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WHAT'S GOING ON BEHIND THE EURO AREA BEVERIDGE CURVE(S)?

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2012 STRUCTURAL ISSUES REPORT

2012 Structural Issues Report "Euro area labour markets and the crisis"
This paper contains research underlying the 2012 Structural Issues Report "Euro area labour markets and the crisis'', which was prepared by a Task Force of the Monetary Policy Committee of the European System of Central Banks. The Task Force was chaired by Robert Anderton (ECB). Mario Izquierdo (Banco de España) acted as Secretary. The Task Force consisted of experts from the ECB as well as the National Central Banks of the euro area countries. The main objectives of the Report was to shed light on developments in euro area labour markets during the crisis, including the notable heterogeneity across the euro area countries, as well as the medium-term consequences of these developments, along with the policy implications.

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Abstract

This paper studies unemployment and vacancy developments in the euro area at the aggregate and country level over the Great Recession. The recent crisis has had a heterogeneous impact on euro area labour markets, leading to significant employment losses, especially in some sectors. The extent to which the rise in unemployment and particularly long-term unemployment reflects growing mismatch across euro area labour markets is one of the biggest questions facing euro area labour market policy makers. This paper attempts to shed light on this question by analysing developments in euro area Beveridge curves over the past 20 years, at both the aggregate level and on a disaggregated basis for all euro area countries. Using a simple model of Beveridge curve developments, we test for statistical significance of observed developments and find a significant shift in the euro area Beveridge curve since the onset of the crisis, but considerable heterogeneity at the country level. At the extremes, country level differences include a significant outward shift in the Beveridge curve for Spain and France, an inward shift for Germany, while some euro area countries reveal no significant changes in the responsiveness of unemployment to vacancy developments over the course of the crisis. We include an examination of factors underlying the observed developments across the countries.

JEL classifications: J62, J63, E24, E32

Keywords: Beveridge curve, mismatch, unemployment, labour shortages, vacancies.

Executive Summary

This paper analyses developments in euro area Beveridge curves over the past 20 years. The paper includes both graphical depictions and econometric analysis of Beveridge curve developments for both the euro area as a whole and for the constituent economies.

Graphical representations suggest evidence for emerging Beveridge curve shifts for the euro area as a whole, and outward shifts in Spain, France, Cyprus, Greece, Italy, the Netherlands, Portugal, Slovenia and Slovakia. Germany looks to have experienced an inward shift since the mid-2000s, possibly as a result of earlier structural reforms. The econometric analysis also tests separate specifications for the aggregate euro area and the individual constituent economies. A reduced form model appears to work well at the aggregate euro area level, generating a well-behaved negatively-sloped and concave Beveridge curves for the euro area aggregate and most euro area countries. We find a significant shift in the euro area Beveridge curve since the onset of the crisis, but considerable heterogeneity at country level. At the extremes, country level differences include a significant outward shift in the Beveridge curve for France and Spain, but an inward shift for Germany.

In a second step, estimated Beveridge curve shifts were used as dependent variables in a probit model, designed to shed light on the drivers of observed shifts. Our results confirm the importance of sectoral employment losses as an important determinant of observed Beveridge curve shifts, particularly so for the construction, general business services and non-market services sectors. Labour force characteristics (age and, to a lesser extent, skills), further influence the probability of a shift. Institutional factors (such as employment protection, temporary contracts, union density) are discussed, but their impact on labour market relationships cannot be isolated in large part, it is suspected, due to the lack of variation in these data over time and across countries over the period considered.

It seems clear that a major force driving the large outward shifts in the Beveridge curves seen for the euro area as a whole, as well as for France and Spain, are the large sectoral declines seen in the construction sector. Where such losses reflect earlier macroeconomic imbalances, these job losses are unlikely to be reversed. Some sectoral rebalancing will therefore be required, so as to provide the preconditions to absorb displaced workers from permanently downsized sectors. Policy measures will need to target active labour market programmes focusing on the up-skilling and re-training of low- skilled workers, so as to equip them with the broader transferable skills necessary to allow for sectoral reallocation.

1 Introduction

The Beveridge curve is widely used to describe the state of the labour market and to distinguish structural shifts from cyclical developments. It traces a negative relationship between unemployment rates and vacancy rates over the course of a business cycle, with low unemployment and high vacancies in expansionary phases and vice versa in contractions. In the initial stages of the global economic and financial crisis, vacancy rates fell sharply, while unemployment rates rose across all euro area economies. Since 2009 vacancy rates have recovered somewhat in many countries, but unemployment rates have remained high or kept rising, suggesting outward shifts in Beveridge curves. Such shifts in the Beveridge curve are of particular interest in times of crisis, since they are suggestive of structural changes in the unemployment-vacancy relationship, and thus the labour market as a whole.[1] As Reinhart and Rogoff (2009) point out, restructuring that takes place during deep recessions is a factor behind the perhaps strikingly large and persistent employment consequences of deep recessions.

This paper analyses euro area Beveridge curves over the past 20 years, at both the aggregate euro area level and at country level, focusing in particular on Beveridge curve developments across euro area labour markets since the onset of the global financial crisis. From graphical depictions of Beveridge curves we observe deviations from pre-crisis patterns that point to possible shifts of the curve in a number of euro area countries since the onset of the crisis Using a simple Beveridge curve model, we test for statistical significance of observed shifts across the euro area economies, and proceed to examining the underlying features which have led to the shifts observed at both euro area and country level.

In the literature, cross-country analysis of euro area Beveridge curves has been limited by the absence of a long, harmonised and seasonally-adjusted vacancy series for the euro area and its constituent economies. To address this challenge, we consider two vacancy series: firstly, Eurostat's relatively recent (still somewhat embryonic) series on euro area job vacancy rates; secondly, the longer European Commission series of employers' perceptions of labour shortages in manufacturing (European Commissions' Surveys of Business Confidence (European Commission (2011a)), as used by ECB (2002) and European Commission (2011c). The latter correlate well with the official job vacancy series, but have the advantage of a much longer time series. In a graphical depiction of recent Beveridge curve developments using both vacancy series, we illustrate shifts of the curve in a number of euro area countries since the onset of the crisis. This overview also demonstrates and motivates our use of the series of employers' perceptions of labour shortages in manufacturing as a reasonable proxy for vacancies. Both series produce a similar picture of recent labour market developments, and the series correlate well.

[1] For detailed descriptions see Yashiv (2006), Blanchard and Diamond (1989), and for theoretical underpinnings, see Pissarides (1979) or Blanchard and Diamond (1994)

We then proceed to the econometric analysis to examine the statistical significance of observed shifts, and their underlying determinants. We test for Beveridge curve shifts for both the euro area aggregate and the individual countries since the onset of the global financial and economic crisis. As a first step, we use a basic OLS specification originally applied to the United States by Valletta (2005) and, more recently, the European Commission (2011c). Our model is estimated on quarterly data covering the period 1991Q1 to 2012Q1. Two specifications are tested: (i) on the basis of aggregate data for the euro area as a whole; (ii) separately for the individual countries.

Our reduced-form model generates well-behaved downward sloping and concave Beveridge curves for most euro area countries and the euro area aggregate, with estimates for the euro area aggregate broadly in line with those of the European Commission (2011c). We find a significant shift in the euro area Beveridge curve since the onset of the crisis, but considerable heterogeneity at country level. At the extremes, country level differences include a significant outward shift in the Beveridge curve for Spain and France, but an inward shift for Germany.

We then extend our analysis to a second stage, in order to examine some of the key factors underlying the observed developments across the countries. Using our estimated Beveridge curve shifts as dependent variables in a pooled probit model, we examine the role of structural and institutional variables as drivers of the observed shifts. A range of country-specific factors - including labour force characteristics, sectoral employment composition and (to the extent possible, given data limitations) institutional features are tested. Our results show that the age and skill composition of the labour force, coupled with sectoral employment developments, are strong drivers of recent Beveridge curve movements.

Our study relates to a number of studies on movements of the Beveridge curve. The Beveridge curve has raised a lot of interest in the literature lately, as the recent crisis has had a severe impact on labour markets in many countries, leading to big employment losses, especially in some sectors. With some exceptions (e.g. ECB (2002), European Commission (2011c), Hobijn and Sahin (2012)), most Beveridge curve studies are country specific, in part due to the lack of long and comparable cross-country vacancy series.[2] Our choice of using the European Commission series of employers' perceptions of labour shortages in manufacturing data allows us to do cross country analysis. Like our analysis, ECB (2002) covers most euro area countries, but that study relates to developments in the 1990s whereas we focus on the ongoing crisis. Hobijn and Sahin (2012) provide a cross-country analysis for a number of OECD countries, including some Euro area countries, however their analysis does not cover all Euro area coutries.

Our econometric analysis builds on earlier work by Borsch-Supan (1991), Wall and Zoega

[2]There is an increasing number of recent studies that study estimate matching functions and Beveridge curves for the U.S., including Barnichon et al. (2010), Barnichon and Figura (2011), Daly et al. (2011), Elsby et al. (2010).

(2002), Groenewold (2003), but follows most closely Valletta (2005). Borsch-Supan (1991) uses panel estimation techniques to test for structural shifts in unemployment as a consequence of recessions across the German federal states from 1963 to 1988. Shift periods are identified by visual inspection of regional Beveridge curves, so as to specify shift dummies, which are then tested for statistical significance. Wall and Zoega (2002) use a similar, though two-stage, approach; first identifying shifts in the Beveridge curve, before trying to explain the shifts by means of institutional variables, but not education or skills. In a similar vein, Groenewold (2003) uses a benchmark approach with a standard matching function to examine Beveridge curves and its shifts for Australia. His work suggests coefficients of a similar magnitude to that of Wall and Zoega (2002) and confirms the importance of worker characteristics as a major determinant of increased structural unemployment. More recently Valletta (2005) estimates a reduced form equation using a similar method to Borsch-Supan (1991). This method does not fully isolate the structural shifts in Beveridge curve movements, since Beveridge curves are able to move back and forth from year to year, because of the use of yearly dummies. Our method restricts the movements to specific - and rather more protracted - periods.

The paper proceeds as follows. Section 2 briefly describes the Beveridge curve relationship and the data used, before presenting a graphical depiction of Beveridge curve developments over the past two decades at both the aggregate euro area level and at the country level. Section 3 proceeds to examine the statistical significance of observed shifts via econometric analysis. In section 4 we extend the analysis to a second stage, in order to examine some of the key factors underlying the observed shifts. Section 5 summarises the main findings of the paper and draws out the policy conclusions.

2 Overview of Beveridge curve developments

2.1 Background

The Beveridge curve is widely used to describe the cyclical state of the labour market and the efficiency of the labour market in terms of matching unemployed workers to job vacancies. It traces a negative relationship between unemployment and vacancy rates over the course of a business cycle, tracing the evolution of the economy from expansionary phases (with lower unemployment and higher vacancies) to contractions in activity (with higher unemployment and lower vacancies). Movements along the Beveridge curve have typically been interpreted as reflecting cyclical labour market dynamics, whereas shifts in the Beveridge curve have typically been interpreted as reflecting changes in matching efficiency or structural change. Shifts in the Beveridge curve are of particular interest, since they are suggestive of structural changes in the unemployment-vacancy relationship, and thus the labour market as a whole. As Reinhart and

Rogoff (2009) point out, restructuring that takes place during deep recessions is a factor behind the perhaps strikingly large and persistent employment consequences of deep recessions.

Estimated Beveridge curves have established a relatively robust negative long-run relationship between the vacancy rate and the unemployment rate across countries. But the recent crisis has had a severe impact on euro area labour markets, leading to large employment losses, especially in some sectors and countries. The strong increases in unemployment observed in some euro area economies may therefore reflect large structural changes in the underlying Beveridge curve relationship. These changes manifest themselves as shifts in the Beveridge curve and may stem from a wide range of factors. Several of these factors feature strongly in the economic literature, including those reflecting an increased mismatch between the attributes of the unemployed and the available vacancies (for instance, due to skill, sectoral or locational mismatches), and those reflecting broader institutional features of national labour markets (such as the generosity of the unemployment insurance system, the impact of employment protection legislation, etc), which effectively reduce the competition among workers for jobs in the labour market.

2.2 The Data

The basis for our analysis of euro area Beveridge curves are quarterly data on unemployment and vacancy developments. To ensure cross-country comparability, we use Eurostat's harmonised unemployment rate for the euro area countries and aggregate. Since official data on job vacancy developments are still somewhat embryonic, two vacancy series are considered: firstly, Eurostat's job vacancy rates for the euro area as a whole[3]; secondly, the rather longer European Commission series of employers' perceptions of labour shortages in manufacturing. These data are taken from the European Commission's regular Confidence Surveys - specifically the aggregated responses from the question relating to employers' perceptions of labour shortages as limits to business.[4] Advantages of these data over Eurostat's job vacancy rates stem from the longer availability of the series (for most countries, from at least 1990) and their seasonally-adjusted form. We use labour shortages for manufacturing, since this is the longest of the three series and has been

[3]Although job vacancy data are available from Eurostat since the first quarter of 2006, these data are not yet fully harmonised across countries. Important concerns remain about the comparability of the data collected across the Member States, both in sectoral and coverage terms, with some member states reporting vacancies only for private sector businesses (i.e., excluding the public sector), others reporting data only for enterprises employing 10 or more, etc. Grossing factors often vary considerably and job vacancy rates are expressed as a proportion of total posts (that is, total employment plus vacancies), rather than as a proportion of the labour force, as is more typically cited. These concerns, together with the short nature of the series (and the consequent lack, as yet, of any seasonal adjustment) render these data unsuitable for the econometric analysis undertaken in this paper.

[4]See European Commission (2011a). For a comparison of the co-movements between the official euro area vacancy rates and employers' perceptions of labour shortages, see Annex A.1. The main advantages of these data over Eurostat's job vacancy rates stem from the longer availability of the series (for most countries, from at least 1990) and their seasonally adjusted form. We use labour shortages for manufacturing, since this is the longest of the three series and has been widely used in the literature (see, for instance, ECB (2002), European Commission (2011c)).

widely used in the literature (see, for instance, ECB (2002), European Commission (2011c)).[5] These data behave pro-cyclically in the same way as Eurostat's job vacancy rates, correlating well with contemporaneous vacancy movements in the Eurostat series.

2.3 Beveridge curves in the euro area

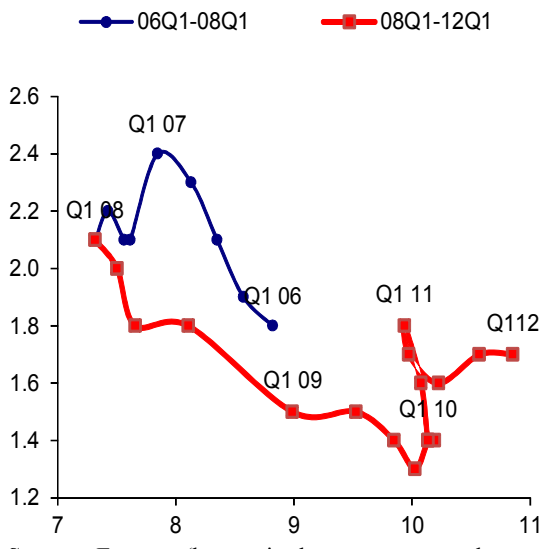
Figure 1(i) shows developments in the aggregate euro area Beveridge curve since the first quarter of 2006 on the basis of Eurostat job vacancy data. While this series has yet to iron out fully a variety of "teething problems" (as outlined above), these data nevertheless provide a first insight into euro area Beveridge curve developments since the second half of the 2000s. The counter-clockwise movements of the pre-crisis observations trace the typical business cycle pattern of falling unemployment as labour demand and job vacancies increased. As the recession took hold, the vacancy rate fell sharply and unemployment increased strongly, represented by a "south-easterly" movement (that is, outwards and down) in the Beveridge coordinates. This pattern continued even after the resumption of economic growth (from the third quarter of 2009). Such developments are, a typical feature of recessions, but the non-seasonally adjusted nature of the vacancy series made it difficult - at least, initially - to disentangle the extent to which such observations reflected protracted cyclical dynamics (outward movements along and towards the extremities of a given Beveridge curve) or the first signs of a structural change in the euro area unemployment-vacancy relationship (resulting in an outward shift in Beveridge curve). However, two years on and following a subsequent partial recovery in the aggregate euro area vacancy rate, the unemployment rate has not declined - fueled in part by ongoing adjustments in some countries, but also by strong permanent employment declines in some previously over-heated sectors. While these corrections are likely to lead to some distortion in the Beveridge curve relationship, further back-data are required in order to assess the full extent of the crisis on the unemployment-vacancy relationship in the euro area.

