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Labour market adjustment dynamics and labour mobility within the euro area

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The opinions expressed in this working paper are those of the authors and do not necessarily reflect views of the DGTPE.

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ABSTRACT

In order to increase the resilience of euro area Member States to asymmetric shocks, both national policies and real adjustment mechanisms, such as relative competitiveness adjustments or the mobility of capital and labor, are crucial. Two major contributions from the 1990s showed that labor mobility was lower in Europe in response to asymmetric shocks than in the United States. However, since the creation of the euro area, dynamic adjustment mechanisms may have improved. We analyze adjustment mechanisms to national asymmetric shocks within the euro area between 1973 and 2005. Comparisons with the United States' labor market dynamics suggest that labor mobility in response to asymmetric labor demand shocks is lower in the euro area than in the United States. Most of the shocks' effects are instead absorbed by changes in the participation rate on labor markets.

However, estimates based on a shorter and more recent period (1990-2005) indicate that the reactions of labor markets to asymmetric labor demand shocks in the euro area have become closer to those observed in the United States. The contribution of labor participation to the adjustment process appears to have diminished, and relative movements of labor forces between Member States seem to have become a more efficient adjustment mechanism.

RÉSUMÉ

Pour améliorer la résilience de la zone euro face aux chocs asymétriques, les politiques nationales, budgétaires notamment, ainsi que des mécanismes d'ajustement réels tels que les ajustements de compétitivité relative ou la mobilité du travail ou du capital, sont primordiaux. Deux études des années 1990 ont montré que la mobilité du travail était plus faible en Europe, face à des chocs asymétriques, qu'aux Etats-Unis. Toutefois, grâce à la poursuite du processus d'intégration européenne, les mécanismes d'ajustement réels ont pu s'améliorer dans la zone euro. Nous analysons les dynamiques sur les marchés du travail dans les 12 Etats Membres de la zone euro entre 1973 et 2005. La comparaison des résultats obtenus pour la zone euro et pour les Etats-Unis suggère que la réponse de la mobilité du travail à un choc asymétrique de demande de travail est plus faible dans la zone euro qu'aux Etats-Unis. La majeure partie de l'effet du choc est absorbée par une variation du taux de participation au marché du travail.

Les estimations sur période plus récente (1990-2005) indiquent toutefois que la réaction des marchés du travail européens aux chocs asymétriques s'est rapprochée de celle observée aux Etats-Unis. La contribution de la participation du travail au processus d'ajustement semble avoir diminué alors que la mobilité du travail semble au contraire être devenue un mécanisme d'ajustement plus efficace.

EXECUTIVE SUMMARY

Moving to a single currency has reduced trading and information costs, enhanced price transparency and fostered competition. However, the euro area is subject to asymmetric shocks, which can cause divergences in terms of GDP, prices, wages and competitiveness. National budgetary policies can be used to respond to these shocks, and in this respect, it is essential to coordinate national budget policies. However, these policies may not allow sufficiently fine tuning in response to asymmetric shocks. In order to increase the resilience of EMU Member States, other real dynamic adjustment mechanisms are crucial, for example relative competitiveness adjustments or the mobility of production factors, such as capital and labor.

Financial integration and capital mobility are relatively strong in the euro area. On the contrary, **it is traditionally considered that labor mobility is low in Europe in response to asymmetric shocks, compared to the United States. Two major contributions, Blanchard and Katz (1992) for the United States and Decressin and Fatás (1995) for the EU15 gave results that went in this direction.** Using 1978-1990 data on the US states, Blanchard and Katz found that local US labor markets adjusted relatively rapidly to asymmetric shocks, with migration playing a key role in this process. By contrast, using a similar methodology, Decressin and Fatás found that labor adjustments through migration across 51 regions of the EU15 were less important between 1975 and 1987 than in the United States. The consequence is that most of the shocks' effects were absorbed by changes in the participation rate on labor markets (in other words, by persons leaving the labor market in response to a negative shock to labor demand).

However, since the creation of the euro area, dynamic adjustment mechanisms may have improved. It is therefore interesting to test whether, ten years later, Decressin's and Fatás' results are still relevant for the euro area Member States and whether labor market adjustment dynamics in the euro area have changed with respect to those observed in the United States.

Our analysis is based on recent labor market data (1973-2005) for the 12 EMU Member States (and not for EU 15 regions as in Decressin and Fatás, in order to analyze adjustment mechanisms to national asymmetric shocks within the monetary union). Results must of course be interpreted with caution, since data reconciliation for active population, employment and unemployment is not always easy, and since direct information of international labor mobility is scarce. Comparisons with the United States can give some insight on the differences between labor market dynamics in both areas. Without much surprise, they suggest that labor mobility in response to asymmetric labor demand shocks is lower in the euro area than in the United States; changes in labor participation are a stronger adjustment mechanism.

Estimates based on a shorter and more recent period (1990-2005), however, indicate that the reactions of labor markets to asymmetric labor demand shocks in the euro area have become closer to those observed in the United States. The contribution of labor participation to the adjustment process appears to have diminished, and relative movements of labor forces between Member States seem to have become a more efficient adjustment mechanism.

Introduction

The euro area is subject to shocks, which can have diverging consequences for individual Member States in terms of growth or inflation. In this context, losing the direct control of monetary or exchange rate policy may represent a loss in terms of flexibility. For the euro area to be considered an "optimal currency area", as economic theory puts it, flexibility should increase in other domains in order to compensate for this loss.

National policies, budgetary in particular, can be used to respond to the shocks that affect each Member State. In this respect, it is useful to coordinate national budget policies. However, these policies may not allow sufficiently fine tuning in response to asymmetric shocks. In order to increase the resilience of the euro area, other real dynamic adjustment mechanisms are crucial, for example relative competitiveness adjustments or the mobility of production factors, such as capital and labor.

Financial integration and capital mobility are relatively strong in the euro area. On the contrary, two major contributions from the 1990s found that labor mobility was lower in Europe, in response to asymmetric shocks, compared to the United States.

However, with the pursuit of the European integration process, dynamic adjustment mechanisms may have improved in the euro area. It is therefore interesting to test whether, ten years later, the results found in these two contributions are still relevant for the euro area Member States, and whether labor market adjustment dynamics in the euro area have changed with respect to those observed in the United States.

The paper compares the labor market dynamics in the 12 euro area Member States on the one hand and in the 51 United States on the other over the 1973-2005 period. It analysis, in an "average" State in each zone, the contribution of employment, unemployment, participation and net migration to the adjustment process, in the short and medium term, in response to an asymmetric shock to the labor demand addressed to a particular State.

Section 1 describes the econometric method used, based upon that suggested by Blanchard and Katz in their seminal 1992 paper.

Section 2 provides simple stylized facts on labor market dynamics observed in the euro area between 1973 and 2005, reflecting differences between US and euro area labor markets.

In particular, we investigate the persistence of employment, unemployment and participation within the euro area, by estimating, for example, the response of "relative" national employment – i.e. relatively to total euro area employment - to an asymmetric shock to employment, **and compare it to that observed in the United States.** Both in the United States and in the euro area, consistently with Blanchard and Katz's theoretical model, employment seems to be relatively persistent, whereas unemployment rates and participation rates appear much less so. On European labor markets however, the persistence of unemployment and participation appear to be much stronger: after an asymmetric shock (these being relatively frequent in the euro area), relative unemployment and participation rates return more slowly to their long-term equilibrium rate in the euro area than in the United States.

In order to investigate formally how shocks to national labor demand are absorbed, **Section 3 analyzes the joint behavior of relative employment, relative unemployment and relative participation rates in response to labor demand shocks to euro area Member States**. In order

to understand how the response of labor markets to these shocks have changed since the creation of the euro, we estimate the VAR first for two periods:1973-2005 and 1990-2005.

Because results can depend on the theoretical model and the VAR specification chosen, it is useful to analyze them not only in absolute terms but also by comparing them to United States estimates. Because Blanchard and Katz's results were limited to the 1978-1990 period, we run similar regressions using more recent data for the United States.

1- The method

Due to the limited data availability for working-age population migrations between States or even countries, Blanchard and Katz (1992) suggested a simple accounting framework in order to analyse the effects of an asymmetric shock on the labor market of an "average" State in the United States between 1978 and 1990: **a given person between 15 and 64 years of age is either employed, unemployed, out of the labor force or out of the country. Based upon this framework, labor force movements, to or from a given State, in response to asymmetric shocks, correspond to the adjustments to employment developments unexplained by changes in unemployment or participation. These movements correspond to "net out-migrations" in response to shocks, which can represent both stronger out-migrations and weaker in-migrations.**

Decressin and Fatas applied a similar method to the 51 EU15 regions between 1975 and 1987. Whereas in the United States, migrations represented an efficient adjustment mechanism, in Europe, most of the asymmetric shocks' effects were on the contrary absorbed by changes in the participation rates on labor markets (in other words, by persons leaving the labor market in response to a negative shock to labor demand). With the pursuit of the European integration process, dynamic adjustment mechanisms may have improved. It is therefore interesting to test whether these results are still relevant for the euro area. **Since direct information on international labor mobility in the euro area is scarce, we chose to follow and econometric approach similar to that followed by Blanchard and Katz.**

We are interested in responses to <u>asymmetric</u> shocks. We therefore consider developments for each Member State that diverge from the euro area average. More precisely, we consider evolutions of labor market aggregates "relatively" to the same euro area aggregates[1]. In this way, we can identify changes in migration to or from euro area countries is response to asymmetric shocks[2]. **These migrations can include migrations between euro area Member States as well as**

1 For example, relative variation in annual French employment is the difference between the variation in annual French employment and the variation in annual employment for the euro area as a whole.

[2] Note that we consider that in response to asymmetric shock, changes in the size of national working-age populations, relatively to the euro area average, are mostly due to migrations. Results must be interpreted with caution, since annual changes in the size of the working-age population through ageing are not entirely similar across the euro area. The ECP's Ageing Working Group and the Commission (ECP, Commission 2005a) analyzed past fertility rates. They showed that the trend of falling fertility rates differed across countries in scale and timing over the past 50 years. Fertility rates fell below replacement levels in the late 1960s in Sweden, Denmark, Finland, Luxembourg and Germany. The fall took place somewhat later in Belgium, the Netherlands, Austria, the United Kingdom, France (1972–73) and Italy (1975). Declines in fertility rates occurred much later in Greece, Spain, Portugal (1981–82) and Ireland (1990).

asymmetric migrations flows to and from the euro area as a whole (for instance when non-European migrants settle more in one euro area country than in the other ones).

We then run vector autoregressions (VARs) on state-specific changes in relative employment, unemployment and participation, for the working-age population.

Decressin and Fatás analyzed the labor markets in 51 EU15 regions and captured labor migrations between these 51 regions. These probably represented, to a great extent, migrations between regions of the same country. We prefer to use data for the 12 euro area Member States in order to focus on real dynamic adjustments to national asymmetric shocks, that could be a source of concern within a monetary union, and to better evaluate changes that have occurred since the creation of the euro. We run our regressions on OECD annual data[3] between 1973 and 2005, to capture the developments in labor mobility before and, more importantly, since the creation of the euro area.

Box 1: A theoretical labor market model based on Blanchard and Katz (1992)

Blanchard and Katz's theoretical model allows us to explain basic univariate facts about regional evolutions in employment, unemployment and wages and provides a simple framework for the VAR analysis. We summarize the model in this box.

Each Member State produces different bundles of goods and both labor and firms are mobile across States. The model can be represented by five equations:

$$\begin{cases} w_{i,t} = -dn_{i,t} + z_{i,t} & (1) \\ z_{i,t+1} - z_{i,t} = -aw_{i,t} + x_i^d + \varepsilon_{i,t+1}^d & (2) \\ n_{i,t+1}^s - n_{i,t}^s = bw_{i,t} - gu_{i,t} + x_i^s + \varepsilon_{i,t+1}^s & (3) \\ u_{i,t} = n_{i,t}^s - n_{i,t} & (4) \\ w_{i,t} = -cu_{i,t} & (5) \end{cases}$$

where $w_{i,t}$ is the relative[4] wage in Member State i at time t, $u_{i,t}$ relative unemployment, $n_{i,t}$ relative employment (labor demand) and $n_{i,t}^s$ relative labor supply. a, b, c, d and g are positive parameters. $z_{i,t}$ is the position of the labor demand curve, relating relative product demand to relative labor demand in Member State i at date t. x_i^s and x_i^d are exogenous "drift" factors characteristic of Member State i. Finally $\varepsilon_{i,t}^d$ and $\varepsilon_{i,t}^s$ are white noises representing shocks respectively to labor demand and to labor supply.

Equation (1) gives the impact of relative demand for each product and of relative wages on relative labor demand. Production takes place under constant returns to labor and the demand for each product is downward sloping.

Equation (2) formalizes **movements in relative labor demand.** Shocks to labor demand are assumed to be for the most part permanent. Therefore, variations in relative labor demand are considered to depend on an exogenous country-specific factor, x_i^d, that captures national

[3] OECD Economic Outlook 2006. Annual data are for working-age (15-64) population, active population, unemployment and employment in each of the 12 countries that made up the euro area in 2006. Before 1991, Germany is only represented by West Germany (German labor market evolutions for 1991 are those of West Germany). We are very grateful to Pascal Marianna (OECD), who provided us with these series.

[4] National wage minus the average wage in the euro area. All the other variables, when specified, are "relative" to the euro area in the same way.

characteristics, other than wages, that can affect firms' decisions to create or locate their business in a particular country (infrastructures, taxes, natural resources). It also depends on wages (*ceteris paribus*, lower wages make a country more attractive for incoming firms). $\varepsilon_{i,t}^{d}$ is the innovation to labor demand.

Equation (3) reflects **movements in relative labor supply**. *Ceteris paribus*, immigrating workers are attracted by higher relative wages and lower relative unemployment. Other factors that make a country more attractive to immigrants (weather, infrastructures) are captured by the x_i^s term. $\varepsilon_{i,t}^{s}$ is the innovation to labor supply.

Equation (4) simply gives unemployment as the difference between labor supply and labor demand.

Equation (5) is a simplified version of the Phillips curve.

