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Abstract

We present empirical evidence of the extent of wage rigidity in the euro area and European countries derived from longitudinal data on individuals. Wage rigidity is measured by the elasticity of individual real wages with respect to local unemployment. The results suggest that the elasticity is indeed negative, i.e. that real wages are lower in local labour markets with higher unemployment. The size of the elasticity for the euro area is similar to that found in previous studies for a number of countries, including the United States. Furthermore, there is some variation in the unemployment elasticity by worker groups and along the wage distribution. In particular, public sector wages are relatively rigid compared to wages in the private sector, contributing significantly to wage rigidity in the euro area. Country results show some heterogeneity in wage rigidity across European countries and suggest a tentative ranking of countries.

Keywords: real wages, local unemployment, wage curve, panel data
JEL Classification: E24; J45; J64

Non-technical summary

During the last decade, numerous empirical studies have examined the role that local unemployment plays in pay determination. Blanchflower and Oswald (1990, 1994) used individual data to explore the relationship between a worker's pay and the unemployment rate in the local labour market, a relationship they labelled "the wage curve", and concluded that wages are lower in labour markets with higher unemployment. Following Blanchflower and Oswald's approach many studies have verified that the unemployment elasticity of real wages is remarkably similar across countries and estimated at approximately –0.1. We provide first estimates of the wage curve elasticity for the euro area as a whole. After the introduction of a single monetary policy, estimating the extent of wage rigidity in the euro area is important for understanding the monetary policy transmission mechanism.

We estimate the elasticity of real wages with respect to local unemployment for the euro area, as well as for a number of euro area countries and the United Kingdom (UK) in 1994-2001. For this purpose we combine data of individuals from the European Community Household Panel (ECHP) with data on regional unemployment rates from the REGIO database. The ECHP includes detailed information about individual characteristics, including earnings, as well as a regional identifier for each individual that is consistent with Eurostat's NUTS classification of regions. REGIO provides a rich source of regional data for NUTS regions, including unemployment rates. After combining the two data sources we construct samples for the euro area as a whole, the euro area plus the UK and for six European countries (Germany, France, Italy, Spain, Portugal and the UK). Using these data we estimate earnings equations with the hourly wage as the dependent variable and regional unemployment, together with personal characteristics and region and year dummies, as regressors. We carefully consider several empirical issues such as representativeness, regional clustering of individuals and unobserved individual heterogeneity.

Compared to previous studies, we extend the analysis in several dimensions. First, we provide first evidence of the wage curve for the euro area as a whole. The results thus provide information about the nature and extent of euro area wage rigidity, allowing for a direct comparison of the extent of rigidity with other economic areas. We also evaluate whether there have been significant changes in wage rigidity over this time period. Second, the focus on the euro area provides significantly more region per year observations than are available for the individual countries. As a result, we are also able to explore heterogeneity in wage rigidity by estimating the elasticity e.g. for groups of workers with different observed characteristics. Third, we also estimate the elasticity in a number of euro area countries and, as a comparison, with the UK using harmonised data.

Fourth, we take into account composition bias in the estimates due to unobserved individual heterogeneity.

The results show that the elasticity of real wages with respect to local unemployment is indeed negative in the euro area and in many European countries. The estimated elasticity for the euro area is similar to that found in previous studies for a number of countries, including the United States (US). This suggests that wage adjustment at the regional level contributes to euro area domestic adjustment to external shocks to a similar extent as in other economic areas. However, this does not exclude the possibility that other rigidities, such as lower labour mobility in European countries compared to the US, result in a differences in labour market adjustment across countries. Furthermore, there is some variation in the elasticity by worker groups and across the wage distribution. In particular, public sector wages are relatively rigid compared to wages in the private sector, contributing significantly to overall wage rigidity in the euro area. Over time the extent of euro area wage rigidity appears to have increased somewhat. Country results show some heterogeneity across countries and suggest a tentative ranking of countries in terms of wage flexibility with France showing most and Germany least flexible wages over this time period.

1 Introduction

During the last decade, numerous empirical studies have examined the role that local unemployment plays in pay determination. Blanchflower and Oswald (1990, 1994) used individual data to explore the relationship between a worker's pay and the unemployment rate in the local labour market, a relationship they labelled "the wage curve", and concluded that wages are lower in labour markets with higher unemployment. Following Blanchflower and Oswald's approach many studies have verified that the unemployment elasticity of real wages is remarkably similar across countries and estimated at approximately –0.1.[1]

Our study adds to the existing wage curve literature in several important ways. First, we provide estimates of the wage curve elasticity, a measure of real wage rigidity, for the euro area as a whole.[2] After the introduction of a single monetary policy, estimating the extent of wage rigidity in the euro area is important for understanding the monetary policy transmission mechanism.[3] The results provide information about the nature and extent of euro area wage rigidity and allow for a direct comparison with other economic areas. In order to estimate the euro area wage curve elasticity, we use individual data from the European Community Household Panel (ECHP) in 1994-2001.

Second, the focus on the euro area provides significantly more region per year observations than are available for the individual countries. Previous studies for European countries have generally suffered from a small number of region per year observations that result in inaccurate

[1] See Table 1 for selected evidence for euro area countries and Nijkamp and Poot (2002) for a broader meta-analysis and references.

[2] The empirical measure of wage rigidity is meant to capture the slope of a wage-setting schedule that emerges from non-market clearing models of the labour market. The slope of this schedule determines the relative adjustment of wages and employment to shocks to labour demand at the local labour market, and thus serves as a measure of wage rigidity. It is important to note that alternative measures of real wage rigidity exist and may refer to somewhat different underlying concepts. In particular, while most alternative measures are estimated using unemployment measured at the national level (eg. Layard *et al*, 1991), the elasticity analysed here refers to responsiveness to local unemployment. The impact of exclusively national or area wide developments is excluded from the estimated elasticity due to the inclusion of time effects. More specific measures, such as measures of downward nominal and real wage rigidities can also be obtained from wage change distributions using microdata (as in Dickens *et al.* 2004; for a recent survey see Camba-Mendez *et al.*, 2004).