Figure 1(ii) makes use of a longer time series on labour shortages (used as a proxy for vacancy developments) to trace the evolution of the euro area Beveridge curve since 1991. This suggests that, following some deterioration (i.e., an outward shift) in the Beveridge curve relationship in the late 1990s, euro area labour markets seem to have shown a greater correspondence between the unemployed and available vacancies following the launch of EMU and the ensuing reforms undertaken in many euro area countries, resulting in an inward shift in the proxy Beveridge curve during the middle years of the 2000s (see blue lines in Figure 1(ii)). But the onset of the global financial and economic crisis clearly hit euro area labour markets hard, causing a sharp rise in

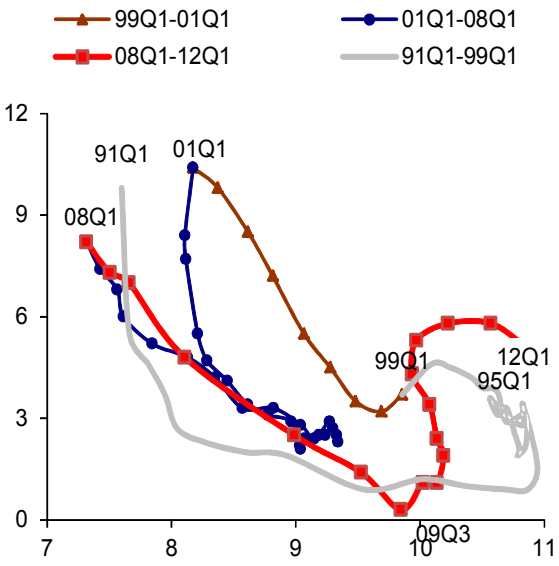
[5] We also tried composite indexes of manufacturing, services and construction labour shortages rendering largely similar results. The problem with construction labour shortages is that these series typically behave overly pro-cyclical, while services labour shortages series on the other hand have limited observations.

Figure 1: Movements in the euro area Beveridge curve

(i) Beveridge curve for the euro area



(ii) Beveridge curve for the euro area, using labour shortages



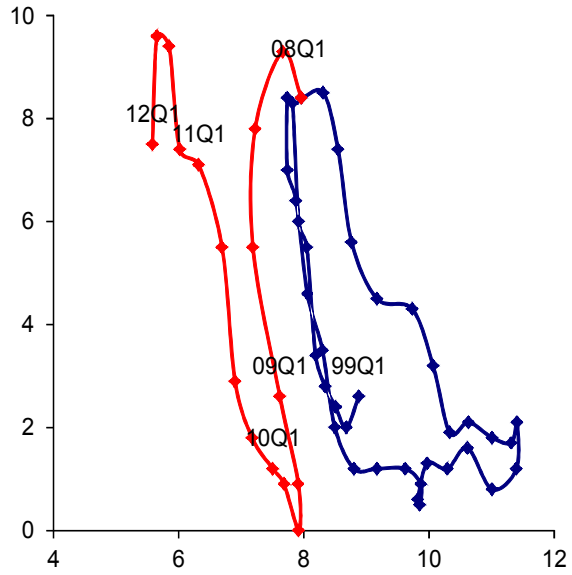
x-axis: unemployment rate (%);
y-axis: (i) Eurostat vacancy series (%); (ii) labour shortages (diffusion index)
Sources: Eurostat; own calculations.

unemployment as vacancies plummeted (as illustrated by the red line, which traces the path of the Beveridge curve since the pre-recession peak in GDP in the first quarter of 2008). In the aftermath of the crisis, this longer series suggests a clear structural break in the unemployment-vacancy relationship for the euro area - with the latest observations above and beyond any seen over the past two decades. The graphical representation suggests both an outward shift in the euro area Beveridge curve, signifying a higher level of unemployment associated with a given level of vacancies and a marked change in the slope of the Beveridge curve, suggesting a change in the efficiency in the potential matches between available vacancies and unemployed workers. Both phenomena allude to growing structural problems in some euro area labour markets. However, as is well known, a key feature of euro area labour markets in the recent period has been the growing degree of cross country heterogeneity in the aftermath of the crisis - with some countries showing strong and continuing increases in unemployment since the onset of recession in 2008, others showing little change or even declines.

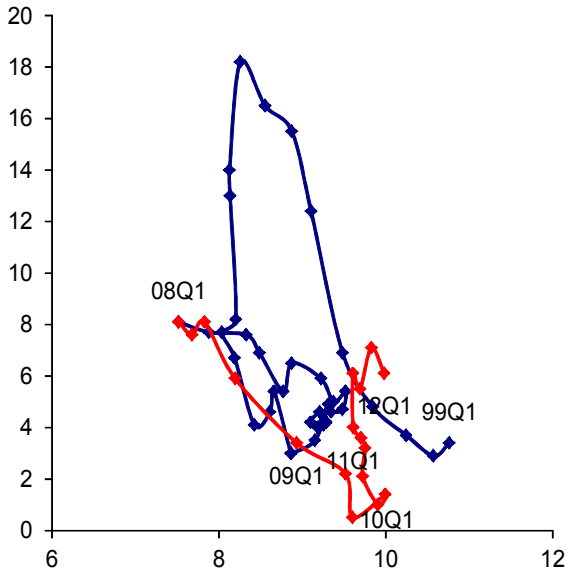
To understand better the possible sources of the apparent shift in euro area Beveridge curves, Figure 2 shows Beveridge curve developments for the four largest euro area economies over the course of EMU, again using labour shortages as a proxy for vacancy developments. For Germany, the recession looks to have had a relatively short-lived impact on the labour market. Following a long period of deterioration in the first half of the decade, from 2005 the German Beveridge

Figure 2: Longer term Beveridge curves for euro area countries, using employers' perceptions of labour shortages as proxy for vacancy rates.

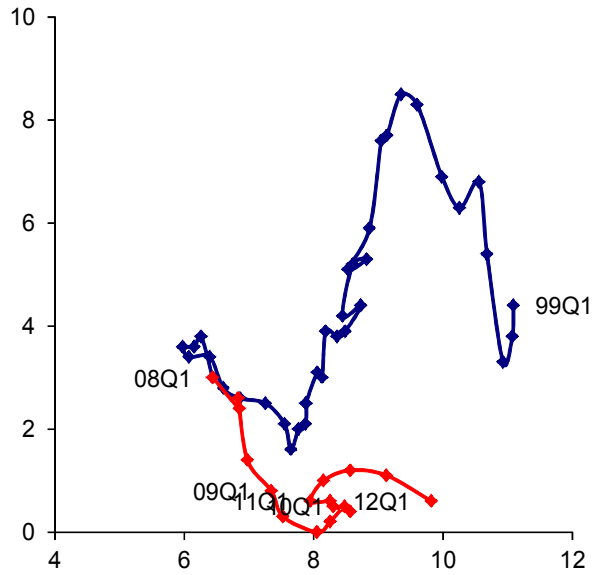
(i) Germany



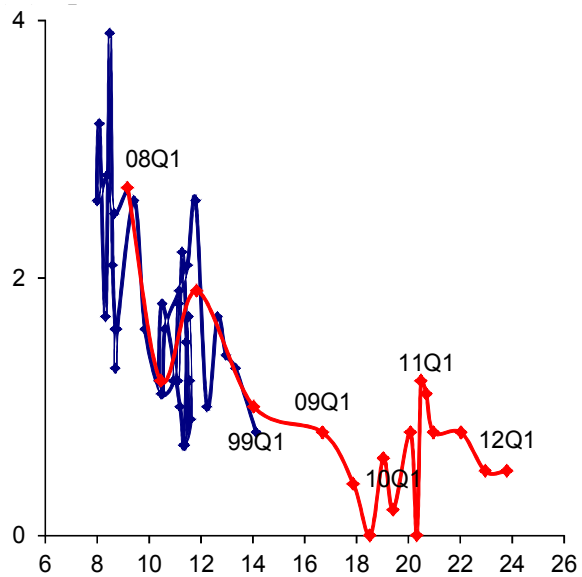
(ii) France



(iii) Italy



(iv) Spain



x-axis: unemployment rate (%);
y-axis: labour shortages (diffusion index)
Blue lines: 1999Q1-2008Q1; red lines from 2008Q1 to latest observation
Sources: Eurostat; own calculations.

curve seems to have exhibited the typical expansionary pattern of a decline in unemployment and an associated increase in vacancies, reflecting the tightening phase in the German labour market. The relatively short-lived fall in the vacancy rate following the onset of recession (in the second quarter of 2008) did not lead to an increase in unemployment in Germany, partly due to the relatively low unemployment inflows as a consequence of the private sector's strong reliance on publicly-funded short-time working schemes. Since the start of the recovery, the German labour market has continued its seemingly virtuous path of both an increase in vacancies and a declining unemployment rate (albeit with perhaps some moderation in recent quarters), to the extent that the data suggest a further inward shift in the German Beveridge curve.

Meanwhile in France, the aftermath of the crisis looks to have led to some considerable labour market disruption - at least in the short term. Despite a considerable rebound in labour shortages since the recession, the unemployment rate remains stubbornly "stuck" at around 10%. This contrasts sharply with that country's pre-crisis experience, where signs of an inward shift in the Beveridge relationship since the early 2000s suggest improvement in labour market matching of the unemployed to new vacancies in France up to that point. The pattern is similar in Italy, though the traditionally rather sluggish speed at which the Italian labour market appears to adjust (see the rather slow decline in vacancies and unemployment involved in the inward "shift" of Italy's Beveridge curve over the first half of decade) - and a strong slowing in GDP growth already since the first quarter of 2007 - makes interpretation of the full impact on the crisis difficult to disentangle.

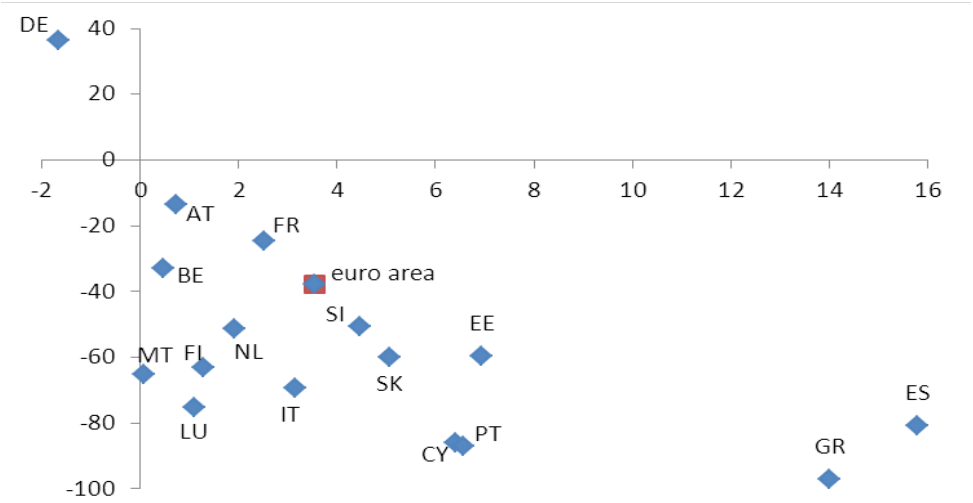
Developments in Spain, on the other hand, are clearly less ambiguous: vacancy rates and reports of labour shortages remain close to their series lows and there is a clear outward shift in the unemployment rate (an increase of over 10 percentage points on its EMU-entry level). This, together with the dramatic increase in long-term unemployment and the strong sectoral dimension to the employment losses in that country (following the bursting of the housing bubble) are all highly suggestive of a deep and significant increase in structural mismatch in the Spanish labour market.

Figure 3 summarises the full effect of Beveridge-type movements for all euro area countries since the onset of the financial crisis in 2008.[6] This chart shows that, on average over the subsequent period, vacancy requirements (as proxied by labour shortages in manufacturing) remain considerably below their pre-crisis level, while unemployment has increased by almost four percentage points across the euro area as a whole.[7] More importantly, the chart summarises

[6] Annex A.2 shows Beveridge curve profiles for the remaining euro area countries The movements shown remain largely unchanged regardless of whether aggregate vacancy rates, as published by Eurostat, or labour shortages are used. The latter are preferred for this analysis, due to the longer nature of the labour shortage series and the lack of seasonal adjustment in the vacancy data, which makes comparison of recent developments less straightforward.

[7] A simple OLS regression confirms the relationship: change in unemployment rate (pp) = -0.04 - 0.08 % change in labour shortages.

Figure 3: Summary of Beveridge curve developments since the financial crisis



x-axis: change in unemployment rate (pp);
y-axis: percentage change in labour shortages since the country-specific pre-crisis trough in unemployment rate.
Source: Eurostat and own calculations. Notes: All changes relate to country-specific movements since pre-crisis unemployment trough. Ireland omitted due to data limitations.

the considerable heterogeneity in unemployment responses to subdued labour demand conditions since the 2008 recession.

Only one country - Germany - has seen labour demand rise significantly since the crisis, resulting in an increase in vacancies and a notable decline in unemployment (see the upper left-hand side observation for Germany in Figure 3). Among the remaining countries, - as well as for the euro area as a whole, - labour shortages and vacancies remain below their pre-crisis levels, though to markedly differing degrees. Unemployment reactions have varied significantly, with disproportionately large unemployment reactions in Spain and Greece (on the right-hand side of Figure 3) in stark contrast to the lesser unemployment reactions of say, Malta, Luxembourg and Finland (to the left of Figure 3) despite broadly similar proportional declines in labour demand. Annex A.3 confirms this finding, regardless of the nature of the vacancy data used. From a policy perspective, it is countries to the right hand side of Figure 3 which warrant the greatest concern, as disproportionate increases in unemployment - if long-standing - may reflect signs of an emerging structural mismatch between the attributes of those seeking work and labour demand. While several of these countries have experienced strong and long-lasting recessions over part, if not much, of the intervening period, even a strong increase in labour demand is unlikely to lead to a substantial decline in unemployment rates if worker attributes and sectoral demands are not well matched.

3 Econometric analysis of euro area Beveridge curve movements

In an effort to establish statistical significance of the results suggested by visual inspection of individual country Beveridge curves, we also employ a multivariate analysis. This econometric analysis has two specific aims: (1) to look explicitly for Beveridge curve shifts for both the euro area aggregate and the individual countries over the crisis and (2) to investigate - to the extent possible in the light of data availability - the institutional features behind the cross-country heterogeneity in this respect.

A review of the economic literature suggests several potential specifications.[8] Our starting point is a basic Beveridge curve specification, regressing the unemployment rate on labour shortages (used as a proxy for vacancy rate developments), plus a range of shift parameters, in the spirit of earlier studies by Valletta (2005) and, more recently, the European Commission (2011c). Augmenting these models slightly, our benchmark model is:

$$U_{it} = \alpha_i + \beta_{1i}U_{it-1} + \beta_{2i}LS_{it} + \beta_{3i}LS_{it}^2 + \beta_{4i}CRI_{it} + \beta_{5i}CRI_{it} * LS_{it} + \beta_{6i}EMU_{it} + \epsilon_{it}, \quad (1)$$

where U_{it} is the official Eurostat harmonised unemployment rate; LS is the labour shortages variable representing vacancy developments; and the subscripts i and t are country and time subscripts. The quadratic term LS^2 is designed to ensure the convexity of the Beveridge curve and thus capture nonlinearities in the Beveridge relationship (for instance, a smaller unemployment reaction when vacancies or labour shortages are very high, but a higher reaction when labour demand is weak and vacancies low).

