:

$$e_t^{wr} = c_{11}\varepsilon_t^{N} + c_{12}\varepsilon_t^{R} \tag{3}$$

[4] The SVAR model discussed also has a number of limitations reported in Blanchard and Quah (1989), e.g. the unique identification of permanent and transitory shocks does not always exist. We will check whether our data would allow a meaningful SVAR decomposition.

One way to improve the proposed SVAR model (and to better identify the underlying shocks) is to augment SVAR with additional 'real' variables, for example employment or GDP. Another modification would be to relax the assumption of equal variance of permanent and transitory shocks.

[5] We select K according to the Akaike and Schwarz information criteria, which suggest two, or, in some cases, three or four lags. Then, we check the VARs for stability (characteristic roots should lie outside the unit circle) and perform diagnostic checks of the residuals for higher-order serial correlation (Ljung-Box test) and normality (Jarque-Bera test).

$$e_t^w = c_{21}\varepsilon_t^N + c_{22}\varepsilon_t^R \tag{4}$$

where ε_t^N and ε_t^R are nominal (transitory) and real (permanent) disturbances respectively. These equations state that the unexplainable components in the movements of real and nominal wage growth are linear combinations of structural shocks. In order to recover the four coefficients of matrix *C*, four restrictions have to be imposed. The first three restrictions are the normalisation conditions, namely that the variance of nominal and real shocks is unity: $Var(\varepsilon^N) = Var(\varepsilon^R) = 1$ and that nominal and real shocks are orthogonal: $Cov(\varepsilon^N, \varepsilon^R) = 0$. The fourth restriction on the coefficients of matrix *C* is that nominal shocks ε_t^N have no long-term impact on the level of real wages. Having identified matrix C, the real and nominal disturbances can be recovered from the VAR residuals by inverting matrix C: $\varepsilon_t = C^{-1}e_t$.

One should, however, be aware of the simplifications and limitations of such a VAR technique. In particular, the nominal and real shocks identified do not necessarily have a direct relationship to aggregate demand and supply disturbances.

Once the structural shocks are identified, we examine the responses of real wages to real (permanent) and nominal (transitory) shocks in order to check whether the decomposition was successful. Using the parameters of equations (1) and (2) estimated for each of the countries in our sample for the VAR decomposition described above, we verify the reaction of real wages in each country to one standard deviation innovations to real (permanent) and nominal (transitory) shocks.

Next, while the impulse responses allow us to illustrate the dynamic effects of shocks on real wages, the variance decomposition measures the relative contribution of real and nominal shocks to fluctuations in real wages. Real wages are said to be flexible if their variation is mainly due to real shocks.

Differences in wage flexibility across countries are further linked to such factors as: (i) the sector (business economy, services and manufacturing[6]); (ii) the type of labour cost (wage versus non-wage costs); and (iii) the deflator (GDP deflator, the HICP, and the HICP excluding energy). The robustness of the results is also assessed for two periods, namely the one covering the 'pre-crisis' episode 2001Q1–2008Q2 and the other one including data up to 2010Q2.

Finally, we compare our estimates of wage rigidities to the WDN firm-level survey measures of wage rigidity, and we link the results to institutional features of national labour markets such as collective bargaining coverage and strictness of employment protection legislation.

[6] The business economy is defined by codes B to N, manufacturing by code C and the service sector by codes G to N of the NACE Rev. 2 classification.

3. Data Description

Our sample includes 24 EU member states (EU-24).[7] As of 2010 (the end of the data series), 14 sample countries belong to the euro area, namely Austria, Belgium, Cyprus, France, Germany, Greece, Italy, Luxembourg, the Netherlands, Portugal, Slovenia, Slovakia and Spain (EA-14 henceforth).

In order to measure real wage flexibility, we need a variable characterising the development of labour costs in both nominal and real terms. For this purpose, we use the hourly labour cost index provided by Eurostat at quarterly frequency. In addition to wages and salaries, the labour cost index includes employers' social security contributions plus taxes paid less subsidies received by the employer. Furthermore, the labour cost index is available at the first-digit sectoral level (NACE Rev. 2) and by components (wage versus non-wage costs). In our analysis we work with three alternative measures, namely total labour costs, the wage component and other (non-wage) labour costs. Total labour costs are representative from the firms' viewpoint. Thus, if we are interested in the most aggregate measure of real wage flexibility, we take total labour costs. On the other hand, for comparison with survey-based studies (in which wages were investigated), we should employ the wage component of labour costs. Finally, in order to examine firms' adjustment during the 2008/2009 crisis, we compare the wage and non-wage components of labour costs.

Labour cost indices are available in nominal terms, starting from 2000Q1, and the data have the advantage of being harmonised for cross-country comparison. Nominal indices are seasonally adjusted and adjusted by working days, and normalised to 100 in 2008. While real labour cost indices were available from Eurostat a couple of years ago (Babecký and Dybczak, 2008), currently real labour cost indices are no longer provided. Therefore, we construct real indices ourselves by applying deflators. We use the GDP deflator, the harmonised index of consumer prices (HICP), and the HICP excluding energy prices (HICPex) as the three alternatives for obtaining real cost indices on the aggregate level, that is for the business economy (codes B–N in the NACE Rev. 2 classification). The producer price index (PPI) is used for obtaining real wages in manufacturing (code C) and we apply the HICPex to define real wages in the service sector (of the business economy, codes G–N).

Table 1 shows average yearly real wage growth in the sample countries, grouped by deflator, labour cost component and sector, yielding seven combinations in total. A comparison of euro area versus non-euro area aggregates (the last row of Table 1) reveals that in all seven cases real wages, on average, tend to grow faster in the non-euro area EU countries compared to their euro area counterparts. This reflects the process of real convergence. Differences across countries, deflators, labour cost components and sectors suggest fertile ground for the analysis of real wage dynamics.

[7] Out of the 27 EU member countries, labour cost data are unavailable for two euro area countries, Finland and Ireland, and for one non-euro area EU country, Sweden.

Table 1: Real Wage Growth in the EU-24, 2001Q1–2010Q2 (%, y-o-y)

