

Hogrefe, Jan; Sachs, Andreas

Working Paper

Unemployment and labor reallocation in Europe

ZEW Discussion Papers, No. 14-083

Provided in Cooperation with:

ZEW - Leibniz Centre for European Economic Research

Suggested Citation: Hogrefe, Jan; Sachs, Andreas (2014) : Unemployment and labor reallocation in Europe, ZEW Discussion Papers, No. 14-083, Zentrum für Europäische Wirtschaftsforschung (ZEW), Mannheim,
<https://nbn-resolving.de/urn:nbn:de:bsz:180-madoc-373002>

This Version is available at:

<https://hdl.handle.net/10419/103548>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Discussion Paper No. 14-083

Unemployment and Labor Reallocation in Europe

Jan Hogrefe and Andreas Sachs

ZEW

Zentrum für Europäische
Wirtschaftsforschung GmbH

Centre for European
Economic Research

Discussion Paper No. 14-083

Unemployment and Labor Reallocation in Europe

Jan Hogrefe and Andreas Sachs

Download this ZEW Discussion Paper from our ftp server:

<http://ftp.zew.de/pub/zew-docs/dp/dp14083.pdf>

Die Discussion Papers dienen einer möglichst schnellen Verbreitung von neueren Forschungsarbeiten des ZEW. Die Beiträge liegen in alleiniger Verantwortung der Autoren und stellen nicht notwendigerweise die Meinung des ZEW dar.

Discussion Papers are intended to make results of ZEW research promptly available to other economists in order to encourage discussion and suggestions for revisions. The authors are solely responsible for the contents which do not necessarily represent the opinion of the ZEW.

Unemployment and labor reallocation in Europe*

Jan Hogrefe**

Andreas Sachs***

ZEW Mannheim

ZEW Mannheim

October 20, 2014

Abstract

We ask whether sectoral shocks and the subsequent labor reallocation are responsible for unemployment within selected European economies. Our measure of sectoral labor reallocation is adjusted for aggregate influences and the remaining variation is linked to unemployment in country specific dynamic models. For Spain, the ADL-model estimation reveals a significant impact of sectoral reallocation on unemployment that goes beyond usual business cycle patterns. In Italy, there is weaker yet detectable evidence for this mechanism. In Ireland, Portugal and France, no significant influence of sector level shocks on unemployment is found. The results emphasize the potential structural supply side policies have for reducing unemployment in Spain.

JEL-Classification: E24, J62, J64

Keywords: unemployment, sectoral shocks, labor reallocation, Europe

*We are grateful to Peter Winker for very helpful comments on an earlier version of this paper.

**Centre for European Economic Research (ZEW), L7 1, 68161 Mannheim, Germany, e-mail: hogrefe@zew.de.

*****Corresponding author:** Centre for European Economic Research (ZEW), L7 1, 68161 Mannheim, Germany, e-mail: sachs@zew.de.

1 Introduction

More than five years from the start of the Great Recession, employment in the euro area still has not recovered. Compared to 2008, aggregate employment in the euro-12 countries was lower by over five million people in 2013 and unemployment is at historic highs. While there are important differences across countries, out of the euro-12 economies 8 have not yet made up for the employment lost since 2008. Observers such as the European Central Bank attribute an important part of this negative employment experience to reallocation frictions (European Central Bank, 2012). Given unbalanced growth across sectors before the crisis, they attribute the employment slack in the subsequent bust to mismatch between the skills of the workers set free in declining industries and the jobs demanded in more viable ones. With skill-mismatch being one possible issue, looking at frictions stemming from sectoral reallocation more generally is of crucial importance from a policy perspective. The reason is straight forward: If subdued employment growth and high unemployment are mainly due to weak aggregate demand, monetary or fiscal policy may have a lever to stimulate demand and lift employment. However, with structural issues such as reallocation of workers as a result of sector specific shocks at play these policies are of limited help. Instead, supply side measures such as active labor market policies are in order to remove the structural obstacles to labor market recovery. In the United States, this important discussion is well under way. Some researchers tend to conclude in favor of the aggregate demand explanation (Farber, 2012; Rothstein, 2012; Ball et al., 2013). Others present evidence for structural impediments and mismatch (Estevão and Tsounta, 2011; Mulligan, 2011; Kocherlakota, 2010). However, the topic does not yet feature equally prominently on the European agenda.