Long run equilibrium:

Member States exhibit different growth rates in employment. Supply and demand innovations permanently affect employment. When both workers and firms are mobile, the long run equilibrium is given by the following equations:

$$\begin{cases} u_i = -\dfrac{w_i}{c} = \dfrac{dx_i^s - x_i^d}{ca + d(cb+g)} \\ \Delta n_i = \Delta n_i^s = \dfrac{cax_i^s + (cb+g)x_i^d}{ca + d(cb+g)} \end{cases}$$

In the long run, relative **employment** grows or declines at an average rate determined by the "drift" factors x_i^s and x_i^d. In countries attractive to workers, where x_i^s is positive, the steady flow of *workers* leads to lower wages and higher unemployment, which triggers a steady flow of new jobs and sustains growth. In countries attractive to firms, where x_i^d is positive, the steady flow of *firms* leads to higher wages and lower unemployment, which triggers an inflow of workers and sustains growth. On the other hand, in the long run, relative **unemployment** follows a stationary process around state-specific means. If $dx_i^s > x_i^d$, Member State i is more attractive to workers than to firms and unemployment is therefore stronger than the euro area average.

Effects of an innovation in labor demand:

We investigate the dynamic response of a Member State's labor market to a shock to the demand for the goods it produces ($\varepsilon_{i,t}^{d}$). **The theoretical model predicts that the effects of an innovation in labor demand on unemployment and employment growth are only temporary. Migrations and movements of firms act as dynamic adjustment mechanisms.**

The model gives the following dynamic equations:

$$\begin{cases} (n_{i,t+1} - n_{i,t}) = \dfrac{c(1-a) + d(1-cb-g)}{c+d}(n_{i,t} - n_{i,t-1}) + \dfrac{cax_i^s + (cb+g)x_i^d}{c+d} \\ \qquad + \dfrac{c\left[\varepsilon_{i,t+1}^s + (a-1)\varepsilon_{i,t}^s\right] + \varepsilon_{i,t+1}^d + \left[(cb+g)-1\right]\varepsilon_{i,t}^d}{c+d} \\ u_{i,t+1} = \dfrac{c(1-a) + d(1-cb-g)}{c+d}u_{i,t} + \dfrac{dx_i^s - x_i^d}{c+d} + \dfrac{d\varepsilon_{i,t+1}^s - \varepsilon_{i,t+1}^d}{c+d} \end{cases}$$

[5] We denote by a hat the deviation of a variable from its long term equilibrium path.

The effects of an innovation of -1 on ε_i^d at date 0 on unemployment and employment growth at date t are given by[5]:

$$\begin{cases} (\hat{n}_{i,t+1} - \hat{n}_{i,t}) = \dfrac{c(a-cb-g)}{(c+d)^2}\left(\dfrac{c(1-a)+d(1-cb-g)}{c+d}\right)^{t-1} \text{ for } t \geq 1 \text{ and } \hat{n}_{i,0} - \hat{n}_{i,0} = -\dfrac{1}{c-d} \\ \hat{u}_{i,t+1} = \dfrac{1}{c+d}\left(\dfrac{c(1-a)+d(1-cb-g)}{c+d}\right)^{t-1} \end{cases}$$

Under the assumption that $0 < \dfrac{c(1-a)+d(1-cb-g)}{c+d} < 1$,

$$\begin{cases} (\hat{n}_{i,t+1} - \hat{n}_{i,t}) \xrightarrow{t \to +\infty} 0 \quad \text{and } \hat{n}_{i,+\infty} = -\dfrac{cb+g}{ca+d(cb+g)} \\ \hat{u}_{i,t+1} \xrightarrow{t \to +\infty} 0 \end{cases}$$

Therefore, after a negative shock on labor demand, unemployment initially increases but eventually returns to its long-run equilibrium value. The level of employment is permanently changed, and its long-run value depends on the relative values of the short-run elasticities of firms and workers to wages and unemployment. If firms enter rapidly when wages drop after the shock (*a* is large), the long-term level of employment is not strongly affected. If wages react strongly to the drop in relative labor demand (*d* is large), the corresponding adjustment mechanism is efficient and the long term level of employment is close to the initial level.

2- Simple stylized facts reflecting differences in US and euro area labor markets.

We begin by laying out basic stylized facts surrounding the dynamics of employment, unemployment and participation in the 12 euro area countries[6]., in order to compare them to the labor market dynamics described by Blanchard and Katz for the United States, between 1950 and 1990.

A simple graphic analysis of the joint dynamics of these variables, in the euro area and in each Member State, suggests that national labor market dynamics have been complex within the euro area since 1973. The influence that all three of these variables have upon one another is not always clear cut. A more formal stochastic analysis seems necessary to understand the relative movements of these variables.

We consider national employment, unemployment and participation individually, and begin by comparing the stability of these variables over the past thirty years in both monetary unions. In order to understand more precisely these trends (for example the fact that national unemployment rates have appeared to be more stable over time within the euro area than across the United States for the past thirty years), we attempt to answer the following questions: To what extent have these variables been subject to asymmetric shocks? If, for example, shocks to national unemployment rates appear to be more asymmetric in the euro area than in the United States, can a statistical analysis of the reaction of "relative" unemployment rates to one of these asymmetric shocks shed light on the stronger stability of national unemployment rates in the euro area?
We run the corresponding univariate regressions and show, for example, that the return of national unemployment rates to their long-run equilibrium level is slower in the euro area (the "persistence" of unemployment is stronger), thus providing a partial explanation for national unemployment rates' stronger stability over time in the euro area.

2-1 National labor market dynamics

The first figure of appendix 1 gives the movements of the working-age population, the labor force, employment and unemployment in the euro area as a whole since 1974. The movements of employment and unemployment appear to have been strongly linked over the period (the decrease in employment between 1981 and 1984 was matched with an increase in the unemployment rate, from 6.2% to 9.4%, and again between 1992 and 1994, with an increase in the unemployment rate, from 7.5% to 10.5%). However, the movements of the working-age population and the labor force also appear to have contributed to the euro area labor market dynamics. Thus, from the mid-1990s onward, both employment and the labor force strongly increased. The increase in the labor force was stronger than that of the working-age population, reflecting the increase in the participation rate, from 66% in 1995 to 72% in 2005.

The movements of these aggregate variables do not reflect the sometimes strong differences between national labor market dynamics within the euro area. The movements of "relative" employment, unemployment and participation in each Member State are of course closely linked. It is therefore interesting to analyze labor market dynamics, country by country. The second part of Appendix 1 gives the corresponding figures. Whereas, for instance, France's, Germany's, Austria's

[6] We do not consider Slovenia, which only belongs to the euro area since 2007.

and Belgium's labor market dynamics appear to have been relatively similar to that of the euro area as a whole[7] between 1973 and 2005, differences appear in other countries.

In Spain and Ireland for example, since the beginning of the 1990s, there has been a joint increase in relative working-age population, labor force and employment, in particular thanks to strong net migration flows.

In the Netherlands, relative employment and labor force appear to have increased much more over the past fifteen years than relative working-age population. This seems to reflect the strong increase in labor participation observed in Netherlands since the beginning of the 1990s, relatively to the euro area average[8].

In Finland, after the severe economic crisis at the beginning of the 1990s, the sharp decrease in employment was matched by a strong increase in the unemployment rate, whereas labor force and working-age dynamics were much smoother.

This simple graphic analysis suggests that national labor market dynamics have been complex within the euro area since 1973. A more formal stochastic analysis – first considering each variable individually, then jointly - seems necessary to understand the movements of these variables in response to asymmetric labor demand shocks.

2-2 Employment:

Over the past three decades, national employment growth rates have on average been lower in the euro area than in the United States. The euro area's average annual employment growth rate was 0.7% over the 1973-2005 period, ranging from 1.8% on average in Ireland to 0.3% on average in Belgium. In the United States, the annual employment growth rate averaged 1.6% over the 1976-2005 period, ranging from 4.7% on average in Nevada to -0.3% on average in the District of Columbia.

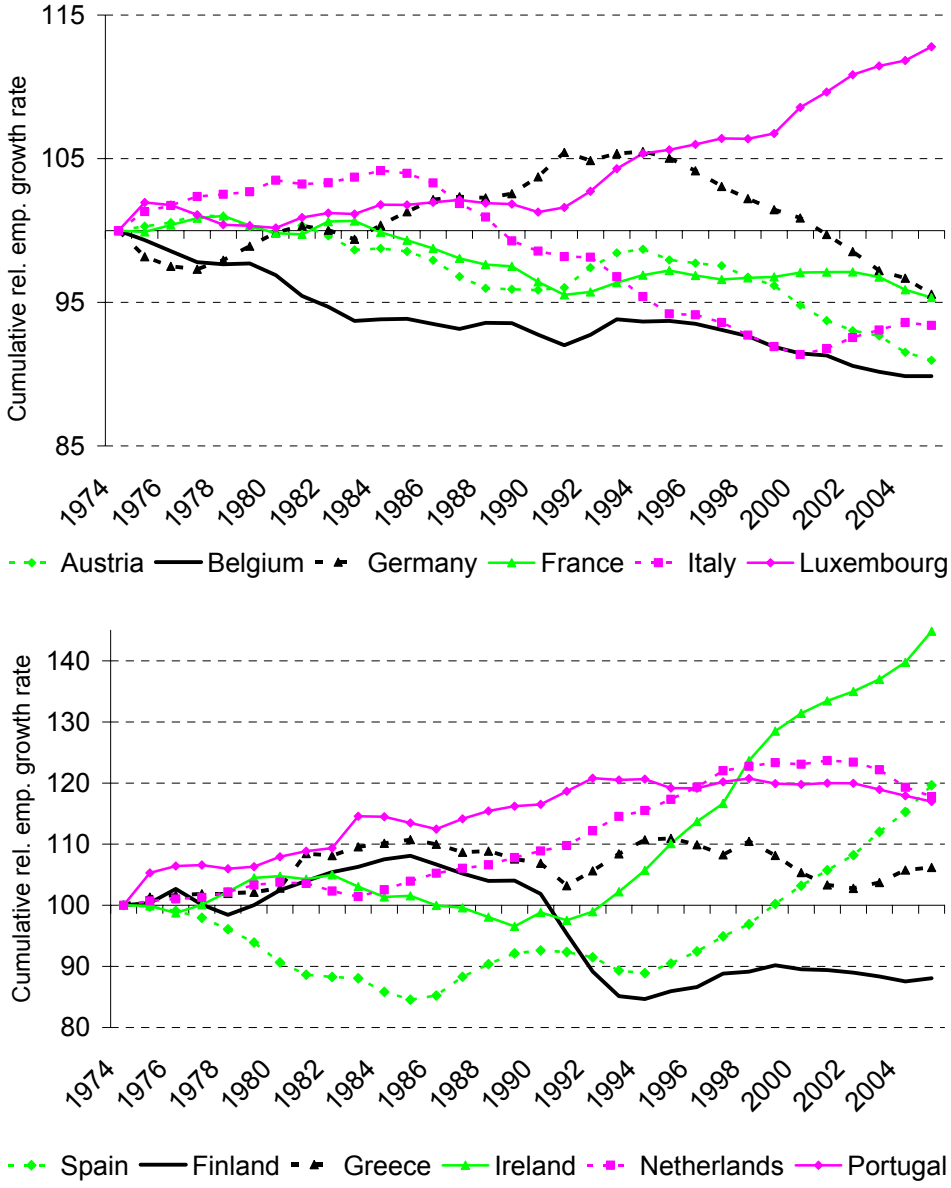
National employment dynamics have been relatively different within the euro area. Figure 1 gives the cumulative "relative" employment growth rate – i.e. relatively to the euro area average – of the 12 countries considered (with two different scales). Employment dynamics of Germany, France, Austria, Luxembourg and Italy have been relative similar to those of the euro area as the whole between 1973 and 2005. On the other hand, employment in Ireland has grown strongly above average since 1992. The same can be said for Spain since 1995. Finland's employment dynamics reflect the economic recession of the beginning of the 1990s.

[7] Germany's situation must be analyzed with caution. The statistical effects of the German reunification do not appear in the figure in Appendix 6, since the growth rates of working-age population, employment and labor force for Germany in 1991 have been replaced by the corresponding figures for West Germany. Moreover, whereas Germany has recorded a comparatively large number of arrivals over the past thirty years, the high number of outflows kept net immigration comparable to that of other euro area countries (ECP and Commission, 2005a).

[8] The participation rate increased by 10.4 percentage points between 1990 and 2004 in the Netherlands, from 66.2% to 76.6%. It only increased by 6.0 percentage points on average in the euro area over the same period.

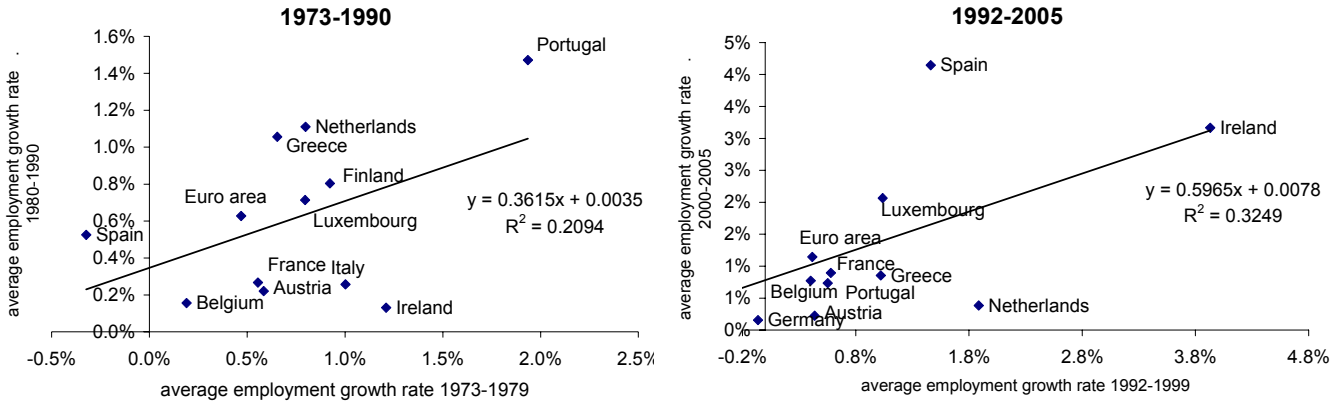
Figure 1: Cumulative relative employment growth rate in the euro area

(100 = employment level in the euro area)



Blanchard and Katz's results showed that across US states, national trends in employment growth rates were relatively stable across time. In the euro area, the correlation between national employment growth rates between two successive periods is weaker.