To test the impact of the crisis on euro area Beveridge curves, we incorporated the dummy variable, CRI, (taking a value of one from the first of at least two consecutive quarters of negative quarter-on-quarter GDP growth to the end of the series, this way identifying the period from the

[8] In an early investigation of Beveridge curve relationships for Germany, Borsch-Supan (1991) uses panel estimation techniques to test for structural shifts in unemployment as a consequence of recessions across the German federal states from 1963 to 1988. The dependent variable is the unemployment rate. Shift periods are identified by visual inspection of regional Beveridge curves, so as to specify shift dummies, which are then tested for statistical significance. Vacancy data are compiled from the official Bureau of Labour vacancy statistics (self-reported), adjusted for unreported vacancies. A variety of functional forms are explored, substituting the simple vacancy rate, the vacancy rate squared, a combination of these, as well as a hyperbolic function ($1/v$). Wall and Zoega (2002) use a similar, though two-stage, approach (first identifying shifts in the Beveridge curve, before trying to explain the shifts by means of institutional variables), but unfortunately not education or skills. In a similar vein, Groenewold (2003) uses a benchmark approach with a standard matching function to examine Beveridge curves and its shifts for Australia. His work suggests coefficients of a similar magnitude to that of Wall and Zoega (2002) and confirms the importance of worker characteristics as a major determinant of increased structural unemployment, despite the very different institutional framework studied. More recently Valletta (2005) estimates a reduced form $u_t = \alpha + \beta_1 v_t + \beta_2 v_t^2 + \theta Y + \epsilon_t$, where u is the unemployment rate, v is a synthetic vacancy rate, Y represents time effects using a similar method to Borsch-Supan (1991). In the authors' views, this method does not adequately isolate the structural shifts in Beveridge curve movements, since Beveridge curves are able to move back and forth from year to year. Our method restricts the movements to specific - and rather more protracted - periods (determined by observation of wider macroeconomic data), as outlined in the text.

start of the crisis until now)[9] In addition, the dummy variable $CRI*LS$ represents an interaction term between the crisis dummy and the labour shortages variable, designed to capture changes in the slope of the Beveridge curve - i.e., changes in the efficiency of the matching process. Finally, a dummy variable, EMU, (taking a value of 1 from country i's entry into economic and monetary union) is used to identify possible shifts in the Beveridge curve over the course of monetary union.[10] Therefore, in our model we effectively allow for three different Beveridge curve positions; our baseline 90s, the EMU period and the crisis period. The reason to pick these three periods is that the focus of this paper is Beverigde curve movement over the course of the crisis. We compare the crisis period with the pre-crisis period allowing for the crisis to offset (or less likely, exacerbate) any possible effects of the entry into the monetary union. Our model can therefore be thought of as comparing the average position of the Beveridge curve during the crisis with the average pre-crisis position.[11] Finally, in our model errors and omissions are captured by ϵ_{it} .

The model was estimated on quarterly data covering the period 1991Q1 to 2012Q1, again using data on employers' perceptions of labour shortages as a proxy for vacancy developments.[12] To improve the comparability of the Beveridge curve parameter estimates across typical country-specific business cycles, labour shortage data were mean-adjusted. Earlier theoretical and empirical studies suggest a strongly significant and positive coefficient on the lagged dependent variable U_{t-1},[13] underlying the highly persistent nature of unemployment in Europe, and a negative and significant coefficient on the labour shortages variable LS_t, confirming the inherent negative correlation of the Beveridge curve.[14]

[9]For country regressions, all crisis periods are country-specific.

[10]In an attempt to ensure that the EMU dummy was not simply reflecting general temporal effects, the model was also tried with the addition of a simple time trend. In the event, this proved largely insignificant for most countries (as it should be in theory). The notable exception was Finland, where the addition of time trend proved generally negative, though significant, largely reflecting the strong outward shift in that country in the aftermath of the strong economic crisis suffered by that country in the early 1990s. As for the remaining countries and the euro area aggregate, only Belgium, Malta and Slovakia showed any hint of a permanent temporal trend, though these tended to be only very weakly significant in most specifications.

[11]Identifying more possible shifts is problematic and beyond the scope of this paper. Using yearly dummies like Valletta (2005), will most likely lead to over- or under identification of shifts. If a country has a very volatile labour market the model with yearly dummies will most likely identify a large number of shifts while in fact the unemployment rate underor overshot the underlying Beveridge curve on a number of occasions, The model is likely to predict less shifts than actually occurred if a country has a slowly adjusting labour market on the other hand, since each year dummy is probably not significantly different from its preceding dummy even though the Beveridge curve ends up at very different positions if longer time periods are considered. In our sample the first scenario is prevalent, using yearly dummies would lead to identifying 2 out of every 3 years as a shift in the Beveridge curve. This is clearly an over prediction of Beveridge curve shifts which is why we choose for three exogenously picked time periods and a lagged dependent variable to adjust for the persistence in unemployment.

[12]Data for France and Finland from 1992Q1, for Malta from 2004 and for Slovakia from 2000. Earlier observations (often the first in the labour shortages series for these countries) appear exceptionally volatile and outside the range of all subsequent observations in these series.

[13]For stability, the coefficient should be strictly less than unity.

[14]In our benchmark specification, several variants of the respective variables were explored, including logarithmic and differenced transformations, which resulted in parameter estimates of a similar magnitude, though less

Table 1: Beveridge curve estimation using manufacturing labour shortages
Sample period: 1991Q1-2012Q1

	Euro area	DE	ES	FR	IT
U_{t-1}	0.89***	0.89***	0.90***	0.85***	0.99***
	[0.02]	[0.02]	[0.02]	[0.03]	[0.03]
LS_t	-0.08***	-0.10***	-0.41***	-0.05***	-0.03
	[0.01]	[0.01]	[0.11]	[0.01]	[0.02]
LS_t^2	0.01***	0.01**	0.16**	0.00**	0.00
	[0.00]	[0.00]	[0.06]	[0.00]	[0.00]
EMU_t	-0.16***	0.05	-0.65***	-0.19***	-0.20***
	[0.04]	[0.08]	[0.17]	[0.06]	[0.07]
CRI_t	0.31***	-0.31***	1.68***	0.18***	0.32*
	[0.07]	[0.11]	[0.20]	[0.06]	[0.17]
$CRI_t * LS_t$	0.05	0.02	0.48	0.03	0.04
	[0.04]	[0.02]	[0.29]	[0.02]	[0.09]
$Cons.$	1.05***	0.83***	1.67***	1.48***	0.22
	[0.24]	[0.18]	[0.38]	[0.36]	[0.28]
Obs.	85	84	85	81	85
Prob. > F	0.000	0.000	0.000	0.000	0.000
Adj R-squared	0.984	0.985	0.992	0.973	0.980
RSME	0.136	0.175	0.410	0.168	0.226

Notes: Standard errors in brackets. Standard errors are corrected for autocorrelation using Newey-West procedure. ***, **, * denote statistical significance at 1%, 5% and 10% levels, respectively.

Two specifications were tested: (i) on the basis of aggregate data for the euro area as a whole; (ii) separately for the individual countries. Table 1 summarises the main results for the euro area and the four largest constituent economies. Overall, this simple model appears to work reasonably well for both the euro area aggregate and most euro area countries.

Beginning with the results at the aggregate level, parameter estimates for the euro area as

significant; various transformations and combinations of the vacancy term (omitting LS^2 or using instead $1/LS$); the inclusion of the share of longterm unemployment (LTU) as an explanatory variable; etc. To test for the robustness of the results we conducted a number of alternative estimations. Simply using vacancy rates instead of labour shortages yielded largely insignificant results, since the vacancy series are generally too short for regression techniques for most euro area countries. (see table 5 in annex B; Note: The EMU dummy is excluded from the estimation since the entire sample contains data from the EMU period only.). We can estimate a downward sloping Beveridge curve, however, given the short time series the stability of the system is an issue. We also replicated the European Commission (2011c) method directly by estimating country-level Beveridge curves in a two stage approach (see table 6 in annex B) - that is, first by estimating the relationship between vacancy rates and labour shortages and by using predicted values for vacancy rates (i.e., over the entire labour shortage series) as regressors in our Beveridge curve estimations. This approach largely yields similar results to our baseline model. However, the Beveridge curves for Spain and Greece are no longer well defined. Finally we investigated a possible lagged effect of labour shortages in the Beveridge curve relationship, so as to capture instances whereby employers express labour shortages in advance of posting a vacancy. Econometrically, instead of including only the contemporaneous value of labour shortages we included 5 lags (from contemporaneous, t to $t-4$) and tested for the joint significance of the coefficients (see table 7 in annex B). The results confirm our baseline model.

a whole are broadly in line with those of the European Commission (2011c).[15] As anticipated, the coefficient on the lagged unemployment rate U_{t-1} is large and highly significant, suggesting considerable persistence in euro area unemployment. As expected, labour shortages, LS_t, display the necessary negative coefficient, clearly illustrating the inverse relationship between unemployment and vacancies, which underlies the Beveridge curve over the course of the typical business cycle, and the convexity condition (the squared term on labour shortages, LS_t^2) holds.

Turning to the dummy variables, economic and monetary union looks to have had a significant and favourable impact on euro area labour markets, coinciding with an *inward* shift in the euro area Beveridge curve (as suggested by the highly significant *negative* parameter estimate on the EMU dummy). To some extent, this inward shift could be expected - in part as a result of structural labour market reforms which accompanied EMU membership in several euro area countries. As regards the impact of the crisis, CRI is both positive and highly statistically significant, suggestive of a strong outward shift in the euro area Beveridge curve since the onset of the recession. Recalling the earlier suggestion of an additional change in the "slope" of the euro area Beveridge curve reflecting an overall decline in the responsiveness of unemployment to vacancy developments - since the trough of activity was reached in 2009Q2 (see again, the most recent observations in, Figure 1(ii)), this does not appear to be borne out statistically (with no significance on the interaction term, $CRI * LS$) from this model.

Table 1 also includes results for each of the four largest euro area countries. The model performs well for Germany, Spain and France, with the expected signs on all variables. The coefficient on the crisis dummy for Germany is strongly significant but negative, confirming the apparent inward shift of the German Beveridge curve since the crisis seen in the earlier charts and suggestive of something of an ongoing improvement in labour market matching in that country in recent years. Intuitively speaking, however, this inward shift is more likely to reflect the rather later implementation of the structural labour market reforms (Hartz reforms) undertaken from the mid-2000s in Germany, than the impact of the economic crisis. Also, the widespread use of short time working schemes (Kurzarbeit) as a form of labour hoarding and working time accounts have played a role in containing adverse labour market effects of the crisis.

For France and Spain, meanwhile, the model suggests strong and significant outward shifts in the Beveridge curves of these countries. For France, this result appears to confirm that the recent "outward kick" seen in the graphical representations of the French Beveridge curve (in Figure 2) is likely to reflect an adverse structural shift in that country's labour market. Results

[15] European Commission (2011c). The model is the same, but the data used are slightly different. In the European Commission's variant, fitted 1996Q1 to 2010Q4, Eurostat vacancy data are used for the middle part of the sample; for the remaining period (i.e., up to 2003) the vacancy rates are modelled on the basis of the labour shortages data used directly here. Our sample period is somewhat longer. In annex B table 6 similar results are shown for our sample period.

Table 2: Cluster of Beveridge curve movements

BEVERIDGE CURVE SHIFTS	
No shift	Shift
AT, BE, FI, NL^1, SI	*euro area*(+), $DE(-)$, $ES(+)$, $FR(+)$

Sources: Eurostat, own calculations.
Notes: 1 Outward shift and slope change suggested at 10% level. Positive shifts (+) reflect outward shifts in the Beveridge curve; negative shifts are denoted by (-).

for Spain, meanwhile, suggest that the crisis may have led to a substantial shift in that country's unemployment-vacancy relationship. The strongly negative relationship between unemployment and labour shortages looks to have declined considerably since the onset of the crisis, however, the coefficient on the interaction term is not significant. The significance of the positively-signed shift dummy CRI is strongly suggestive of a significant increase in the degree of sectoral mismatch since the onset of the crisis for Spain.

The model does not perform well for Italy. All parameters are estimated with the correct signs, but the almost unit root on the lagged dependent variable, together with the lack of any significance on the labour shortages variable is worrisome.[16] In short, the Beveridge curve for Italy is not well specified, with neither a clear downward sloping relationship between unemployment and labour shortages, nor a significantly concave relationship. The explanation for this may be linked to the typically rather strong movements into and out of the labour force in Italy during crisis periods, which tend to dampen unemployment developments over the business cycle, despite large changes in employment totals. Overall, however, the lack of a well-behaved Beveridge curve relationship for Italy means that the (albeit weak) suggestion of an outward shift of the Italian Beveridge curve since the onset of recession and up to the first quarter of 2012 should be viewed with caution.

Analysis of the four largest euro area economies draws a picture of large shifts in the Beveridge curve. This not the general picture of the euro area, however. Table 2 summarises the results for all euro area countries with a well specified Beveridge curve (that is: parameter estimates on labour shortages variable should be significant at 5% level and no unit root on lagged dependent variable), with full estimates for all 17 member states provided in Annex B. In the annex we can see that only three of the 13 remaining countries - Ireland, Greece and Cyprus - have any

[16]To an extent, this was to be expected, given the very pronounced, but protracted, separate phases of inward movements seen over the estimation period (see again, panel (iii) in Chart 2). At first blush, it is tempting to think that the graphically strong inward movement of Italy's Beveridge curve seen over the course of EMU is likely to reflect significant structural improvements in the Italian labour market over the 2000s. But the unemployment rate bears somewhat less of a relation to Italian labour market developments than in other euro area countries. In addition, the recession has significantly increased the degree of labour market slack, while participation has fallen to a rather greater degree than in many euro area economies. As a result, while the present estimates do not support a clear view of a (statistically) significant shift in the Italian Beveridge curve as a consequence of the recession, concerns regarding a longer-standing structural mismatch cannot yet be fully dismissed.

suggestion of an outward shift in their respective Beveridge curves, though in all three cases the Beveridge curves are generally not well specified by the model.[17] Overall, it seems that only Germany has exhibited, over the course of recession, to a clear favourable "shift" in the structural relationship between labour demand and unemployment since the start of the financial crisis. It is then hardly surprising that Germany is one of the select group of countries which has started to see not only a decline in the unemployment rates, but also in the share of long-term unemployment since the start of the crisis. Meanwhile Spain and France appear to have experienced unambiguous outward shifts - as has the euro area as a whole.

4 What drives shifts in euro area Beveridge curves?

The diverse responses of the various euro area countries reflect varied and often ongoing labour market transitions in the wake of a deep recession. None of the euro area economies have emerged unscathed, though for policy makers, it is not sufficient to know whether shifts in the Beveridge curves are evident, but rather to understand what is driving those shifts. Labour force characteristics, sectoral composition and institutional factors are all likely to play important roles in influencing an economy's ability to respond to the strong shocks observed over the course of the recent crisis. To examine the relative importance of these various factors, we thus employ a probit analysis to test the features most likely to influence the impact of an adverse (outward) shift in a given country's Beveridge curve. In this explanatory work, the sample of countries is restricted to those euro area economies where the Beveridge curve is well defined at the 5% level, of which two - France and Spain - exhibit clear outward shifts in the aftermath of the financial crisis.

4.1 Labour force characteristics and sectoral declines

Strong increases in unemployment have been heavily concentrated among young people in many euro area countries. Similarly, the strong sectoral dimension of the recent crisis has been well

[17] For Ireland, data are unavailable beyond 2008Q2. In Greece, the strong growth in unemployment, coupled with an ongoing decline in vacancies, over the crisis renders the lagged dependent variable somewhat unstable. Part of this instability probably results from the relatively small number of observations included prior to the crisis and the very dramatic labour market reaction to its onset, marking the onset of a clear "vicious circle" with respect to labour market developments. The results for Cyprus are also not without problems. A unit root cannot be ruled out plus the coefficient on labour shortages is not significant. Part of the problem lies in the small number of pre-crisis observations; more likely still is the strong labour market reaction in this country since the start of the downturn. Whilst it would be tempting to dismiss the model as a good indicator of labour market developments (at least, in the absence of a longer data series), it is worth remembering that the positive correlation found between unemployment developments and labour demand is itself often a first indication of growing structural mismatch. See: European Commission (2011b). Ireland, Greece and Cyprus, all include an explosive unit root on the lagged dependent variable, suggesting that this model may not be stable over the long-term.

documented.[18] In an attempt to shed light on the extent to sectoral developments were a key driver of the observed outward shifts, we extend our analysis, using estimated Beveridge curve shifts (or nonshifts) as dependent variables regressed against labour force and sectoral characteristics, in a pooled sample probit model. Our probit analysis is limited to the eight euro area countries which provided a well-defined Beveridge curve in the preceding analysis (non-explosive and downward-sloping at the 5% confidence level) - namely, Austria, Belgium, Germany, Spain, France, the Netherlands, Slovenia and Finland. Of these, only two - France and Spain - exhibit unambiguous outward shifts, as estimated in our previous analysis.