In this paper we make reference to a traditional concept of sectoral reallocation and seek to stimulate the current European debate. We contribute an analysis using a modern version of the traditional measure of sectoral reallocation presented in Lilien (1982) and link it to unemployment. Reallocation is measured as the weighted standard deviation of sectoral employment growth rates in an economy. The intuition behind this simple measure is the following. Given all sectors grow at an equal rate, there will be no reallocation and, hence, the standard deviation will be zero. At the same time, there is less concern for friction in the labor market dragging on employment. If, however, employment grows unequally across sectors, the corresponding shift of workers into new sectors

of employment is likely accompanied by frictions, leading to aggregate unemployment. Our analysis picks up this idea and links unemployment developments to Lilien’s measure of sectoral reallocation in selected euro area economies. Specifically, we focus on a set of relatively deeply troubled economies (Portugal, Ireland, Italy, Spain) and include France for comparison.¹

In our analysis we recognize an important limitation to Lilien’s initial measure and adjust it accordingly. Among others, Abraham and Katz (1986) pointed out that simply using the weighted standard deviation of employment growth across sectors can be largely misleading. If sectors react differently to aggregate shocks, the patterns of sectoral employment growth rates in the economy could be observationally equivalent to employment being driven by sector specific shocks. In fact, it is likely that sectors adjust differently to aggregate shocks, leading to a “normal” pattern of divergence in sectoral employment growth across sectors. This matters for policy conclusions as well in that heterogeneous reactions to aggregate shocks across sectors could still lead to frictional unemployment - yet this type of unemployment would see aggregate demand stimulus as a possible cure. Our aim is to single out the impact of sector level shocks. We thus take this concern seriously and purge Lilien’s measure from aggregate effects before employing it in our econometric exercise.² While there are various other (sometimes similar) ways to measure sectoral reallocation, we use the adjusted Lilien measure as it allows a simple but reliable illustration of sectoral reallocation. Other measures based on stock market indices or VAR models might also be considered. Limitations in data quality and availability forced us to neglect this issue, although such measures might be equally suitable compared to the purged Lilien measure (see Gallipoli and Pelloni (2013) for a profound analysis of various alternative methods to approximate sectoral reallocation).

In the end, with a valid measure of sectoral reallocation, we can investigate what role sectoral shocks played for unemployment in several euro area countries over the last decade. If unemployment surges correlate with increases in (purged) sectoral reallocation, we consider this evidence for frictional issues due to labor reallocation stemming

¹Limitations to reliable data preclude us from looking at Greece. A comparison with Germany, on the other hand, is difficult since the German economy showed a distinctly different trajectory of unemployment, the causes of which are themselves intensely discussed, for instance in Dustmann et al. (2014) and Burda and Hunt (2011).

²For in-depth discussions of the Lilien approach and how to deal with its shortcomings, see Gallipoli and Pelloni (2013) and Rissman (1997).

from sectoral shocks. Moreover, this type of mismatch unemployment might well be more persistent than unemployment caused by shortfalls in aggregate demand. In this paper, we estimate this relationship and link the patterns of the estimated correlation to how different countries fared in terms of unemployment changes in the recent economic turmoil. Importantly, we construct our analysis within a model that controls for aggregate influences on unemployment. That is, we filter out movements of unemployment over the business cycle and only link the remaining variation to sector level shocks. In particular, we control for the depth of a recession and for sectoral reallocation of labor stemming from typical adjustment patterns across industries to aggregate shocks.

We find sectoral reallocation to be most strongly and significantly correlated with unemployment in Spain. It seems that the Spanish economy is undergoing sector level restructuring needed to equilibrate employment growth across sectors. This raises the possibility that its recent dismal labor market is – at least in part – linked to structural frictions. For Italy, there is some evidence pointing at sectoral reallocation being linked to unemployment, but the relationship is somewhat weaker. Given the absence of a significant link in the other economies, we infer that aggregate demand shortfalls seem to matter most for their unemployment record.

Our paper is embedded into several strands of literature. First, it connects to the discussion on the long-term consequences of economic and financial crises. If sectoral reallocation due to pre-crisis unbalanced expansion is a main factor, the corresponding frictions are likely to limit potential employment and, hence, potential output as well. Using a methodology similar to Cerra and Saxena (2008), Furceri and Mourougane (2012) present international evidence on the long-term effects of crises on potential output through long lasting drag on labor supply and deterioration of the capital stock. Bernal-Verdugo et al. (2012) directly link high and persistent unemployment to the occurrence of financial crises across countries.

A second major strand of the literature directly analyses the different types of mismatch that can result from sectoral reallocation.³ Skill-mismatch – defined as the gap between the skills of labor supply and demand at an aggregate level – is prominently discussed in a study by the European Central Bank (2012), where an indicator of skill-

³We focus our discussion on a macroeconomic interpretation of skill-mismatch. For studies on individual level skill-mismatch, often interpreted as a bad match of qualifications and occupational tasks, see Liu et al. (2012), Desjardins and Rubenson (2011), and Leuven and Oosterbeek (2011).

mismatch is significantly related to unemployment across Europe. Estevão and Tsounta (2011), as well as Estevão and Smith (2013), show U.S. unemployment fluctuations to significantly correlate with skill-mismatch indicators and infer that structural impediments slow down the U.S. labor market recovery. Besides skill-mismatch, researchers have investigated regional mismatch due to limited regional mobility, possibly related to low house prices, but the picture is yet to be completed (Farber, 2012; Rothstein, 2012; Estevão and Tsounta, 2011). We maintain that ultimately sectoral reallocation is linked to these types of mismatch in that it is often referred to as the cause of mismatch to arise in the first place. We thus believe that a study of sectoral reallocation potentially captures a variety of different types of mismatch frictions.