Figure 2: Stability of national employment growth trends in the euro area



Regressing national employment growth for the 1990-2005 period on that for the 1973-1990 period would suggest there is no stability of national employment growth trends in the euro area (the slope is negative). This result can however be due to the fact that in the years that led to the creation of the single currency, in some catching-up countries - namely Spain and Ireland-, average employment growth was below the euro area average between 1973 and 1990, but was much higher that the euro area average after 1990[9]. Since employment evolutions in the biggest European countries are quite similar and since their relative evolutions are therefore quite flat, the results of the regressions strongly depend on the evolutions observed in smaller catching-up countries[10].

Regressing national employment growth between 1973 and 1979 on national employment growth between 1980 and 1990 on the one hand, and national employment growth between 1992 and 1999 on national employment growth between 2000 and 2005 on the other hand (figure 2) gives a slope between 0.3 and 0.6, with an R^2 around 0.3.

This is lower than Blanchard and Katz's results (a slope of 0.70 with an R^2 of 0.75 for the regression of average employment growth from 1973 to 1990 on employment growth from 1950 to 1973). In short, despite all the limits expressed above concerning the analysis of euro-area evolutions, the stability of national employment growth trends appears to be lower in the euro area than in the United States.

A more detailed analysis of **the stochastic behavior of employment in reaction to asymmetric shocks within the euro area** will shed more light on the apparent lower stability of national employment growth rate trends in Europe. However, another important question is **whether labor markets have been more subject to (symmetric or asymmetric) shocks for the past thirty years.** We define N_{it} as the logarithm of employment in Member State i at date t and N_t as the logarithm of total employment in the euro area at date t. We run the following regression for the 1973-2005 period: $\Delta N_{it} = \alpha_i + \beta_i \Delta N_t + \theta_{it}$.

In all of the regressions of this paper, we correct for the statistical effect of the German reunification, by replacing German labor market growth rates for the years 1991 onwards with West-German labor market growth rates.

[9]Between 1973 and 1990, average employment growth was 0.1% in Spain, 0.3% in Ireland and 0.5% in the euro area as a whole. Between 1990 and 2005, it reached 2.5% in Spain, 3.4% in Ireland and remained at 0.8% in the euro area.

[10] Because of the number of US States (50 + the district of Columbia) compared to the number of Euro-area countries (12 considered in this paper), Blanchard and Katz's results are less dependent on the evolutions observed in specific areas.

Table 1 gives the results of the regression. The adjusted R^2 gives an indication on the extent to which national shocks are correlated to shocks that affect the euro area as a whole. A low adjusted R^2 suggests more asymmetric national shocks.

Table 1: Regression relating national employment growth rates to euro area employment growth rates (1973-2005) 11

Member State	Coefficient β		adjusted R^2
	Value	*Standard error*	
Austria	0.57	0.10	0.48
Belgium	0.87	0.10	0.68
Finland	1.44	0.42	0.25
France	0.81	0.09	0.71
Germany	0.98	0.17	0.49
Greece	-0.15	0.26	-0.02
Ireland	1.35	0.38	0.27
Italy	0.81	0.15	0.48
Luxembourg	0.80	0.12	0.57
Netherlands	0.84	0.20	0.34
Portugal	0.57	0.33	0.06
Spain	2.34	0.33	0.61
Average			**0.41**

The average adjusted R^2 is worth 0.41. This is lower than the 0.66 value found by Blanchard and Katz for the U.S. States between 1948 and 1990. However, it is interesting to investigate whether the asymmetric nature of the shocks to State employment in the United States has increased since 1990. We therefore run the same estimation on data[12] for the 51 United States, between 1976 and 2005. Appendix 2 summarizes the results. We find an adjusted R^2 of 0.51 for the United States. Comparisons with the United States must however be interpreted with caution, since the sizes of the Member States considered, relatively to the entire area, are much larger in the euro area than in the United States. The asymmetric nature of shocks to US States could therefore be biased upwards in our estimations, which reinforces our interpretation of the results.

All in all, employment fluctuations appear to be slightly more asymmetric in the euro area than in the United States. Some countries' employment developments seem to be more correlated to those of the euro area as a whole (Germany, France, Luxembourg, Belgium, Italy, Spain), whereas others' (Greece, Portugal, Finland) appear to be relatively different. Because each country has the same weight in the estimates, these results are again influenced by the catching-up processes observed in some euro area countries.

A univariate model can shed light of the stochastic behavior of relative employment – in other words, the difference between national employment and average employment in the euro area - in

[11]The estimation for the 1990-2005 period is also interesting; it provides more recent results, even if the period considered is shorter and results are therefore less robust. The average R^2 is stronger than for the 1973-2005 period, but remains lower than for the United States.

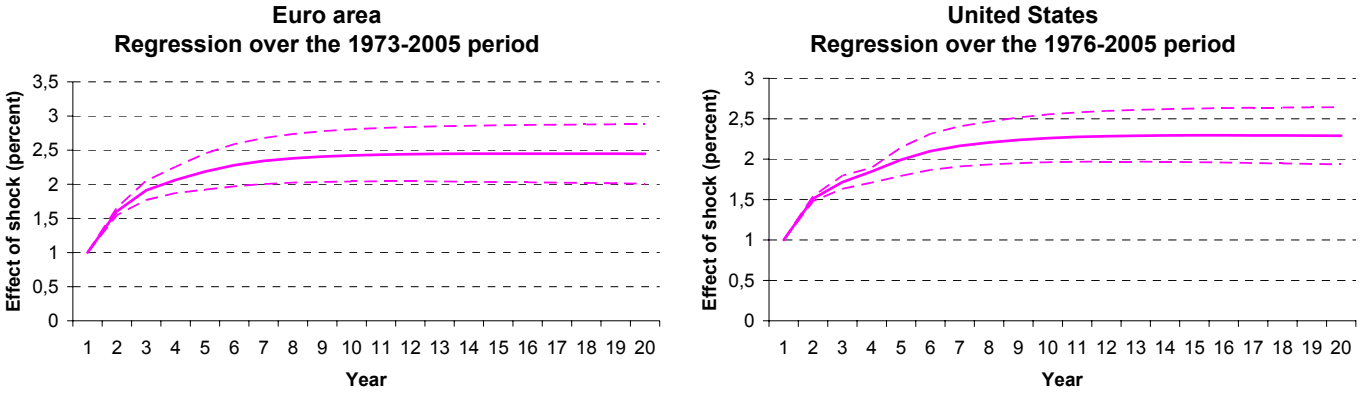
[12] Data comes from the United States Bureau of Labor Statistics. We are grateful to Jim Cambell, who made the series available to us.

response to an asymmetric shock. We define n_{it} as the logarithm of employment in Member State i at date t minus the logarithm of employment in the euro area as a whole ($n_{it} = N_{it} - N_t$).

After having confirmed, using unit root tests (see appendix 3), that the logarithm of relative employment within the euro area is integrated of order 1, we estimate the following AR(4) autoregressive process[13], over the 1973-2005 period on the one hand, and over the 1990-2005 period on the other hand: $\Delta n_{it} = \alpha_{1,i} + \alpha_2(L)\Delta n_{i,t-1} + \varepsilon_{it}$

The first two columns of the table in appendix 4 give the results of the estimations for the euro area. Results for the United States are given in appendix 5. Figure 3 plots the corresponding impulse response functions. These can give useful insight on the **persistence of relative employment, which we define, in this paper, with respect to the speed of return to the long-term equilibrium level after an asymmetric shock.**

Figure 3: Response of relative employment to a positive 1% asymmetric shock



Bands of one standard error are represented by dotted lines.

For employment, the estimated univariate model suggests that asymmetric shocks have permanent effects. This result is consistent with the theoretical model described in box 1.

Results are similar to those found for the United States. Therefore, this univariate analysis of the stochastic behavior of employment in response to asymmetric shocks does not help to explain the weaker persistence of employment in the euro area compared to the United States.

An analysis of other components of labor market adjustment dynamics, namely unemployment and participation, can provide a broader view of the adjustment process and of differences between the US and the euro zone.

[13]We suppose, as Blanchard and Katz do for the United States, that Member States have different employment growth rates trends (different constants for each Member State in the regressions) but that the reaction of employment to an asymmetric shock is the same within the euro area.

2-3 Unemployment:

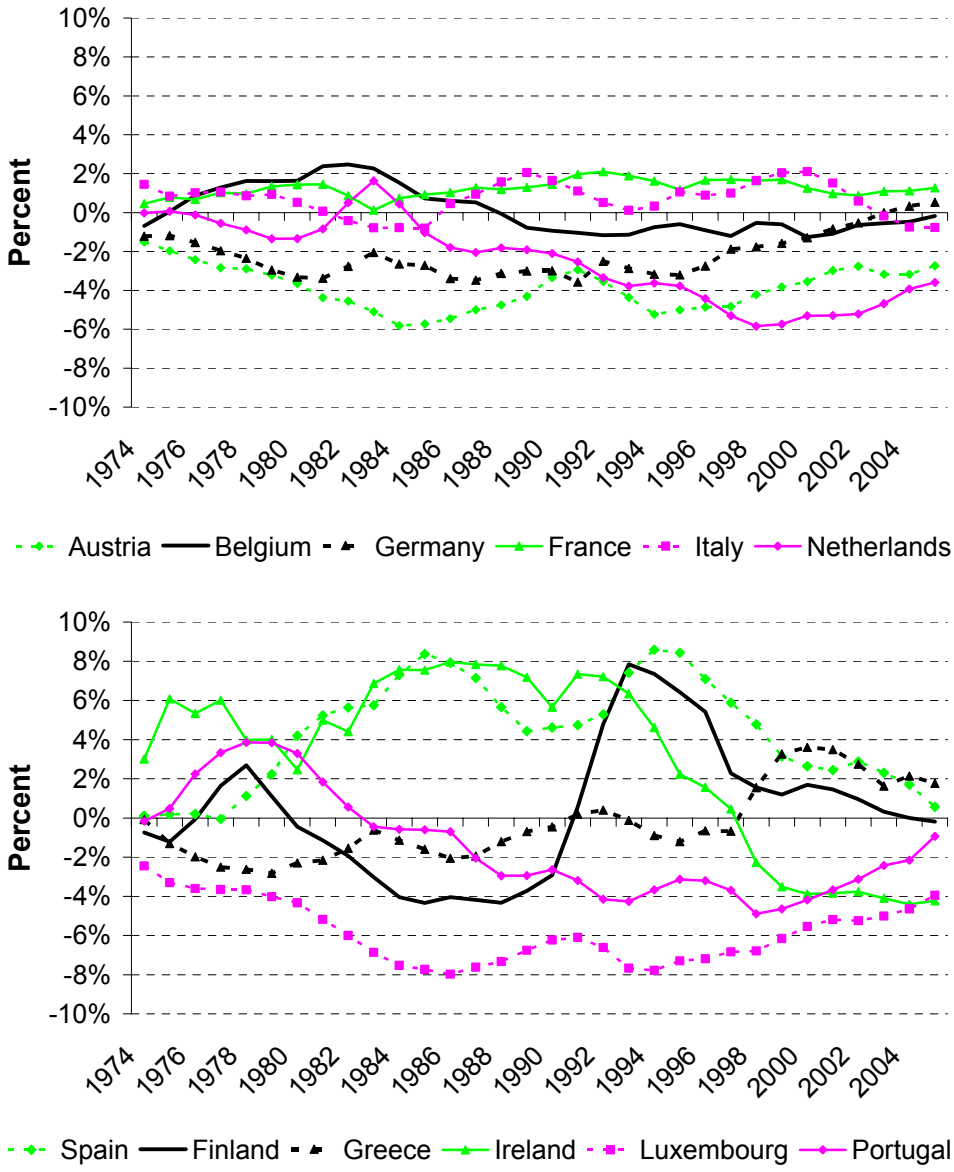
The differences between American and euro area labor markets seem to be more pronounced when it comes to unemployment developments.

Unemployment in the euro area was low at the beginning of the 1970s (around 2.5% on average), and progressively increased to reach the 8-10% range in the 1980s and 1990s, reaching 8.6% in 2005, with ranges from 1.9% in Luxembourg to 10.4% in Greece.

Figure 4 gives "relative" unemployment rates – national unemployment rates minus euro area unemployment rates - from 1973 to 2005 in the euro area.

Figure 4: Relative unemployment rates in the euro area

(0% = unemployment rate in the euro area)

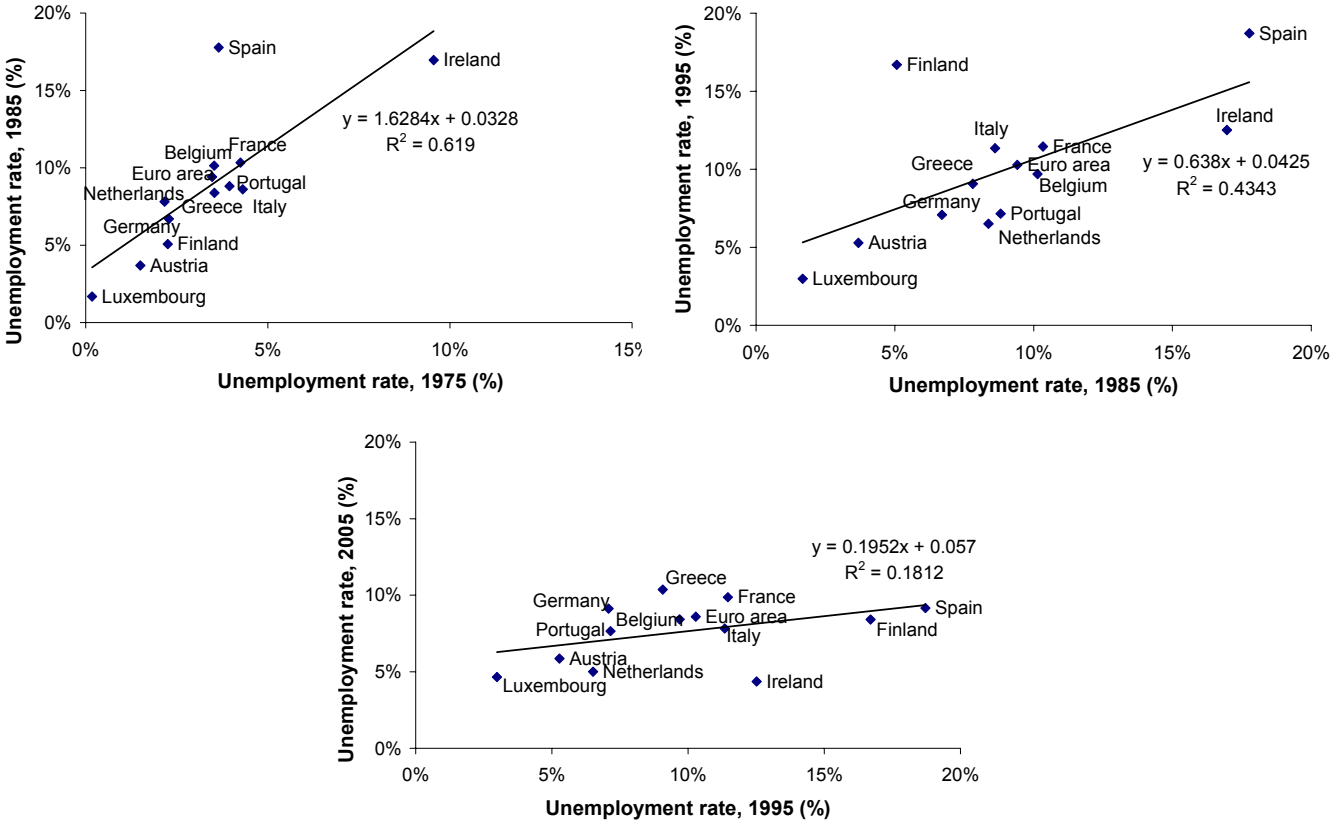


National unemployment dynamics appear to have been relatively different across euro area Member States. Similarly to employment dynamics, countries such as Spain, Ireland or Finland stand out,

although unemployment rates appear to have somewhat converged in the euro area since the creation of the common currency.