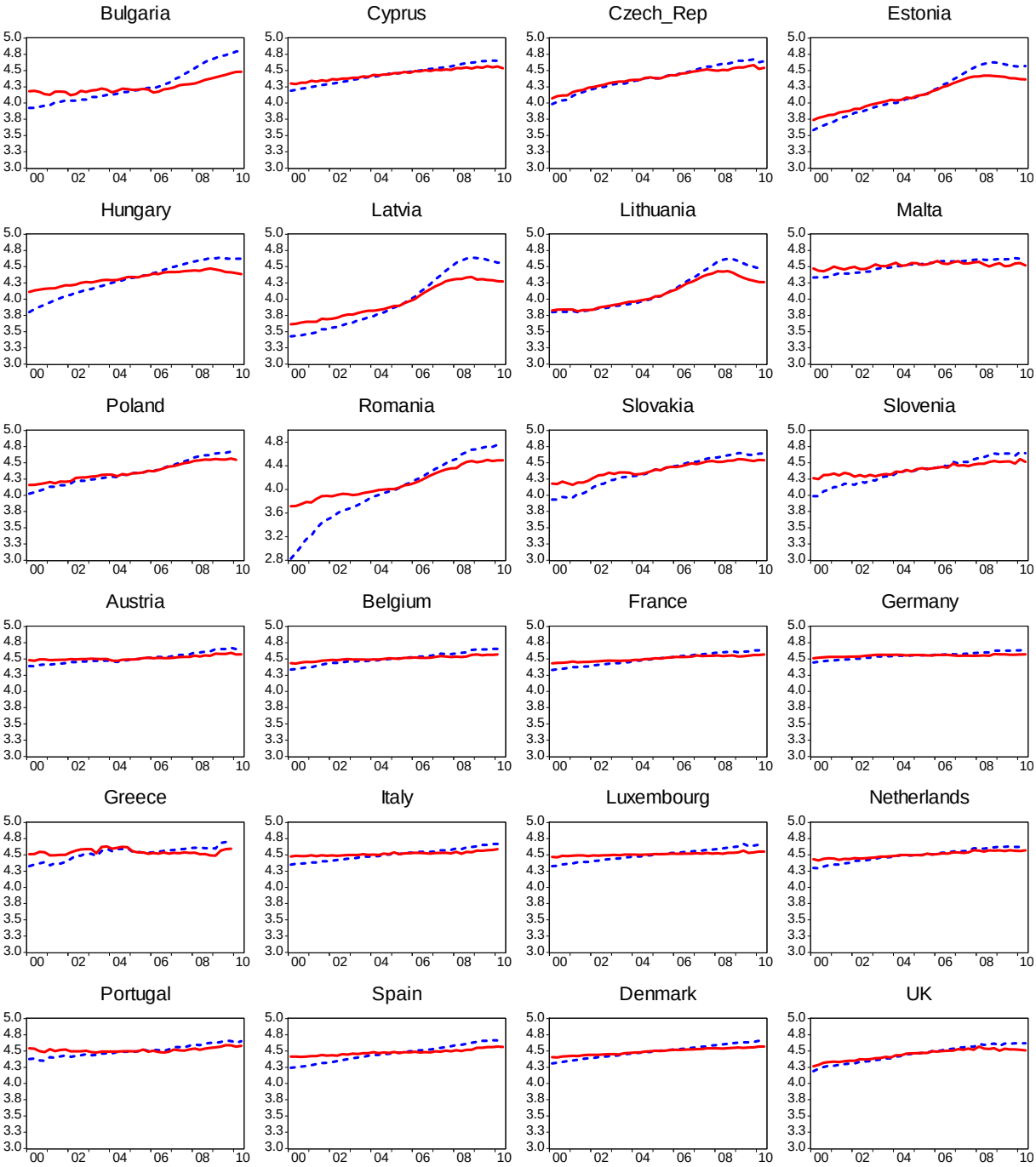
	Business economy			Business economy		**Services**	**Manufact**
	Components: Total labour costs			**Components:** **Wages**	**Other lc**	Components: Total labour costs	
	Deflators:			Deflators:		Deflators:	
Countries	**GDP**	**HICP**	**HICPex**	HICPex	HICPex	HICPex	PPI
Austria	1.1	0.9	1.0	1.2	0.5	1.1	1.8
Belgium	1.3	1.3	1.3	1.3	1.6	1.3	1.0
Bulgaria	3.5	3.0	3.3	4.9	-2.1	4.0	3.2
Cyprus	1.7	2.2	2.7	2.6	3.0	2.9	0.2
Czech Republic	4.6	4.5	4.9	5.0	4.5	5.0	7.3
Denmark	1.1	1.5	1.6	1.1	5.5	1.6	1.5
Estonia	5.1	5.9	6.6	6.4	6.9	6.3	7.6
France	1.2	1.2	1.3	1.1	1.7	1.2	2.2
Germany	0.7	0.2	0.5	0.8	-0.4	0.4	1.1
Greece	0.7	0.5	0.5	0.3	1.1	0.6	-0.4
Hungary	3.0	2.6	2.9	3.9	0.3	2.9	5.8
Italy	0.8	1.0	1.0	1.0	1.0	0.6	2.5
Latvia	5.7	6.9	7.3	7.6	6.8	7.5	7.1
Lithuania	4.4	4.6	5.1	4.9	5.4	5.2	4.8
Luxembourg	0.2	0.7	0.7	0.9	0.2	0.8	0.9
Malta	0.5	0.7	0.9	1.0	0.4	0.4	5.4
Netherlands	1.2	1.2	1.4	1.1	2.9	1.3	1.9
Poland	3.9	3.8	4.2	4.2	4.6	4.0	5.6
Portugal	0.5	0.5	0.7	0.7	1.0	0.7	1.8
Romania	3.7	7.2	8.3	9.7	4.8	7.8	5.6
Slovakia	4.4	3.1	3.8	4.1	3.0	4.1	7.8
Slovenia	2.4	2.2	2.6	3.0	0.5	2.0	4.7
Spain	1.0	1.5	1.6	1.3	2.5	1.4	2.3
UK	1.4	2.1	2.4	2.2	3.8	2.4	2.0
Euro area	*2.0*	*2.3*	*2.6*	*2.8*	*2.4*	*2.6*	*2.8*
Non-euro area	*2.6*	*2.7*	*3.0*	*3.1*	*2.6*	*3.0*	*4.4*
EU average	*2.3*	*2.5*	*2.8*	*2.9*	*2.5*	*2.7*	*3.5*

Note: HICPex is the Harmonised Index of Consumer Prices (HICP) excluding energy. '*Euro area*' includes countries which were members of the euro area as of 2010.
Business economy: codes B–N in the NACE Rev. 2 classification; Manufacturing: code C; Services (of the business economy): codes G–N.

Source: Authors' calculations based on Eurostat.

Figure 1 illustrates the evolution of nominal and real wages in the 24 countries over the sample period. As expected, nominal wages grew faster than real ones, and nominal wages grew on average faster in the non-euro area countries than in the euro area ones. A number of non-core EU member countries, in particular Bulgaria, Estonia, Latvia, Lithuania and Romania, experienced high inflation episodes during the past decade.

Figure 1: Logarithm of Real (—) and Nominal (- - -) Total Labour Costs for the Business Economy in the EU-24, 2001Q1–2010Q2. Real Costs are Obtained Using the HICPex



Note: The upper dozen plots display labour cost indices for the so-called 'new' EU member states (Bulgaria to Slovenia). They are followed by ten 'mature' EU member states inside the euro area (Austria to Spain) and by the remaining two 'mature' EU member states outside the euro area (Denmark and the United Kingdom).

Source: Authors' calculations based on Eurostat.

4. Results

The seven combinations of sector, deflator and labour cost component presented in Table 1 correspond to our seven basic sets of results. Furthermore, the number of outcomes should be multiplied by two since we perform a robustness check for two overlapping periods, namely 'before the Great Recession' (2001Q1–2008Q2) and 'including the Great Recession' (2001Q1–2010Q2). To facilitate the exposition, we present detailed results corresponding to the central scenario (the third column of Table 1), namely for the combination given by the business economy, total labour costs and the HICP excluding energy prices, and we illustrate the sensitivity of the results with respect to the period ('before the crisis' versus 'including the crisis').

Our choice of the central scenario is motivated by the intention to present results which are maximally representative of the total economy. Hence, we focus on the largest NACE category available, labelled *Business Economy*. Total costs are in turn representative from the firms' viewpoint. Regarding the choice of deflators, the CPI-based deflator is consistent with a process of wage setting in a bargaining framework, where wages represent the outcome of negotiations between firms, workers and unions. We choose the HICP excluding energy prices to minimise the impact of (volatile) energy prices – in particular during our estimation period – on the measure of real wages. Nevertheless, as a robustness check, we derive results for the other six combinations listed in Table 1. These results are summarised in the form of tables.

Prior to commenting on the results, we shall mention some common estimation steps: stationarity of the series, SVAR estimation and diagnostics. First, we assess the time series properties of the data by applying a unit root test (the augmented Dickey-Fuller and Phillips-Perron test) and a stationarity test (the Kwiatkowski-Phillips-Schmidt-Shin test).[8] The results of the unit root and stationarity tests for our central scenario are shown in Table 2. Visual inspection of the series plotted in Figure 1 suggests that they are non-stationary in levels, and the formal tests indeed confirm that. Overall, the series of log nominal and log real wages are found to be integrated of order one, although we acknowledge that out of the bunch of combinations of three sectors, three deflators, two labour cost components and 24 countries, there are some cases where (nominal) wages could be characterised as integrated of order two. However, since ten years of data might be too short a period for a robust inference, and to preserve homogeneity, we estimate all the SVARs as if the series were integrated of order one, that is using first differences. As mentioned in the methodological section, the lag length is selected on the basis of information criteria. Then, importantly, we test the estimated SVARs for stability (a test for the roots of the characteristic polynomial to be outside the unit circle). All the SVARs pass this test. Furthermore, visual inspection of the impulse responses is used to check that the responses of real and nominal wages converge to some constant levels as the time horizon increases (convergence is typically achieved at a horizon shorter than 40 observations).

[8] A popular description of the identification strategy is provided, for example, in Enders (2004).

Table 2: Unit Root and Stationarity Tests for the Central Scenario: Total Labour Costs, Business Economy, HICPex, 2001Q1–2010Q2