The probit is estimated over the period 2002Q1-2012Q1, reflecting the availability of harmonised data for the labour force variables. Specifically, we estimate the model:

$$S_{it} = \alpha + X_{it}\beta_1 + Z_{it}\beta_2 + \epsilon_{it}, \tag{2}$$

where s_{it} is a dummy regressor, similar to section 3 taking a value of 1 from the first quarter-on-quarter decline in GDP to the end of the sample in those countries which exhibited a significant outward shift in their Beveridge curve over the course of the recession in the previous analysis (see Section 3), 0 otherwise;[19] X_{it} is a matrix of country- and time-specific labour force characteristics by age, sex and skill level - in particular: the proportion of younger (YOUNG) and older (OLDER) workers, aged below 25 and 55-64, respectively, as a proportion of the labour force in each country; the ratio of low- and highly-skilled workers (LOWSKL and HIGHSKL, respectively).[20]

In an effort to determine the extent to which observed shifts were likely to be due to sectoral mismatch (whereby displaced workers from one sector were not able to reallocate to employment in alternative sectors), we included the sectoral matrix, Z_{it}, expressed as the difference in the annual rate of growth of employment in sector j in comparison to total employment growth rate

[18] See, for instance, ECB (2012).

[19] This dummy is therefore comparable to the dummy used in section 3 in the sense that it covers the same time period and follows the same rule with the addition that the analysis in section 3 should have identified a significant outward shift of the Beveridge curve. Therefore, only Spain and France exhibit positive values for this variable.

[20] Early versions of these specifications included also a variable MALE, capturing the proportion of the labour force accounted for by men, though this was not significant in any of the regressions and thus has been omitted. Previous analyses have often included LTU as an explanatory variable in Beveridge curve regressions and found this to be an important causal factor. (Inclusion of LTU in our specification resulted in a considerable instability of the model) But this shortcut seems somewhat unsatisfactory, since both increases in LTU and shifts in Beveridge curves are likely to be symptoms of a common causal relationship. (Our model also tried substituting the LTU as the dependent variable in an effort to see whether, as anticipated, LTU would be less responsive to changes in labour demand. As expected, variation in the labour shortages variable yielded no significant effects on LTU, but this is not a very satisfactory - or robust test - for structural mismatch at the wider level.)

in country i at time t, weighted by the average share in employment of sector j:

$$Z_{ijt} = -\frac{1}{5}\sum_{k=0}^{4}\frac{X_{ijt-k}}{X_{it-k}}\left[\Delta ln(X_{ijt}) - \Delta ln(X_{it})\right], \tag{3}$$

Using the recently-released NACE2 sectoral breakdown, the sectoral matrix distinguished six discrete sectoral groupings as follows: INDUSTRY - that is, industrial employment including manufacturing, mining and energy generation (NACE2 B-E), but excluding construction (NACE2 F) which was included separately as CONSTRUC; TRADTRAN (NACE2 G-I) - including both retail and wholesale trade and transport activities; FINRE - NACE2 category K-L, which regroups financial intermediation (including banking and insurance) and the real estate sector; BUSSVCS - NACE2 category M-N, which covers general business services including professional, scientific and technical services, administration and employment agencies; and finally, the largely non-marketed services - NON-MKT (NACE2 O-Q) - of the public sector, education and health services. Finally, we included a variable for the country- and time-specific ratio of workers on temporary (i.e., non-permanent/non-open-ended) contracts (TEMP).

The results for our pooled sample are shown in Table 3. Significance of positive (negative) parameters denotes an increased (decreased) probability of an outward shift.

The results in Table 3 confirm that labour force composition had an important bearing on the probability of an outward shift of a country's Beveridge curve over the crisis period. As the relationship underlying col. (1) shows, countries with a higher proportion of younger workers (YOUNG, aged below 25) in their labour force were significantly less likely to experience an outward shift than those with a lower ratio of younger workers. Thus, it seems that although young people in many countries may have been particularly hard hit by the recent economic crisis, a younger average labour force is likely to reduce the likelihood of structural mismatch. This result is line with the fact that job-finding rates are higher for younger workers than for their older counterparts, and that younger workers who lose their jobs spend less time unemployed than their older counterparts. Several lines of argument are possible: for instance, younger workers are typically less specialized and have less (firm, tenure or sector) specific skills than older workers.[21]

[21]It is a common finding in the literature that the job-finding rate is decreasing in age. Esteban-Pretel and Fujimoto (2011) find that in the United States (1976-2005) the job finding rate is almost the same for workers aged 16 to 20 and 21 to 25, but after the age of 25 it decreases with age. For the U.K. Elsby et al. (2011) confirm earlier findings that while young workers are much more likely to lose their jobs, they are also more likely to find new jobs. Thus, younger workers face a more volatile labour market, experiencing more jobless spells, but for shorter durations. The results of Bassanini and Marianna (2009) produce a similar picture for 11 countries. Darby et al. (1985), Davis et al. (1998), and more recently Fujita and Ramey (2006) argue that young workers are new entrants to the labour market, often are in the process of job shopping, and may therefore accumulate little (occupational or sectoral) job-specific capital. These young workers are characterized by high rates of entry into unemployment and high probability of leaving it. In normal times, the bulk of unemployment comes from this group. Older workers, however, more commonly possess more a higher degree of job- or firm-specific human capital (and more frequently have open-ended jobs). In normal times they rarely become unemployed, but job

Table 3: Determinants of Beveridge curve shifts
Sample period: 2002Q1-2012Q1
Dependent variable: Probability of outward shift Beveridge curve

	Sectors weighted by size of sector (j) in total employment in country (i)						Unweighted
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
YOUNG	-0.94**	-1.09***	-0.55***				-1.07***
	[0.39]	[0.24]	[0.11]				[0.37]
OLDER	0.45**	0.53***	0.12***				0.68***
	[0.208]	[0.12]	[0.05]				[0.21]
LOWSK	0.18***	0.15***		0.05***			0.32***
	[0.0638]	[0.04]		[0.01]			[0.09]
HIGHSK	-0.10	-0.18***		0.06**			-0.17*
	[0.09]	[0.06]		[0.03]			[0.10]
INDUSTRY	0.45				1.00*		-5.07
	[1.12]				[0.60]		[21.67]
CONSTRN	4.72***				4.42***		72.77***
	[1.67]				[0.94]		[23.96]
TRADTRAN	2.09				0.50		91.34*
	[1.34]				[0.64]		[49.06]
FINRE	0.27				-2.80		0.33
	[3.44]				[1.94]		[12.23]
BUSSVCS	5.86***				3.85***		105.7***
	[1.54]				[0.91]		[30.48]
NONMKT	3.45**				3.28***		136.7**
	[1.41]				[0.88]		[55.45]
TEMP	-0.12	-0.09				0.06***	-0.19*
	[0.11]	[0.06]				[0.02]	[0.11]
CONSTANT	5.16	7.41***	3.24***	-4.42***	-0.73***	-2.12***	4.74
	[3.969]	[2.73]	[1.02]	[0.96]	[0.21]	[0.30]	[4.18]
Observations	308	315	316	316	320	315	308
$Prb. > chi^2$	0.00	0.00	0.00	0.00	0.00	0.00	0.00
$PseudoR^2$	0.69	0.50	0.25	0.20	0.47	0.05	0.72

Note: sectoral variables relate to differential employment losses (i.e., employment growth, multiplied by minus 1, to reflect employment losses as a consequence of recession) in sector j, compared to total employment losses in country i, (that is, xij - xi), weighted (in cols. (1)-(6)) by the average share (averaged over five quarters from current t to t-4) of sector, j, in the total employment of country i (Eij/Ei). Industry data are de-trended throughout. Figures in brackets are standard errors. ***, ** and * represent significance at the 1, 5 and 10% level, respectively.

search takes longer. Loss of permanent jobs is more prevalent during recessions because firms may need to extend labour force reductions also to permanent skilled workers when downsizing, especially in declining industries. The slow search process of this second group dominates cyclical unemployment during the recovery from recessions.

Similarly, it is probable that the costs (monetary and otherwise) of geographical relocation are rather lower among young people starting out in the labour market than for older workers with stronger family (and property) commitments.[22] Consequently, (both sectoral and geographical) reallocation costs are likely to be lower for younger workers than their older counterparts, thus improving their chances of reabsorption into changing labour markets.[23] These reasons are likely to help explain the strongly positive and significant impact of higher proportions of older workers (OLDER, aged 55-64 and often perceived as less flexible to labour market changes) in the labour force influencing outward shifts of the Beveridge curves. These results are highly robust to changes in the specification (see also columns (2)-(3)). Higher proportions of low-skilled workers also significantly increase the probability of an outward shift of a country's Beveridge curve (see columns (1), (2) and (4)). Inclusion of the variable HIGHSK to capture the effect of greater proportions of high-skilled workers yields the correct sign, but is not statistically significant.

Broadening out from the labour force characteristics, the inclusion of sectoral variables appears to improve the explanatory power of the probit considerably, raising the pseudo-R-squared from below 0.5 to approximately 0.7, as shown by comparison of cols (1) and (2) in Table 3.[24] Three sectors stand out as particularly important, with the coefficients attached to construction (CONSTRN), business services (BUSSVCS) and the non-market sector (NONMKT) all highly significant and negatively-signed. These results indicate that, ceteris paribus, over the 8 countries considered, an above -average employment contraction in these sectors raises the probability of an outward shift of a country's aggregate Beveridge curve. These sectors remain robustly significant to changes in the specification (see also col. (5), which excludes labour force characteristics, and col. (7), which presents unweighted parameter estimates for the sectors, in Table 3) and to changes in sample period.[25] The use of sectoral employment weighting in Table 3 enables a convenient interpretation of the relative magnitude of the coefficients attached to the sectoral variables, though produces some perhaps surprising results - with the estimates suggesting that strong contractions in employment in business services and the non-market sector are just as likely to lead to an outward shift of a country's Beveridge curve as employment losses in the construction sector.[26] While this result appears, at first blush, somewhat hard to comprehend, it

[22] See e.g. Farber (2012) or Sahin et al. (2012) for recent assessments of the effects of the state of the housing market on labour mark labour market outcomes in the U.S.

[23] For example, Fujita and Ramey (2006) discuss the welfare implications for prime-age and young workers. As young workers typically have low-wage, low tenure jobs, displacement has smaller welfare costs that job losses of prime-age workers who tend to work in high-wage, long term jobs.

[24] R-squared statistics are generally not considered as true measures of goodness of fit in binomial models, with their dependence on log likelihood values. However, without attaching too much weight to the exact values reported, they nevertheless provide a helpful shortcut for selecting between specifications, in terms of the additional explanatory power of additional variables.

[25] Results for the shorter sample period 2006Q1 to 2011Q3 or increasing the sample to contain all countries confirm the results in Table 3. These estimates are included in Annex B

[26] Even though parameters of probit regressions can generally not be readily interpreted as marginal effects, here

should be remembered that employment developments in these sectors have taken very different paths over the course of the crisis.

Heavy job losses in the construction sector have been a common feature of euro area labour markets since the start of the crisis. Across the euro area as a whole, construction employment declined by roughly 7% year-on-year - over twice the rate of contraction as in the economy as a whole - at the depths of the crisis; in some countries, losses were higher still. Moreover, employment contractions have tended to be rather longer-lived in construction - as job losses began rather earlier than in other sectors and, in some countries, remain on-going. This has resulted in employment levels well below their pre-crisis peaks in many euro area economies. Part of the downsizing observed is likely to be permanent, reflecting some correction to previously over-expanded construction sectors in some euro area economies. This, coupled with the generally low-skilled nature of construction work, are clear prerequisites for the structural mismatch which underlie an outward shift in the Beveridge curve. Displaced construction workers are unlikely to be readily absorbed into other (less deeply-hit) activities with ease, given the often low- or sector-specific nature of their skills.

While business services - particularly, professional services - also suffered strong employment contractions at the depths of the crisis, in general, the losses were both less deep (with euro area contractions of around 3.3% at the worst point in the third quarter of 2009) and shorter lived. Most euro area countries returned to robust employment growth in this sector by the first quarter of 2010 - with the notable exceptions of France and Spain. In non-market services, employment continued to expand until the first quarter of 2011 in 7 of the 8 euro area countries considered here (i.e., excluding Finland). Given that employment losses tended to be modest in both sectors, it is plausible that the strong positive coefficients estimated on the BUSSVCS and NONMKT variables in Table 3 in fact reflect the strong performance of these sectors in the no-shift countries resulting in a reduction of the probability of an outward shift for the no-shift countries rather than an increase of the probability of an outward shift. Overall this translates into a decrease of relative probability of an outward shift for countries with a strong performance in the business and non-market services compared to countries with an average or below average performance.

4.2 Institutional factors

From the above, it seems that workforce characteristics and the sectoral dimension explain much of the pattern of Beveridge curve movements for the countries in our analysis. Institutional variables - employment protection, the use of temporary contacts; trade union density and effective

we are comparing parameters of the same denomination, rendering comparison possible. Our model suggests that the magnitude of these three parameters is similar.

trade union coverage of collective bargaining arrangements and replacement ratios- which characterise national labour markets are a further set of variables of particular interest to policy makers. From the outset, it needs to be emphasised that institutional variables often do not work well in econometric analyses - due, in large part, to data limitations, such as: short and infrequent series (often annual, at best)[27]; the inherent need for heavy synthesis of complex cross-country indicators in very different institutional settings; lack of temporal variation in slow-moving structural variables, etc.[28] In addition, attempts to group countries by institutional framework often result in unlikely outcomes.[29] These difficulties may lead to low statistical significance in econometric specifications. One set of variables often used in the literature as a leading determinant of cross-country differences in labour market dynamics relates to the degree of employment protection which incumbent workers are afforded. Correlation analysis suggests that variables such as temporary contracts and EPL appear positively correlated with recent strong increases in unemployment in some euro area countries (see Annex C). Strong EPL potentially leads to stickiness in the Beveridge curve relationship - with worker shedding taking place in downsized sectors, but employers reluctant to hire in expanding sectors. In unemployment-vacancy space, the Beveridge curve effectively shifts outwards. Even the best EPL variables tend to be slow-moving and infrequently collated, making them hard to include in our econometric analysis.[30] Only the ratio of temporary contracts in the labour force ("TEMP" in Table 3) provided sufficient variation across time to be useable. However, the results are ambiguous. In the main specification the parameter is insignificant, when included on its own a higher share of temporary workers seem to increase the probability of an outward shift, however, this is contradicted when unweighted sectoral growth rates are included. Further exploratory work showing underlying institutional relationships which could not be tested empirically are discussed in Annex C.

5 Concluding remarks

The labour market consequences of the recent crisis have been heterogeneous across countries and sectors in the euro area. Overall, there are risks that the rise in euro area unemployment

[27] Until recently, the OECD's synthetic indicator of the overall degree of employment protection legislation (EPL) was collated only at yearly intervals; even then, there was often very little variation in overall scores from one year to the next.

[28] While some authors interpret a lack of statistical significance for low explanatory power (see, for instance, Oswald (1997), Bell and Blanchflower (2009), we take issue with this conclusion. In many instances, low explanatory power is likely to be an artifact of both over-compression or -simplification of cross-country distinctions in complex, multilayered variables and the lack of temporal variation.

[29] According to the employment protection legislation categorisation of the OECD, Germany had the same level of employment protection as Italy in 2008 and Ireland had the same level of employment protection for regular employees as Italy in 2008. Similarly, According to the ICTWSS database of the Amsterdam Institute for Advanced Labour Studies, France had the lowest union density rate of all Euro area countries.

[30] Substitution of annual data results in a strong loss of both degrees of freedom and intertemporal variation.

over the crisis may become persistent at both the aggregate euro area level and for some of the constituent economies. Whether the high unemployment rates are due to cyclical factors and a lack of labour demand, or to labour market mismatches, has important policy implications. When unemployment is cyclical and due to a lack of job creation, a recovery in the economy will tend to reduce unemployment. However, if there is a problem of structural mismatch between job vacancies and available workers, a recovery is unlikely to reduce unemployment.