Third, we also place our paper in the middle of a recently revived discussion of how to best estimate the relationship between economic growth and unemployment – the so-called Okun’s law (Okun, 1962). Estimating the impact of changes in aggregate output on unemployment is key to specifying a model in which to discuss sectoral reallocation. It is crucial to have a valid model of aggregate demand influences in order to subsequently draw conclusions on possible structural issues negatively affecting employment. Several features have recently been highlighted. Lee (2000) and Ball et al. (2013) emphasize the importance to estimate country specific models because of institutional and other country specific effects that make one particular economy’s experience after a shock seldom resemble the average across a group of countries. A case in point is the study by Pissarides (2013), which finds large unexplained variation in unemployment across OECD countries in a cross section of recession-time economic fluctuations. Using country specific estimates of the impact output fluctuations have on employment as in Ball et al. (2013), most of the unexplained variation vanishes, however. Author’s such as Knotek (2007) and Cazes et al. (2013) have additionally pointed out that the coefficient on output in the Okun equation varies over time with an increasing coefficient leading to an underestimation of the employment response to output declines in the Great Recession. However, our sample is restricted to a single decade, which we think limits this concern and leads us to assume zero time variation in the Okun coefficient, i.e. sticking to the standard model. Finally, some author’s such as Virén (2001) and Chinn et al. (2013) advocate non-linear specifications of Okun’s law, with coefficients depending on the state of the economy – e.g. a positive or negative output gap. Yet, non-linearity may well be country specific and is likely to depend on the time period chosen (Ball et al., 2013). From a technical point,

the limited number of observations in our sample makes it infeasible to reliably test for nonlinearity.⁴ We implemented these tests which appeared to be highly sensitive to the chosen test specification.

This paper is organized as follows. In the next section, we provide details on the sources and construction of the elements of our estimation exercise. We also describe our modelling choices and present our preferred specification in which to link employment and reallocation measures. Subsequently, we present our results in section 3 and discuss their interpretation and robustness in section 4. After taking a closer look at the Spanish labor market in section 5, we conclude in section 6.

2 Data and Model Specification

Specifying a suitable model of unemployment fluctuations that captures both aggregate influences and sectoral reallocation requires two main elements. First, we will describe our main variable of interest: the sectoral reallocation measure. Second, we will lay out the details for our general model, which is a modern version of Okun's law. We treat these two elements in order – after a brief introduction to the data used.

2.1 Data

We source our data on seasonally adjusted quarterly real GDP from the OECD Quarterly National Accounts, while quarterly data on unemployment in absolute values stem from the Eurostat database.⁵ The construction of our measure for sectoral reallocation requires sectoral employment data with sufficient coverage both over time as well as across countries. We rely on sectoral employment values for 10 sectors from the OECD Quarterly National Accounts. Given the need for sector level data on employment, our sample starts in Q1 2004 and covers the 41 quarters through Q1 2014. The time period is also chosen with a focus on the recent economic turmoil. We wish to include sufficient time periods,

⁴See, for instance, Teräsvirta (1994) or van Dijk et al. (2002) on the requirements for nonlinearity tests.

⁵An alternative to using seasonally adjusted data is modelling seasonal dummies together with the original series. We do not follow this route since then the number of degrees of freedom would be further reduced.

yet avoid having blurred our results by long periods of little to no reallocation and trend growth in unemployment figures. Ultimately, we would like to interpret our findings in light of the recent crisis and hence choose a period that sufficiently reflects its influence. Finally, money growth required for purging the Lilien measure is growth of M1 and stems from the ECB. For all time series not seasonally adjusted, we perform the $X - 11$ seasonal adjustment method.

2.1.1 Measuring sectoral reallocation

Lilien (1982) has been the first to assign a prominent role to sectoral demand shifts among the causes of unemployment. The intuitive idea is that differences in labor demand across sectors require labor shifts from some sectors to others. If reallocation frictions, e.g. restricted geographic mobility or skill-mismatch, hamper the instantaneous reallocation of labor across sectors, aggregate employment is detrimentally affected. Lilien's original measure for sectoral reallocation is the weighted standard deviation of employment growth rates across sectors:

$$\sigma_t = \sqrt{\sum_{i=1}^I \frac{e_{i,t}}{e_t} \left[\Delta \ln(e_{i,t}) - \Delta \ln(e_t) \right]^2} \quad (1)$$

In equation (1), $e_{i,t}$ is employment in sector i at time t , and $e_t = \sum_{i=1}^I e_{i,t}$ is aggregate employment. This original measure has been criticized for being insufficient to causally identify sectoral shocks as main drivers of aggregate unemployment. Most prominently, Abraham and Katz (1986) argued that sectors are likely to react heterogeneously to aggregate shocks, which in turn generates a positive correlation between unemployment and the measure for sectoral reallocation. That is, sectoral reallocation can have aggregate causes and the unemployment outcome is possibly observationally equivalent to a situation in which sectoral shocks drive unemployment.