[3] Measuring the extent of wage rigidity in the euro area may also have a bearing on the debate about optimal inflation (Akerlof, Dickens and Perry, 1996). Although Akerlof *et al.* (1996) focus on the US and therefore on the extent of downward nominal wage rigidity, real wage rigidity is found to be a fundamental element in most European countries (Dickens *et al.* 2004).

estimates of the elasticity of real wages with respect to unemployment. As a result, we are also able to explore heterogeneity in wage rigidity by estimating the elasticity e.g. for groups of workers with different observed characteristics. In particular we provide first evidence of wage rigidity across the wage distribution and in the public sector compared to the private sector. Given the large share of public sector employment in total employment, this aspect is particularly relevant for the euro area and European countries.

Third, as a means of providing evidence about variation in wage rigidity within the euro area we estimate the elasticity in a number of euro area countries and, as a comparison, with the United Kingdom (UK). Compared to previous results the harmonised design of ECHP allows for comparable estimates across countries. In this respect we extend results in Montuenga *et al.* (2003) by using data for a significantly longer time period, adding results for Germany and exploiting the panel structure of the ECHP. Fourth, the longitudinal design of the ECHP allows for a correct specification of the wage curve relationship taking into account composition bias in the estimates due to unobserved individual heterogeneity.

The results show that the elasticity of real wages with respect to local unemployment is indeed negative in the euro area and in many European countries. The estimated elasticity for the euro area is similar to that found in previous studies for a number of countries, including the US, and the elasticity estimated here for the UK. This suggests that wage adjustment at the regional level contributes to euro area domestic adjustment to external shocks to a similar extent as in other economic areas. Furthermore, there is some variation in the elasticity by worker groups and across the wage distribution. In particular, public sector wages are relatively rigid compared to wages in the private sector, contributing significantly to overall wage rigidity in the euro area. Over time the extent of euro area wage rigidity appears to have increased somewhat. Country results show some heterogeneity across countries and suggest a tentative ranking of countries in terms of wage flexibility with France showing most and Germany least flexible wages over this time period.

The rest of the paper is organised as follows. In section 2 we survey existing results for the euro area countries. We describe the data sources and samples used in the empirical investigation in section 3 and the methods in section 4. We present results for the euro area sample as a whole, disaggregated by worker characteristics, across the wage distribution and over time in section 5. In that section we also present results for a number of euro area countries and the UK. In section 6 we conclude with a summary of the results.

2 Literature

In their original contributions, Blanchflower and Oswald (1990, 1994) claim to have found an empirical law of economics concerning the relationship between wages and unemployment – the wage curve. Their main innovation was to include the local unemployment rate in a standard wage equation estimated using data on individuals. A detailed review of the original results was provided by Card (1995) who also pointed to various relevant theoretical and empirical issues related with their results.[4]

Since the original contributions, various authors have estimated wage curves using data from a number of countries. While there has been no study of the euro area wage curve, a number of studies exist for individual euro area countries (see Table 1). It is worth noting that most of the studies use data from the 1980's or early 1990's, i.e. prior to the formation of the euro area. While the results summarised in Table 1 indicate that there is indeed evidence to support the wage curve in many euro area countries, they also show significant variation in the size of the unemployment elasticity both across and within euro area countries. It may be that some of this variation reflects true cross country differences in wage rigidity. However, some of the variation is also likely to reflect differences in the characteristics of the data and methods used in the various studies. As shown in Table 1, illustrative examples of differences across studies include the time period covered, available region-by-year variation and the use of monthly earnings versus the hourly wage as the dependent variable. The very low number of region-by-year observations in some studies suggests that the unemployment elasticity is not estimated accurately. In addition, most wage curves studies for euro area countries use annual or monthly earnings as opposed to the hourly wage as the dependent variable. Card (1995) shows that the estimated elasticity is then likely to reflect the reaction of both wages and hours worked to changes in the unemployment

[4] Theoretical justification for the relationship between wages and local unemployment can be found in theories of non-competitive labour markets. First, within a bargaining model local unemployment is a measure of the value of the outside option of employed union members: i.e. reflects the probability to find an alternative job (McDonald and Solow, 1981). In this model the wage as the outcome of the bargaining process depends on the outside option. For example, an increase in local unemployment results in a lower outside option, and consequently a lower bargained wage for the union members. Second, in a version of the efficiency wage model, unemployment acts as a discipline device for workers who have an opportunity to choose their effort in a given job (Shapiro and Stiglitz, 1984). When monitoring is imperfect, the employer will choose to pay a higher wage to increase effort. However, higher unemployment increases the potential cost of getting caught shirking to the worker, reducing the efficiency wage that the employer has to pay to induce effort. The wage curve can be derived from both models as a negative relationship between the real wage and the unemployment rate.

rate, possibly overstating the unemployment elasticity of wages. Empirical evidence for the US shows that this is indeed the case (Card, 1995 and Bratsberg and Turunen, 1996). Finally, some studies report estimates of the relationship without controlling for regional fixed effects. As discussed in Card (1995), without controlling for regional fixed effects, the wage curve elasticity reflects a combination of contemporaneous and "permanent" regional factors. Card finds that the inclusion of permanent factors results in a lower (and sometimes positive) unemployment elasticity for the US, due to a positive correlation between average unemployment and average wages within regions. This is less likely to be the case in Europe where the level of regional unemployment is more persistent (see for example Decressin and Fatah, 1995 and Jimeno and Bentolila, 1998).

Among the various studies shown in Table 1 the results presented in Montuenga *et al.* (2003) are of particular interest. They use the first three waves (1994-1996) of the ECHP to estimate unemployment elasticities in five European countries and find largely negative unemployment elasticities and significant variation in wage rigidity across countries. While using the same data set, our study differs from Montuenga *et al.* (2003) in that we use data for a significantly longer time period, exploit the longitudinal structure of the ECHP to estimate fixed effects models and, most importantly, estimate the wage curve at the euro area level.