In this paper we find a significant shift in the aggregate euro area Beveridge curve since the onset of the crisis, suggestive of a marked increase in labour market mismatch over the subsequent period. At country level, however, there is considerable heterogeneity. At the extremes, country level differences include significant outward shifts in the Beveridge curves for France and Spain, an inward shift for Germany, while the majority of euro area countries reveal no significant changes in the responsiveness of unemployment to vacancy developments over the course of the crisis. Our results find some evidence also of outward shifts in Ireland, Greece and Cyprus, though for these countries - often still in the grips of recession - the results are less unequivocal given that the Beveridge curves for these countries are generally not-well specified (in terms of a clear inverse relationship between unemployment and vacancy developments).

The results from a Probit analysis, designed to isolate the salient structural features influencing Beveridge curve movements, suggest that labour force characteristics, such as a high proportion of young workers and a smaller proportion of lower-skilled workers in the total labour force, significantly decrease the probability of an outward shift. Sectoral factors - particularly, the heavy employment losses in the construction sector - are also important determinants of observed Beveridge curve shifts.

Attempts to isolate the impact of institutional variables on structural labour market relationships are fraught with difficulties. In part, these problems relate to data limitations (often short and infrequently-collated series; need for heavy synthesis of complex cross-country indicators, etc); in part, it is due to the well-known lack of temporal variation in slow-moving structural variables. These difficulties may lead to low statistical significance in econometric specifications

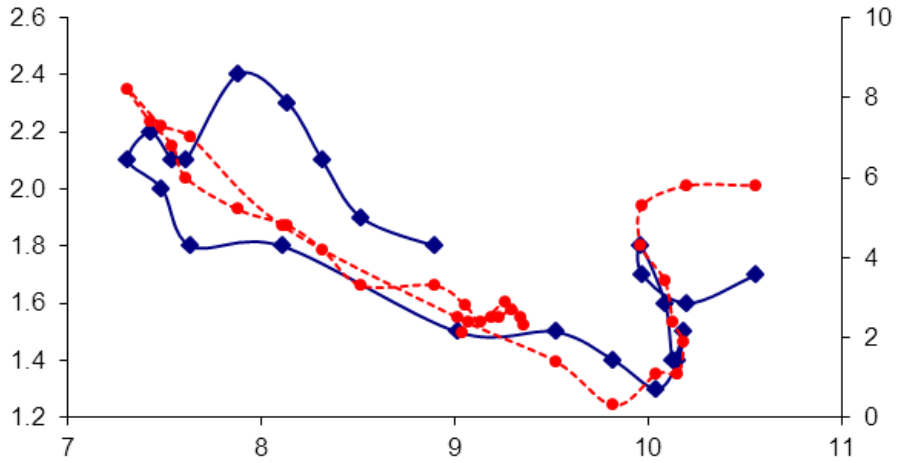
As regards policy, it seems clear that a major force driving the large outward shifts in the Beveridge curves seen for the euro area as a whole, as well as for France and Spain, are the large sectoral declines seen in the construction sector. Where such losses reflect earlier macroeconomic imbalances in advance of the crisis, these job losses are unlikely to be reversed. Some sectoral rebalancing will therefore be required in order to generate employment in alternative sectors. This will - in time - provide the preconditions to absorb some of those workers displaced from permanently downsized sectors. Policy measures will need to target active labour market programmes focusing on the upskilling and re-training of low-skilled workers, so as to equip them with the broader transferable skills necessary to allow for sectoral reallocation.

A Graphical annex

A.1

Figure 4: Beveridge curves for euro area Vacancies versus labour shortages, 2003Q2-2011Q4

(i) euro area



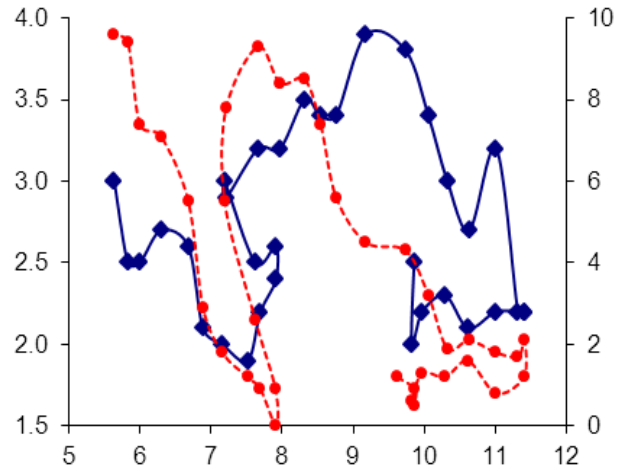
x-axis (all charts) unemployment rate (% of civilian labour force);
y-axis: Eurostat vacancy series (%; left hand scale);
Blue lines: 2003Q2-2008Q1; red lines from 2008Q1 to latest observation
Labour shortages (mean-adjusted diffusion index; right hand scale)
Sources: Eurostat; own calculations.

Figure 4 shows the correspondence between the official Eurostat vacancy rates (continuous blue line) and national series behind EC's monthly surveys of employers' perceptions of labour shortages (dashed red line). Despite (i) the differences in the methods used in the compilation of the various series, (ii) the lack of seasonal adjustment in the Eurostat series and (iii) the rather narrower sectoral coverage of the employers' perceptions (manufacturing only, as opposed to whole economy for Eurostat), the two series produce nevertheless a similar pattern.

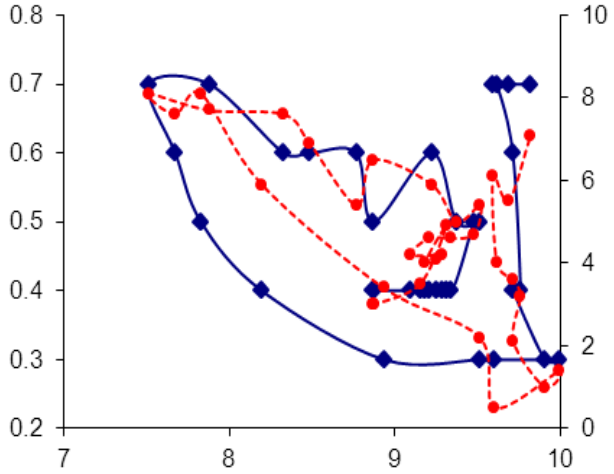
Vacancy rates are Eurostat estimates for non-agricultural economy. Labour shortages from EC surveys of manufacturing employers' perceptions of limits to business from labour shortages. Spanish vacancy data not shown beyond 2009Q4, due to structural break in series. Sources: Eurostat and authors' calculations.

Figure 4 cont.: Beveridge curves for four largest economies
Vacancies versus labour shortages, 2003Q2-2011Q4

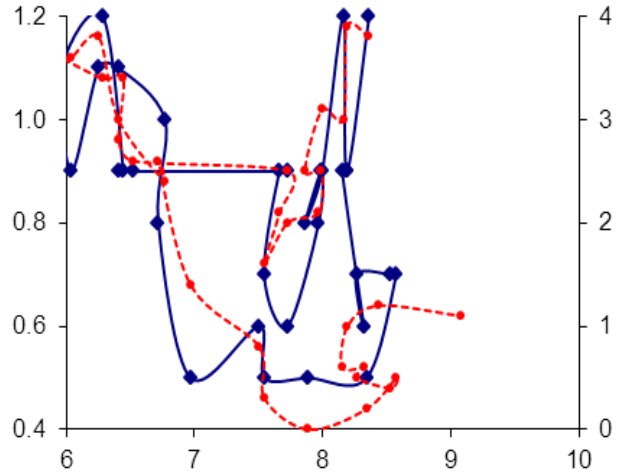
(ii) Germany



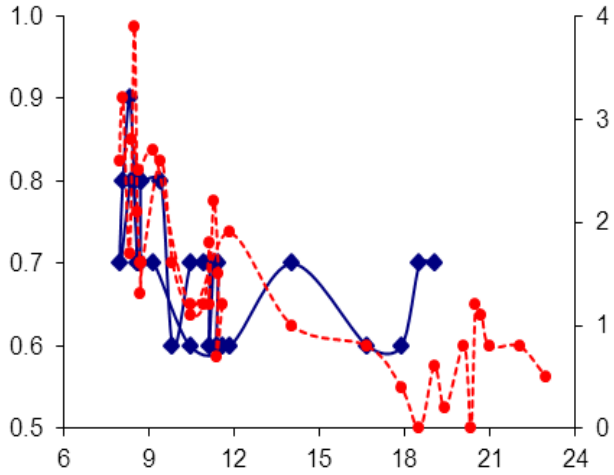
(iii) France



(iv) Italy



(v) Spain



x-axis (all charts) unemployment rate (% of civilian labour force);
y-axis: Eurostat vacancy series (%; left hand scale);
Blue lines: 2003Q2-2008Q1; red lines from 2008Q1 to latest observation
Labour shortages (mean-adjusted diffusion index; right hand scale)
Sources: Eurostat; own calculations.

A.2

Figure 5: Beveridge curves for euro area countries over EMU
x-axis: unemployment rate (% of civilian labour force)
y-axis: Labour shortages (diffusion index, mean-adjusted)
Blue lines: 1999Q1-2008Q1; red lines from 2008Q1 to latest observation*

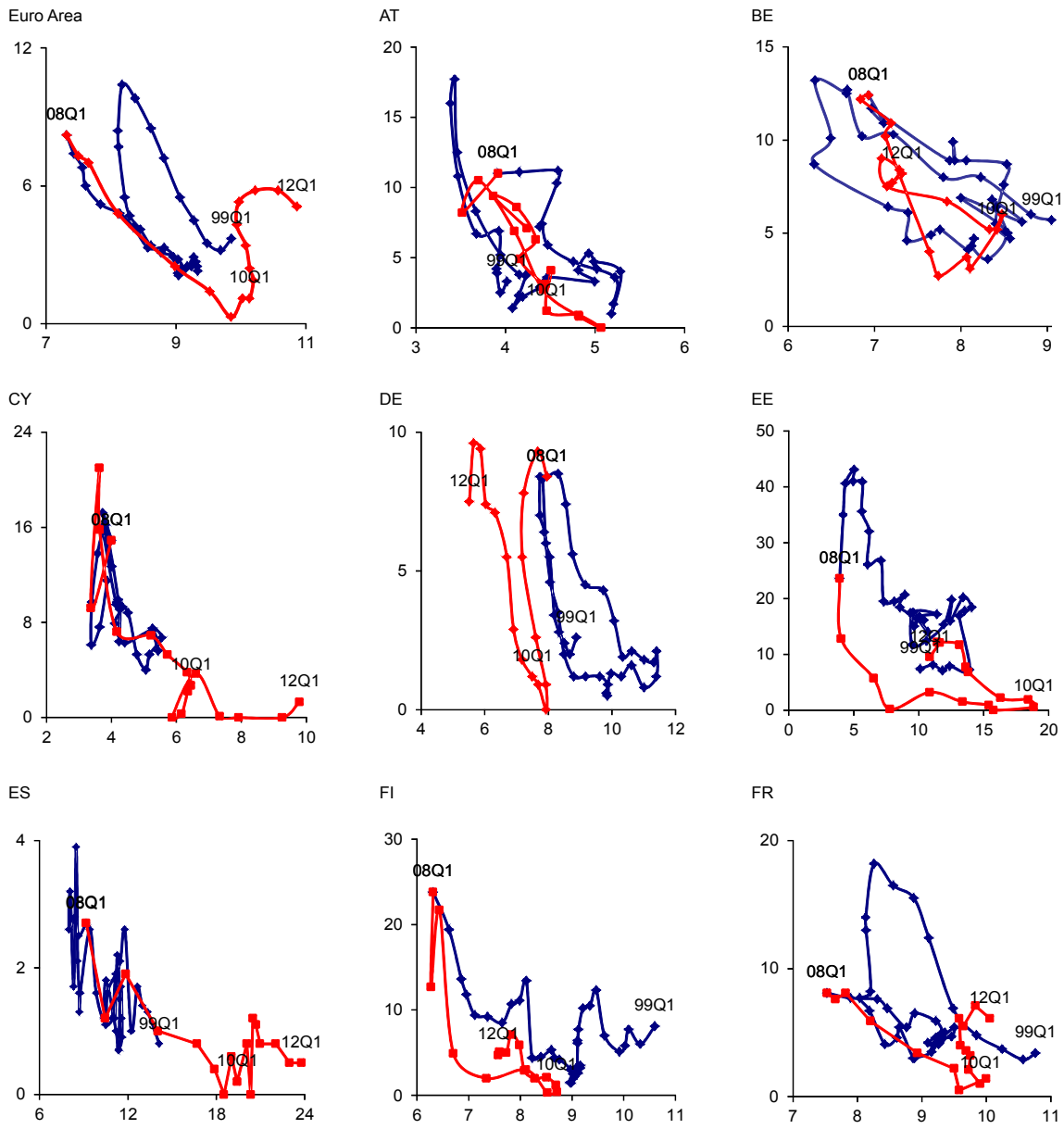
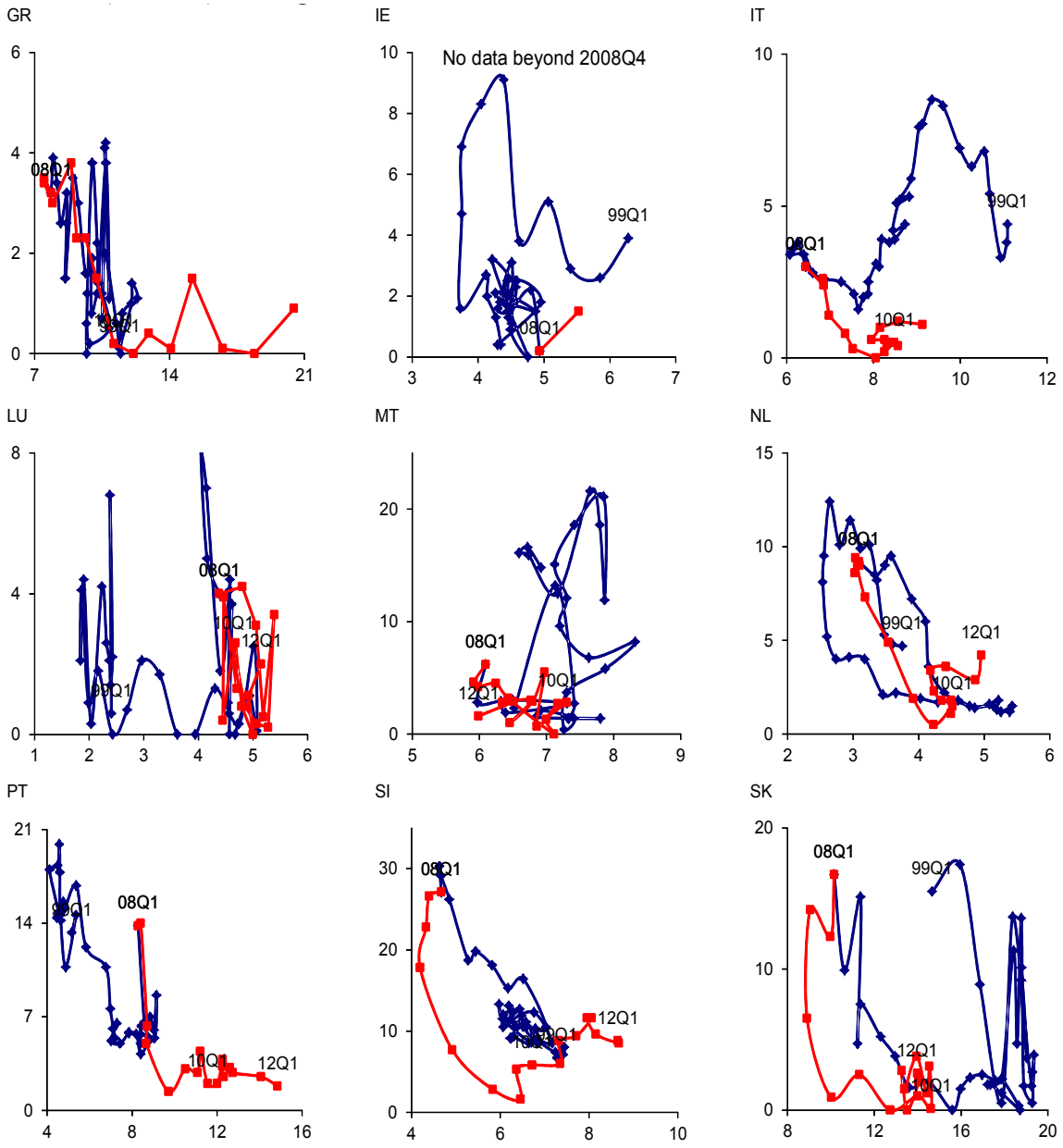