As a remedy, Abraham and Katz (1986) suggest to purge the sectoral employment series from aggregate demand influences. Following this idea, many researchers have tried to take account of the differential responses of sectoral employment to aggregate shocks. Samson (1990) and Mills et al. (1995), among others, use expected and unexpected money growth to purge the sectoral reallocation measure from aggregate influences. Mills et al.

(1996) extend the approach and purge relative sectoral employment by regressing it on a variety of explanatory factors, and Abraham and Katz (1986) use step-wise purging methods – which are criticized for over-purging, however. Gallipoli and Pelloni (2013) provide a summary of different approaches.

Following Mills et al. (1995), we implement a parsimonious yet practical specification and purge the original Lilien measure by regressing sectoral relative employment growth on GDP (y) growth and money (M) growth to capture aggregate demand influences. We subjectively chose a lag length of 2 since additional lags do not change the results. More specifically, we estimate

$$\Delta \ln(e_{i,t}) - \Delta \ln(e_t) = c + \sum_{s=0}^2 \Delta \ln(M_{i,t-s}) + \sum_{s=0}^2 \Delta \ln(y_{i,t-s}) + \xi_{i,t} \quad (2)$$

In this model we capture the “usual” deviation from average employment growth that emerges across sectors due to different absorption patterns. In order to calculate the measure of sectoral reallocation, we take the predicted residual series and aggregate it as follows:

$$\tilde{\sigma}_t^2 = \sum_{i=1}^I \frac{e_{i,t}}{e_t} \xi_{i,t}^2 \quad (3)$$

Our resulting measure approximates the intensity of sectoral reallocation above what the usual response across sectors to aggregate shocks implies. That is, we are now capturing the specific impact of sectoral shocks for unemployment in the economy. Figure 1 shows the cross-country average of the purged measure of sectoral reallocation for our sample. Not surprisingly, the crisis is clearly visible as a stark increase in unbalanced sector level employment growth. With our measure of sectoral reallocation at hand, we can proceed and specify a model of unemployment in which to include it.

2.2 Specifying a model of unemployment

Okun’s law describes a statistical relationship between labor market performance, usually measured by employment or unemployment, and aggregate output. In the following, we focus on unemployment and GDP as the relevant variables. Okun (1962) documented this

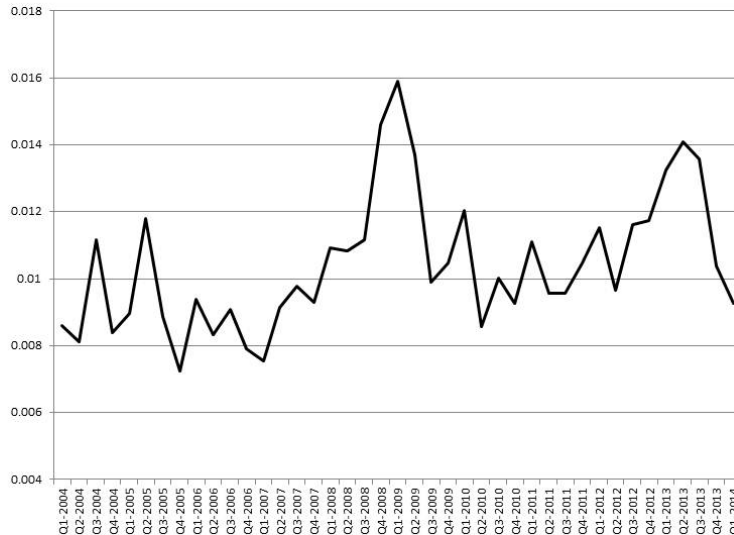


Figure 1: *Average purged Lilien measure of sectoral reallocation*

significant link by using two empirical specifications. First, the model can be specified in differences where changes in unemployment are related to changes in GDP. Second, the employment gap, that is the deviation of actual employment from potential employment, is linked to the output gap. The gap specification requires the identification of potential unemployment as well as potential GDP. While there are various approaches to estimate both trend series including unobserved component models (Kuttner, 1994), production function approaches (Giorno et al., 1995) or filtering techniques (Canova, 1998), results can differ substantially across methods and depend on country-specific characteristics (Scacciavillani and Swagel, 2002). This makes the gap approach considerably less attractive for our purpose since we aim at valid comparisons across countries.