Various additional dimensions have been identified in the wage curve literature, but have received little attention in studies for euro area countries thus far. First, the wage curve is likely to be different for workers with different observable characteristics. Previous studies have indeed found that the unemployment elasticity is larger for younger workers and for those with less education (see e.g. Card, 1995, Turunen, 1998 and Baltagi and Blien, 1998). These results suggest that some groups of workers are more vulnerable to changes in local labour market conditions. At the other extreme, public sector workers are likely to have more rigid national wage structures. While no results are available for euro area countries, Turunen (1998) finds that the unemployment elasticity is indeed lower for government workers in the US.[5] [6]

Second, Card suggests that variation in the size of the unemployment elasticity across worker groups can be used to discriminate between the theories that motivate the wage curve (Card,

[5] Available evidence from aggregate time series suggests that wages in the US and UK public sectors are also less responsive to changes in the (national) business cycle (Blank, 1994).

[6] The composition of unemployment by duration is also likely to influence the size of the elasticity. In particular, long term unemployment may have a dampening influence on the responsiveness of wages to unemployment. Winter-Ebmer (1996) and Pekkarinen (2001) provide some evidence that this is indeed the case in Austria and Finland, respectively. Llaudes (2005) provides similar evidence for the euro area using aggregate data.

1995). Following this suggestion Barth *et al.* (2002) show that wages are less sensitive to local unemployment when union bargaining power is high. In their empirical analysis they find that wages of non-union members in Norway, the UK and the US are indeed more responsive to local unemployment, possibly providing evidence for an efficiency wage explanation of the wage curve (Barth *et al.*, 2002).

Finally, few studies in this literature have attempted to control for composition bias due to unobserved individual heterogeneity. Studies of the real wage over the business cycle have found that changes in the composition of the workforce over the business cycle tend to mask an underlying procyclical movement of wages (Solon, Barsky and Parker, 1994). This effect is explained by the higher variability in working hours for those with lower wages. To the extent that the composition of the workforce is not fully captured by the observed characteristics used as control variables in the regression this effect is also likely to influence the unemployment elasticity. Bratsberg and Turunen (1996) find that controlling for unobserved individual heterogeneity results in a slightly smaller unemployment elasticity in the US.

3 Data

We combine two data sources, ECHP individual data on wages and personal characteristics and REGIO data on regional unemployment rates. The ECHP is a survey of households in all EU countries that includes detailed information about individual characteristics, including earnings. The data also includes detailed information about households and supplementary information at the country level (e.g. PPP, CPI and Population information). The survey begins in 1994 (Austria, Finland and Sweden join in 1995, 1996 and 1997, respectively) and continues until 2001 (for more information on the ECHP data see Peracchi, 2002). With the exception of the Netherlands, the first three waves of the ECHP are based on a common independent ECHP survey. However, for the fourth wave in 1997, the original surveys were replaced by existing national panels in Germany (with the German Socio-Economic Panel), Luxembourg (Luxembourg Social Economic Panel) and the UK (The British Household Panel Survey). For use in longitudinal analysis, Eurostat recommends using the data based on national surveys. We follow this recommendation. Sampling weights are available for calculating summary statistics and for performing weighted regression analysis. Wages are reported in the ECHP as net wages (including bonuses) in the

previous month in national currency.[7] We use the PPP exchange rates provided with the ECHP to convert wages into 2001 PPP units and then deflate them by using the Consumer Price Index. In order to derive hourly wages we divide the monthly wage by monthly hours worked.

The ECHP data include a regional identifier for each individual that is consistent with Eurostat's NUTS classification of regions making it possible to merge ECHP data with regional data from the REGIO database. The level of detail of the regional identifier varies, but for most countries (except the Netherlands where the regional identifier is not available) the identifier is available at the NUTS 1 level. REGIO provides a relatively rich source of regional data, including unemployment rates, based mainly on European Labour Force Survey sources. We use the overall regional unemployment rate at the NUTS 1 level.

After combining the two data sources we construct samples for the euro area as a whole and for six European countries. Note that the euro area sample includes data for all euro area countries except the Netherlands. We restrict the sample to employees, not enrolled in school and in working age (15-64). Furthermore, to eliminate the possible impact of wage outliers we drop extreme wage observations from both tails of the hourly wage distribution. The same sample restrictions are applied to the euro area and country samples.

Table 2 describes the relevant dimensions of the euro area and the country samples. Notice that the number of region by year observations for the euro area sample is large compared to most studies in Table 1. This allows a precise estimation of the unemployment elasticity for the whole of the euro area, as well as for disaggregated groups of workers. It is notable that most of the available variation is in the region dimension with only eight years of data available for the time dimension. In contrast to the euro area sample, the number of region by year observations is significantly lower for individual countries. For this reason we estimate wage curves for six European countries only, i.e. Germany, France, Italy, Spain, Portugal and the UK.

Table 3 provides descriptive statistics of the euro area sample. The average of the regional unemployment rates is 10% with significant variation across regions and over time with the lowest unemployment rate equalling 1% and highest 33%.

[7] Except for France and Finland where wages are reported as gross wages. Wages for these countries have been converted to net wages using gross/net ratio.

4 Methodology

Following Blanchflower and Oswald (1990, 1994), we use the following specification of the wage curve:

$$\log w_{irt} = \alpha \log U_{rt} + \beta X_{irt} + \delta_r + \gamma_t + \varepsilon_{irt} \quad (1)$$

$$i = 1, ..., N; t = 1, ..., T_i \quad (2)$$

where:

i denotes individuals, t denotes time and r denotes regions

w_{irt} is the wage for individual i observed in region r in period t

U_{rt} is the unemployment rate in region r in period t

X_{irt} is a set of observed characteristics of individual i in region r in period t

δ_r and γ_t are region and time effects

ε_{irt} is the error term.