	Test Statistics											
	ADF[a)]				PP[a)]				KPSS[b)]			
	cons.		cons. & trend		cons.		cons. & trend		cons.		cons. & trend	
	Δwn	Δwr	Δwn	Δwr	Δwn	Δwr	Δwn	Δwr	Δwn	Δwr	Δwn	Δwr
BG	-2.061*	-5.345	-2.564*	-6.654	-4.262	-5.333	-4.905	-10.821	0.428*	0.441*	0.088	0.426*
CY	-2.466*	-2.890	-3.352	-4.951	-2.561*	-20.861	-3.409	-25.632	0.501*	0.345	0.104	0.192*
CZ	-6.051	-6.712	-6.962	-6.340	-6.060	-6.741	-6.983	-7.925	0.477*	0.609*	0.095	0.056
EE	-4.199	-0.515*	-4.111	-1.034*	-3.760	-4.910	-4.074	-5.601	0.212	0.321	0.115	0.130*
HU	-1.473*	-4.647	-2.464*	-5.711	-3.012	-4.647	-5.179	-5.702	0.611*	0.694*	0.110	0.132*
LV	-2.885	-3.340	-5.569	-3.338	-2.043*	-3.844	-1.914*	-3.855	0.150	0.147	0.150*	0.143*
LT	-2.929	-1.441*	-2.920*	-1.555*	-2.203*	-2.838	-2.130*	-2.862*	0.147	0.176	0.148*	0.155*
MT	-5.814	-1.016*	-6.819	-2.599*	-5.814	-7.645	-8.293	-13.982	0.399*	0.221	0.142*	0.200*
PL	-7.483	-8.388	-7.421	-8.283	-7.407	-8.161	-7.346	-8.067	0.111	0.107	0.107	0.105
RO	-3.097	-4.980	-4.164	-4.909	-2.851	-5.004	-4.326	-4.934	0.539*	0.122	0.134*	0.125
SK	-6.042	-6.507	-7.009	-6.605	-6.138	-6.505	-7.009	-6.600	0.400*	0.137	0.079	0.061
SI	-11.270	-12.115	-12.121	-11.945	-10.719	-12.134	-12.151	-11.953	0.311	0.096	0.104	0.093
AT	-8.469	-8.684	-8.370	-8.598	-8.350	-8.684	-8.283	-8.600	0.133	0.108	0.071	0.057
BE	-6.406	-6.592	-2.055*	-5.879	-6.406	-7.016	-6.423	-7.060	0.119	0.132	0.083	0.114
FR	-8.004	-8.927	-8.191	-8.854	-8.004	-9.011	-8.921	-8.988	0.258	0.200	0.137*	0.258*
DE	-7.559	-7.185	-7.629	-7.174	-7.559	-7.201	-7.642	-7.184	0.216	0.222	0.110	0.109
GR	-6.921	-6.601	-6.819	-6.511	-6.923	-6.677	-6.821	-6.556	0.088	0.093	0.084	0.095
IT	-11.964	-16.346	-11.942	-16.898	-12.257	-16.179	-12.308	-18.079	0.081	0.267	0.075	0.175*
LU	-7.541	-7.621	-7.532	-7.486	-15.080	-17.402	-15.859	-17.007	0.166	0.182	0.132*	0.153*
NL	-7.988	-7.213	-6.532	-7.136	-8.152	-17.448	-12.557	-23.388	0.327	0.196	0.332*	0.196*
PT	-8.271	-7.234	-8.133	-7.844	-10.388	-8.281	-10.308	-12.426	0.091	0.278	0.059	0.096
ES	-2.420*	-3.956	-2.731*	-3.960	-5.485	-14.137	-5.673	-16.962	0.194	0.202	0.075	0.103
DK	-7.805	-2.436*	-8.371	-2.377*	-7.783	-9.122	-8.532	-14.714	0.346	0.275	0.138*	0.175*
UK	-10.931	-10.294	-12.021	-12.008	-11.099	-9.900	-12.879	-12.336	0.496*	0.619*	0.060	0.073

	Critical Values					
	ADF		PP		KPSS	
	cons.	cons. & trend	cons.	cons. & trend	cons.	cons. & trend
1%	-3.621	-4.227	-3.606	-4.205	0.739	0.216
5%	-2.943	-3.537	-2.937	-3.527	0.463	0.146
10%	-2.610	-3.200	-2.607	-3.195	0.347	0.119

Note: [a)] Values represent the test statistics of the Ho that the series has a unit root; [b)] Values represent the test statistics of the Ho that the series is (trend) stationary; * denotes the rejection of the Ho at the 10% significance level.

4.1 Real Wage Flexibility for the Central Scenario: the Business Economy, Total Labour Costs and the HICP Excluding Energy Prices

This sub-section presents the results for the central scenario, namely for the business economy and for real wages, defined as the ratio of nominal aggregate labour costs to the HICP deflator excluding energy prices.

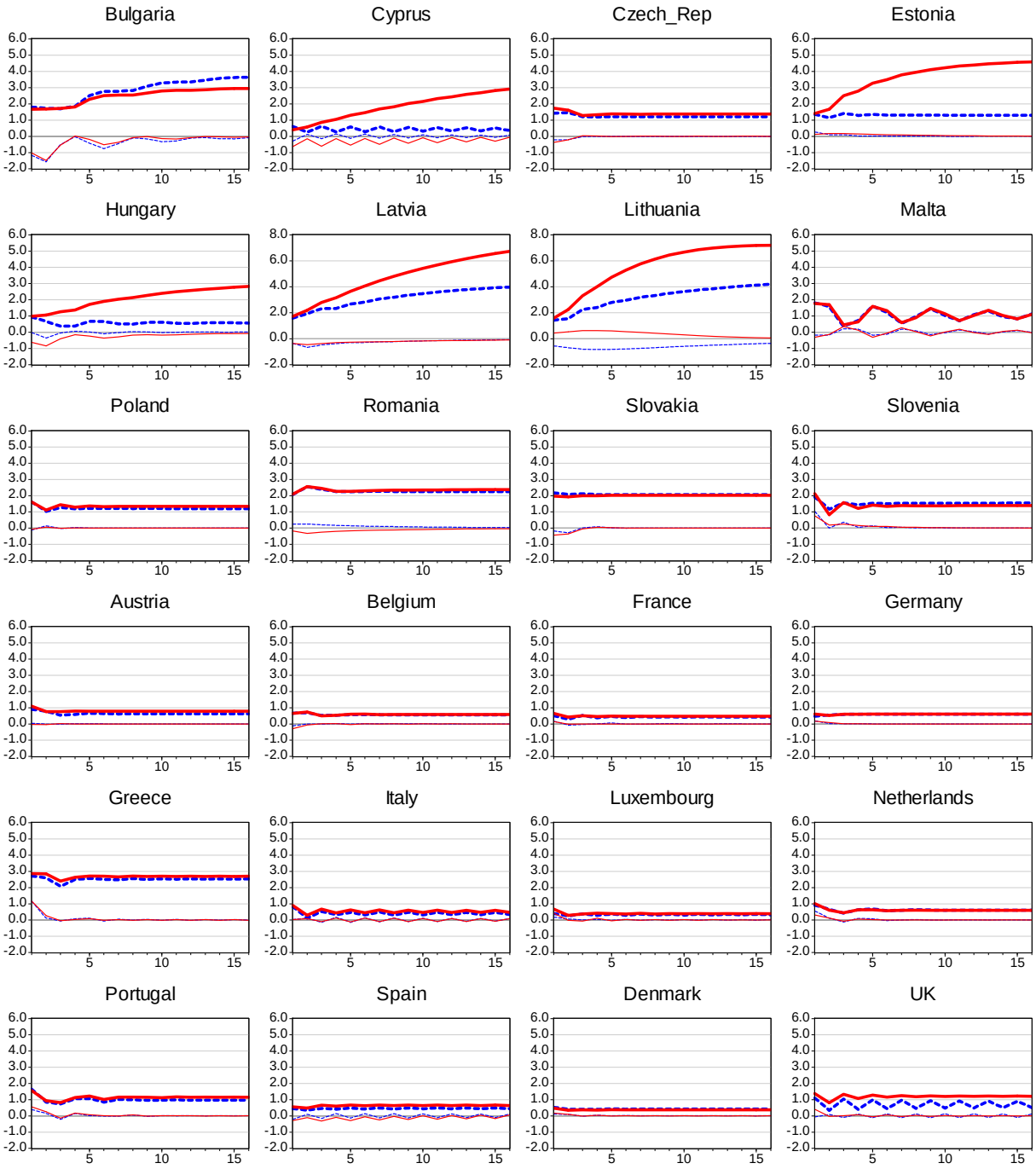
Impulse Responses of Real Wages

Figure 2 shows the identified reactions of real wages to one standard deviation in real (permanent) and nominal (transitory) shocks over the forecast horizon from one to sixteen quarters. In order to facilitate cross-country comparison, the impulse response functions (IRFs) are plotted on a scale from -2% to 6%. The long-term IRFs of real wages to real shocks range from 0.3% to 4%. In general, the effects of shocks on real wages are more substantial in the non-core EU countries shown in the upper part of Figure 2, largely because a one standard deviation innovation to shocks is larger in these countries. This is consistent with higher real wage growth in such countries compared to the EU average (see e.g. Figure 1 and Table 1).

Even though the SVAR identification scheme does not impose any restriction on the sign of the impulse responses, real wages react positively to a positive real (permanent) shock in all 24 countries, the same result as reported in Moore and Pentecost (2006) and Babecký and Dybczak (2008). The main specification IRFs for the period 2001Q1–2008Q2 are quite similar to those reported in Babecký and Dybczak (2008), which were estimated on the sample from 1996Q1 to 2007Q3 using the real labour cost indices available at that time from Eurostat.

The response of real wages to nominal shocks dies out over time by construction. However, in the short run, the effect of nominal shocks on real wages illustrates relative price/wage stickiness. The development of real wages in response to a nominal shock ('cyclicality of real wages') is crucially affected by the degree of relative price and nominal wage stickiness. In reality, sticky wages and sticky prices co-exist. Thus, the final impact of a nominal (transitory) shock on the economy is critically affected by the degree of price and wage rigidity.