Whereas in U.S. States, national unemployment rates do not appear to be stable in the long run[14], Figure 5 suggests that national unemployment rates are more stable across time in the euro area than State unemployment rates in the United States, although this stability has been less pronounced in recent years.

Figure 5: Stability of national unemployment rates across the euro area



The fact that national unemployment rates appear to be more stable over time within the euro area than across U.S. States can have several explanations. One could be that differences in average national unemployment rates reflect persistent differences in – exogenous – national factors, even if we consider the convergence of unemployment rates in the euro area since its creation. Another could be that the effects of asymmetric shocks on national labor markets are more persistent in the euro area. **Once again, analyzing the stochastic behavior of unemployment in reaction to asymmetric shocks can shed light on the stability of national unemployment rates in the euro area.**

We begin by analyzing the degree of asymmetry of shocks affecting national unemployment rates across the euro area. We define U_{it} as the unemployment rate observed in Member State i at date t

[14] Blanchard and Katz plot relative unemployment rates ten years apart, in 1975 and 1985. The regression line has a slope of 0.03 and a R² of 0.

and U_t as the unemployment rate for the euro area as a whole at date t. We estimate the following equation over the 1973-2005 period: $U_{it} = \alpha_i + \gamma_i U_t + \varepsilon_{it}$. Table 2 gives the results of the estimations.

Table 2: Regression relating national unemployment rates to euro-area unemployment rates (1973-2005)

Etat	Coefficient γ		R² ajusté
	Valeur	*Ecart-type*	
Autriche	0.62	0.06	-0.01
Belgique	0.85	0.08	0.76
Finlande	1.24	0.25	0.43
France	1.09	0.03	0.98
Allemagne	0.94	0.08	0.79
Grèce	1.22	0.13	0.72
Irlande	0.73	0.32	0.11
Italie	0.90	0.07	0.85
Luxembourg	0.39	0.06	0.58
Pays-Bas	0.49	0.13	0.30
Portugal	0.21	0.13	0.04
Espagne	1.88	0.13	0.86
Moyenne			**0.54**

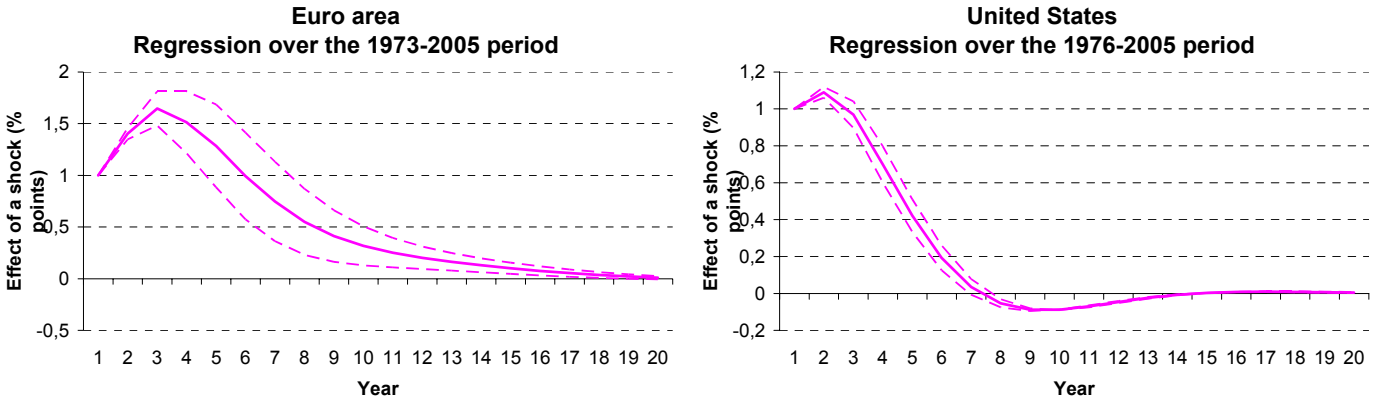
We find an average adjusted R² of 0.54 in the euro area. **Shocks to national unemployment rates in the euro area are relatively asymmetric. Although less asymmetric than shocks on employment,** they are more so than in the United State (R² of 0.64, see appendix 2[15]), which can again be interpreted as a consequence of the convergence process in Europe.

To analyze the response of relative unemployment rates to an asymmetric shock, we define u_{it} as relative unemployment rate, in other words the unemployment rate in Member State i at date t minus the unemployment rate for the euro area at date t ($u_{it} = U_{it} - U_t$). The unit root tests given in appendix 3 suggest that relative unemployment rates are stationary within the euro area. This is consistent with the theoretic model. We therefore regress the following univariate AR(4) model, over the 1973-2005 period: $u_i = \beta_1 + \beta_2(L)u_{i,t-1} + \kappa_{i,t}$

Results are given in the third column of the table in appendix 4 and Figure 6 plots the associated impulse response functions.

[15] Blanchard and Katz do not provide the corresponding results.

Figure 6: Response of relative unemployment rates to a positive 1% asymmetric shock



Bands of one standard error are represented by dotted lines.

The impulse responses show unemployment rates returning to their initial value after an asymmetric shock. **However, the return to the long-run equilibrium rate is slower than in the United States. Whereas in the United States over the 1976-2005 period, the effect of a shock is essentially equal to zero within 7-8 years, the effect of a shock in the euro area, for the 1973-2005 period, still represents around 30% of the initial shock after ten years and the effect only disappears after about 15-20 years.**

The reaction of national unemployment to asymmetric shocks can therefore explain a part of national unemployment rates' stronger stability over time in the euro area, since after a shock, national unemployment returns to its long term mean more slowly in the euro area than in the United States.

Over a more recent period (1990-2005), the persistence in national unemployment rates appears to have diminished in the euro area. The results summarized in the fourth column of the table in appendix 4 confirm this. According to the estimation of the univariate process for unemployment in the euro area over the 1990-2005 period, the effect of an asymmetric shock to unemployment essentially disappears after 10 years. In this sense, unemployment dynamics in response to asymmetric shocks in the euro area appear to have moved closer to those observed in the United States.

2-4 Participation

Recall that a given employed person subject to a negative shock in labor demand can either (1) become unemployed, (2) leave the active population but remain in the country or (3) migrate out of the country[16]. The analysis of the stochastic behavior of labor participation in response to a shock is therefore important within our empirical framework.

Appendix 6 gives some simple stylized facts on labor force and working-age population growth rates within the euro area since 1973. They appear to have been relatively stable over time.

We investigate the asymmetric or symmetric nature of national shocks to labor participation by running the following regression over the 1973-2005 period: $P_{it} = \alpha_i + \delta_i P_t + \xi_{it}$. P_{it} is the participation rate observed in Member State i at date t and P_t the participation rate for the euro area at date t. Table 3 gives the results of the estimations.

[16]This is under the hypothesis that exits out of the working-age population due to ageing are relatively similar across the euro area.

Table 3: Regression relating national participation rates to euro-area participation rate (1973-2005)

Member State	Coefficient δ		adjusted R^2
	Value	*Standard error*	
Austria	0.20	0.12	0.05
Belgium	0.72	0.04	0.90
Finland	-0.12	0.14	-0.01
France	0.49	0.06	0.65
Germany	1.45	0.11	0.84
Greece	0.79	0.12	0.55
Ireland	1.16	0.08	0.87
Italy	0.20	0.09	0.10
Luxembourg	1.02	0.04	0.96
Netherlands	2.02	0.12	0.90
Portugal	1.39	0.15	0.73
Spain	1.65	0.16	0.77
Average			**0.61**

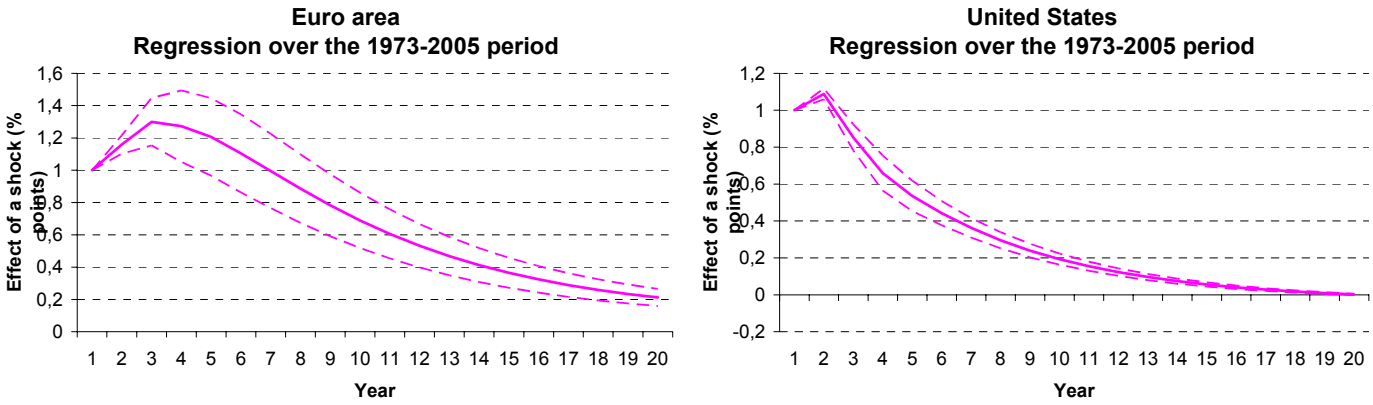
The average adjusted R^2 of 0.61 for the euro area suggest that shocks to national participation rates in the euro area are relatively asymmetric, although less than unemployment and employment. They however appear to be more asymmetric than in the United States (R^2 of 0.71, see appendix 2)

Again, a stochastic analysis of the response to participation to an asymmetric shock can provide insight on developments in participation rates. We define p_{it} as the participation rate in Member State i at date t minus the participation rate for the euro area at date t ($p_{it} = P_{it} - P_t$).

The unit root tests given in appendix 3 are less clear than for employment and the unemployment rate. Not all tests allow us to reject the hypothesis of a unit root for the relative participation rate. However, since our theoretical prior is that the participation rate is stationary, we estimate the following AR(4) univariate process, over the 1973-2005 period: $p_{it} = \gamma_{1,i} + \gamma_2(L)p_{i,t-1} + \varepsilon_{it}$.

The fifth and sixth columns of the table in appendix 4 give the corresponding results and Figure 7 plots the associated impulse response functions.

Figure 7: Response of relative participation rates to a positive 1% asymmetric shock



Bands of one standard error are represented by dotted lines.

After an asymmetric shock, relative participation rates slowly return to their long-term equilibrium rate. The estimation for the 1973-2005 period suggests that around 40% of the initial shock is still visible after 15 years. The persistence of labor participation therefore appears to be strong, and in particular stronger than what can be observed in the United States. Relative participation rates return to their long-term equilibrium rate within 15-20 years in the United States over the 1976-2005 period.

However, estimations carried out over a more recent period (1990-2005) (see appendix 4 and 5) indicate that the response of labor participation to asymmetric shocks is becoming more rapid. The effect of the asymmetric shock falls to only 12% of the initial shock after 20 years. Labor participation therefore appears to have become less persistent in the euro area in response to asymmetric shocks, moving closer to the dynamics observed in the United States.

2-5 Conclusion

We investigated the persistence of employment, unemployment and participation within the euro area, by estimating the response of each national variable, relatively to the total euro area variable, to an asymmetric shock, **and compared it to that observed in the United States.** Both in the United States and in the euro area, consistently with Blanchard and Katz's theoretical model, employment seems to be relatively persistent, whereas unemployment rates and participation rates appear much less so. On European labor markets however, the persistence of unemployment and participation appear to be much stronger: after an asymmetric shock (these being relatively frequent in the euro area), relative unemployment and participation rates return more slowly to their long-term equilibrium rate in the euro area than in the United States.

3- Dynamic responses of employment, unemployment and participation to asymmetric labor demand shocks.

Both in the United States and in the euro area, deviations of national/state relative unemployment and participation from their long-term means are not permanent. This suggests that national employment shocks are not entirely absorbed by changes in national unemployment and participation, but by migrations. In order to investigate formally how shocks to national labor demand in Europe are absorbed, we analyze the joint behavior of relative employment, relative unemployment rates and relative participation rates in response to labor demand shocks to euro area Member States.