Since it operates on directly observable variables, the difference approach is simpler to implement compared to the gap approach. It rests on the assumption that both GDP and unemployment are $I(1)$ processes which become stationary through differencing. If, however, GDP and unemployment are non-stationary but cointegrated the difference equation is misspecified (Attfield and Silverstone (1997)). This can be corrected by specifying an

error correction model which explicitly takes the long-term relationship between unemployment and GDP into account.⁶ We follow this route and specify our unemployment model as follows:

$$\Delta(\ln u_t) = \alpha + \beta \tilde{\sigma}_t + \sum_{i=0}^N \gamma_i \Delta(\ln y_{t-i}) + \phi \left(\sum_{j=1}^M \delta_j \Delta(\ln u_{t-j}) \right) + \theta z_{t-1} + \epsilon_t \quad (4)$$

The difference operator is given by Δ ; $\ln u_t$ and $\ln y_t$ are the natural logarithms of total unemployment and real GDP, respectively. Describing the dynamics of the model, ϕ is a scalar which equals 0 if no lags of the dependent variable are included, and 1 otherwise. The model's coefficients are α , β , γ_i , δ_j and θ . Finally, $\tilde{\sigma}_t$ is our adjusted version of the Lilien measure we use to model sectoral reallocation processes – it is our main variable of interest. We derive the residuum of the cointegrating equation, z_{t-1} , as:

$$z_t = \ln u_t - \pi - \mu \ln y_t \quad (5)$$

As explained above, the estimation of the error correction model described in (4) and (5) requires $\ln u_t$ and $\ln y_t$ to be I(1) and cointegrated. We test this assumption using the Augmented Dickey-Fuller (ADF) test for unit roots. The results are presented in the following.

Table 1: *Unit root tests for GDP and unemployment*

	Spain	Italy	Ireland	Portugal	France
$\ln y_t$	-2.422701 (0.1418)	-1.553504 (0.4971)	-1.973982 (0.2968)	-1.647088 (0.4502)	-2.004259 (0.284)
$\ln u_t$	-1.405173 (0.5707)	-0.066146 (0.9464)	-1.495868 (0.5259)	-1.271361 (0.634)	-1.375417 (0.5851)

The p-values are given in parentheses. The null is that series are non-stationary.

We find that the null of non-stationarity is not rejected for unemployment and GDP series for all countries in our sample. Next, we use the Johansen cointegration test to identify a cointegrating relation between $\ln u_t$ and $\ln y_t$ (Johansen, 1991; Johansen and

⁶Attfield and Silverstone (1998) show that, under certain assumptions, the coefficient of the cointegrating equation in an error correction model is equivalent to the Okun coefficient in the gap model.

Juselius, 1990). We specify the test without a deterministic trend in the data and an intercept but no trend in the cointegrating equation. The results are presented in the following.

Table 2: *Test for cointegration relationship between GDP and unemployment*

	Spain	Italy	Ireland	Portugal	France
Trace statistic	28.21352 (0.0001)	1.886496 (0.9587)	18.99217 (0.0033)	7.957181 (0.2400)	12.21752 (0.0520)
Eigenvalue statistic	27.64647 (0.0000)	1.424452 (0.9729)	18.99205 (0.0018)	7.619931 (0.2003)	9.452449 (0.1009)

p-values are given in parentheses. The null is that $\ln u_t$ and $\ln y_t$ are not cointegrated.

According to table 2, we find a cointegration relationship between unemployment and GDP for Spain, Ireland, and France. However, the null of no cointegration is rejected for Italy and Portugal. Hence, we specify an error-correction model for Spain, Ireland and France taking the long-term relation between GDP and unemployment into account. For Italy and Portugal, we do not include the error-correction term.

Having established the cointegration relationship between the I(1) variables $\ln u_t$ and $\ln y_t$, we consider the selection of lags of both $\ln u_t$ and $\ln y_t$ as explanatory variables. More specifically, we estimate a basic model including only α , $\ln y_t$ and z_{t-1} and take the Akaike information criterion (AIC) as the reference model fit. We then successively extend the basic model with lags of $\ln u_t$ and $\ln y_t$ and compare the AIC of the respective model with the AIC of the basic model. Thereby, we identify the lag structure which provides the final model with the best model fit.

Furthermore, we check the final model for autocorrelation by applying the Breusch-Godfrey LM test with a lag order of 4. In case of remaining serial correlation, the error term ϵ_t in (1) can be described as:

$$\epsilon_t = \sum_{q=1}^S \tau_q \epsilon_{t-q} + v_t \quad (6)$$

We successively include AR-terms up to order $S = 4$ as long as autocorrelation is detected. Finally, we apply the heteroskedasticity consistent White estimator to avoid invalid infer-

ence.

3 Results

We now present the results we received upon estimation of the model described in the previous section. We estimate a separate model for each country, including an optimized lag-structure, and present the results in table 3. The most visible effect is detected for the Spanish economy. The measure of sectoral reallocation is positively and significantly linked to unemployment changes. If there is unequal employment growth across sectors, unemployment tends to rise – possibly due to reallocation frictions and various types of mismatch.⁷ It is also remarkable that the Spanish model has the best fit by far. The importance of the reallocation variable is underscored by the fact that the adjusted R^2 falls from 0.81 to 0.73 if it is excluded. For Italy, we find similar evidence. Yet, the coefficient is only marginally significant. We do not find any significant relationship between sectoral reallocation and unemployment changes in neither Ireland, nor Portugal or France. The further variables of the model generally show the expected signs. Unemployment shows significant positive autocorrelation in Spain, Italy and Portugal, while positive output growth tends to reduce unemployment across countries.