Figure 2: Reaction of Real Total Labour Costs (Deflated by the HICP excluding Energy Prices) to 1 std. dev. in Real (▬) and Nominal (▬) Shocks, before (- - -) and including (—) the Crisis



Note: Accumulated impulse responses from SVAR estimated over two periods labelled 'before the crisis' (2001Q1–2008Q2) and 'including the crisis' (2001Q1–2010Q2). The horizontal axis shows the forecast horizon, from one to sixteen quarters. The vertical axis plots the responses of real total labour costs to one standard deviation innovations in real (permanent) and nominal (transitory) shocks. The country ordering is the same as the one listed in the note to Figure 1.

Source: Authors' calculations based on Eurostat.

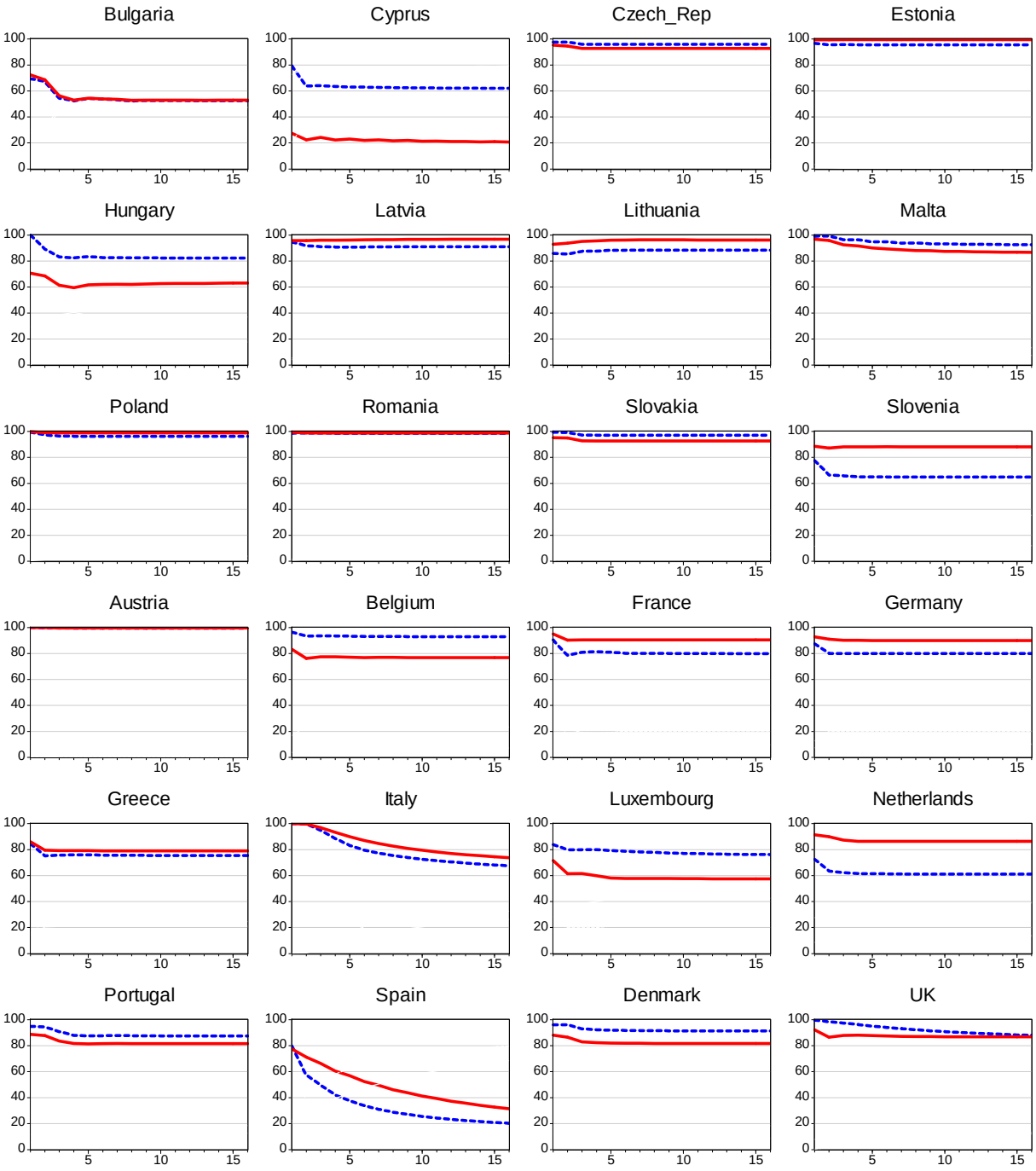
According to economic theory, the reaction of the real wage to a nominal shock can be positive, negative or close to zero. Our results suggest that in the short run the IRFs of real wages to nominal shocks are negative in the case of Bulgaria, Latvia and Lithuania, positive for Slovenia, Greece, the Netherlands and Portugal, and close to zero for most of the countries. In order to give a precise answer on the cyclical properties of real wages, confidence intervals need to be carefully constructed, accounting for the finite sample size. This could be one possibility for future research. In this paper we focus on real wage flexibility, which is defined on the basis of variance decomposition. Impulse responses are used as a cross-check of the structural decomposition. As one can see from Figure 2, in some countries – e.g. Cyprus, Malta and the UK – the impulse responses of real wages fluctuate around constant levels, while in other countries – e.g. Bulgaria, Latvia and Lithuania – it takes longer for the impulse responses to converge to constant levels. Overall, the structural decomposition can be characterised as meaningful.

A comparison of the impulse responses for the shorter sample ending in 2008Q2 and the full sample going up to 2010Q2 reveals that overall the reactions of real wages to shocks remain qualitatively similar. In some countries – e.g. Cyprus, Estonia, Hungary, Latvia and Lithuania – real wages show stronger responses to real shocks for the entire sample. Moreover, for Lithuania there is an indication of a change of real wage adjustment from counter- to pro-cyclical (as measured by the response to nominal shocks).

Real Wage Flexibility – Variance Decomposition

While impulse responses illustrate the dynamic effects of shocks on real wages, variance decomposition measures the relative contributions of real and nominal shocks to fluctuations in real wages. Real wages are said to be flexible if their variation is mainly due to real shocks. Figure 3 shows the percentage of the forecast variance in real wages explained by real (permanent) as opposed to nominal (transitory) shocks, at the horizon from one to sixteen quarters. Since at each horizon the contribution of nominal and real shocks to the variance of real wages sums to 100, only real shock contributions are illustrated. All estimations are statistically significant at the 5% level. Several observations follow from the results over the pre-crisis period 2000Q1–2008Q2.

Figure 3: Real Wage Flexibility before (- - -) and including (—) the Crisis Period: Percentage of Variance in Real Labour Costs (Deflated by the HICP excl. Energy Prices) due to Real Shocks



Note: Variance decomposition from SVAR estimated over two periods labelled 'before the crisis' (2001Q1–2008Q2) and 'including the crisis' (2001Q1–2010Q2). The horizontal axis shows the forecast horizon, from one to sixteen quarters. The country codes and ordering are the same as those listed in the note to Figure 1.

Source: Authors' calculations based on Eurostat.

First, the EU-24 group is characterised by a variety of outcomes. The percentage of variance explained by real shocks varies from as low as 20 to near 100%. Second, the contribution of shocks to the variance of real wages depends on the forecast horizon. For example, fluctuations in real wages are almost entirely due to real shocks one quarter ahead for Hungary, Italy and Malta, but the impact of real shocks on real wage variance drops to 92% (Malta), 83% (Hungary) and 70% (Italy) at the four-year horizon. Such an outcome corresponds to the delayed pass-through of nominal shocks to real variables. On the other hand, in, for example, Austria, the Czech Republic, Estonia, Poland, Romania and Slovakia, the contribution of real shocks to real wage variance – real wage flexibility – remains at nearly constant levels, above 95%, over all time horizons.

Extension of the sample up to 2010Q2 leads to some changes in the degree of wage flexibility, for example (marginally) higher responsiveness of real wages to real shocks in Estonia, Latvia, Lithuania, Slovenia, France, Germany and the Netherlands, which corresponds to an increase in real wage flexibility. On the other hand, a decrease in real wage flexibility happens in Cyprus, Hungary, Malta, Belgium, Luxembourg and Denmark. Thus, the effect of the 2008–2009 crisis on real wage flexibility has not been uniform across the EU-24, or across the sub-groups of euro area and non-euro area countries.

At first glance, a finding of rising real wage rigidity during the crisis might sound paradoxical. However, one reason for the observed increase in real wage rigidity during the crisis is the prevalence of rigidity in nominal wages on a background of declining (near-zero) inflation. Indeed, the lower inflation is, the smaller the downward real wage changes are. In other words, declining inflation reduces the potential for 'grease' effects on real wages, all other factors being equal. The survey evidence confirms that nominal wage rigidities in the EU countries remain persistent. Results from the WDN follow-up survey, conducted in the middle of 2009 with the objective of investigating firms' reactions to the crisis, indicate that nominal wage cuts have been extremely rare. Moreover, the frequency of nominal wage freezes increased during the crisis of 2008/2009 (Messina and Rõõm, 2011). To sum up, while in normal times real wages can adjust (decrease) in reaction to shocks, largely due to the 'grease' effects of inflation, a combination of rigid nominal wages and low inflation during the recent crisis has reduced the scope for real wage adjustment.