We estimate the following VAR for the euro area, between 1973 and 2005:

$$\begin{cases} \Delta n_{it} = \lambda_{i,0} + \lambda_1(L)\Delta n_{i,t-1} + \lambda_2(L)le_{i,t-1} + \lambda_3(L)lp_{i,t-1} + \varepsilon_{i\lambda t} \\ le_{it} = \mu_{i,0} + \mu_1(L)\Delta n_{i,t} + \mu_2(L)le_{i,t-1} + \mu_3(L)lp_{i,t-1} + \varepsilon_{i\mu t} \\ lp_{it} = \nu_{i,0} + \nu_1(L)\Delta n_{i,t} + \nu_2(L)le_{i,t-1} + \nu_3(L)lp_{i,t-1} + \varepsilon_{i\nu t} \end{cases}$$

n_{it} stands for the logarithm of employment in State i at date t minus the logarithm of employment in the euro area at the same date, le_{it} is the logarithm of the employment rate in State i at date t minus the logarithm of the employment rate in the euro area at the same date and lp_{it} is the logarithm of the participation rate in State i at date t minus the logarithm of the participation rate in the euro area at the same date.

As in Blanchard and Katz but contrary to Decressin and Fatás, we do not only consider the effects of asymmetric shocks on national labor markets, but also the asymmetric effects of common shocks. More formally, we consider, for example for relative changes in employment, the variable:

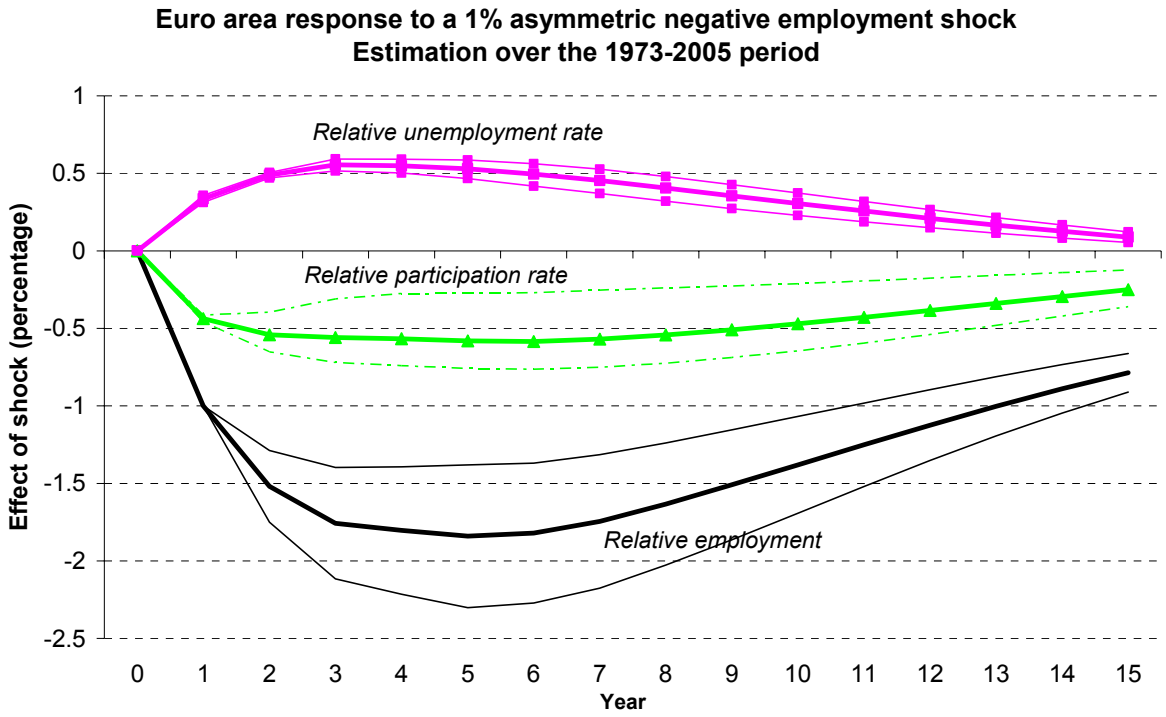
$$\Delta n_{it} = \Delta N_{it} - \Delta N_t = \underbrace{\Delta N_{it} - \beta_i \Delta N_t}_{\text{asymmetric shocks}} + \underbrace{(\beta_i - 1)\Delta N_t}_{\text{common shocks with asymmetric effects}}$$

We allow for four lags for each variable. We run a pooled OLS estimation, allowing in each case for State-fixed effects (State-specific constant terms in each equation).

We trace the effects, in one representative Member State, of an innovation to relative labor demand on relative employment, unemployment rates and participation rates. In order to do this, we need to identify shocks to labor demand. Following Blanchard and Katz, we associate unexpected changes in national relative employment within the year to changes in labor demand. Appendix 7 suggests that this hypothesis is relatively plausible, since only a small fraction of these changes seems to be due to exogenous changes in labor supply or migrations. We therefore assume that current changes in relative employment can affect unemployment and participation rates but not vice-versa.

Table 1 of appendix 8 gives the values of estimated coefficients for the euro area. Figure 8 plots the response, in one representative Member State of the euro area, of employment, unemployment and labor force participation to a negative innovation in relative labor demand ($\varepsilon_{i\lambda t}$).

Figure 8:

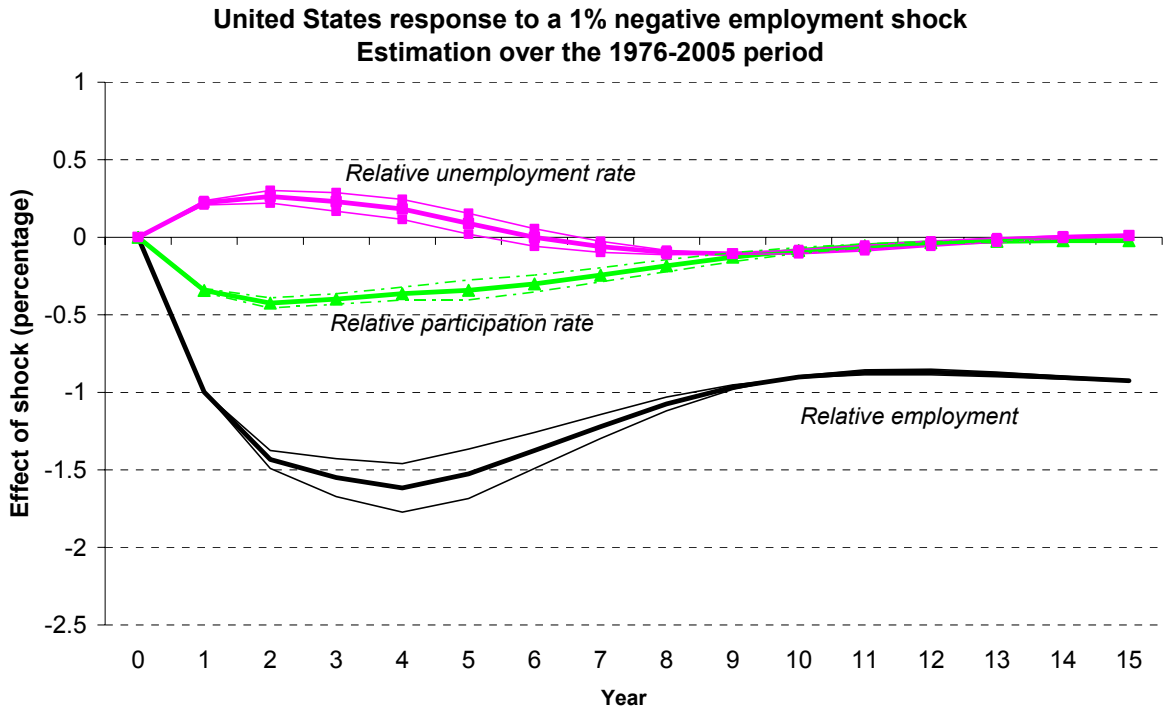


Bands of one standard error are represented by dotted lines.

We also run the VAR described above on data[17] for the 51 United States, between 1976 and 2005. We again allow for four lags for each variable. Figure 9 plots the response of one American State's employment, unemployment and labor force participation to a negative innovation in labor demand ($\varepsilon_{i\lambda t}$).

[17] Data comes from the United States Bureau of Labor Statistics. We are grateful to Jim Cambell, who made the series available to us.

Figure 9:



Bands of one standard error are represented by dotted lines.

The reactions of employment to the asymmetric shock are not identical in the euro area and in the United States. Over time, the effects on employment build up, due to the lagged effects of the shock, to reach a peak between -1.5% and -2% after four to six years, and progressively return, in particular thanks to job creations in response to the increase in unemployment, to reach a plateau. The plateau is however reached later in the euro area (after 20 years) than in the United States (after 10 years) and is closer to the long-term level in the euro area.

In the euro area, the short-term responses of unemployment and participation to an asymmetric shock to labor demand are stronger than in the United States. In the euro area, the first year, an asymmetric decrease in employment of 1 percent is reflected in an increase in the unemployment rate of 0.33 percentage points and a decrease in the participation rate of 0.44 percentage points. The corresponding figures for the United States are 0.22 for unemployment and 0.34 for participation.

The impulse response functions moreover suggest that the medium-term persistence of unemployment and participation rates in reaction to the labor demand shock differs in the two monetary unions. In the United States, unemployment and participation rates return to their initial level more rapidly (after 5 to 7 years for unemployment and after 8 to 10 years for participation) than in the euro area (after 15 to 20 years, both for unemployment and participation).

Recall that since a given person between the ages of 15 and 64 in a euro area Member State is either employed, unemployed, out of the labor force or out of the country**, the portion of the adjustment to the shock not accounted for by changes in the unemployment rate or in the participation rate corresponds to net out-migration of workers**[18]. The reconciliation of national data for active

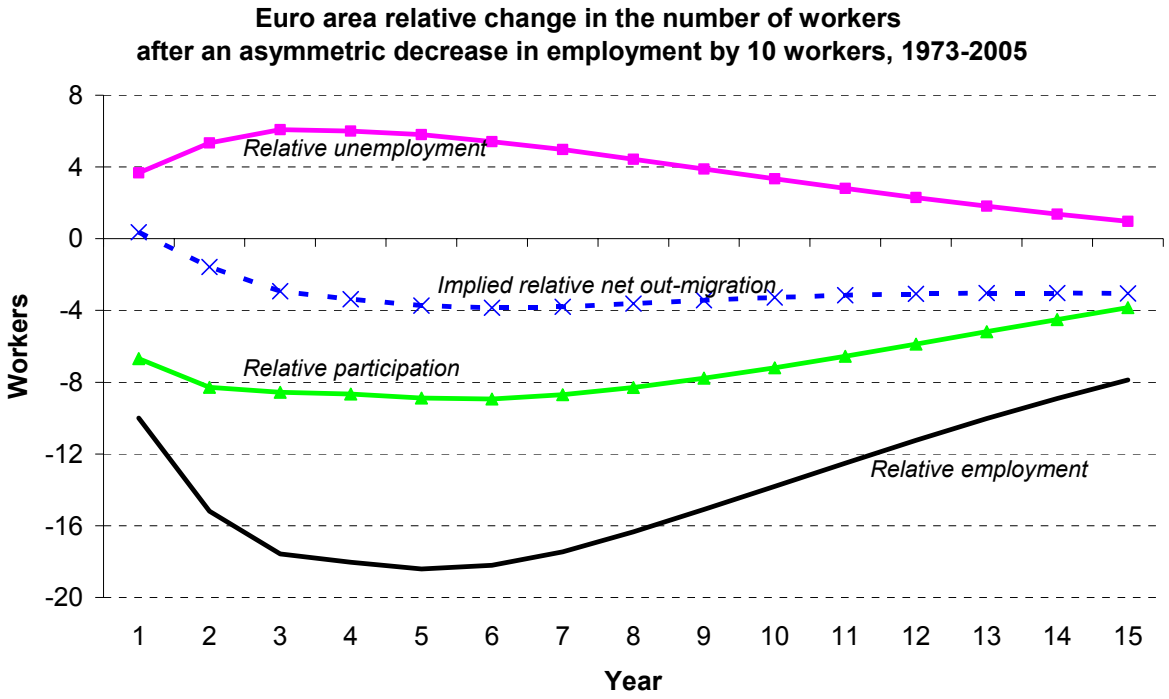
[18]The VAR is based on the following accounting framework: ln(employment) – ln(employment/active population) – ln(active population / working-age population) = ln(working-age population). Therefore, implied net out-migration of labor after a negative asymmetric shock can be inferred, indirectly, from the response of the other variables to the

population, employment and unemployment is not always easy. Results must therefore be interpreted with caution. **They however suggest that in the short and medium term, the implied response of net out-migration to an asymmetric labor demand shock is weaker in the euro area than in the United States.**

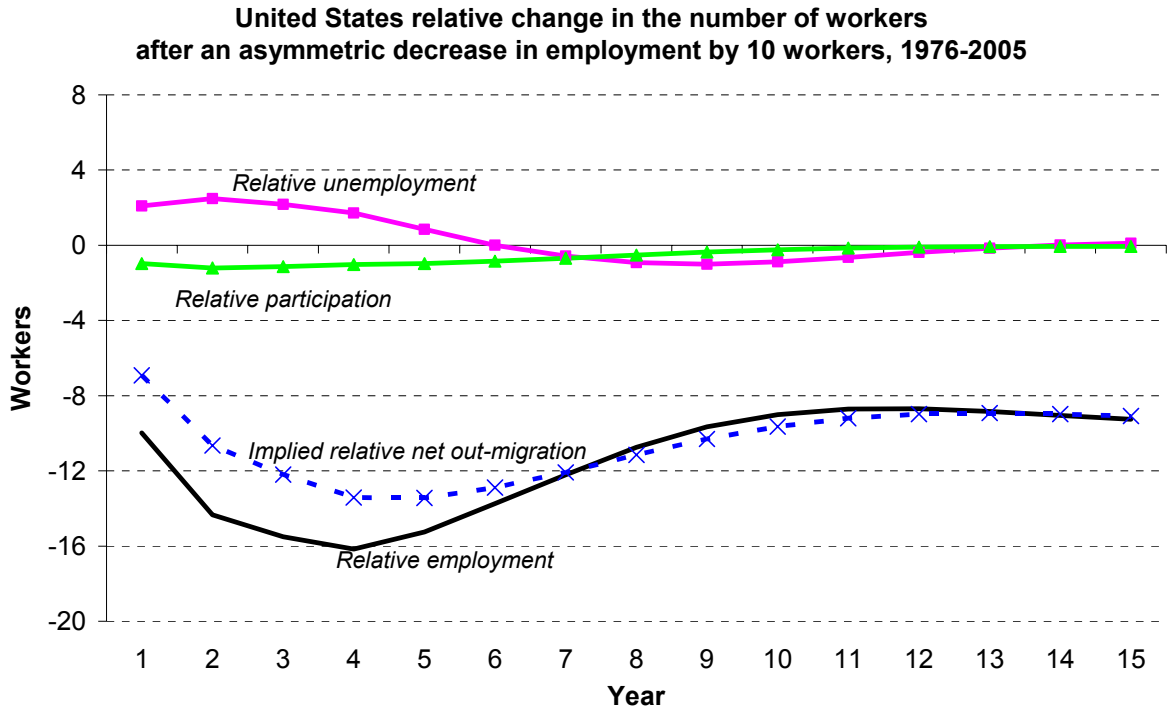
In order to compare the results for the euro area and the United States, it is useful, as Blanchard and Katz, to report these results in terms of changes in numbers of workers. Figure 10 gives the implied net-out migration after a negative asymmetric shock to employment of one worker the first year, over a 15 year period, both for the euro area and the United States.