4 Robustness and Discussion

The above results link sectoral reallocation to changes in unemployment. The latter variable could be an imperfect approximation to true frictional issues since it depends on the activity rate by definition. If sectoral shocks are linked to changes in the activity rate in the labor market, our results would suffer from an omitted variable bias. In general, it seems possible that such a link exists: Individuals set free in shrinking sectors could be shying away from reporting as unemployed, or longer term unemployed individuals could be dropping out of the labor force if the observed sectoral shock strongly diminishes their perceived chances of reemployment. The bias could go in either direction, depending on

⁷We take a closer look at the Spanish case in subsection 5 and find evidence for a crucial role played by the construction sector, which showed the most distinct pattern of boom and bust and by itself accounts for around 46% of the employment lost in the period of Q1-2008 through Q4-2012.

Table 3: *Unemployment and Lilien (purged), 2004-2014*

Dependent variable: Δu_t , 2004-2014					
	Spain	Italy	Ireland	Portugal	France
	Coef (S.E.)	Coef (S.E.)	Coef (S.E.)	Coef (S.E.)	Coef (S.E.)
$\tilde{\sigma}_t$	2.92*** (0.737)	2.38* (1.374)	0.77 (1.632)	-1.92 (1.739)	6.02 (4.028)
c	-0.036*** (0.009)	-0.02 (0.016)	0.01 (0.032)	0.03 (0.018)	-0.01 (0.017)
Δu_{t-1}	0.96*** (0.172)	0.33*** (0.127)	0.13 (0.236)	0.37*** (0.147)	0.18 (0.193)
Δu_{t-2}	-	-	0.24 (0.195)	-	-
Δy	-2.79** (1.260)	-0.92 (0.600)	-0.47 (0.776)	-1.68** (0.757)	-1.72*** (0.689)
Δy_{t-1}	4.50*** (1.136)	0.04 (0.763)	-0.85 (0.894)	-0.32 (0.524)	-0.19 (0.836)
Δy_{t-2}		-1.49*** (0.590)	-1.13 (0.823)	-0.51 (0.715)	
z_{t-1}	0.00 (0.014)	-	-0.05 (0.030)	-	0.08 (0.055)
Obs	41	41	41	41	41
<i>Adj.R</i> ²	0.81	0.39	0.29	0.29	0.56

Heteroskedasticity-consistent standard errors, AR-terms included if autocorrelation detected (using an LM-test).

whether inflows into inactivity are larger out of employment or unemployment. In order to avoid any bias stemming from the omission of activity rates, we include it in our model in a robustness exercise.⁸ Reassuringly, we find our results do not change much. We still only find sectoral reallocation to matter for Spain and Italy. The coefficient on the activity rate itself is insignificant, speaking against mis-specification in our previous estimations.

We also take a look at the effect our model specification has on the results. First, we allowed for up to four lags in both output and unemployment in our regressions. This reduces statistical significance a bit – which does not come as a surprise, considering that we are now including more independent variables. However, we still find the coefficient for sectoral reallocation to be significant at the 5% level for Spain. For Italy, there no longer is a significant link, which leads us to be cautious in proclaiming a prominent role for sectoral shocks in the Italian unemployment numbers. Instead of including more lags of output and unemployment and in order to reduce the risk of reverse causality, we also tested whether allowing for lagged effects of the sectoral reallocation variable plays a role. Doing so, the optimized model selection changes and in many cases two lags of unemployment are now included. In such a model, the effect for Spain is estimated to emerge with a one-quarter lag. For Italy, the contemporaneous impact of sectoral reallocation remains marginally significant.

Our main motivation for studying the link between sectoral shocks and unemployment was the experience in the recent crisis - including the build-up of sector level imbalances before the bust in 2008. This led us to have a sample from 2004 to 2014, roughly covering the boom-bust-cycle. If we change the sample to (i) include the quarters from Q1 2000 onwards and to (ii) additionally exclude the quarters from Q1 2011 on, we no longer find a significant effect for any country in our analysis. This emphasizes the effect of the recent crisis and its role as providing the variation which is crucial for the identification of our results. The 4 years before 2004 did not see as much of a build-up of imbalances, and there were no strong corrections in sectoral growth patterns - hence, including it in the sample means including a period with little to no variation to identify the effect. Therefore, we acknowledge the limits to potential generalization of our results; but we do see sectoral reallocation as an important explanatory factor for Spanish unemployment during the

⁸We are happy to provide the detailed results of this exercise, as well as those following in this section, upon request.

recent times of crisis.