Figure 5 (continued): Beveridge curves for euro area countries over EMU

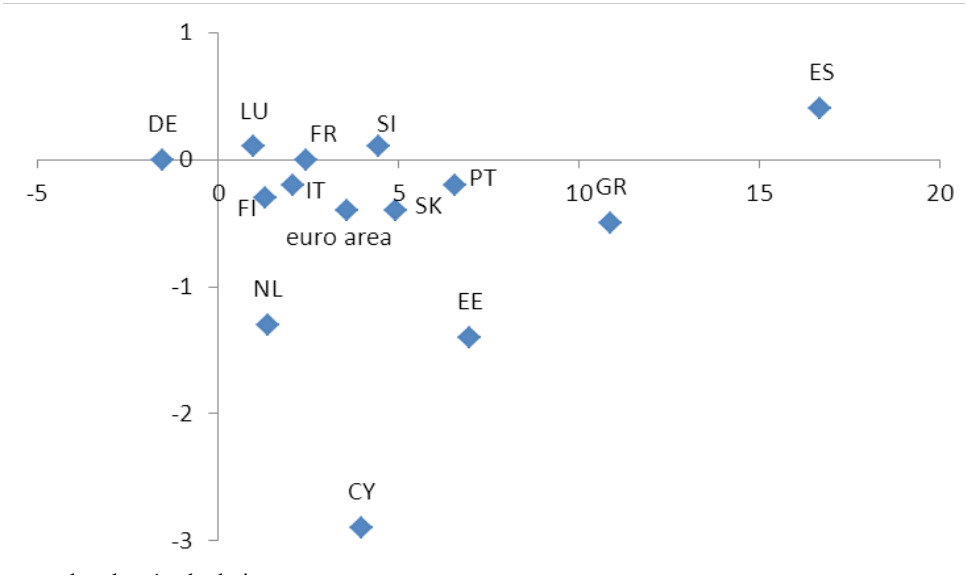


Sources: Eurostat; own calculations.
Notes: Labour shortages from EC surveys of manufacturing employers' perceptions of limits to business from labour shortages. *All countries to 2012Q1, except: Ireland (to 2008Q2); Austria, Estonia, Greece and Italy (to 2011Q4).

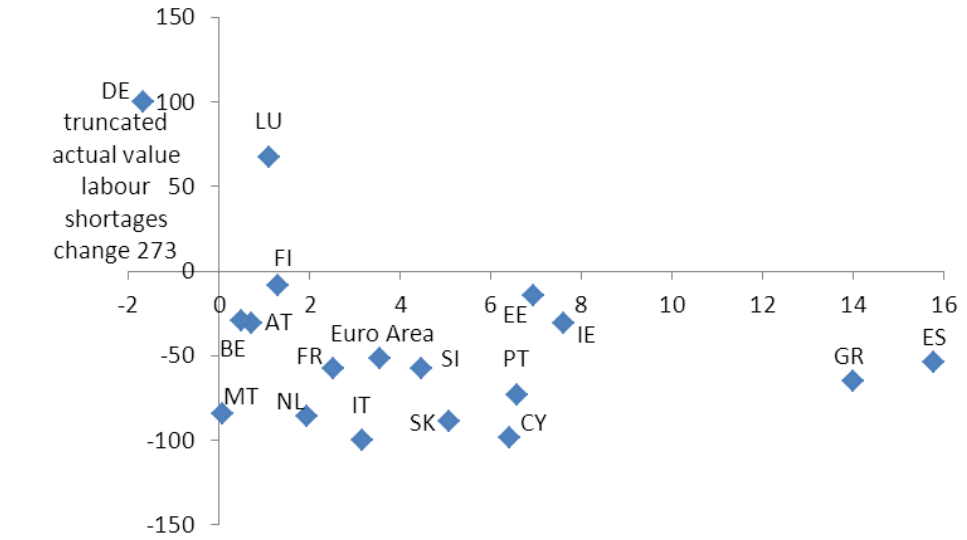
A.3

Figure 6: Beveridge curve type developments since the financial crisis

(i) using Eurostat vacancy rates



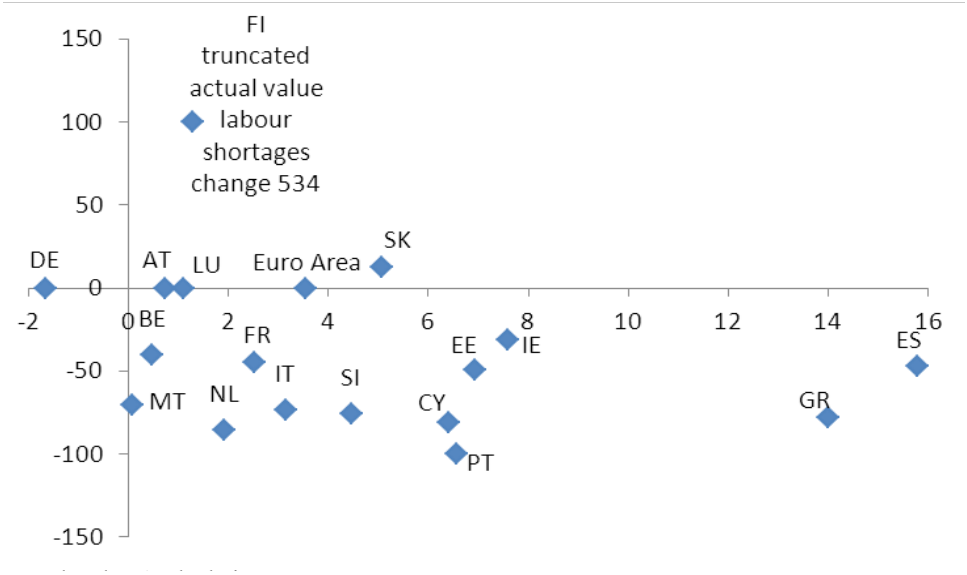
(ii) using labour shortages in construction



x-axis: change in unemployment rate
y-axis: (i) percentage point change in vacancy rate (ii) percentage change labour shortages in construction since the country-specific pre-crisis trough in unemployment rate
Source: Eurostat and authors' calculations
Notes: All changes relate to country-specific movements since pre-crisis unemployment trough. Austria, Belgium, Ireland and Malta omitted due to data limitations.

Figure 6 cont.: Beveridge curve type developments since the financial crisis

(iii) using labour shortages in services



x-axis: change in unemployment rate
y-axis: percentage change labour shortages in services since the country-specific pre-crisis trough in unemployment rate
Source: Eurostat and authors' calculations
Notes: All changes relate to country-specific movements since pre-crisis unemployment trough. Austria, Belgium, Ireland and Malta omitted due to data limitations.

B Econometric annex

Table 4: Beveridge curve estimation using manufacturing labour shortages
Sample period: 1991Q1-2012Q1

Dependent variable: U_t	(1) AT	(2) BE	(3) CY	(4) DE	(5) EE	(6) ES	(7) FI	(8) FR	(9) GR
U_{t-1}	0.81***	0.86***	1.06***	0.89***	0.83***	0.90***	0.82***	0.85***	1.07***
	[0.08]	[0.04]	[0.11]	[0.02]	[0.07]	[0.02]	[0.07]	[0.03]	[0.02]
LS_t	-0.03**	-0.08***	-0.01	-0.10***	-0.08*	-0.41***	-0.06**	-0.05***	-0.1
	[0.01]	[0.02]	[0.03]	[0.01]	[0.04]	[0.11]	[0.03]	[0.01]	[0.06]
LS_t^2	0.00	0.00	0.00	0.01**	0.00	0.16**	0.00	0.00**	0.05*
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.06]	[0.00]	[0.00]	[0.03]
EMU_t	0.02	-0.02	-0.10	0.05	-0.39	-0.65***	-1.10**	-0.19***	0.09
	[0.05]	[0.08]	[0.15]	[0.08]	[0.57]	[0.17]	[0.51]	[0.06]	[0.19]
CRI_t	0.03	-0.03	0.92***	-0.31***	-0.05	1.68***	-0.12	0.18***	0.84***
	[0.09]	[0.09]	[0.23]	[0.11]	[0.54]	[0.20]	[0.14]	[0.06]	[0.10]
$CRI_t * LS_t$	0.00	0.03	0.10	0.02	-0.04	0.48	0.02	0.03	0.02
	[0.02]	[0.02]	[0.08]	[0.02]	[0.04]	[0.29]	[0.01]	[0.02]	[0.06]
$Cons.$	0.79**	1.11***	-0.31	0.83***	1.80**	1.67***	2.57**	1.48***	-0.90***
	[0.36]	[0.37]	[0.48]	[0.18]	[0.72]	[0.38]	[1.10]	[0.36]	[0.32]
$Obs.$	65	85	43	84	60	85	81	81	55
$Prob. > F$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$Adj.R^2$	0.806	0.949	0.938	0.985	0.922	0.992	0.985	0.973	0.987
$RSME$	0.204	0.236	0.388	0.175	0.962	0.410	0.382	0.168	0.324

	(10) IE	(11) IT	(12) LU	(13) MT	(14) NL	(15) PT	(16) SI	(17) SK	(18) euro area
U_{t-1}	1.02***	0.99***	0.98***	0.68***	0.84***	0.94***	0.86***	1.02***	0.89***
	[0.03]	[0.03]	[0.03]	[0.09]	[0.03]	[0.03]	[0.04]	[0.04]	[0.02]
LS_t	-0.09***	-0.03	-0.02	0.01	-0.08***	-0.06**	-0.05***	-0.05	-0.08***
	[0.03]	[0.02]	[0.02]	[0.01]	[0.01]	[0.02]	[0.01]	[0.04]	[0.01]
LS_t^2	0.01	0.00	0.00	0.00	0.01***	0.01*	0.00	0.01*	0.01***
	[0.01]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
EMU_t	0.36	-0.20***	0.08	-0.34**	-0.11	-0.01	0.18*	0.59	-0.16***
	[0.22]	[0.07]	[0.08]	[0.16]	[0.08]	[0.15]	[0.10]	[0.36]	[0.04]
CRI_t	0.45***	0.32*	-0.01	0.27	0.11*	0.02	0.03		0.31***
	[0.13]	[0.17]	[0.09]	[0.47]	[0.07]	[0.14]	[0.16]		[0.07]
$CRI_t * LS_t$	0.27***	0.04	0.06	0.00	0.04*	-0.01	0.01		0.05
	[0.05]	[0.09]	[0.04]	[0.07]	[0.02]	[0.04]	[0.03]		[0.04]
$Cons.$	-0.53	0.22	0.07	2.33***	0.71***	0.42*	0.86***	-0.64	1.05***
	[0.32]	[0.28]	[0.09]	[0.66]	[0.17]	[0.22]	[0.26]	[0.67]	[0.24]
$Obs.$	70	85	85	48	85	85	64	49	85
$Prob. > F$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$Adj.R^2$	0.996	0.980	0.979	0.573	0.982	0.986	0.935	0.971	0.984
$RSME$	0.295	0.226	0.170	0.382	0.161	0.307	0.251	0.555	0.136

Notes: Standard errors in brackets. Standard errors are corrected for autocorrelation using Newey-West procedure. ***, **, * denote statistical significance at 1%, 5% and 10% levels, respectively.

Table 5: Beveridge curve estimation using vacancy rates
Sample period: 2001Q1-2012Q1

Dependent variable: U_t	(1) AT	(2) BE	(3) CY	(4) DE	(5) EE	(6) ES	(7) FI	(8) FR	(9) GR
U_{t-1}	0.24**	0.90***	0.87***	0.98***	0.61***	0.94***	0.98***	0.86***	1.10***
	[0.09]	[0.11]	[0.10]	[0.04]	[0.06]	[0.03]	[0.06]	[0.07]	[0.02]
VR_t	-0.69***	-0.14	-0.17**	-0.39***	-3.32***	-0.85	-0.01	-2.01***	-0.06
	[0.11]	[0.28]	[0.06]	[0.10]	[0.66]	[0.59]	[0.05]	[0.50]	[0.09]
VR_t^2	1.81**	-0.22	0.08	0.00	1.24**	1.30	-0.01	3.68	0.05*
	[0.61]	[0.66]	[0.06]	[0.17]	[0.45]	[1.34]	[0.07]	[2.67]	[0.03]
CRI_t		-0.03	0.73***	-0.15	-1.12*	1.64***	0.16	0.18***	0.89***
		[0.20]	[0.23]	[0.13]	[0.60]	[0.28]	[0.12]	[0.05]	[0.09]
$CRI_t * VR_t$		0.38	-0.03	0.37**	1.36	-0.77	-0.13	1.41***	0.08
		[0.31]	[0.30]	[0.17]	[0.90]	[1.07]	[0.09]	[0.49]	[0.16]
$Cons.$	3.20***	0.82	0.41	0.11	3.95***	0.48	0.04	1.15*	-1.10***
	[0.35]	[0.92]	[0.55]	[0.33]	[0.47]	[0.30]	[0.47]	[0.56]	[0.23]
$Obs.$	13	25	29	35	29	45	41	36	31
$Prob. > F$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$Adj.R^2$	0.677	0.610	0.931	0.986	0.953	0.994	0.942	0.935	0.988
$RSME$	0.193	0.366	0.441	0.215	0.998	0.389	0.211	0.170	0.286

	(10) IE	(11) IT	(12) LU	(13) MT	(14) NL	(15) PT	(16) SI	(17) SK	(18) euro area
U_{t-1}	0.64***	0.94***	0.98***	0.65***	0.90***	0.97***	0.86***	0.69***	0.86***
	[0.03]	[0.05]	[0.04]	[0.16]	[0.03]	[0.04]	[0.05]	[0.11]	[0.07]
VR_t	0.89*	-0.35	-0.55*	-0.11	-0.30***	0.64	-0.57**	-3.87***	-0.40**
	[0.47]	[0.33]	[0.30]	[0.13]	[0.03]	[0.60]	[0.22]	[1.24]	[0.11]
VR_t^2	-6.00	1.03	-0.16	0.13	-0.01	-7.38	-1.08	2.71*	-0.45
	[3.83]	[1.08]	[0.64]	[0.16]	[0.09]	[4.87]	[1.05]	[1.48]	[0.51]
CRI_t		0.23**	-0.06		-0.10	0.13	0.41***		0.27***
		[0.08]	[0.09]		[0.09]	[0.15]	[0.11]		[0.07]
$CRI_t * VR_t$		0.18	1.14***		-0.18	-3.07***	1.01**		-0.17
		[0.71]	[0.32]		[0.13]	[0.93]	[0.48]		[0.37]
$Cons.$	5.28***	0.37	0.16	2.26*	0.47***	0.46	0.83**	4.01**	1.25**
	[0.27]	[0.38]	[0.16]	[1.05]	[0.14]	[0.29]	[0.36]	[1.53]	[0.61]
$Obs.$	13	34	45	13	45	45	45	33	35
$Prob. > F$	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000
$Adj.R^2$	0.965	0.939	0.972	0.256	0.972	0.982	0.920	0.954	0.973
$RSME$	0.252	0.209	0.174	0.322	0.144	0.346	0.304	0.582	0.163

Notes: Standard errors in brackets. Standard errors are corrected for autocorrelation using Newey-West procedure. ***, **, * denote statistical significance at 1%, 5% and 10% levels, respectively. Official vacancy rate data is not yet seasonally adjusted because of the relatively short nature of the series. In this approach we try to adjust for that by regressing the vacancy rate on a set of quarterly dummies and using the residuals as a regressor in the main estimation. Admittedly this method does not a perfect seasonal adjustment but given - as mentioned above - the short series we deem it as good as any other seasonal adjustment approach at this stage.