We plot the labor markets' responses to a negative asymmetric shock to employment (results are symmetrical after a positive asymmetric shock). Note that the implied net-out migration may not only correspond to an increase in relative out-migrations after a negative choc but also to a decrease in in-migration, relatively to the other euro area Member States.

Figure 10:



shock. This result depends on the hypothesis that exits out of the working-age population due to ageing are relatively similar across the euro area or are not correlated with asymmetric shocks affecting labor demand.



In the United States, a relative decrease in employment of 10 workers in the initial year is associated with a relative increase in unemployment of 2 workers, a relative decrease in participation of 1 worker and thus an implied relative increase in net out-migration of 7 workers. After 3 years, due to the lagged effect of the shock, relative employment decreases by 15 workers. The implied relative increase in net out-migration increases to reach 12 workers after 3 years, and 9 workers after 15 years[19], when the negative effect of the shock to relative employment begins to decrease. Appendix 9 summarizes these results.

By contrast, in the euro area, a relative decrease in employment of 10 workers in the initial year is associated with a relative increase in unemployment of 3 workers, a relative decrease in participation of 7 workers, and thus an implied non significant relative increase in net out-migration the first year. The implied relative increase in net out-migration increases over the years however, reaching 3 workers after 3 years and staying at this level after 15 years.

Results must of course be interpreted with caution. They are dependant on the quality of the data and on the VAR specification chosen. Since we use data for 12 euro area Member States, and choose not to set different weights for each country[20], results equally reflect the labor market dynamics of each of these Member States. We therefore run robustness tests, excluding one country from the estimation, one after another[21]. Table 4 gives the corresponding results.

[19] These results are relatively consistent with those found by Blanchard and Katz: a relative increase in unemployment of 30 workers the first year, a relative decrease in participation of 5 workers and an implied relative net out-migration of 65 workers. The stronger response of relative participation in our estimations may result from the recent revisions to unemployment data in the United States, reflected in participation rates.

[20] If we did, we would be essentially capturing the labor market dynamics of the larger euro area countries.

[21] We do not, however, change the euro area average values each time.

Table 4: Member State robustness tests for implied relative labor migration over the 1973-2005 period

Member State excluded from the estimation	Implied relative migration after 10 years	Difference w.r.t. total estimation
Austria	-3	0
Belgium	-3	0
Finland	-5	2
France	-3	0
Germany	-3	0
Greece	-5	2
Ireland	-1	-2
Italy	-3	0
Luxembourg	-3	0
Netherlands	-3	0
Portugal	-3	0
Spain	-2	-1
Average	-3	0

Example: If Ireland is excluded, relative migration after an asymmetric shock to labor demand is around 1 worker after 10 years, which is 2 workers lower than the figure obtained for the whole sample. Therefore, ***including Ireland increases implied relative labor migration after an asymmetric*** *shock*

Results appear to be relatively robust when single countries are excluded from the estimation and therefore do not appear to reflect massive labor movements in individual countries. Some countries appear to increase the implied relative labor migration response of the euro area: Ireland and Spain.

Without surprise, results therefore suggest that immigration accounts for a much lower portion of adjustment to asymmetric labor demand shocks in the euro area than in the United States. Moreover, in the euro area, participation appears to be a stronger adjustment mechanism than in the United States[22].

Note that the econometric framework allows us to compare the responses of unemployment, labor participation and labor migration to a given, identical, labor demand shock. **Results are therefore independent of the effects that other types of real dynamic adjustment mechanisms can have on labor market dynamics, such as wage movements or changes in the number of hours worked. These mechanisms can change the size of employment's response to a labor demand shock, but the latter is normalized to one before the subsequent response of unemployment, participation, and labor migration is considered (see Box 2).**

Box 2: How have average wages and hours worked influenced euro area employment trends over the past thirty years?

We run VARs for relative employment growth and relative growth of average hours worked per job on the one hand and for relative growth of average wages per person on the other hand. Blanchard and Katz showed that there was a weak effect of wages on job creation and job in-migration, and therefore that adjustment to asymmetric labor demand shocks across the United States passed mostly through quantities and less through prices. Contrary to Blanchard and Katz however, in the euro area between 1973 and 2005, the first-year response of both relative hours and relative wages to a positive asymmetric shock to labor demand is negative. This result can be explained by the fact that structural developments such as reductions in average hours worked or reductions of social

[22] This can be due to a stronger reliance on early retirement in the euro area or to the fact that women drop more frequently out of the labor force in the euro area than in the United States.

contribution for low paid workers have had a positive impact on employment growth in the euro area over the past thirty years. The negative econometric relation between relative hours and wages on the one hand and relative employment on the other may therefore not reflect negative responses of hours and wages to labor demand shocks but, on the contrary, a positive response of employment to exogenous reductions in average wages and hours worked[23].

The ECB (2005)[24] showed that between 1970 and 2004, the euro area observed a downward trend in **average annual hours worked per worker**. National discrepancies of course existed, with Belgium, Germany, France, Ireland, Luxembourg, Portugal and Finland experiencing a steady downward trend, whereas in Spain and Italy, the downward trend significantly slowed from the mid- to late 1980s and in Greece, average working hours remained stable over the whole period.
To an important extent, these downward trends may reflect national preferences. Thus, according to the ECB, increasing shares of voluntary part-time employment across many euro area countries have contributed to the downward trend in average hours worked, while contributing strongly and positively to employment growth in the euro area over the 1990s.
Another explanation for the downward trend in average annual working hours may be the changes in working time regulations in Europe (1993 EU Directive on working time, implementation of the 35-hours week in France, enforced shorter working hours in Germany in the 1980s, changes in part-time legislation in the Netherlands in 1982).

Average wages (labor costs) have also influenced employment dynamics in the euro area. In the late 1980s and the 1990s, growth in hourly real labor costs slowed significantly in the euro area countries - particularly in Spain and Italy -, in particular as a result of labor market reforms which lowered the cost of hiring young and unskilled workers, and of wage moderation. According to the ECB, this may have induced firms to shift to more labor-intensive production, reversing earlier substitution policies in favor of capital.

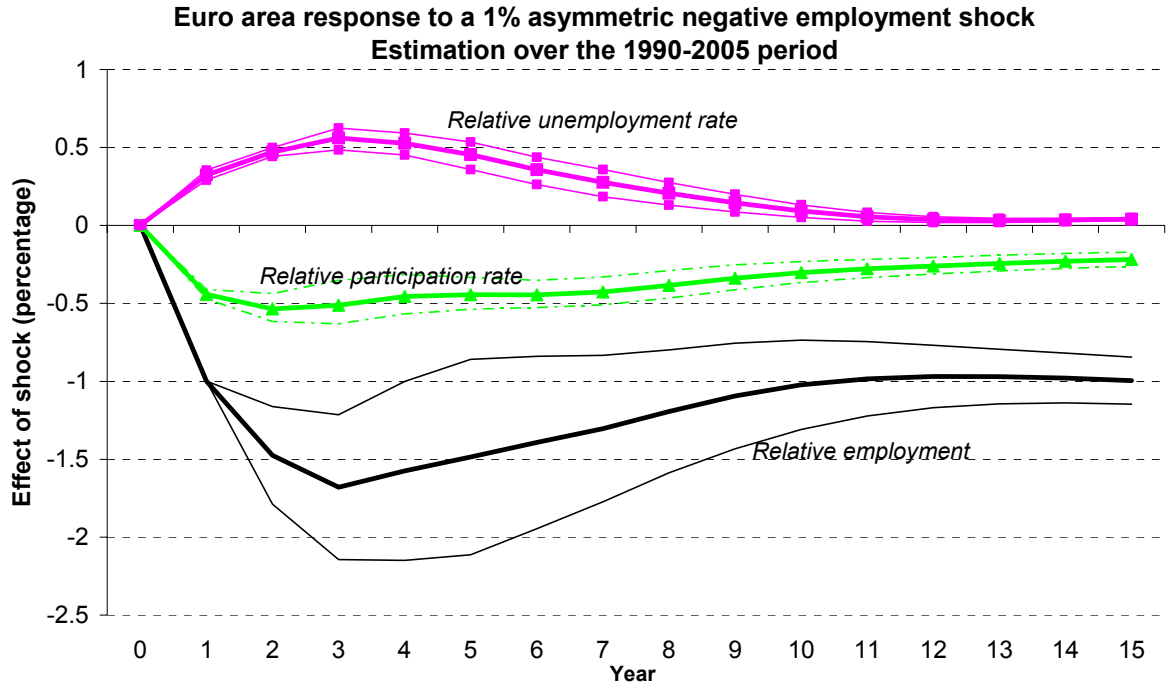
[23] Granger causality tests do not, however, allow us to discriminate between the two hypotheses.
[24] ECB december 2005 : « Trends and Patterns in Working Time across Euro area Countries -1970-2004 »

4- How have euro area labor market dynamics changed since 1990?

The previous regression indicates that the responsiveness of labor mobility to shocks to labor demand is much lower, in the euro area, for the 1973-2005 period, than in the United States for the 1976-2002 period. However, **since the creation of the euro area, the dynamic adjustment mechanisms in the monetary union may have improved. It is therefore interesting to analyze the response of national labor markets to asymmetric labor demand shocks for a more recent period, both in the euro area and in the United States.**

We therefore run the same vector autoregressive regression for the euro area for the years 1990-2005. The estimated coefficients are given in Table 2 of Appendix 8 and Figure 11 plots the responses to a 1% negative shock in labor demand, over a 15 year period.

Figure 11:

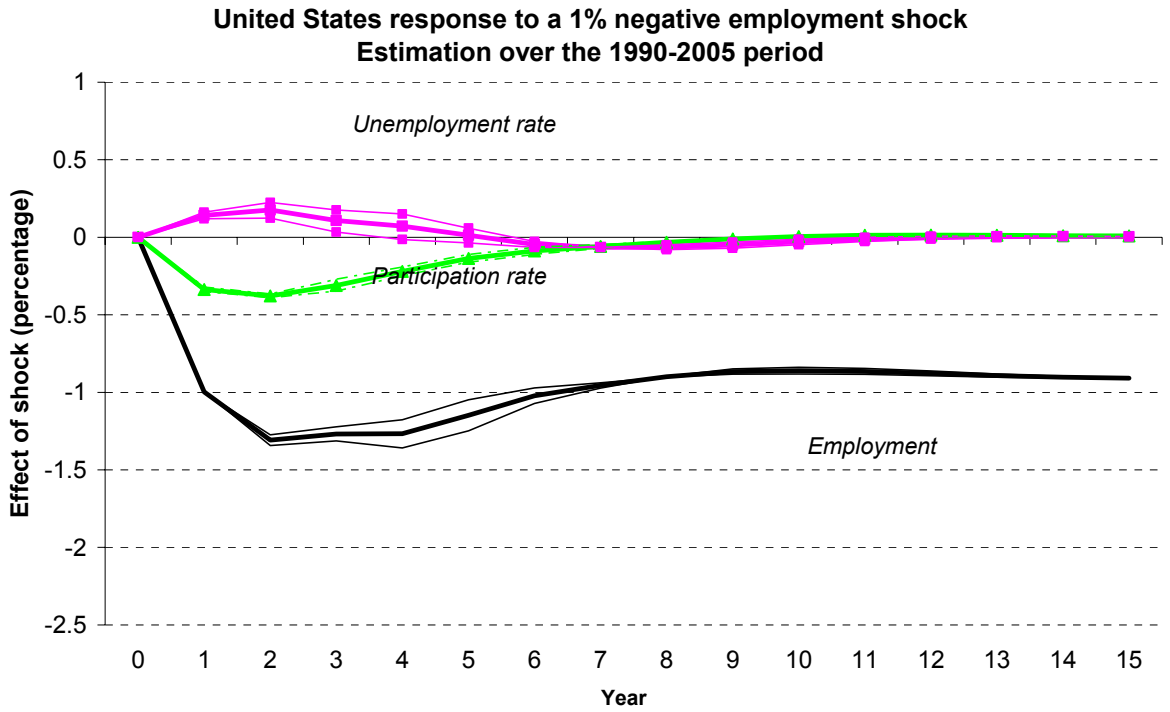


Bands of one standard error are represented by dotted lines.

The response of employment to a labor demand shock is similar to that observed for the 1973-2005 period. The response of relative employment again builds up to reach a peak after three to four years, and progressively diminishes to reach a plateau of around 1%. **However, the relative unemployment and participation rates return more rapidly to their long term mean than over the 1973-2005 period. The responses to an asymmetric shock to labor demand are essentially equal to zero after about 10 years, which is closer to, but still higher than the 5 to 7 years found in the United States.**

It is however interesting to investigate whether, since 1990, labor mobility in the United States has also become more efficient in response to asymmetric shocks. Figure 12 plots the United States' response to a 1% negative shock in labor demand for the 1990-2005 period.