The implicit assumption underlying the specification in (1) is that with a negative unemployment elasticity (β) individual log wages are a monotonically decreasing and convex function of regional unemployment. Blanchflower and Oswald (1994) present a wide range of evidence suggesting that this is the most empirically supported functional form.

Following suggestions in the literature we carefully consider several empirical issues when estimating equation (1). First, our micro data are drawn from a population with a structure that is grouped by year and region cells and as a result the error term ε_{irt} is correlated within groups. Moulton shows that in this situation unadjusted OLS standard errors are biased downward (Moulton, 1990). Card finds that unadjusted OLS estimation overstate the t-ratio of the wage curve elasticity approximately by a factor of 2 (Card, 1995). In order to correct for this bias we apply region-by-year clustering so that any period specific intragroup correlation is taken into account when calculating the standard errors. Second, in order to account for the possible impact of unobserved individual heterogeneity, we estimate (1) also with individual specific fixed effects. This procedure accounts for composition bias due to the changing unobserved characteristics of the workers. As a result, throughout the study we use two main models, one with the standard specification as in (1) and another with this specification augmented by an individual fixed effect. We also estimated individual random effects models. However, Hausman tests based on the random versus fixed effects estimators generally rejects the random effects estimator, indicating correlation between the random effects and the regressors. Third, in all estimated models we use sampling weights provided with the ECHP to ensure that the sample of workers is representative

within the euro area and over time. However, the results are not significantly altered by estimating the models without the sampling weights. Finally, we also use quantile regression methods to estimate the impact of local unemployment on wages along then wage distribution instead of the mean (see Koenker and Hallock, 2001 for a review of quantile regression methods).[8]

5 Results

As discussed above, we focus on results for the euro area sample. As a comparison we also report results for the broader European sample including the UK. The main results for these samples are shown in Table 4. In addition to the regional unemployment rate, each regression also includes a set of control variables, including time dummies. Results are shown using two versions of equation (1): (1) standard specification including region dummies and (2) including individual fixed effects.[9]

The results from all models indicate that the unemployment elasticity for the euro area is indeed negative and similar in size to results found in previous studies for other economic areas. This implies that wage rigidity in the euro area, as it is measured here, does not appear to be significantly different from rigidity observed for other currency areas, including the US. The choice of the modelling strategy matter relatively little for the main results. There is some evidence, in line with Solon *et al.* (1994), that composition bias tends to reduce the unemployment elasticity. For the whole sample, however, the results based on OLS are broadly comparable to those from the individual fixed effects model.

Previous literature has shown that the unemployment elasticity varies across worker groups

[8] Some studies using regional data on unemployment and wages attempt to evaluate possible endogeneity of unemployment by estimating 2SLS models (see for example, Baltagi *et al.* 2000 and Elhorst *et al.* 2003). However, wage curve studies that find that endogeneity is an issue are based on wage data aggregated to the region level, not data on individual wages. As also argued by Nijkamp and Poot (2002), it is unlikely that endogeneity is an important issue in our context because we use individual data on wages and our individual wage outcome is not expected to have an effect on the aggregate regional unemployment rate.

[9] As the focus is on wage adjustment we show results with the hourly wage as the dependent variable. All of the models have also been estimated using monthly wages as the dependent variable. The results are not substantially different from those with hourly wages and are available upon request. These results suggests that hours adjust relatively little to local unemployment and may point to more substantial rigidity in the adjustment of quantities to local labour market conditions in the euro area. This contrasts with results for the US, where hours are found to decline when local unemployment increases. As a result the estimated unemployment elasticities are significantly smaller when hourly wages are used as the dependent variable as opposed to annual (or monthly) earnings (Card, 1995 and Bratsberg and Turunen, 1996).

(see e.g. Blanchflower and Oswald, 1994 and Turunen, 1998 for the US, and Baltagi and Blien, 1998 for West Germany). In order to confirm this finding for the euro area, we estimate unemployment elasticities by five worker characteristics: gender, age, education, public versus private sector employment and type of contract (temporary versus permanent) (see panels 2-6 of Table 4).[10] First, we find that wages of men are more responsive to regional unemployment rates than the wages of women. Second, our evidence also suggests that wages of younger workers vary more with regional unemployment than the wages of older workers. Third, results for education are less clear cut than those for gender and age. OLS estimates suggest that the wages of highly educated workers are clearly less affected by local unemployment rates. However, the fixed effects estimates suggest that the unemployment elasticities are the same across groups of workers with different education levels. Overall, these results are in line with the suggestion that workers in internal labor markets and workers that are likely to have higher levels of firm specific human capital are more isolated from cyclical shocks (Card, 1995). The differences across worker groups may also be linked more generally to differences in labour market behavior, such as attachment to the labour force and mobility between jobs and regions. It is notable that while the differences across groups appear very marked for the OLS specification, once individual unobserved heterogeneity is correctly accounted many of these differences are significantly reduced. This suggests that for some worker groups, such as those with different educational levels, previous results may have overstated the actual differences across groups.

The role of regional conditions in wage bargaining is likely to be significantly different for workers in the public and private sectors. In particular, wages of those working in the public sector are more likely to reflect national labour market conditions and less likely to vary by region. The results by sector suggest that this is indeed the case: wages of public sector workers are less responsive to local unemployment. This result holds irrespective of model specification and is in line with evidence for the US (Turunen, 1998) and with the limited evidence available on cyclicality of public sector wages (Blank, 1994). Given the large share of the euro area employed working in the public sector, it is clear that the public sector contributes significantly to observed wage rigidity in the euro area. Finally, there is some evidence that wages of those with temporary contracts are more sensitive to local unemployment than those with permanent contracts.

In addition to dividing the sample by observed worker characteristics, we also use quantile regression methods to investigate whether the unemployment elasticity varies along the wage dis-

[10] Unfortunately, the ECHP does not contain information on union membership. Again the results are broadly similar when using a sample including the UK.

tribution. This is a relatively unexplored dimension in the literature.[11] Given that the centralised bargaining structures that are common in Europe tend to compress the wage distribution, it is likely that the responsiveness of wages to local labour market conditions also varies across the wage distribution. Figures 1 and 2 present results from quantile regressions for the euro area and EU samples respectively. The results indicate that wages of those towards the bottom of the wage distribution are more responsive to the local unemployment rate.