Second, the extent of real wage rigidity during the crisis could have been influenced by structural changes, for example that low-earning workers were fired first. Thus, the aggregate wage could even have statistically increased, at least in the initial phase of the crisis, following the lay-off of low-earning workers.

Third, in a situation of rigid base wages, firms make use of alternative cost-cutting strategies, for example cutting hours of work or employment, as well as adjusting non-wage labour costs (Fabiani et al, 2011). Burda and Hunt (2011) draw on the successful experience of German firms in adjusting hours of work and largely preserving 'bodies' (i.e. employment) during the Great Recession. Given that our measure of real wage rigidity is based on hourly total labour costs, adjustment in the number of hours of work or employment is not reflected in our estimates of real wage rigidity.

Also, notice that the labour cost indicators may have been affected by changes in income taxation and social security contributions. During the crisis of 2008/2009 many countries introduced

measures to promote employment, stimulate hiring and avoid depreciation of labour skills. These measures come in different forms, as they can be targeted at either employers or employees depending on whether they are direct transfers, reductions in social security contributions or income tax credits (see World Bank, 2009, for an overview of wage subsidy and work-sharing programmes in OECD countries). Some of these measures, in particular direct transfers to employers and reductions in social security contributions, may have contributed, at least in the short run, to the decline in the total labour costs of employers during the recent crisis. However, the ultimate effect of these measures on our indicator of real wage flexibility is difficult to articulate, since real wage flexibility is measured as the responsiveness of real wages (labour costs) to real shocks, and the effect also depends on the magnitude of the shocks.

4.2 The Role of the Price Deflator, the Labour Cost Component and Sector

As recently pointed out, for example, by Messina et al. (2009) and Messina et al. (2010), the assessment of real wage adjustment over the business cycle depends critically on the data used. In particular, taking into account the role of price deflators when constructing real wages, these studies find that the deflators used have a significant effect on the results. In other words, whether real wages are constructed using the PPI, CPI or GDP deflator has a critical effect on the overall assessment of the cyclical properties of real wages. Following these studies, and in order to check the robustness of our results, we quantify the impact of price deflators on the assessment of aggregate real wage flexibility for two sub-periods, namely prior to and including the crisis of 2008/2009.

In order to check the sensitivity of the overall real wage flexibility assessment to the deflation method, we divide nominal wages by the GDP deflator, the harmonised consumer price index (HICP) and the harmonised consumer price index excluding prices of energy (HICPex). Regardless of the price deflator used, a decrease in real wage flexibility after the 2008/2009 crisis was found in nine out of the 24 countries in our sample. A rather convincing decrease in flexibility was measured in three countries. On the contrary, an unambiguous increase and a rather convincing increase were found in five countries and one country respectively. In the case of six countries, the price deflation effect prevents us from drawing a conclusion on the overall effect of a real shock on real wage flexibility. Thus, in line with Messina et al. (2009) and Messina et al. (2010) we confirm the effect of the construction of real wages on the final results. The differences among countries could possibly be explained by other labour and product market characteristics, as described, for example, in Bertola et al. (2010).

Table 3 allocates the EU countries to these groups, in addition differentiating between euro area and non-euro area member states. The results suggest that for about half of the sample countries real wage flexibility decreased during the recent crisis. This could be related to the documented rigidity of base wages and the use of non-wage forms of labour cost adjustment, for example employment or hours of work, as well as adjustment via non-labour costs (Burda and Hunt, 2011; Fabiani et al., 2011; Messina and Rõõm, 2011).

Table 3: The Effect of the Price Deflator on the Overall Assessment of Real Wage Flexibility during the Recent Crisis

	Non-euro area	Euro area
Unambiguous decrease in real wage flexibility (three deflators lead to the same result) 9	Czech Republic, Denmark, Hungary, UK	Belgium, Cyprus, Malta, Portugal, Slovakia
Convincing decrease in real wage flexibility (two deflators lead to the same result) 3	Lithuania	Germany, Luxembourg
Unambiguous increase in real wage flexibility (two deflators lead to the same result) 5	Poland, Romania	Italy, Netherlands, Slovenia
Convincing increase in real wage flexibility (three deflators lead to the same result) 1		France
Undetermined change in real wage flexibility (other cases) 6	Bulgaria, Estonia*, Latvia	Austria, Greece, Spain

Note: Comparison of real wage flexibility between two periods: 2001Q1–2010Q2 and 2001Q1–2008Q2.
* Estonia joined the euro area in 2011.

Next, we study the role of the definition of nominal aggregate labour costs in the overall assessment of real wage flexibility. Consequently, we use two alternative definitions of labour costs provided by Eurostat, one including only wages and salaries, and the other covering non-wage labour costs. In Table 4 one can see a significant role of the nominal wage definition in overall real wage flexibility, as in 13 out of the 24 cases it is not possible to decide on the direction of real wage flexibility before and after the crisis, i.e. the variance decomposition based on the two measures of total labour costs delivers results of the opposite sign. Still, in six and five countries respectively, real wage flexibility decreased and increased after the crisis based on both measures.

Table 4: The Effect of the Nominal Labour Cost Definition (either Wages and Salaries or Non-Wage Labour Costs) on the Overall Assessment of Real Wage Flexibility during the Recent Crisis

	Non-euro area	Euro area
Both types of nominal labour costs decreasing 6	Czech Republic, Hungary, Romania, UK	Cyprus, Slovakia
Both types of nominal labour costs increasing 5		Austria, Germany, Italy, Netherlands, Slovenia
Indeterminate 13	Bulgaria, Denmark, Estonia*, Latvia, Lithuania, Poland	Belgium, France, Greece, Luxembourg, Malta, Portugal, Spain

Note: Comparison of real wage flexibility between two periods: 2001Q1–2010Q2 and 2001Q1–2008Q2.
* Estonia joined the euro area in 2011.

The last part of the robustness exercise focuses on the change in real wage flexibility before and after the crisis in specific economic sectors. In particular, we compare the situation in the services and manufacturing sectors. We are aware that these two representatives cannot represent the rest of the economic activity in the economy. Still, we find services and manufacturing to be both very specific and distinct from each other, so that they are good candidates for our robustness exercise.

Based on Table 5, we see that only in a few countries, i.e. seven, real wage flexibility either decreased (five) or increased (two) for both sectors. Real wage flexibility increased either in services or in manufacturing in ten countries. For seven countries it is not possible to decide upon the direction of change in real wage flexibility.

Table 5: The Effect of Economic Activity on the Overall Assessment of Real Wage Flexibility during the Recent Crisis

	Non-euro area	Euro area
Real wage flexibility decreasing for both services and manufacturing 5	Denmark	Austria, Cyprus, Luxembourg, Slovakia
Real wage flexibility increasing for both services and manufacturing 2	Czech Republic	Netherlands
Real wage flexibility increasing just for services 5	Estonia*, Latvia, Lithuania, Poland	France
Real wage flexibility increasing just for manufacturing 5	Denmark	Belgium, Greece, Italy, Portugal
Undetermined 7	Bulgaria, Hungary, Romania, UK	Malta, Spain, Slovenia

Note: Comparison of real wage flexibility between two periods: 2001Q1–2010Q2 and 2001Q1–2008Q2.
* Estonia joined the euro area in 2011.

5. Assessment of Real Wage Flexibility

In this section we compare our macroeconomic estimates of wage rigidity with (i) the WDN firm-level indicators of downward real wage rigidity, (ii) the microeconomic estimates of downward real wage rigidity based on the methodology of the International Wage Flexibility Project, and (iii) labour market institutions.

5.1 Real Wage Flexibility: Comparison with the WDN Survey

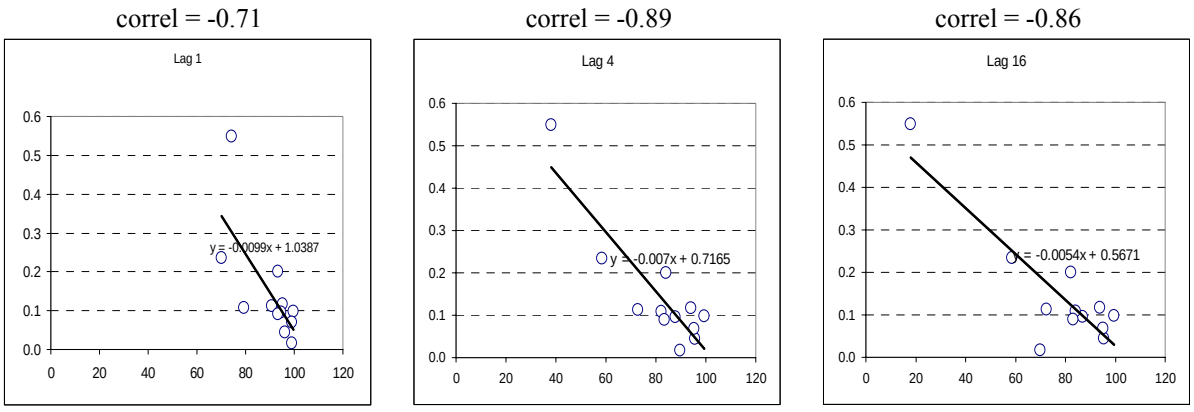
For the purpose of comparison with the WDN survey, we take our measure of real wage flexibility based on the wage component of total labour costs, since this measure is the closest one to the notion of wages used in the survey. To be representative of the total economy, the wage component was taken for the NACE2 category of the business economy, and the HICP deflator excluding energy prices was applied to define real wages. The estimations were performed for the period 2001Q1–2008Q2. This 'pre-crisis' period is chosen to better match the WDN survey, which was conducted between the second half of 2007 and the beginning of 2008, the questions about wage setting having been asked for the past five years. The WDN firm-level measure of downward real wage rigidity is measured as an index and is constructed by determining the proportion of firms having frozen wages over the past five years and applying an automatic indexation mechanism. Further details are provided in Babecký et al. (2010). Although we have estimates of real wage flexibility based on SVAR available for 24 EU countries, the estimates of real wage rigidity from the WDN survey are only available for 13 countries of our sample, out of which one country (Belgium) has to be excluded from the analysis since almost all firms in