Figure 12:

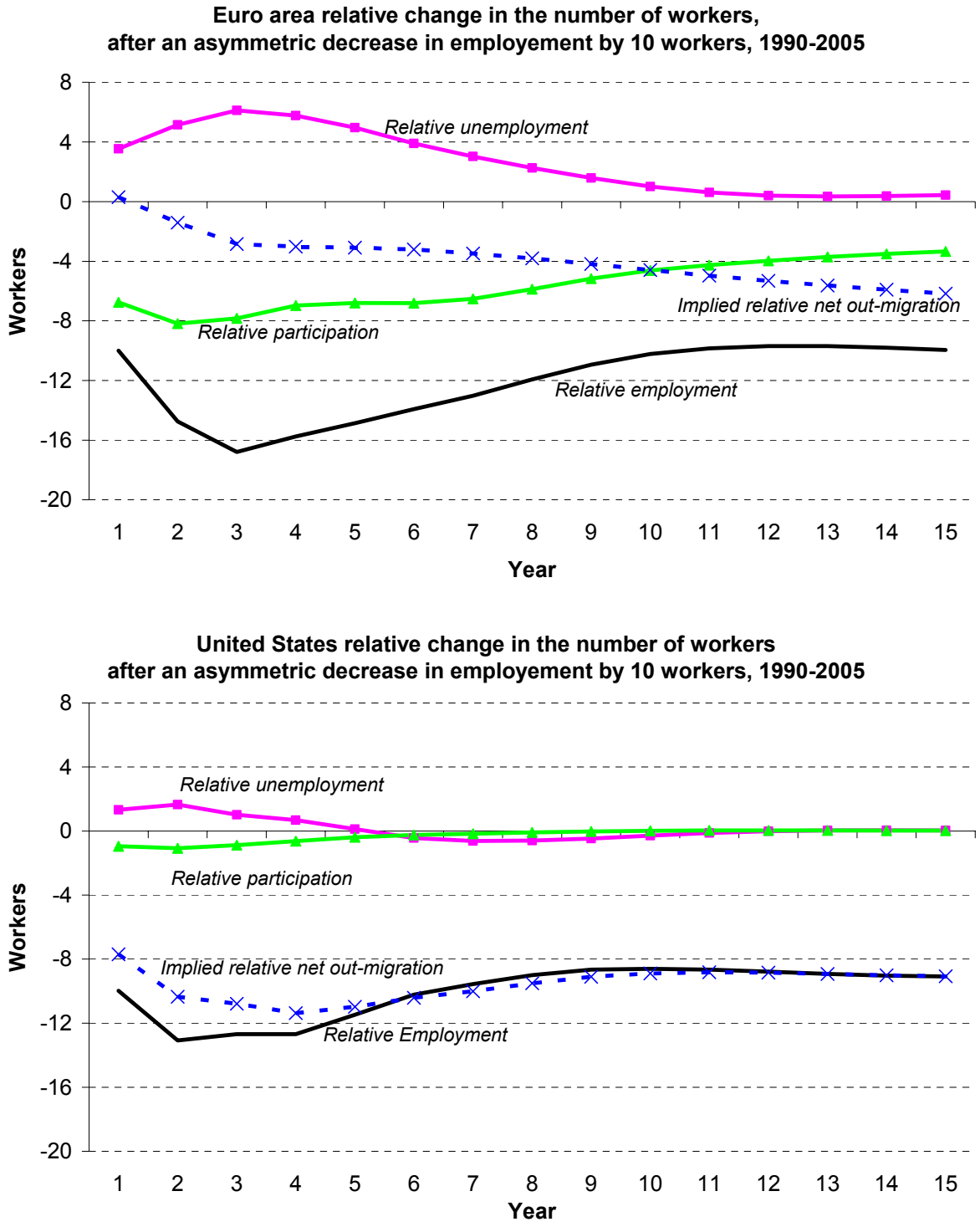


Bands of one standard error are represented by dotted lines.

Results for the 1990-2005 period for the United States suggest that relative unemployment and participation still return to their long term value quickly after an asymmetric labor demand shock, in around 4-6 years, but that labor market dynamics have not significantly changed in the United States over the more recent period. Euro area labor market dynamics therefore appear to have moved closer to those observed in the United States since the beginning of the 1990s.

Figure 13 gives the corresponding results in terms of relative labor migration. **Although the response of relative migrations to an asymmetric labor demand shock still appears to be lower in the euro area than in the United States during the 1990-2005 period, results suggest that it is stronger than for the 1973-2005 period in the medium-term.**

Figure 13:



In the euro area over the 1990-2005 period, an asymmetric decrease in employment by 10 workers in the initial year is still associated with an increase in relative unemployment of 3 workers, a decrease in relative participation of 7 workers and a non significant implied increase of net relative out-migration. However, implied net relative migration increases in the medium run. It reaches 5 workers after 10 years, compared to 3 for the 1973-2005 period, and 6 after 15 years, compared to 3 for the 1973-2005 period (see Appendix 9).

Over the same period, results have not changed significantly in the United States; the implied net out-migration in response to an asymmetric shock to labor demand of 10 workers is still around 9 workers after 15 years.

We once again run robustness tests, excluding one country from the estimation, one after another. Table 5 gives the corresponding results.

Table 5: Member State robustness tests for implied relative labor migration over the 1990-2005 period

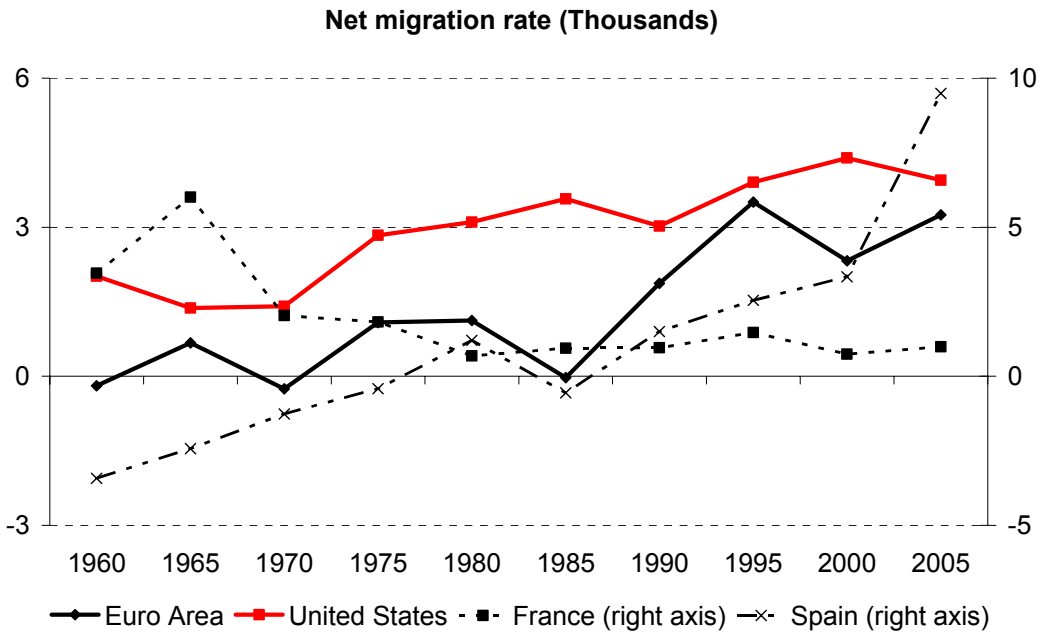
Member State excluded from the estimation	Implied relative migration after 10 years	Difference w.r.t. total estimation
Austria	-5	0
Belgium	-4	0
Finland	-8	3
France	-4	0
Germany	-4	-1
Greece	-4	-1
Ireland	-7	2
Italy	-4	0
Luxembourg	-5	0
Netherlands	-4	0
Portugal	-4	0
Spain	-3	-1
Average	-5	0

*Example: If **Spain** is excluded, relative migration after an asymmetric shock to labor demand is around 3workers after 10 years, which is 1 worker lower than the figure obtained for the whole sample. Therefore, **including Spain increases implied relative labor migration after an asymmetric** shock*

Results again appear to be relatively robust when single countries are excluded from the estimation and therefore do not appear to reflect massive labor movements in individual countries. Some countries appear to increase the implied relative labor migration response of the euro area: Germany (effect of the reunification), Greece and Spain.

Figure 14 may provide a possible explanation for this recent increase in the responsiveness of labor mobility in the euro area to asymmetric shocks.

Figure 14:



Source: World Bank (WDI)

The net migration rate of the euro area as a whole strongly increased, relatively to the United States, since the beginning of the 1990s. **The increased migration response to shocks in the euro area may thus possibly be driven by a greater inflow of immigrants from outside of the euro area (to particular Member States, in response to *asymmetric* shocks), rather than by labor flows between euro area Member States.**

Conclusion

Results must of course be interpreted with caution, since data reconciliation for active population, employment and unemployment is not always easy. Comparisons between the euro area and the United States can give insight on the differences between labor market dynamics in both areas.

Without much surprise, results suggest that labor mobility in response to asymmetric labor demand shocks is lower in the euro area than in the United States. Changes in labor participation are a stronger adjustment mechanism.

Estimates based on a shorter and more recent period (1990-2005), however, indicate that the reactions of labor markets to asymmetric labor demand shocks in the euro area have become closer to those observed in the United States. The contribution of labor participation to the adjustment process appears to have diminished, and relative movements of labor forces between Member States seem to have become a more efficient adjustment mechanism.

The responsiveness of labor mobility to asymmetric labor market shocks therefore seems to have improved in the euro area since the creation of the common currency, bringing euro area labor market dynamics closer to those observed in the United States.

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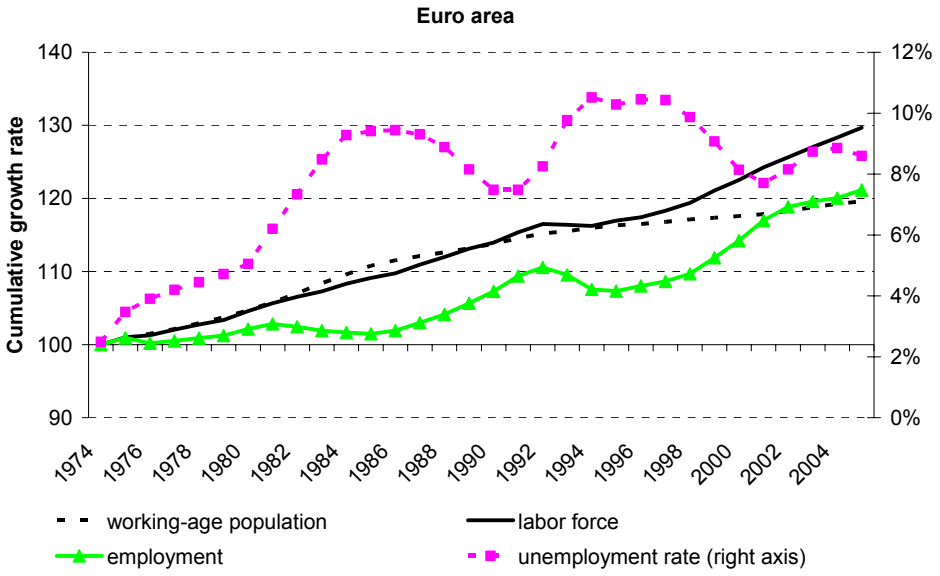
Appendix 1:

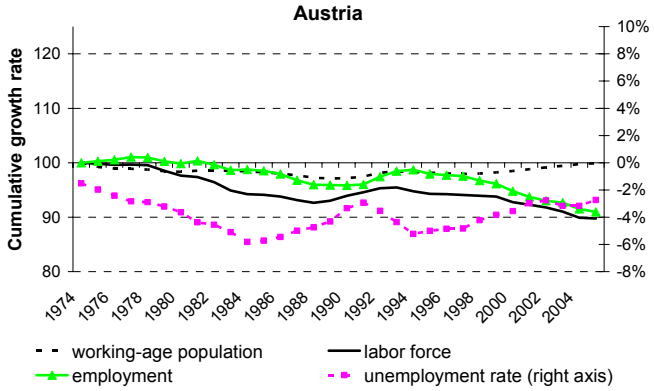
1) Joint euro area labor market dynamics

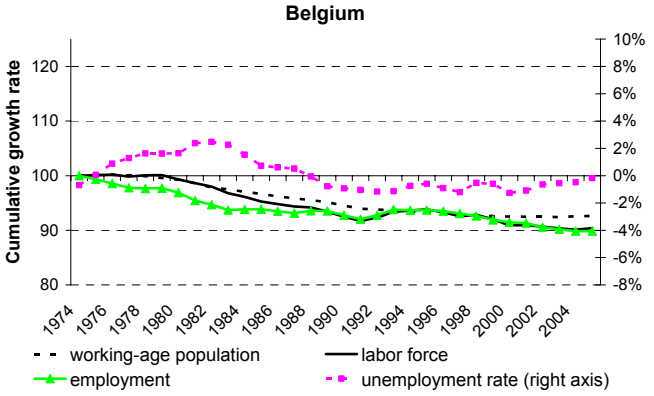
(100 = employment level in the euro area in 1974)

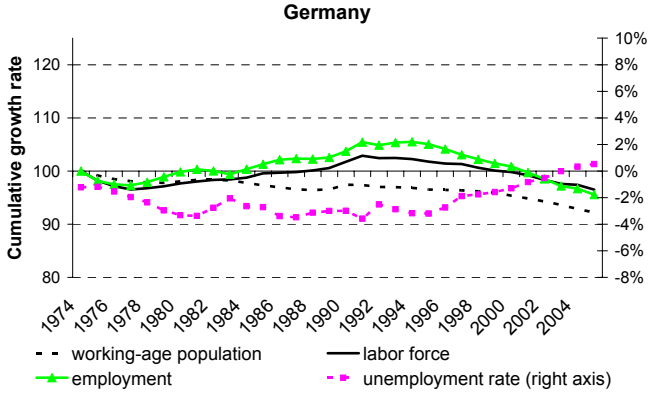


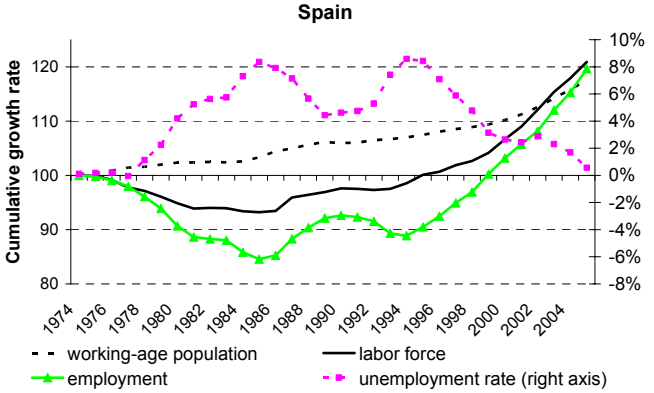
2) Joint *relative* national labor market dynamics

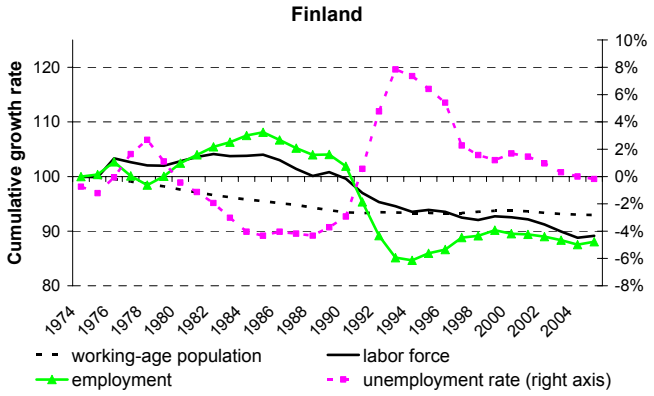
(100 = employment level in the euro area, 0% = unemployment rate in the euro area).