Several authors have given political economy arguments to suggest that the EMU could lead to more flexibility in wage adjustment (see e.g. Calmfors, 2001). Thus we also evaluate changes in wage rigidity over time by estimating equation (1) with interactions for the unemployment rate and the year dummies (see Table 5). The results suggest that wage rigidity has been increasing somewhat during this time period. The fact that there is no evidence of a decline in rigidity may not be surprising given the long-term nature of the changes that have been suggested in the literature. At the same time macroeconomic conditions are likely to influence the extent of wage rigidity. In addition to the creation of the EMU, the sample period coincides with a general decline in the euro area (and national) unemployment rate, declining inflation and relatively moderate growth in wages.

Finally, we present results separately for a number of euro area countries and the UK. The relatively harmonised structure of the ECHP allows for a consistent evaluation of differences in wage rigidity across European countries. Compared to previous studies the current results also refer to a more recent time period, in particular covering the period prior to and early years of participation in the EMU. In this sense the results are also indicative of the possible differences in wage rigidities within euro area countries.

Compared to the results for the larger euro area sample, the results by countries are significantly more sensitive to changes in the specification of the estimated model (see Table 6). In particular, compared to the model with region effects only, for most countries the unemployment elasticity becomes insignificant once time dummies are included as well (not shown).[12] This is likely to reflect the fact that there is not enough region by year variation in the country data to consistently estimate models with both year and region effects. In particular, while averages of regional unemployment rates tend to vary across regions, the evolution of regional unemploy-

[11] Buettner and Fitzenberger (2003) use quantile regression methods to estimate the impact of local and national unemployment on wages in Germany in 1978-1990.

[12] This contrasts with the results for the euro area. While the size of the unemployment elasticity changes somewhat, it is consistently negative across the two different models for the euro area sample.

ment rates over time tend to be similar within countries. In addition, an implication of omitting time effects is that the estimated elasticity includes also the impact of variation over time that is common at the national level, such as the national business cycle or the national unemployment rate. Thus an alternative interpretation is that this information is needed to estimate a negative unemployment elasticity at the country level, whereas it is not as important at the euro area level. However, note that the euro area unemployment elasticity is also significantly more negative when time dummies are excluded (-0.237). This interpretation is consistent with a union bargaining framework that largely determines a reference wage based on national developments.

The sensitivity of country estimates to model specification suggests some caution in interpreting these results as providing a country ranking of wage rigidity. With this caveat in mind, country results suggest a tentative ranking of countries according to real wage rigidity. According to the results in Table 6, France is the country with most flexibility in wage adjustment whereas both Germany and Italy show wage rigidity that is higher than rigidity in the euro area as a whole. In terms of the country ranking these results are broadly in line with those in Montuenga *et al.* (2003) for a shorter time period. Compared with the UK, the euro area unemployment elasticity is similar, suggesting that wages adjust to a similar extent in the two economic areas. Differences across countries could be explained by various factors, including the extent of regional migration within countries, the institutional setting for wage bargaining and the unemployment benefit system, as well as the impact of the national business cycle over this time period. However, analysing national determinants of wage rigidity is outside the scope of this study and left for further research.

6 Conclusions

In this study we have evaluated the extent of wage rigidity in the euro area and in European countries, as measured by the responsiveness of individual real wages to regional unemployment rates. The results are in line with previous results for euro area countries and show that the elasticity of real wages with respect to local unemployment is indeed negative in the euro area and in a number of European countries. Furthermore, the estimated elasticity for the euro area is similar to that found in previous studies for a number of countries, including the US. Confirming this result, the results are similar for the euro area and the larger EU sample including UK. As a result, relative to other currency areas, wage rigidity at the regional level does not appear to be a more significant constraint for the internal adjustment of the euro area to economic shocks.

However, this does not exclude the possibility that other rigidities, such as lower labour mobility in European countries compared to the US, result in a differences in labour market adjustment across countries.

The evidence also show that there is some variation in the elasticity by worker groups, along the wage distribution and across euro area countries. In general our results seem to support the view that wages of some groups of workers, in particular those with more experience and higher wages, are more protected from changes in local labour market conditions. The fact that these differences emerge despite the importance of central bargaining in Europe suggests that local bargaining has a significant role in determining individual wages. It is also found that public sector wages are relatively rigid compared to wages in the private sector. Given the large share of the public sector of euro area employment, rigid public wages contribute significantly to overall wage rigidity in the euro area. Finally, country results show some heterogeneity in wage rigidity across countries. While the country results are more sensitive to model specification than those for the euro area these results suggest a tentative ranking of countries in terms of wage flexibility. Among euro area countries French wages show most and German wages least flexibility.

References

Akerlof, G., Dickens, W. and Perry, G. (1996): "The Macroeconomics of Low Inflation", Brookings Papers on Economic Activity (1), pages 1-76.

Baltagi, B., Blien, U., Wolf, K. (2000): "The East German Wage Curve 1993-1998", Economics Letters 69(1), October, pages 25-31.

Baltagi, B. and Blien, U. (1998): "The German Wage Curve: Evidence from the IAB Employment Sample", Economics Letters 61(2), November, pages 135-42.

Barth, E., Bratsberg, B., Naylor, R. and Raaum, O. (2002): "Explaining Variations in Wage Curves: Theory and Evidence", University of Oslo memorandum 3.

Blanchflower, D. and Oswald, A. (1994): The Wage Curve, Cambridge and London: MIT Press.

Blanchflower, D. and Oswald, A. (1990): "The Wage Curve", Scandinavian Journal of Economics 92(2), pages 215-35.