5 A closer look at Spain

Our results clearly show the strongest effect of sectoral shocks in Spain. We thus take a closer look at what could be behind the Spanish experience. The natural suspect to look at is the construction sector, which experienced an enormous expansion followed by an unprecedented crisis and is often referred to as the culprit of the Spanish malaise (Bielsa and Duarte, 2011; European Central Bank, 2012; Sun et al., 2013). The numbers are impressive indeed. Construction employment fell by over 50 % between 2008 and 2012 and its share in overall employment was more than halved, falling from around 13% in early 2008 to 6% at the end of 2012. Looking at the overall employment collapse in the Spanish economy between 2008 and 2012, around 46% of the decline of over 3.5 million jobs can be attributed to the construction sector alone. With respect to our analysis, it is crucial to ask whether this fall is in line with the large drop in Spanish output. It is known that construction is among the most volatile sectors and has an employment elasticity well above 1.

We run a simple exercise to determine the magnitude of the most recent shock. To this end, we regress the change in log-construction employment on the log of changes in real GDP using annual data for 1980 through 2012. We obtain an elasticity of 4.47, which means that a one per cent decline in real GDP is estimated to lead to a 4.47 per cent decline in construction employment. Applying this estimate in a simple calculation yields that the observed decrease in construction employment cannot be comprehensively explained by the fall in GDP: had construction employment contracted as predicted by the regression, the fall would only have been roughly half as deep. One reason for the overproportional contraction could be the combination of a deep recession with a financial crisis that is likely to have multiplied effects due to the special linkages between the financial industry and construction activity in the pre-crisis years.

6 Concluding Remarks

It is often argued that much of the persistently high unemployment across a number of European countries is due to reallocation frictions in the process of moving individuals from declining sectors into more viable ones. We put this claim to the test and estimate what role sector level shocks play for the unemployment experience in Spain, Italy, Ireland, Portugal and France. The hypothesis is that a significant correlation between measures of sectoral employment reallocation and unemployment would point to reallocation indeed being behind the labor market slump. Moreover, since we purge our measures of reallocation from aggregate influences, we single out sectoral shocks as a source of unemployment – which holds an important policy measure if confirmed. While monetary and fiscal policy can address aggregate demand shortages to lift the labor market out of trouble, structural frictions stemming from sector level shocks require a supply side approach.

We find sectoral shocks to have driven unemployment in Spain over the period Q1 2004 through Q1 2014 – a results that likely is rooted in the unprecedented boom-bust cycle of the construction sector. Our estimates also show an influence of sectoral reallocation for Italy, but the coefficient is less robust in terms of statistical significance. For the other countries in our sample, we do not find sectoral reallocation to be significantly related to unemployment and hence conclude that aggregate demand policies look promising as a tool to raise employment. As an important qualification to our overall results, we do not maintain that aggregate demand policies will be useless in the Spanish case. On the contrary, a certain part of unemployment will certainly be reduced once the economy gets back on a sustainable growth path. Yet, it won't be enough to completely adjust and repair the damage done to the Spanish labor market over the span of the crisis. Instead, reforms to enable a smooth transition of workers across sectors and to enhance their qualifications will likely be needed to raise employment to satisfying levels over the medium run. Such supply side policies will also be helpful in the countries that, according to our analysis, did not primarily suffer from sectoral shocks. While aggregate demand policies can potentially restore equilibrium unemployment, structural reforms have the potential to lower equilibrium unemployment as such.

References

- Abraham, K. G. and Katz, L. F. (1986). Cyclical unemployment: Sectoral shifts or aggregate disturbances? *Journal of Political Economy*, 94:507–522.
- Attfield, C. L. F. and Silverstone, B. (1997). Okun’s coefficient: A comment. *The Review of Economics and Statistics*, 79(2):326–329.
- Attfield, C. L. F. and Silverstone, B. (1998). Okun’s law, cointegration and gap variables. *Journal of Macroeconomics*, 20(3):625–637.
- Ball, L. M., Leigh, D., and Loungani, P. (2013). Okun’s law: Fit at fifty? *NBER Working Paper*, 18668.
- Bernal-Verdugo, L. E., Furceri, D., and Guillaume, D. (2012). Crises, labor market policy, and unemployment. *IMF Working Paper*, 12/65.
- Bielsa, J. and Duarte, R. (2011). Size and linkages of the Spanish construction industry: Key sector or deformation of the economy? *Cambridge Journal of Economics*, 35(2):317–334.
- Burda, M. C. and Hunt, J. (2011). What explains the German labor market miracle in the Great Recession? *Brookings Papers on Economic Activity*, 2011(1):273–319.
- Canova, F. (1998). Detrending and business cycle facts. *Journal of Monetary Economics*, 41(3):475–512.
- Cazes, S., Verick, S., and Al Hussami, F. (2013). Why did unemployment respond so differently to the global financial crisis across countries? Insights from Okun’s Law. *IZA Journal of Labor Policy*, 2(1):1–18.
- Cerra, V. and Saxena, S. C. (2008). Growth dynamics: The myth of economic recovery. *The American Economic Review*, 98(1):439–457.
- Chinn, M. D., Ferrara, L., and Mignon, V. (2013). Post-recession US employment through the lens of a non-linear Okun’s law. *NBER Working Paper*, 19047.
- Desjardins, R. and Rubenson, K. (2011). An analysis of skill mismatch using direct measures of skills. *OECD Education Working Papers*, 63.