Belgium apply automatic indexation mechanisms by law. Thus, we are left with 12 countries for which both the survey-based and SVAR-based estimates of wage rigidity/flexibility are available.

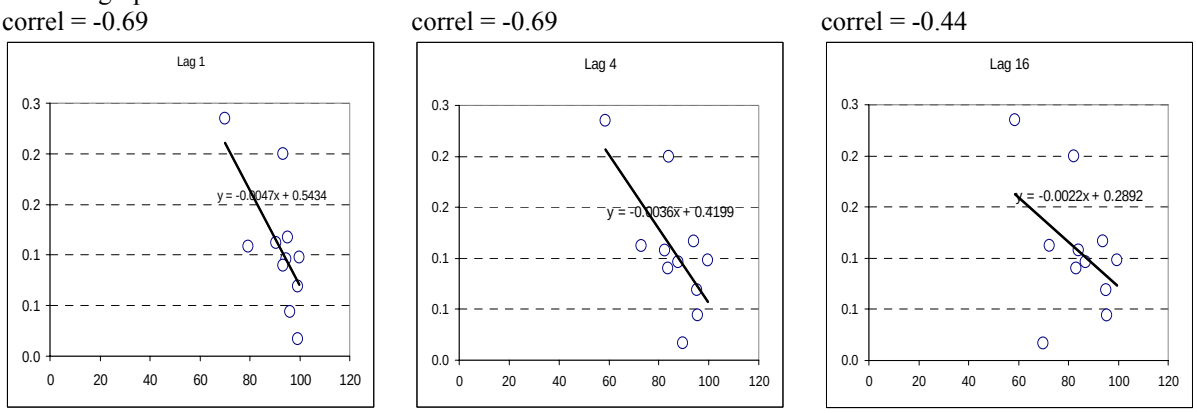
Figure 4 illustrates the correlations between the survey-based indicator of real wage rigidity and the SVAR-based estimate of real wage flexibility. Negative and close to one values suggest that there is high correlation for the degree of wage rigidity (or reciprocally wage flexibility) obtained on the basis of these two alternative measures – survey-based and macro-based. Such a high correlation is observed for various horizons at which the SVAR-based real wage flexibility is defined (variance decomposition at the horizons of 1, 4 or 16 quarters), and also for various combinations of countries: all 12 countries (the upper part of Figure 4), 11 countries with Spain excluded (the lower part of Figure 4) and the sub-groups of the euro area and non-euro area countries (not shown but available upon request).

Figure 4: WDN Downward Real Wage Rigidity (vertical axis) and Real Wage Flexibility Based on SVAR (horizontal axis)

12 countries*



Excluding Spain**



Note: *WDN downward real wage rigidity refers to the survey conducted during 2007/2008. The questions were asked about wage setting practices over the preceding five years. Downward real wage rigidity is measured as an index, i.e. by determining the proportion of firms having frozen wages over the past five years and applying an automatic indexation mechanism. The results are taken from Table 1 in Babecký et al. (2010). The SVAR-based real wage flexibility is measured by variance decomposition of the wage component of labour costs at a horizon from one to sixteen quarters, based on SVAR estimated over 2001Q1–2008Q2. The three columns denoted by Lag 1, Lag 4 and Lag 16 correspond to variance decomposition horizons of 1, 4 and 16 quarters.

** For robustness checking, Spain is excluded here since it is characterised by high indexation (more than half of all firms) and represents an outlier compared to the other sample countries.

We also experimented with alternative deflators – the HICP and the GDP deflator – to construct real wages. The SVAR-based measures of real wage flexibility exhibit somewhat lower correlations with the survey-based measure than displayed in Figure 4. This again stresses the role of the price deflator in constructing real wages. We conjecture that the macroeconomic measure of wage flexibility, which is based on aggregate wages deflated by the HICP excluding energy prices (which is a less volatile deflator than the HICP or the GDP deflator), gives the closest match to the survey-based concept of real wage rigidity.

5.2 Real Wage Flexibility: Comparison with the Microeconomic Evidence

The International Wage Flexibility Project (IWFP), whose outcomes are summarised in Dickens et al. (2007), resulted in a set of microeconomic estimates of downward nominal and real wage rigidities collected for 16 OECD countries in 1970–2003. The indicators of rigidity are defined as the share of workers who were subject to downward real and nominal wage rigidity. Workers are classed as being subject to downward real wage rigidity if their real wages were frozen instead of being cut. During the lifetime of the Wage Dynamics Network, the results of the IWFP project were updated and extended for six countries. New estimates of wage rigidities became available for Hungary in 2000–2004 (Katay, 2011) and Luxembourg in 2001–2007 (Lunnemann and Wintr, 2010), and updates were provided for Belgium, Denmark, Portugal and Spain in 1990–2007 (Messina et al., 2010).

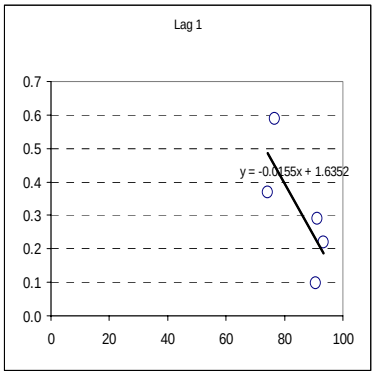
Figure 5 illustrates the correlation between our measure of real wage rigidity (which is the same as that considered in the previous sub-section, that is based on the wage component) and the IWFP-based downward real wage rigidity, for two cases: (i) the recent updates and (ii) all the available estimates (the recent updates and the estimates reported in Dickens et al., 2007). Similarly to the previous comparison with the WDN survey-based measure, negative values of the correlation coefficient suggest that higher downward real wage rigidity (based on the IWFP methodology) goes hand in hand with lower real wage flexibility (based on the macroeconomic SVAR approach); the correlation coefficient varies between -0.48 and -0.76 depending on the horizon chosen and the number of countries considered.

The correlations are qualitatively similar when alternative deflators are considered to construct real wages for the SVAR-based measure of rigidity. Compared to the previous case of the WDN survey, in this case the correlations with the IWFP-based results are somewhat lower. This could be related to the differences in the sample periods (the WDN survey questions cover wage setting during the period from 2002 to 2007, while the IWFP-based estimates use data in 1970–2007), as well as to the differences in the underlying methodology.

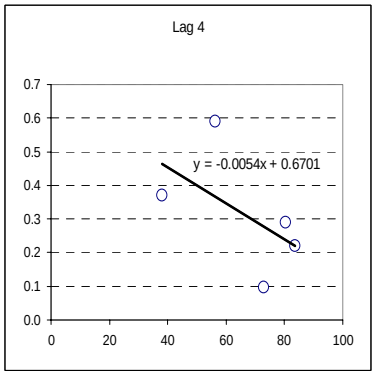
Figure 5: Microeconomic Downward Real Wage Rigidity (vertical axis) and Real Wage Flexibility Based on SVAR (horizontal axis)