Blank, R. (1994): "Public Sector Growth and Labour Market Flexibility: the US versus the UK", in Social Protection vs. Economic Flexibility: Is There a Tradeoff?, University of Chicago Press.

Bratsberg, B. and Turunen, J. (1996): "Wage Curve Evidence from Panel Data", Economics Letters 51(3), June, pages 345-53.

Buettner, T. and Fitzenberger, B. (2003): "Central Wage Bargaining and Wage Flexibility: Evidence from the Entire Wage Distribution", unpublished.

Camba-Mendez, G., Garcia, J. and Rodriguez, D. (2003): "Relevant Economic Issues Concerning the Optimal Rate of Inflation", in Background Studies for the ECB's Evaluation of its Monetary Policy Strategy, ECB.

Calmfors, L. (2001): "Unemployment, Labor Market Reform and Monetary Union", Journal of Labor Economics 19(2), pages 265-289.

Canziani, P. (1997): "The Wage Curve in Italy and Spain. Are European Wages Flexible?", LSE Center for Economic Performance Discussion Paper 375, November.

Card, D. (1995): "The Wage Curve: A Review", Journal of Economic Literature 33(2), June, pages 785-99.

Decressin, J. and Fatas, A. (1995): "Regional Labor Market Dynamics in Europe", European Economic Review 39, pages 1627-1655.

Dickens, W., Messina, J., Turunen, J. and Ward, M. (2004): "Measuring Different Types of Wage Rigidity", unpublished paper.

Elhorst, P., Blien, U. and Wolf, K. (2003): "New Evidence of the Wage Curve. A Spatial Panel Approach", presented at the EALE 2003 annual conference.

Estevao, M. and Nargis. N. (2002): "Wage Moderation in France", IMF Working Paper 02/151.

Gianella, C. (2000): "Local Unemployment and Wages", INSEE working paper 12.

Janssens, S. and Konings, J. (1998): "One More Wage Curve: The Case of Belgium", Economics Letters 60(2), August, pages 223-27.

Jimeno, J. and Bentolila, S. (1998): "Regional Unemployment Persistence (Spain, 1976-1994)", Labour Economics 5, pages 25-51.

Koenker, R. and Hallock, K. (2001): "Quantile Regression", Journal of Economic Perspectives 15, pages 143-156.

Layard, R, Nickell, S. and Jackman, R. (1991): Unemployment: Macroeconomic Performance and the Labour Market, Oxford University Press, Oxford.

Llaudes, R. (2005): "The Phillips Curve and Long Term Unemployment", ECB working paper 441.

McDonald, I. and Solow, R. (1981): "Wage Bargaining and Unemployment", American Economic Review 71, pages 896-908.

Montuenga, V., Garcia, I. and Fernandez, M. (2003): "Wage Flexibility: Evidence from Five EU Countries Based on the Wage Curve", Economics Letters 78(2), pages 169-74

Moulton, B. (1990): "An Illustration of a Pitfall in Estimating the Effects of Aggregate Variables on Micro Units", The Review of Economics and Statistics 72(2), pages 334-338

Nijkamp, P. and Poot, J. (2002): "The Last Word on the Wage Curve? A Meta-analytic Assesment", Tinbergen Institute discussion paper.

Pannenberg, M. and Schwarze, J. (1998): "Labor Market Slack and the Wage Curve", Economics Letters 58(3), March, pages 351-54.

Pekkarinen, T. (2001): "The Wage Curve: Evidence from the Finnish Metal Industry Panel Data", Finnish Economic Papers 14(1), Spring, pages 51-60.

Peracchi, F. (2002): "The European Community Household Panel: A Review", Empirical Economics 27, pages 63-70.

Shapiro, C. and Stiglitz, J. (1984): "Equilibrium Unemployment as Worker Discipline Device", American Economic Review 74, pages 433-444.

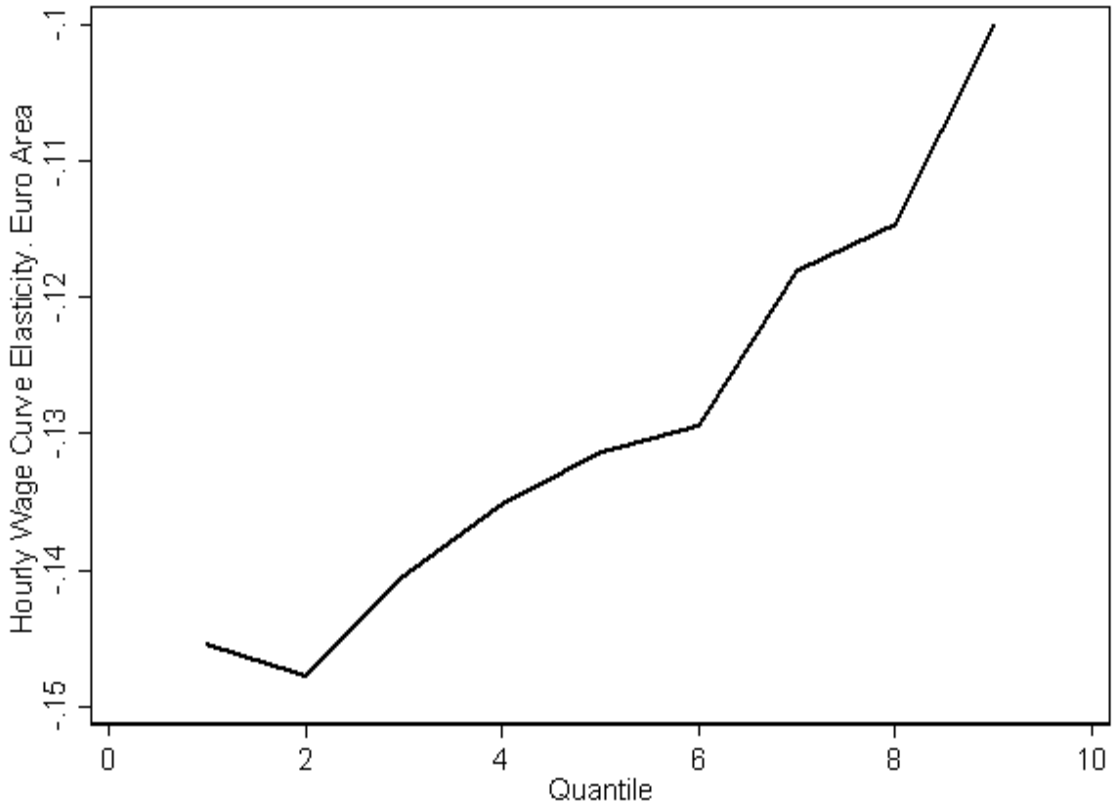
Solon, G., Barsky, R. and Parker, J. (1994): "Measuring Cyclicality of Real Wages: How Importnat is Composition Bias?", Quarterly Journal of Economics 109, pages 1-26.