Table 6: Beveridge curve estimation: "2 Stage approach"
Sample period: 1991Q1-2012Q1

Dependent variable: U_t	(1) AT	(2) BE	(3) CY	(4) DE	(5) EE	(6) ES	(7) FI	(8) FR	(9) GR
U_{t-1}	0.87***	0.89***	0.99***	0.89***	0.75***	0.95***	0.87***	0.89***	1.04***
	[0.06]	[0.04]	[0.12]	[0.02]	[0.06]	[0.03]	[0.03]	[0.03]	[0.03]
$\hat{VR}_t$	-0.22	-0.33	-0.08	-0.94***	-0.92*	0.46	-1.42***	-0.38***	-0.07
	[0.15]	[0.21]	[0.22]	[0.14]	[0.48]	[0.62]	[0.27]	[0.10]	[0.17]
$\hat{VR}_t^2$	-0.05	1.21***	0.07	1.00**	-0.05	4.12	1.64**	-0.31**	-0.13
	[0.38]	[0.43]	[0.11]	[0.40]	[0.29]	[3.43]	[0.67]	[0.16]	[0.29]
CRI_t	0.03	-0.02	0.65*	-0.30***	0.69*	1.39***	-0.06	0.21***	1.15***
	[0.06]	[0.09]	[0.33]	[0.07]	[0.38]	[0.24]	[0.13]	[0.05]	[0.17]
$CRI_t * \hat{VR}_t$	-0.34	0.31	0.23	0.17	-0.74	-2.47**	0.76	-0.32	0.80**
	[0.25]	[0.30]	[0.32]	[0.21]	[0.51]	[0.97]	[0.62]	[0.32]	[0.36]
$Cons.$	0.56**	0.96***	0.05	0.88***	2.60***	0.90*	1.81***	1.24***	-0.45
	[0.28]	[0.33]	[0.60]	[0.16]	[0.68]	[0.51]	[0.41]	[0.30]	[0.35]
$Obs.$	61	85	39	84	60	85	81	81	55
$Prob. > F$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$Adj.R^2$	0.816	0.934	0.929	0.984	0.919	0.991	0.987	0.970	0.988
$RSME$	0.205	0.268	0.413	0.182	0.983	0.441	0.361	0.176	0.316

	(10) IE	(11) IT	(12) LU	(13) MT	(14) NL	(15) PT	(16) SI	(17) SK	(18) euro area
U_{t-1}		0.98***	0.96***	0.69***	0.90***	0.97***	0.84***	1.03***	0.90***
		[0.02]	[0.02]	[0.17]	[0.02]	[0.03]	[0.05]	[0.03]	[0.02]
$\hat{VR}_t$		-0.13	-1.26***	-0.00	-0.47***	-1.72	-2.39***	1.52**	-0.76***
		[0.16]	[0.33]	[0.06]	[0.07]	[1.13]	[0.75]	[0.64]	[0.10]
$\hat{VR}_t^2$		-0.09	5.06***	-0.07*	0.26***	7.44	2.19	-4.18*	0.73***
		[0.27]	[1.78]	[0.03]	[0.09]	[10.81]	[2.47]	[2.27]	[0.19]
CRI_t		0.28	0.05	0.24	0.11**	0.02	0.08		0.30***
		[0.19]	[0.06]	[0.26]	[0.05]	[0.15]	[0.25]		[0.04]
$CRI_t * \hat{VR}_t$		0.02	2.93***	-0.13	0.28**	-1.89	0.75		0.32*
		[0.65]	[0.89]	[0.17]	[0.13]	[2.00]	[1.18]		[0.19]
$Cons.$		0.27	0.07	2.25*	0.41***	0.20	0.95***	-0.58	0.99***
		[0.25]	[0.06]	[1.17]	[0.13]	[0.20]	[0.30]	[0.57]	[0.16]
$Obs.$		85	85	33	85	85	64	49	85
$Prob. > F$		0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000
$Adj.R^2$		0.980	0.982	0.497	0.982	0.984	0.930	0.973	0.985
$RSME$		0.226	0.158	0.363	0.159	0.328	0.260	0.538	0.133

Notes: Standard errors in brackets. Standard errors are corrected for autocorrelation using Newey-West procedure. ***, **, * denote statistical significance at 1%, 5% and 10% levels, respectively. In the first stage the vacancy rate is regressed on 5 lags of labour shortages series $(t, .., t-4)$ and quarterly dummies. This way the effect of a possible delay between identifying shortages of labour and opening a vacancy is reflected and the estimates are somewhat adjusted for seasonal patterns. The predicted values of the vacancy rate (exclusive of seasonality) are then used in the regular estimation. Ireland excluded because of no overlap between labour shortages and vacancy rates.

Table 7: Beveridge curve estimation: auto regressive distributed lag model
Sample period:1991Q1-2012Q1

Dependent variable: U_t	(1) AT	(2) BE	(3) CY	(4) DE	(5) EE	(6) ES	(7) FI	(8) FR	(9) GR
U_{t-1}	0.88	0.85	1.06	0.93	0.83	0.89	0.95	0.87	1.06
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
$\sum_{i=0}^{4} LS_{t-i}$	-0.01	-0.06	-0.02	-0.08	-0.08	-0.48	-0.02	-0.06	-0.13
	[0.26]	[0.00]	[0.58]	[0.00]	[0.11]	[0.07]	[0.17]	[0.00]	[0.12]
LS_t^2	0.00	0.00	0.01	0.01	0.00	0.17	0.00	0.00	0.05
	[0.21]	[0.65]	[0.07]	[0.01]	[0.24]	[0.00]	[0.13]	[0.00]	[0.11]
EMU_t	-0.01	-0.10	-0.29	0.01	-0.33	-0.67	-0.25	-0.19	0.10
	[0.89]	[0.24]	[0.03]	[0.94]	[0.68]	[0.01]	[0.48]	[0.03]	[0.64]
CRI_t	0.04	-0.04	1.21	-0.30	0.00	1.67	0.01	0.19	0.85
	[0.60]	[0.62]	[0.00]	[0.00]	[1.00]	[0.00]	[0.89]	[0.00]	[0.00]
$CRI_t * LS_t$	0.01	0.02	0.15	0.02	-0.02	0.52	0.02	0.05	0.02
	[0.54]	[0.30]	[0.20]	[0.19]	[0.58]	[0.11]	[0.38]	[0.10]	[0.74]
$Cons.$	0.51	1.33	-0.33	0.59	1.72	1.81	0.52	1.34	-0.82
	[0.08]	[0.00]	[0.64]	[0.00]	[0.05]	[0.02]	[0.48]	[0.03]	[0.04]
$Obs.$	61	81	39	81	60	81	77	77	55
$Prob. > F$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$Adj.R^2$	0.815	0.946	0.933	0.985	0.920	0.992	0.989	0.975	0.987
$RSME$	0.206	0.232	0.402	0.165	0.977	0.405	0.330	0.165	0.329

	(10) IE	(11) IT	(12) LU	(13) MT	(14) NL	(15) PT	(16) SI	(17) SK	(18) euro area
U_{t-1}	1.00	0.97	0.99	0.57	0.87	0.97	0.82	1.02	0.94
	[0.00]	[0.00]	[0.00]	[0.05]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
$\sum_{i=0}^{4} LS_{t-i}$	-0.11	-0.02	-0.01	0.00	-0.08	-0.03	-0.06	0.00	-0.05
	[0.01]	[0.40]	[0.91]	[0.96]	[0.00]	[0.19]	[0.00]	[0.98]	[0.00]
LS_t^2	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01
	[0.02]	[0.45]	[0.88]	[0.70]	[0.00]	[0.05]	[0.04]	[0.07]	[0.01]
EMU_t	0.25	-0.30	0.06	-0.17	-0.06	-0.06	0.14	0.60	-0.14
	[0.27]	[0.00]	[0.50]	[0.42]	[0.50]	[0.60]	[0.10]	[0.05]	[0.00]
CRI_t	0.42	0.27	-0.06	0.10	0.11	0.03	0.06		0.27
	[0.00]	[0.16]	[0.55]	[0.83]	[0.16]	[0.81]	[0.60]		[0.00]
$CRI_t * LS_t$	0.25	0.01	0.06	-0.01	0.04	-0.01	-0.01		0.05
	[0.00]	[0.94]	[0.12]	[0.92]	[0.09]	[0.85]	[0.66]		[0.23]
$Cons.$	-0.33	0.44	0.05	1.85	0.53	0.27	1.06	-0.76	0.63
	[0.33]	[0.11]	[0.62]	[0.03]	[0.03]	[0.45]	[0.00]	[0.15]	[0.05]
$Obs.$	66	81	81	48	81	81	64	45	81
$Prob. > F$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$Adj.R^2$	0.996	0.980	0.977	0.614	0.982	0.985	0.944	0.977	0.987
$RSME$	0.259	0.227	0.172	0.363	0.164	0.314	0.233	0.486	0.121

P-values in brackets. In this estimation we include 5 lags of the labour shortage variable $(t, .., t-4)$. This way the effect of a possible delay between identifying shortages of labour and opening a vacancy is reflected. We sum all lags and test for the joint significance.

Table 8: Determinants of shift in the Beveridge curve
Sample period: 2006Q1-2012Q1

Dependent variable: Probability of outward shift Beveridge curve	(1)	(2)	(3)	(4)	(5)	(6)
YOUNG	-1.129**	-0.653**	-0.423***			
	[0.498]	[0.287]	[0.105]			
OLDER	0.636**	0.572***	0.0488			
	[0.314]	[0.203]	[0.0523]			
LOWSK	0.333***	0.258***		0.0814***		
	[0.128]	[0.0917]		[0.0125]		
HIGHSK	-0.297*	-0.249***		0.0106		
	[0.157]	[0.0768]		[0.0286]		
INDUSTRY	-1.657				-0.723	
	[1.963]				[0.688]	
CONSTRN	-8.139***				-3.765***	
	[3.064]				[1.004]	
TRADTRAN	-1.443				0.352	
	[2.061]				[0.699]	
FINRE	-1.246				3.864*	
	[5.457]				[2.206]	
BUSSVCS	-9.003***				-3.656***	
	[2.661]				[0.972]	
NONMKT	-5.622**				-2.822***	
	[2.233]				[0.948]	
TEMP	-0.499**	-0.286**				0.0883***
	[0.242]	[0.142]				[0.0258]
CONSTANT	13.59	4.569	2.957***	-3.311***	-0.464**	-2.160***
	[8.547]	[4.537]	[0.967]	[0.917]	[0.233]	[0.369]
Observations	192	199	200	200	192	199
$Prob. > chi^2$	0.000	0.000	0.000	0.000	0.000	0.000
$PseudoR-squared$	0.765	0.528	0.195	0.315	0.477	0.0680

Note: sectoral variables relate to differential employment losses (i.e., employment growth, multiplied by minus 1, to reflect employment losses as a consequence of recession) in sector j, compared to total employment losses in country i, (that is, $x_{ij} - x_i$), weighted by the average share (averaged over five quarters from current t to $t-4$) of sector j, in the total employment of country i (E_{ij}/E_i). Industry data are de-trended throughout. Figures in brackets are standard errors. ***, ** and * represent significance at the 1, 5 and 10% level, respectively.

Table 9: Determinants of shift in the Beveridge curve: all countries
Sample period: 2002Q1-2012Q1

Dependent variable: Probability of outward shift Beveridge curve	(1)	(2)	(3)	(4)	(5)	(6)
YOUNG	-0.186***	-0.137***	-0.125***			
	[0.0526]	[0.0314]	[0.0265]			
OLDER	-0.101*	0.110***	0.107***			
	[0.0548]	[0.0382]	[0.0277]			
LOWSK	0.0293**	0.0571***		0.0415***		
	[0.0141]	[0.0124]		[0.00814]		
HIGHSK	0.150***	0.157***		0.143***		
	[0.0244]	[0.0215]		[0.0178]		
INDUSTRY	-0.565*				-0.690***	
	[0.303]				[0.228]	
CONSTRN	-2.164***				-2.294***	
	[0.375]				[0.280]	
TRADTRAN	-0.299				-0.676***	
	[0.281]				[0.217]	
FINRE	-0.452				-0.746	
	[0.705]				[0.563]	
BUSSVCS	-2.020***				-1.775***	
	[0.363]				[0.290]	
NONMKT	-1.363***				-1.310***	
	[0.369]				[0.275]	
TEMP	0.0370	-0.0199				0.0278**
	[0.0269]	[0.0198]				[0.0122]
CONSTANT	-3.694***	-7.296***	-1.039***	-6.787***	-1.179***	-1.461***
	[1.250]	[1.191]	[0.396]	[0.776]	[0.0983]	[0.139]
Observations	618	672	673	673	637	672
$Prob. > chi^2$	0.000	0.000	0.000	0.000	0.000	0.024
$PseudoR-squared$	0.550	0.309	0.0861	0.247	0.344	0.0105

Note: sectoral variables relate to differential employment losses (i.e., employment growth, multiplied by minus 1, to reflect employment losses as a consequence of recession) in sector j, compared to total employment losses in country i, (that is, $x_{ij} - x_i$), weighted by the average share (averaged over five quarters from current t to $t-4$) of sector j, in the total employment of country i (E_{ij}/E_i). Industry data are de-trended throughout. Figures in brackets are standard errors. ***, ** and * represent significance at the 1, 5 and 10% level, respectively.

Table 10: Determinants of shift in the Beveridge curve: multinomial logit
Sample period: 2002Q1-2012Q1

Dependent variable: Probability of outward shift Beveridge curve	(1)		(2)		(3)	
	-1	1	-1	1	-1	1
YOUNG	-21.35	-1.878**	-16.53	-2.200***	-0.372**	-0.990***
	[8,812]	[0.745]	[23,429]	[0.507]	[0.182]	[0.192]
OLDER	24.20	0.959**	69.46	1.192***	0.521***	0.276***
	[5,708]	[0.427]	[14,842]	[0.270]	[0.103]	[0.0843]
LOWSK	-2.642	0.344***	-80.85	0.289***		
	[3,826]	[0.115]	[21,610]	[0.0712]		
HIGHSK	-9.706	-0.225	-32.42	-0.445***		
	[2,405]	[0.169]	[6,044]	[0.124]		
INDUSTRY	-148.7	0.0101				
	[30,716]	[2.170]				
CONSTRN	-179.3	7.799**				
	[43,045]	[3.038]				
TRADTRAN	-11.07	3.269				
	[25,452]	[2.472]				
FINRE	-81.09	2.537				
	[47,731]	[6.179]				
BUSSVCS	-35.89	10.40***				
	[19,426]	[3.017]				
NONMKT	-144.4	5.672**				
	[26,799]	[2.727]				
TEMP	-4.473	-0.232	18.13	-0.180		
	[9,496]	[0.192]	[20,038]	[0.110]		
CONSTANT	232.4	10.99	951.2	16.68***	-5.145**	5.371***
	[134,452]	[7.396]	[500,989]	[5.398]	[2.145]	[1.716]
Observations	308		315		316	
$Prob. > chi^2$	0.000		0.000		0.000	
$PseudoR-squared$	0.806		0.704		0.260	

Note: -1 is inward shift and 1 is outward shift, no-shift is reference category. 8 countries included. Sectoral variables relate to differential employment losses (i.e., employment growth, multiplied by minus 1, to reflect employment losses as a consequence of recession) in sector j, compared to total employment losses in country i, (that is, $x_{ij} - x_i$), weighted by the average share (averaged over five quarters from current t to $t-4$) of sector j, in the total employment of country i (E_{ij}/E_i). Industry data are de-trended throughout. Figures in brackets are standard errors. ***, ** and * represent significance at the 1, 5 and 10% level, respectively.

Table 10 cont.: Determinants of shift in the Beveridge curve: multinomial logit
Sample period: 2002Q1-2012Q1

Dependent variable:						
Probability of outward	(4)		(5)		(6)	
shift Beveridge curve	-1	1	-1	1	-1	1
LOWSK	-0.909***	0.0858***				
	[0.243]	[0.0171]				
HIGHSK	-0.00537	0.124**				
	[0.0525]	[0.0541]				
INDUSTRY			-5.214***	1.782		
			[1.559]	[1.113]		
CONSTRN			-3.536*	8.331***		
			[1.871]	[1.807]		
TRADTRAN			0.559	1.026		
			[1.564]	[1.130]		
FINRE			4.372	-4.238		
			[4.285]	[3.445]		
BUSSVCS			-0.837	7.530***		
			[1.341]	[1.755]		
NONMKT			-1.762	6.255***		
			[1.500]	[1.661]		
TEMP					0.00168	0.107***
					[0.0579]	[0.0356]
CONSTANT	10.39***	-8.364***	-3.150***	-1.166***	-2.835***	-3.546***
	[3.816]	[1.972]	[0.610]	[0.383]	[0.747]	[0.543]
Observations	316		320		315	
$Prob. > chi^2$	0.000		0.000		0.014	
$PseudoR-squared$	0.253		0.353		0.0260	

Note: -1 is inward shift and 1 is outward shift, no-shift is reference category. 8 countries included. Sectoral variables relate to differential employment losses (i.e., employment growth, multiplied by minus 1, to reflect employment losses as a consequence of recession) in sector j, compared to total employment losses in country i, (that is, $x_{ij} - x_i$), weighted by the average share (averaged over five quarters from current t to $t-4$) of sector j, in the total employment of country i (E_{ij}/E_i). Industry data are de-trended throughout. Figures in brackets are standard errors. ***, ** and * represent significance at the 1, 5 and 10% level, respectively.