- Dustmann, C., Fitzenberger, B., Schönberg, U., and Spitz-Oener, A. (2014). From sick man of Europe to economic superstar: Germany’s resurgent economy. *The Journal of Economic Perspectives*, 28(1):167–188.
- Estevão, M. and Smith, C. (2013). Skill mismatches and unemployment in the United States. *mimeo*.
- Estevão, M. and Tsounta, E. (2011). Has the Great Recession raised U.S. structural unemployment? *IMF Working Paper*, 11/105.
- European Central Bank (2012). Euro area labour markets and the crisis. *European Central Bank Structural Issue Report*.
- Farber, H. S. (2012). Unemployment in the Great Recession: Did the housing market crisis prevent the unemployed from moving to take jobs? *The American Economic Review*, 102(3):520–525.
- Furceri, D. and Mourougane, A. (2012). The effect of financial crises on potential output: New empirical evidence from OECD countries. *Journal of Macroeconomics*, 34(3):822–832.
- Gallipoli, G. and Pelloni, G. (2013). Macroeconomic effects of job reallocations: A survey. *Review of Economic Analysis*, 5(2):127–176.
- Giorno, C., Richardson, P., Roseveare, D., and van den Noord, P. (1995). Estimating potential output, output gaps and structural budget balances. *OECD Economics Department Working Paper*, 152.
- Johansen, S. (1991). Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models. *Econometrica*, 59(6):1551–80.
- Johansen, S. and Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration – With applications to the demand for money. *Oxford Bulletin of Economics and Statistics*, 52(2):169–210.
- Knotek, E. S. (2007). How useful is Okun’s law? *Federal Reserve Bank of Kansas City Economic Review*, pages 73–103.

- Kocherlakota, N. (2010). Inside the FOMC. Speech in Marquette, Michigan.
- Kuttner, K. N. (1994). Estimating potential output as a latent variable. *Journal of Business & Economic Statistics*, 12(3):361–68.
- Lee, J. (2000). The robustness of Okun’s law: Evidence from OECD countries. *Journal of Macroeconomics*, 22(2):331–356.
- Leuven, E. and Oosterbeek, H. (2011). Overeducation and mismatch in the labor market. *Handbook of the Economics of Education*, 4:283–326.
- Lilien, D. M. (1982). Sectoral shifts and cyclical unemployment. *The Journal of Political Economy*, 90:777–793.
- Liu, K., Salvanes, K. G., and Sorensen, E. (2012). Good skills in bad times: Cyclical skill mismatch and the long-term effects of graduating in a recession. *NHH Norwegian School of Economics Discussion Paper*, 16/2012.
- Mills, T. C., Pelloni, G., and Zervoyianni, A. (1995). Unemployment fluctuations in the United States: Further tests of the sectoral-shifts hypothesis. *The Review of Economics and Statistics*, 77:294–304.
- Mills, T. C., Pelloni, G., and Zervoyianni, A. (1996). Cyclical unemployment and sectoral shifts: Further tests of the Lilien hypothesis for the UK. *Economics Letters*, 52(1):55–60.
- Mulligan, C. B. (2011). The expanding social safety net. *NBER Working paper*, 17654.
- Okun, A. M. (1962). Potential GNP: Its measurement and significance. *Proceedings of the Business and Economic Statistics Section*, pages 98–104.
- Pissarides, C. A. (2013). Unemployment in the Great Recession. *Economica*, 80(319):385–403.
- Rissman, E. R. (1997). Measuring labor market turbulence. *Economic Perspectives-Federal Reserve Bank of Chicago*, 21:2–14.
- Rothstein, J. (2012). The labor market four years into the crisis: Assessing structural explanations. *Industrial & Labor Relations Review*, 65:467–975.

- Samson, L. (1990). Sectoral shifts and aggregate unemployment: Additional empirical evidence. *Applied Economics*, 22(3):331–346.
- Scacciavillani, F. and Swagel, P. (2002). Measures of potential output: An application to Israel. *Applied Economics*, 34(8):945–957.
- Sun, Y., Mitra, P., and Simone, A. S. (2013). The driving force behind the boom and bust in construction in Europe. *IMF Working Paper*, 13/181.
- Teräsvirta, T. (1994). Estimation, and evaluation of smooth transition autoregressive models. *Journal of the American Statistical Association*, 89(425):208–218.
- van Dijk, D., Teräsvirta, T., and Franses, P. H. (2002). Smooth transition autoregressive models - A survey of recent developments. *Econometric Reviews*, 21(1):1–47.
- Virén, M. (2001). The Okun curve is non-linear. *Economics letters*, 70(2):253–257.