Turunen, J. (1998): "Disaggregated Wage Curves in the United States: Evidence from Panel Data of Young Workers", Applied Economics 30(12), December, pages 1665-77.

Wagner, J. (1994): "German Wage Curves, 1979-1990", Economics Letters 44(3), pages 307-11.

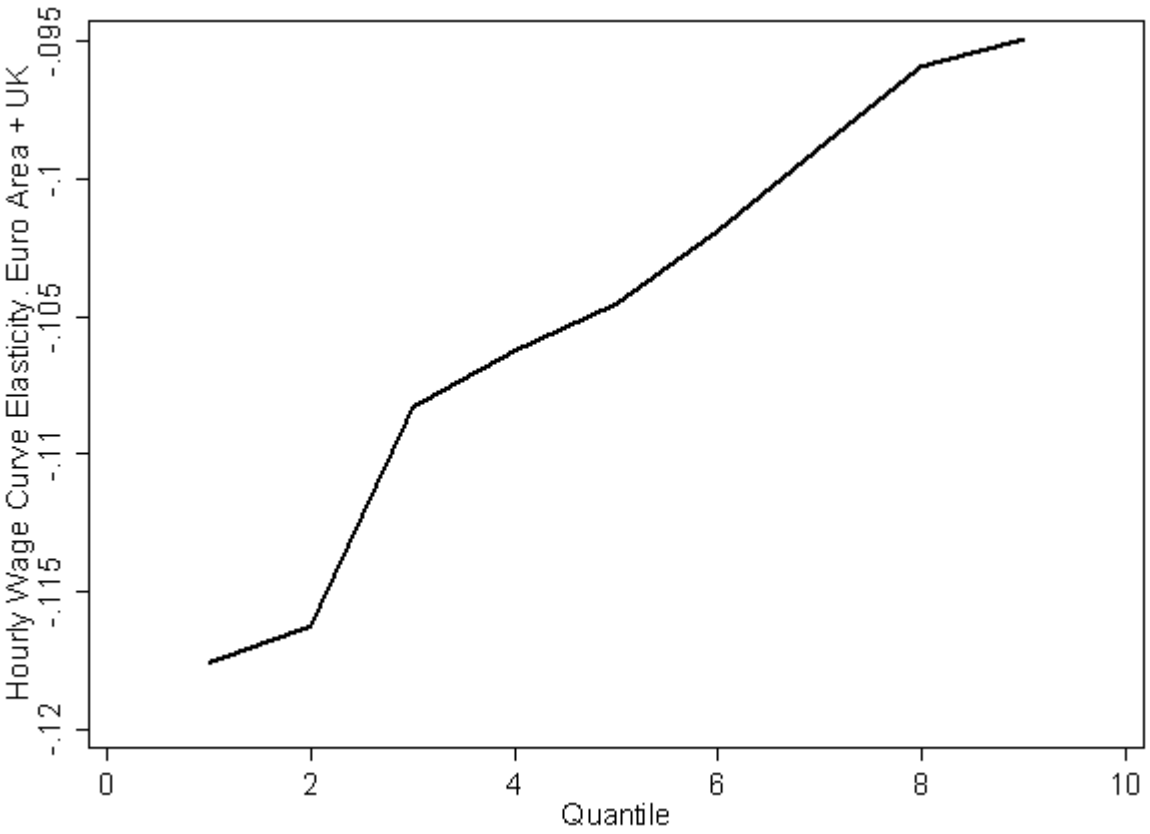
Winter-Ebmer, R. (1996): "Wage Curve, Unemployment Duration and Compensating Differentials", Labour Economics 3(4), December, pages 425-34.

Figure 1: Unemployment Elasticities along the Wage Distribution. Euro Area



Note: For the set of control variables, see note to Table 4.

Figure 2: Unemployment Elasticties along the Wage Distribution. Euro Area + UK



Note: For the set of control variables, see note to Table 4

Table 1: Selected Evidence from Euro Area Countries

Country	**Reference**	**Time period**	**Elasticity**	**Dependent variable**	**Regions**
Belgium	Janssens and Konings (1998)	1985, 1988, 1992	-0.04	Monthly earnings	11
West Germany	Blanchflower and Oswald (1994)	1986-1991	-0.13	Monthly earnings	11
	Wagner (1994)	1979, 1985	-0.13	Monthly earnings	10
	Wagner (1994)	1984-1990	-0.06	Monthly earnings	9
	Baltagi and Blien (1998)	1981-1990	-0.07	Monthly earnings	142
East Germany	Pannenberg and Schwarze (1998)	1992-1994	-0.28	Hourly wages	35
	Baltagi *et al.* (2000)	1993-1998	-0.15	Monthly earnings	114
Spain	Montuenga *et al.* (2003)	1994-1996	-0.24	not reported	7
France	Gianella (2000)	1984-1989, 1991-1995	-0.03	Annual earnings	95
	Estevao and Nargis (2002)	1990-2000	-0.10	Hourly wages	21
	Montuenga *et al.* (2003)	1994-1996	-0.16	not reported	8
Italy	Blanchflower and Oswald (1994)	1986, 1989	-0.12	Monthly earnings	5
	Canziani (1997)	1989, 1991, 1993	-0.06	Annual earnings	20
	Montuenga *et al.* (2003)	1994-1996	-0.08	not reported	11
Netherlands	Blanchflower and Oswald (1994)	1988-1991	-0.17	Monthly earnings	12
Austria	Blanchflower and Oswald (1994)	1986 and 1989	-0.09	Monthly earnings	9
	Winter-Ebmer (1996)	1983	-0.03	Hourly wages	99
Portugal	Montuenga *et al.* (2003)	1994-1996	-0.01	not reported	7
Finland	Pekkarinen (2000)	1991-1995	-0.04	Hourly wages	75

Notes: The reported elasticity refers to a model that is most comparable to the model specification in the current paper, i.e. in most cases OLS with regional fixed effects.