Table 11: Determinants of shift in the Beveridge curve: Tobit
Sample period: 2002Q1-2012Q1

Dependent variable: Size of outward shift Beveridge curve	(1)	(2)	(3)	(4)	(5)	(6)
YOUNG	-0.115***	-0.386***	-0.517***			
	[0.0325]	[0.0554]	[0.108]			
OLDER	0.0585***	0.194***	0.101**			
	[0.0204]	[0.0317]	[0.0407]			
LOWSK	0.0294***	0.0599***		0.0493***		
	[0.00531]	[0.0105]		[0.00879]		
HIGHSK	-0.0126	-0.0644***		0.0572**		
	[0.0109]	[0.0167]		[0.0257]		
INDUSTRY	0.0410				0.222	
	[0.126]				[0.186]	
CONSTRN	0.739***				1.519***	
	[0.142]				[0.252]	
TRADTRAN	0.497***				0.229	
	[0.157]				[0.234]	
FINRE	0.0219				-0.802	
	[0.421]				[0.664]	
BUSSVCS	0.684***				1.188***	
	[0.166]				[0.282]	
NONMKT	0.415**				0.953***	
	[0.175]				[0.276]	
TEMP	-0.00979	-0.0309				0.0814***
	[0.0130]	[0.0216]				[0.0228]
CONSTANT	0.328	2.349***	3.285***	-4.110***	-0.312***	-2.407***
	[0.442]	[0.812]	[0.903]	[1.009]	[0.0947]	[0.466]
Observations	308	315	316	316	320	315
$Prob. > chi^2$	0.000	0.000	0.000	0.000	0.000	0.000
$PseudoR-squared$	0.864	0.604	0.249	0.243	0.555	0.0631

Note: Shifts relative to constant used as dependent variable. Sectoral variables relate to differential employment losses (i.e., employment growth, multiplied by minus 1, to reflect employment losses as a consequence of recession) in sector j, compared to total employment losses in country i, (that is, $x_{ij} - x_i$), weighted by the average share (averaged over five quarters from current t to $t-4$) of sector j, in the total employment of country i (E_{ij}/E_i). Industry data are detrended throughout. Figures in brackets are standard errors. ***, ** and * represent significance at the 1, 5 and 10% level, respectively.

C Institutional factors behind Beveridge curve shifts: an explanatory analysis

Workforce characteristics and sectoral changes clearly explain much of the pattern of Beveridge curve movements for the countries in our analysis. However, there is a further set of variables of particular interest to policy makers - namely, the institutional variables, which characterise national labour markets. Several sets of variables are suggested in the economic literature, including: employment protection and the use of temporary contacts (as a proportion of total employment); trade union density and effective trade union coverage of collective bargaining arrangements and replacement ratios, reflecting the generosity of unemployment benefits (as a ratio of average earnings).

Institutional variables often do not work well in econometric analyses - due, in large part, to data limitations, such as: short and infrequent series (often annual, at best[31]); the inherent need for heavy synthesis of complex cross-country indicators in very different institutional settings; lack of temporal variation in slow-moving structural variables, etc.[32] Given these and associated problems (not least, how best to combine annual observations of institutional features with quarterly data[33]), for the most part, it was difficult to include institutional features directly in our econometric analysis. Only the ratio of temporary contracts in the labour force ("TEMP" in Table 3) provided sufficient variation across time to be useable. This is reported in section 4.2 of the main text. In other cases, it was necessary to take a less quantified approach and instead to seek inferences regarding potential shift factors based on looser correlations between institutional variables and strong rises in unemployment observed in some countries since the start of the crisis.

One set of variables often used in the literature as a leading determinant of cross-country differences in labour market dynamics relates to the degree of employment protection which incumbent workers are afforded. The mechanisms by which employment protection legislation (EPL) are likely to influence Beveridge curve relationships are complex and multi-faceted, but hinge on the premise that EPL affects employers' labour costs, in turn influencing their propensity to hire or post vacancies.[34] Employment protection can take a variety of forms and differs

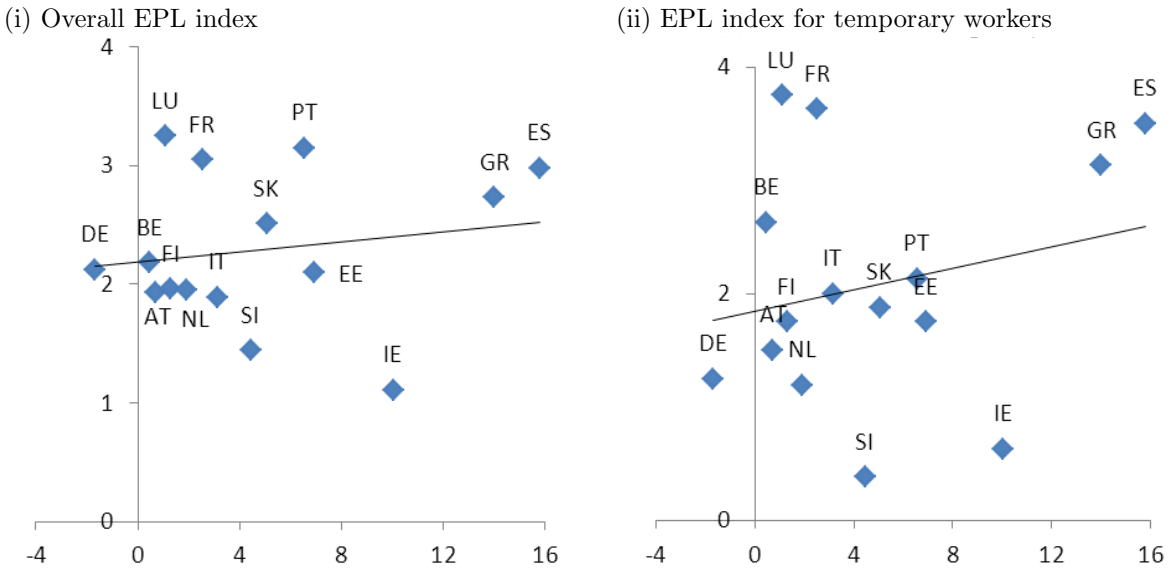
[31] Until recently, the OECD's synthetic indicator of the overall degree of employment protection legislation (EPL) was collated only at yearly intervals; even then, there was often very little variation in overall scores from one year to the next.

[32] While some authors interpret a lack of statistical significance for low explanatory power (see, for instance, Oswald (1997), Bell and Blanchflower (2009), we take issue with this conclusion. In many instances, low explanatory power is likely to be an artefact of both over-compression or -simplification of cross-country distinctions in complex, multilayered variables and the lack of temporal variation.

[33] Substitution of annual data results in a strong loss of both degrees of freedom and intertemporal variation.

[34] On the one hand, by protecting incumbent workers from job losses during recessions, strong EPL could be expected to contain unemployment increases, resulting in relatively muted rightward movements along a given Beveridge curve. On the other hand, as [35] suggest, if firing costs are sufficiently high, aggregate employment -

Figure 7: Correlations of EPL indicators and unemployment increases since the crisis



x-axis: change in unemployment rate since the crisis (pp)
y-axis: OECD employment protection index
Sources: Eurostat, OECD and own calculations.

substantially both in levels and worker coverage across countries. The most widely-used series for analytical purposes is the OECD's

Employment Protection Indicator, which ranks OECD countries on a scale of 1-6, according to the "cost and strictness of regulation on dismissals".[36] Indicators are available on an annual basis for most euro area countries from 1990 to 2008, though with little temporal variation for most countries over the series.[37] The pre-crisis cut-off makes direct use of this indicator impossible in our probit model, but indirect evidence of the influence of EPL on the Beveridge curve components may be gleaned from correlations using relative EPL levels in 2008 to differentiate country experiences.

and vacancies posted - may be lower (and unemployment higher) than in the absence of EPL. These two effects are likely to cause a flattening (change in the slope) of the Beveridge curve, and perhaps an outward shift.

[36]The OECD's Employment Protection Indicator estimates cross-country differences in employment protection legislation (EPL) across a number of different contractual types. In consequence, several versions of the index are available, including an overall index, summarising the general level of employment protection in a country, as well as separate versions for "regular" employees (i.e., those with open-ended contracts) and for those covered by temporary contracts. For the euro area countries covered (all, except Malta and Cyprus), the OECD's "overall" version of the indicator ranges from 1.1 for Ireland to 3.3 for Luxembourg (on a scale of 0-6) in 2008. Euro area countries in the top third of the distribution (with the strictest EPL) include France, Spain, Portugal and Greece, while the third with the lowest EPL include Ireland, Slovakia, Italy, Austria and the Netherlands. Taking only the indicator for employees with "regular" (open-ended) employment contracts, however, dramatically alters the position of some countries, with Greece jumping to the category of lowest protection and the Netherlands to the highest.

[37]For most countries, only one or possibly two changes are visible in the indicator over the almost 20 years of the series.

Figure 7 depicts the correlations between EPL strictness in 2008 and increases in unemployment rates since the crisis. Figure 7(i) shows a weak positive correlation between EPL strictness and unemployment increases using the OECD's "overall" EPL index (that is, for all workers, regardless of contract type), while Figure 7(ii) suggests that the relationship is rather stronger in those countries where even temporary(?) workers are afforded some EPL coverage once a certain employment duration has been reached. In terms of Beveridge curve developments, where EPL is high even for temporary workers, employers may be reluctant to hire until a recovery of output demand is well-established. This slows down the reallocation process necessary to reabsorb displaced workers in downsized sectors and thus keeps unemployment high. (The Beveridge curve shifts outwards since worker shedding taking place in downsized sectors is not matched by hiring in expanding sectors.)

Additional tentative evidence can be found by running our baseline Beveridge curve regression again but this time in panel format; grouping countries by their level of employment protection in 2008 (see table 12 columns 1-3). We see that countries with relatively low EPL (less than 2.5) exhibit no shift while countries with a higher EPL exhibit both an outward shift as well as a slope change (albeit at a 10% level for the medium EPL countries. It should, however, be noted that this estimation is very restrictive in a number of aspects and the results should therefore be treated with caution. First, estimating a panel regression forces every country in a certain group to have the same Beveridge curve shape (the position can be different because of country specific effects) and the same unemployment persistence. Eye-balling the actual Beveridge curves already shows that this is unlikely to be true, both the slope of the Beveridge curves and the speed of adjustment of unemployment are very different between countries. Second, even though countries can be grouped according to EPL, these groups are highly arbitrary. Raising or lowering a certain bound renders different groups since almost all Euro area countries fall roughly in the range 2 to 3.5. France would for instance fall into the medium EPL category if that category would range from 2.5 to 3 inclusive. However, this would not radically change the results. Finally, estimations based on a small number of countries tend to be unreliable as panel estimations typically assume the cross sectional dimension to be large.

Trade union density and coverage is often assessed as a reflection of the degree of centralisation of collective wage bargaining agreements.[38] A good source of harmonised data on trade union representation is provided by the Database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts (ICTWSS database), collated by the Amsterdam Institute for Advanced Labour Studies (AIAS). The data are available on an annual basis only, but cover much of the period of interest to this inquiry - namely, from 1990 to 2011, and

[38]One important point of note is the distinction between the notions of trade union density (that is, the card-carrying members of a given organisation) and trade union coverage (the latter capturing the effective extension of wage agreements to non-union members working in firms and sectors where collective bargaining is the norm).

Table 12: Beveridge curve shift panel estimation
Sample period: 1991Q1-2012Q1

Dependent variable U_t	(1) low EPL	(2) medium EPL	(3) high EPL	(4) low u-cov	(5) medium u-cov	(6) high u-cov
U_{t-1}	0.892***	0.990***	0.900***	0.921***	0.889***	0.851***
	[0.017]	[0.014]	[0.010]	[0.026]	[0.020]	[0.008]
LS_t	-0.060***	-0.064***	-0.081***	-0.080***	-0.024***	-0.072***
	[0.010]	[0.009]	[0.010]	[0.020]	[0.007]	[0.005]
LS_t^2	0.002***	0.003***	0.006***	0.002***	0.001	0.004***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
EMU_t	-0.154	-0.010	-0.426***	-0.025	-0.100*	-0.512***
	[0.108]	[0.060]	[0.048]	[0.218]	[0.060]	[0.036]
CRI_t	0.092	0.289***	0.624***	0.138	0.080	0.468***
	[0.127]	[0.038]	[0.050]	[0.369]	[0.065]	[0.029]
$CRI_t * LS_t$	-0.012	0.030*	0.055***	-0.017	-0.013	0.030***
	[0.014]	[0.016]	[0.019]	[0.029]	[0.014]	[0.008]
$Cons.$	0.910***	0.053	1.056***	0.729**	0.739***	1.487***
	[0.172]	[0.131]	[0.104]	[0.323]	[0.121]	[0.084]
$Obs.$	404	368	332	176	340	623
$Numberofcountries$	6	5	4	3	5	8
$Prob. > chi^2$	0.000	0.000	0.000	0.000	0.000	0.000

Note: Standard errors in brackets *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
Note: Arellano-Bond estimator used because of lagged dependent variable. Only one lag used as instrument because of possible over identification.
EPL classification: Low ($EPL \leq 2.5$); AT, EE, FI, IE, NL, SK; medium ($2.5 < EPL < 3$); BE, DE, GR, IT, SI; high ($3 \leq EPL$); ES, FR, LU, PT. For CY and MT no EPL observations are available.
Union coverage: low ($UC \leq 50\%$) EE, IE, SK; medium ($50 < UC \leq 75$); PT MT CY LU DE; high ($75 < UC$) IT NL ES FR FI SI BE AT. For GR no observations available.

thus include the crisis episode. At a country level, data are available for all euro area countries except Greece. However, the categorical nature of the data makes it difficult to include in econometric analysis. The two variables that are quantitative (union density and union coverage) are slow moving and are only reported yearly. These two variables therefore unfortunately fail to return any significant results when included directly into our Probit analysis. Again, used in a panel setting gives some indication of the effect of union coverage on Beveridge curve movements (see table 12 columns 4-6), with all the cautionary comments of the previous paragraph equally applicable. We see some evidence that countries with a high union coverage ratio are more likely to have experienced an outward shift of the Beveridge curve. It is important to note that the effect of union density/coverage on the Beveridge curve does not necessarily have to run through the wage channel. Too high wage demands probably lead to higher unemployment but they also lead to less vacancies which would result in a movement along the the Beveridge curve rather than a shift of the Beveridge curve.[39] It is therefore more likely that union density/coverage

[39]Union coverage is, as mentioned, often assessed as a reflection of the degree of centralisation of collective wage

has an effect on the sectoral reallocation or lack thereof, which leads to sectoral mismatch in the event of a shock.

Finally, we tried the replacement ratio, which reflects the generosity of unemployment benefits relative to wages, based on OECD indicators from the Directorate for Employment, Labour and Social Affairs. In contemporaneous form, this failed to show any significant effect. Part of the apparent failure of this variable isprobably due to a lack of intertemporal variation; but part is also likely due to inherent inertia - and stickiness - in the wage bargaining process. In the euro area, wage agreements tend to be negotiated for a relatively long period (typically, 18 months plus), and it is thus plausible that the effective lag structure of such developments was not adequately captured by the inclusion of contemporaneous versions of these variables. Undoubtedly, further investigation of this aspect would be helpful.

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bargaining agreements and therefore a measure of inefficiency in the labour market. Setting an inefficient wage would of course affect the position of the Beveridge curve but given that union coverage is a slow moving variable it is not likely that it has an effect on shifts off the Beveridge curve in the event of a shock.

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