5 countries – recent updates*

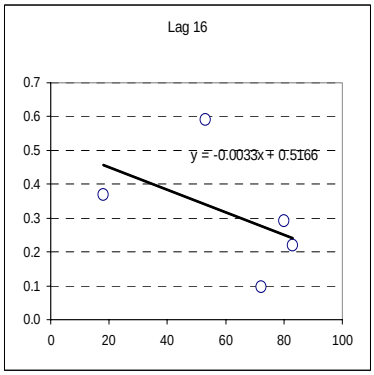
correl = -0.76



correl = -0.55

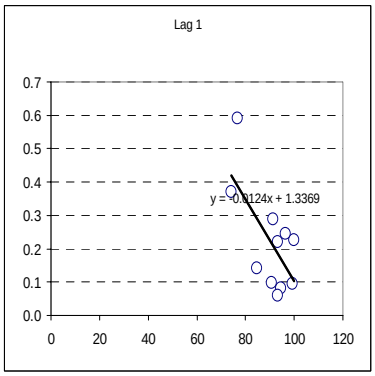


correl = -0.48

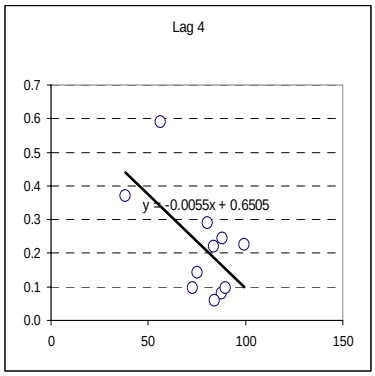


11 countries (6 from Dickens et al., 2007 and 5 from recent updates)**

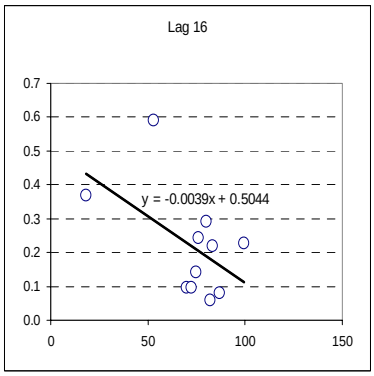
correl = -0.69



correl = -0.66



correl = -0.55



Note: *Microeconomic downward real wage rigidity (DRWR) refers to the results based on the International Wage Flexibility Project (IWFP). Estimates for five countries – recent updates – are taken from Katay (2011) for Hungary and from Messina et al. (2010) for Belgium, Denmark, Portugal and Spain. The estimate available for Luxembourg (Lunnemann and Wintr, 2010) is not used here since virtually all workers (99.8%) are subject to DRWR, due to wage indexation. The SVAR-based real wage flexibility is measured by variance decomposition of the wage component of labour costs at a horizon from one to sixteen quarters, based on SVAR estimated over 2001Q1–2008Q2. The three columns denoted by Lag 1, Lag 4 and Lag 16 correspond to variance decomposition horizons of 1, 4 and 16 quarters.

** Estimates from Dickens et al. (2007) are used for other countries, such as Austria, Germany, France, Greece and Italy. The estimate for the Netherlands is not used here since the share of workers affected is very low (1%).

5.3 Real Wage Flexibility and Labour Market Institutions

According to the literature, the degree of real wage flexibility can be affected by institutional features of the labour market, for example, the presence of unions, the level at which wages are negotiated, and the strictness of employment protection legislation. Indeed, several theoretical models predict a positive association between the presence of unions and the occurrence of wage rigidity, in particular downward wage rigidity (e.g. Dunlop, 1994, and Oswald, 1986). The link between wage rigidity and the share of employees covered by collective agreements is

investigated, for example, in Dickens et al. (2007), Holden and Wulfsberg (2009) and Babecký et al. (2010). Stricter employment protection legislation (EPL) can also increase wage rigidity. However, there is no consensus on the impact of EPL on wage rigidity in the empirical literature. While Dickens et al. (2007) does not find a significant correlation between EPL and cross-country differences in wage rigidity, a positive link is reported by Holden and Wulfsberg (2009). Babecký et al. (2010) find that strictness of EPL is positively related to the extent of nominal wage rigidities, but no significant relationship is found with respect to real wage rigidity.

We compare the estimates of real wage flexibility obtained from our central scenario (the business economy, total labour costs, and the HICP deflator excluding energy prices) with the institutional setting in the countries under review, namely collective bargaining coverage and strictness of employment protection legislation, as shown in Table 6. Since the data reflect the information available at the end of 2008, we take as the reference point our indicators of wage flexibility estimated for the period ending in 2008Q2.

Table 6: Collective Bargaining Coverage and Strictness of Employment Protection

Country	Employees covered (%)	Firms having union agreements (any level, %)	Firms having firm-level agreements (%)	Firms having higher-level agreements (%)	EPL index
Austria	0.946	0.978	0.233	0.962	2.15
Belgium	0.893	0.994	0.353	0.979	2.50
Czech Republic	0.502	0.540	0.514	0.175	2.02
Estonia	0.087	0.121	0.104	0.034	2.33
Spain	0.968	1.000	0.169	0.831	3.07
France	0.671	0.999	0.587	0.988	2.89
Greece	0.910	0.934	0.208	0.859	2.90
Hungary	0.184	0.190	0.190	0.000	1.65
Ireland	0.422	0.724	0.313	0.683	1.32
Italy	0.970	0.996	0.429	0.996	2.44
Lithuania	0.156	0.242	0.237	0.008	2.81
Netherlands	0.676	0.755	0.301	0.454	2.27
Poland	0.193	0.229	0.214	0.047	2.22
Portugal	0.555	0.621	0.099	0.589	3.49
Slovenia	N/A	1.000	0.257	0.743	2.63
Total	*0.678*	*0.764*	*0.330*	*0.655*	*2.50*
Euro area	*0.845*	*0.942*	*0.356*	*0.873*	*2.63*
Non-euro area	*0.241*	*0.277*	*0.263*	*0.060*	*2.15*

Note: Figures are employment-weighted and re-scaled to exclude non-responses. Total and euro area country aggregates exclude Germany.

Source: Table 2 in Babecký et al. (2010)

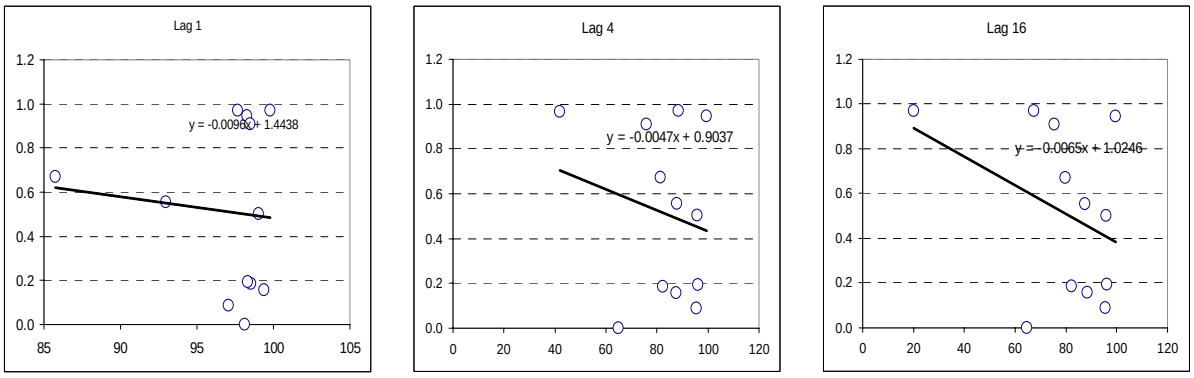
Figure 6a shows the correlation between the share of employees covered and real wage flexibility. Depending on the horizon at which real wage flexibility – i.e. the responsiveness of real wages to real shocks – is calculated, the correlation varies from -0.28 (one quarter) to -0.52 (16 quarters).

Negative values mean that in countries with higher shares of employees covered, lower real wage flexibility is observed.

Figure 6a: Employees Covered (vertical axis) and Real Wage Flexibility Based on SVAR (horizontal axis)

Employees covered

corr = -0.28 | corr = -0.42 | corr = -0.52

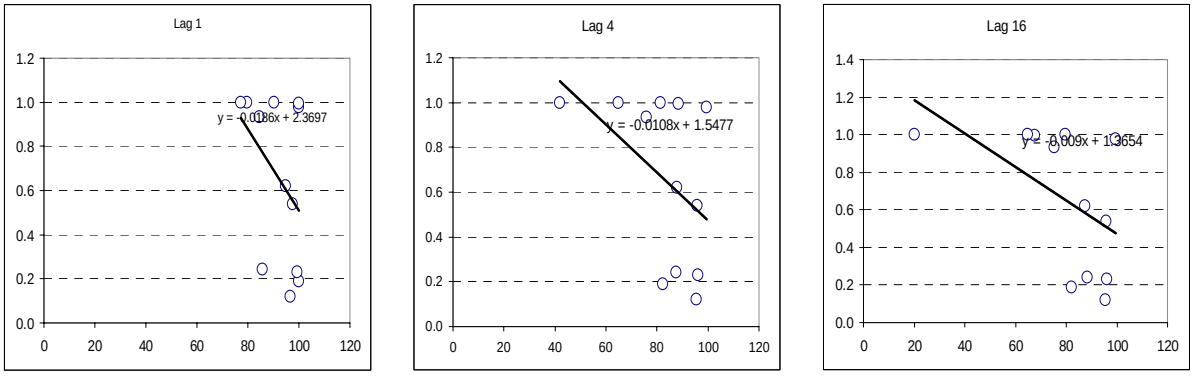


Note: Lag 1, Lag 4 and Lag 16 denote variance decomposition horizons of 1, 4 and 16 quarters.