Table 2: Sample Dimensions

Country	**N**	**R**	**T**	R **times** T
Euro area	216,922	66	8	515
Germany	35,802	15	8	120
Belgium	10,891	3	8	24
Luxembourg	9,287	1	8	8
France	28,228	8	8	64
Ireland	11,811	2	8	16
Italy	31,407	11	8	88
Greece	13,952	4	8	32
Spain	24,692	7	8	56
Portugal	27,025	7	8	56
Austria	13,754	3	7	21
Finland	10,073	5	6	30
Euro area + UK	239,635	76	8	595
UK	22,713	10	8	80

Note: N, R and T denote the number of observations, regions and time periods, respectively. R times T refers to the number of region by year cells.

Table 3: Descriptive Statistics

	Euro Area	**Euro Area + UK**
Variable	**Mean**	**Mean**
Hourly wage	79.1	75.84
	(35.4)	(40.1)
Unemployment rate	10.4	9.7
	(5.5)	(5.8)
Personal characteristics:		
Age	39.4	38.4
	(10.6)	(10.8)
Married	.62	.64
Female	.42	.42
Public	.30	.31
Temporary job	.12	.13
Managers	.03	.04
Professionals	.12	.12
Technicians	.17	.14
Clerks	.16	.16
Service workers	.11	.12
Skilled agricultural workers	.01	.01
Craft workers	.18	.17
Machine operators	.09	.09
Elementary occupations	.09	.10
Primary education	.26	.33
Secondary education	.47	.37
Tertiary education	.25	.28

Note: Standard deviations in parenthesis. Standard deviations are not reported for categorical variables. Wages are measured in 2001 PPP units. All statistics are weighted using sample weights.

Table 4: Unemployment Elasticities by Worker Characteristics

	Euro Area		Euro Area + UK	
	(1)	(2)	(3)	(4)
1. All	-0.135	-0.141	-0.116	-0.126
	(0.014)	(0.012)	(0.011)	(0.009)
2. By Gender				
a. Women	-0.114	-0.120	-0.106	-0.112
	(0.015)	(0.014)	(0.012)	(0.010)
b. Men	-0.150	-0.156	-0.122	-0.134
	(0.017)	(0.013)	(0.014)	(0.010)
3. By Education				
a. Primary	-0.186	-0.121	-0.167	-0.105
	(0.021)	(0.013)	(0.019)	(0.012)
b. Secondary	-0.141	-0.138	-0.135	-0.139
	(0.016)	(0.017)	(0.015)	(0.017)
c. Tertiary	-0.062	-0.135	-0.058	-0.097
	(0.022)	(0.020)	(0.016)	(0.015)
4. By Age				
a. Age 15-29	-0.307	-0.128	-0.255	-0.140
	(0.026)	(0.024)	(0.025)	(0.020)
b. Age 30-44	-0.085	-0.138	-0.093	-0.126
	(0.017)	(0.013)	(0.013)	(0.011)
c. Age 45-64	-0.105	-0.108	-0.069	-0.077
	(0.015)	(0.014)	(0.013)	(0.012)
5. By Sector				
a. Public	-0.053	-0.063	-0.027	-0.033
	(0.018)	(0.015)	(0.015)	(0.012)
b. Private	-0.171	-0.174	-0.155	-0.165
	(0.015)	(0.013)	(0.013)	(0.010)
6. By Type of Contract				
a. Temporary	-0.091	-0.165	-0.094	-0.146
	(0.029)	(0.025)	(0.027)	(0.026)
b. Permanent	-0.111	-0.138	-0.088	-0.123
	(0.014)	(0.014)	(0.012)	(0.011)
Individual Fixed Effects	No	Yes	No	Yes

Note: Standard errors in parentheses. All models include a set of control variables (time invariant variables are omitted from the FE models): age, age squared, female dummy, married dummy, 2 education level dummies (primary education is the omitted category), 8 occupation dummies (elementary occupation is the omitted category), public sector dummy, 7 year dummies (2001 is the omitted category) and 65 region dummies for the euro area sample and 75 region dummies for the euro area + UK sample. Since information on the type of contract is not available in 1994 the corresponding estimates in Panel 6 refer to the period 1995-2001.

Table 5: Variation in the Unemployment Elasticity Over Time. Individual Fixed Effects Estimates.

Year	**Euro Area**	**Euro Area + UK**
1994	-0.158	-0.150
1995	-0.151	-0.146
1996	-0.153	-0.150
1997	-0.146	-0.139
1998	-0.136	-0.121
1999	-0.126	-0.122
2000	-0.110	-0.112
2001	-0.117	-0.121

Note: For the set of control variables, see note to Table 4. The effect is calculated as the sum of the overall unemployment elasticity and the year interaction.

Table 6: Unemployment Elasticities by Country. Individual Fixed Effects Estimates.

Germany	-0.121
	(0.034)
Spain	-0.283
	(0.018)
Italy	-0.179
	(0.017)
France	-0.307
	(0.017)
Portugal	-0.247
	(0.022)
UK	-0.237
	(0.020)

Note: Standard errors in parentheses. For the set of control variables, see note to Table 4. Time dummies are excluded.

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