Figure 6b: Firms with Union Agreements (vertical axis) and Real Wage Flexibility Based on SVAR (horizontal axis)

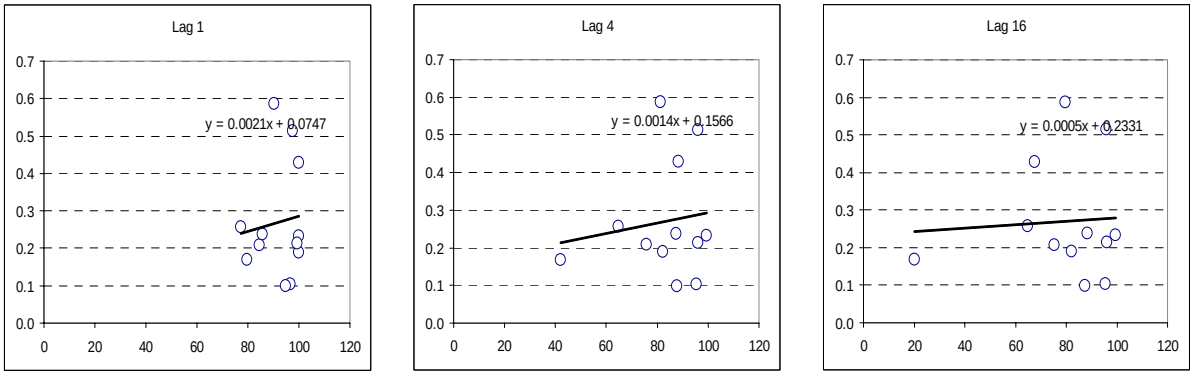
Union agreements (any level)

corr = -0.42 | corr = -0.47 | corr = -0.53

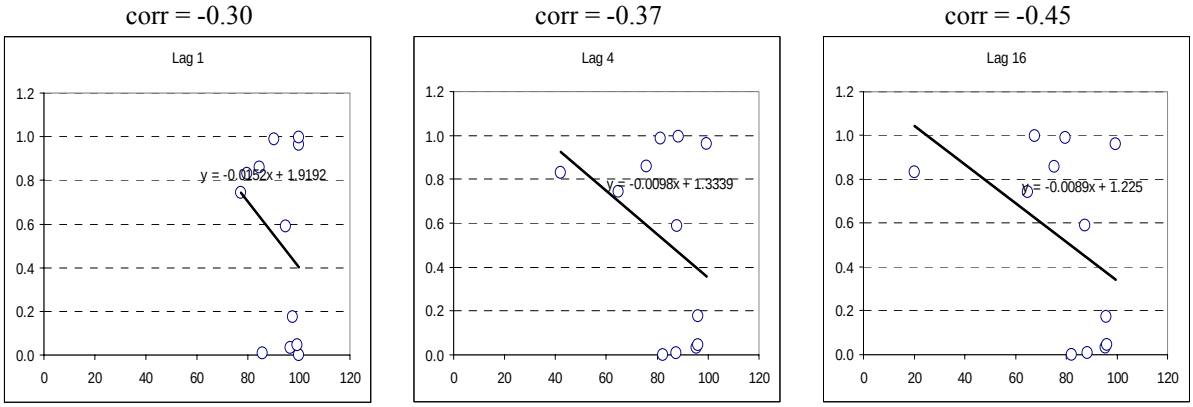


Firm-level agreements

corr = 0.11 | corr = 0.14 | corr = 0.07

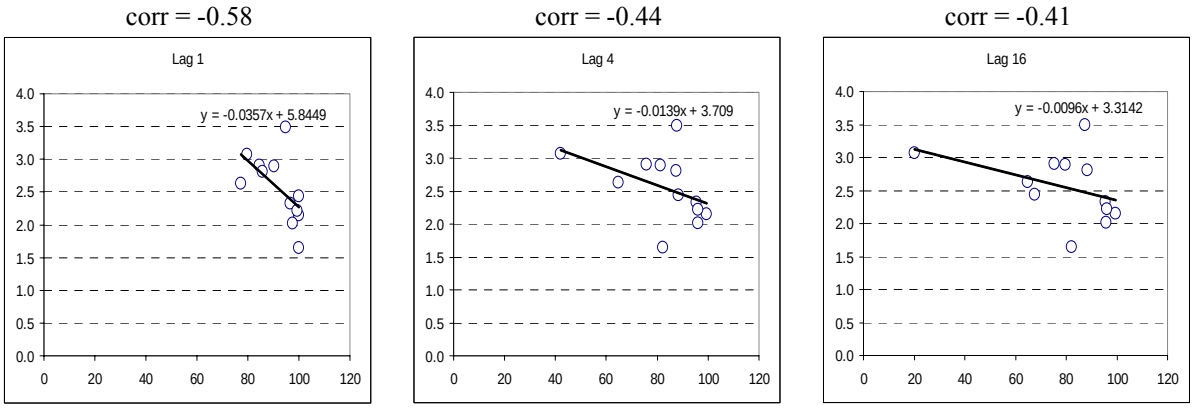


Higher-level agreements



Note: Lag 1, Lag 4 and Lag 16 denote variance decomposition horizons of 1, 4 and 16 quarters.

Figure 6c: EPL Index (vertical axis) and Real Wage Flexibility Based on SVAR (horizontal axis)



Note: Lag 1, Lag 4 and Lag 16 denote variance decomposition horizons of 1, 4 and 16 quarters.

Next, Figure 6b displays the correlation between the level of union agreements (any level, firm-level agreements or higher-level agreements) and our measure of real wage flexibility. While there is only a weak link between the extent of firm-level agreements and real wage flexibility, higher-level agreements as well as union agreements at any level are negatively correlated with real wage flexibility, the correlation coefficient varying between -0.30 and -0.53 depending on the horizon and/or the indicator considered. Thus, our results suggest that union agreements, and in particular higher-level agreements, go hand in hand with lower real wage flexibility, or equivalently with higher real wage rigidity.

Finally, Figure 6c shows the correlation between the index of employment protection legislation (EPL) and the indicator of real wage flexibility. Higher values of the EPL index correspond to higher employment protection. Negative and strong correlations (-0.58 for the horizon of 1 quarter and -0.41 for the horizon of 4 years) illustrate that higher employment protection legislation is related to higher real wage rigidity.

Our results thus corroborate the findings of Babecký et al. (2010) on a positive correlation between union agreements (any level or higher-level agreements) and the survey-based measure of downward real wage rigidity. At the level of firms, there is no strong association with real wage rigidity. Regarding the role of EPL, our results support the conclusion of Holden and Wulfsberg (2009) on a positive correlation between microeconomic-based real wage rigidity and strictness of EPL.

6. Conclusions

In this study we applied structural VAR decomposition to measure real wage flexibility according to the responsiveness of real wages to real shocks in a sample of 24 EU member countries using the Eurostat hourly labour cost indices from 2001Q1 to 2010Q2. We examined real wage flexibility along two dimensions: the type of index (total labour costs, the wage component and the non-wage component) and sector (business economy, services, and manufacturing). We also checked the sensitivity of the results to the choice of the deflator used for constructing real wages (the GDP deflator, the HICP, and the HICP excluding energy prices). The measures of real wage flexibility obtained were compared with the results of the firm-level survey conducted within the Wage Dynamics Network, with the microeconomic estimates of downward real wage rigidity based on the International Wage Flexibility Project methodology, and with the institutional features of the national labour markets. Our key three findings can be summarised as follows.

First, we find evidence of an increase in real wage rigidity during the global crisis of 2008/2009 in about half of cases. This corroborates the finding of limited real wage adjustment to shocks based on the follow-up survey of firms conducted in the middle of 2009 within the WDN, in particular that in a situation of rigid base wages firms use adjustment via non-wage channels, e.g. quantities (for example hours of work and employment) or non-labour costs – see Burda and Hunt (2011), Fabiani et al. (2011) and Messina and Rõõm (2011).

Second, we find that real wage rigidity defined on the basis of the wage component of total labour costs is positively correlated with both the WDN survey-based and IWFP-based measures of downward real wage rigidity. In addition, we should mention that measurement issues do matter. Apart from traditional measurement errors (Gottschalk, 2005), an analysis of which goes beyond the scope of this study, the price index used to construct real wages affects the dynamics of real wages as well as the degree of real wage flexibility. The HICP excluding energy prices, which is the least volatile of the three deflators considered, results in real wages which give the closest results – in terms of real wage rigidity – to the WDN firm-level measure of downward real wage rigidity. The extent of real wage flexibility also depends on the sector and labour cost component considered.

Third, the cross-country variation of our central measure of real wage flexibility, which is based on wages constructed on the basis of the Eurostat labour cost indices for the business economy and deflated by the HICP excluding energy prices, is related to labour market institutions. In particular, real wage rigidity is found to be stronger in countries where more employees are covered by collective bargaining agreements, and in particular for higher- as compared to firm-level bargaining agreements. Finally, countries with higher employment protection legislation are characterised by higher real wage rigidities.

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