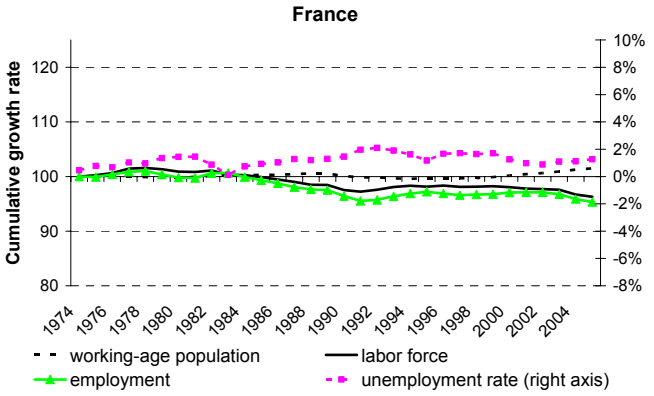


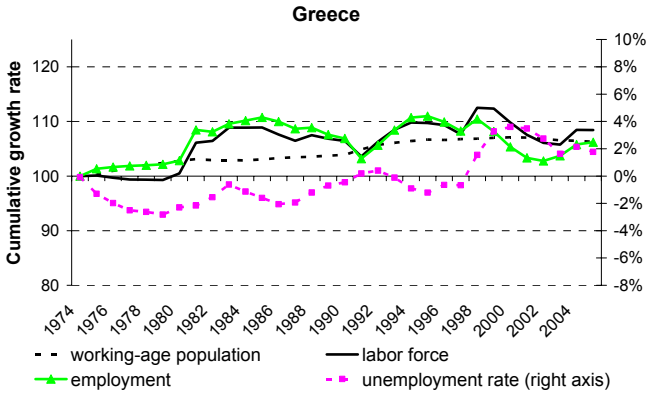


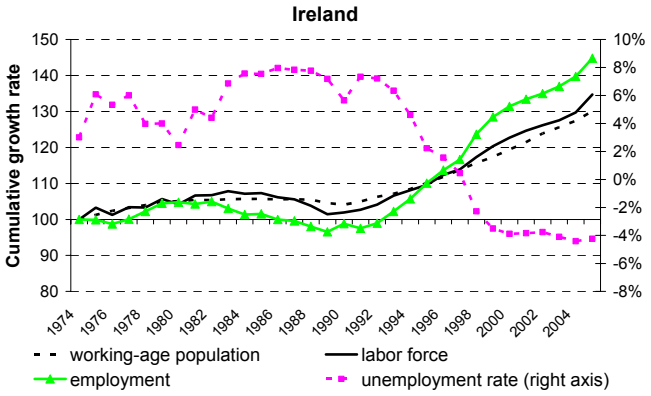


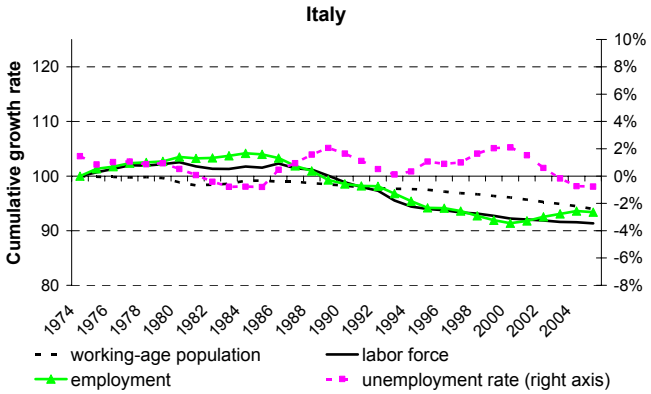


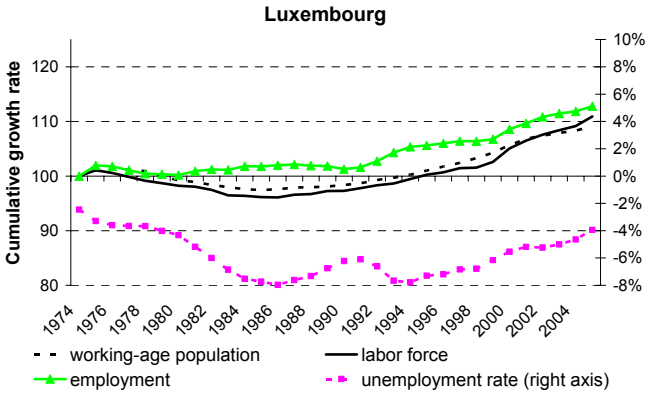


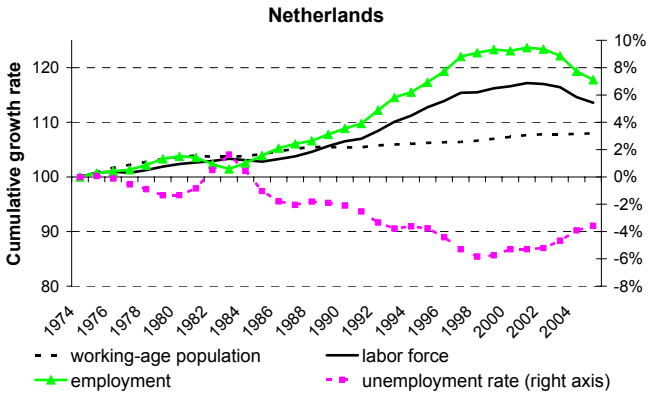


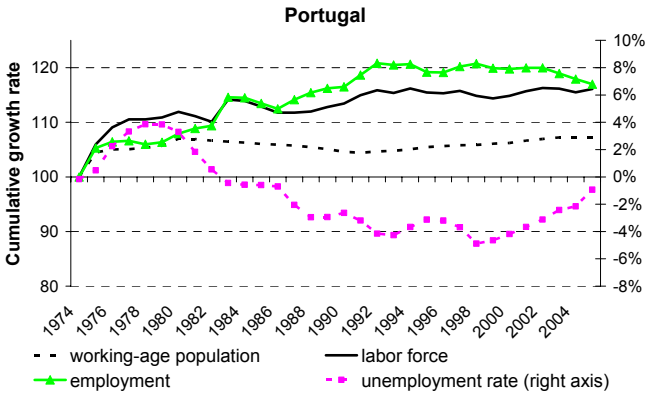

Greece
Cumulative growth rate
working-age population
labor force
employment
unemployment rate (right axis)


Ireland
Cumulative growth rate
working-age population
labor force
employment
unemployment rate (right axis)


Italy
Cumulative growth rate
working-age population
labor force
employment
unemployment rate (right axis)


Luxembourg
Cumulative growth rate
working-age population
labor force
employment
unemployment rate (right axis)


Netherlands
Cumulative growth rate
working-age population
labor force
employment
unemployment rate (right axis)


Portugal
Cumulative growth rate
working-age population
labor force
employment
unemployment rate (right axis)

Appendix 2:

Regression relating State employment growth rates, unemployment rates and participation rates to corresponding USA variables (1976-2005)

State	Employment			Unemployment rate			Participation rate		
	Coefficient δ		adj. R^2	Coefficient δ		adj. R^2	Coefficient δ		adj. R^2
	Value	*St. Error*		*Value*	*St. Error*		*Value*	*St. Error*	
Alabama	1.28	0.14	0.75	1.56	0.14	0.81	1.22	0.08	0.90
Alaska	0.03	0.31	-0.04	0.76	0.14	0.49	0.59	0.09	0.57
Arizona	1.20	0.19	0.58	0.95	0.11	0.71	1.08	0.10	0.81
Arkansas	0.81	0.18	0.40	0.95	0.11	0.70	1.06	0.10	0.79
California	1.37	0.17	0.70	0.89	0.12	0.67	0.50	0.08	0.55
Colorado	0.71	0.28	0.16	0.73	0.12	0.57	0.84	0.14	0.55
Connecticut	0.74	0.15	0.45	0.75	0.16	0.43	0.70	0.17	0.34
Delaware	0.81	0.15	0.49	0.95	0.16	0.55	1.40	0.11	0.84
District of C.	1.07	0.41	0.17	0.78	0.13	0.55	0.46	0.21	0.11
Florida	1.17	0.15	0.67	0.90	0.11	0.71	1.63	0.08	0.94
Georgia	1.00	0.08	0.85	0.75	0.07	0.82	1.10	0.08	0.87
Hawaii	0.33	0.18	0.08	0.39	0.20	0.09	-0.06	0.12	-0.03
Idaho	0.86	0.24	0.30	0.78	0.10	0.68	1.26	0.11	0.83
Illinois	1.19	0.13	0.75	1.22	0.10	0.85	1.04	0.07	0.90
Indiana	1.37	0.19	0.64	1.48	0.14	0.80	1.01	0.11	0.73
Iowa	0.63	0.21	0.23	0.95	0.13	0.65	1.73	0.14	0.84
Kansas	0.80	0.13	0.55	0.34	0.09	0.32	1.01	0.08	0.83
Kentucky	0.61	0.09	0.61	1.08	0.15	0.64	0.40	0.06	0.60
Louisiana	0.77	0.24	0.25	1.03	0.23	0.39	0.70	0.10	0.61
Maine	0.74	0.16	0.43	0.90	0.12	0.65	1.58	0.11	0.88
Maryland	0.87	0.09	0.76	0.76	0.08	0.73	1.09	0.08	0.86
Massachusetts	1.15	0.12	0.76	0.90	0.19	0.43	0.66	0.05	0.84
Michigan	1.77	0.18	0.77	2.03	0.15	0.87	0.99	0.08	0.84
Minnesota	0.78	0.10	0.69	0.89	0.05	0.91	1.70	0.09	0.92
Mississippi	0.69	0.13	0.48	1.13	0.19	0.55	0.89	0.07	0.85
Missouri	1.02	0.13	0.69	0.99	0.07	0.86	1.84	0.10	0.92
Montana	0.80	0.14	0.53	0.66	0.11	0.57	0.95	0.08	0.82
Nebraska	0.53	0.13	0.36	0.48	0.09	0.46	1.80	0.18	0.78
Nevada	1.05	0.21	0.47	1.07	0.07	0.89	-0.53	0.18	0.20
New Hampshire	1.47	0.16	0.75	0.73	0.15	0.43	1.26	0.09	0.86
New Jersey	1.19	0.12	0.77	0.93	0.16	0.52	0.97	0.05	0.93
New Mexico	0.92	0.12	0.69	0.74	0.11	0.62	0.67	0.05	0.85
New York	0.94	0.11	0.74	0.82	0.13	0.57	0.94	0.07	0.85
North Carolina	1.20	0.11	0.80	0.93	0.10	0.74	0.27	0.09	0.20
North Dakota	0.52	0.18	0.20	0.56	0.08	0.65	1.71	0.13	0.86
Ohio	1.00	0.09	0.82	1.48	0.10	0.89	1.03	0.07	0.88
Oklahoma	0.52	0.22	0.14	0.66	0.16	0.36	0.81	0.12	0.61
Oregon	1.27	0.16	0.69	1.12	0.12	0.76	0.91	0.08	0.82
Pennsylvania	0.85	0.11	0.66	1.31	0.06	0.93	1.27	0.10	0.84
Rhode Island	0.95	0.21	0.41	0.90	0.16	0.51	0.66	0.11	0.55
South Carolina	0.63	0.16	0.34	1.02	0.10	0.79	0.47	0.13	0.28
South Dakota	0.55	0.14	0.35	0.41	0.06	0.60	1.62	0.14	0.81
Tennessee	1.04	0.14	0.66	1.27	0.11	0.83	1.11	0.10	0.80
Texas	0.56	0.16	0.28	0.43	0.14	0.22	0.83	0.09	0.73
Utah	0.60	0.17	0.30	0.87	0.10	0.71	2.03	0.09	0.95
Vermont	1.10	0.15	0.65	0.87	0.11	0.66	1.47	0.08	0.91
Virginia	0.60	0.14	0.38	0.79	0.05	0.88	0.65	0.11	0.53
Washington	1.39	0.22	0.57	1.18	0.08	0.88	1.38	0.08	0.92
West Virginia	1.10	0.17	0.59	1.87	0.26	0.64	0.86	0.15	0.52
Wisconsin	0.86	0.14	0.57	1.17	0.11	0.79	1.62	0.13	0.84
Wyoming	0.83	0.39	0.11	0.44	0.20	0.12	0.52	0.13	0.32
Average			**0.51**			**0.64**			**0.71**

Appendix 3:

Unit root tests on relative national labor market variables

Sample: 1960-2005, exogenous individual effects, automatic selection of maximum lags

Logarithm of relative employment (n_{it})

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	1.65	0.95	12	418
Breitung t-stat	1.03	0.85	12	406
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	2.96	1.00	12	418
ADF - Fisher Chi-square	12.74	0.97	12	418
PP - Fisher Chi-square	22.62	0.54	12	420

First difference of the logarithm of relative employment (Δn_{it})

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-13.52	0.00	12	408
Breitung t-stat	-11.49	0.00	12	396
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-12.30	0.00	12	408
ADF - Fisher Chi-square	179.13	0.00	12	408
PP - Fisher Chi-square	196.25	0.00	12	408

Relative unemployment rates (u_{it})

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-1.33	0.09	12	372
Breitung t-stat	0.27	0.61	12	360
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.21	0.11	12	372
ADF - Fisher Chi-square	35.98	0.06	12	372
PP - Fisher Chi-square	19.23	0.74	12	384

Relative participation rates (p_{it})

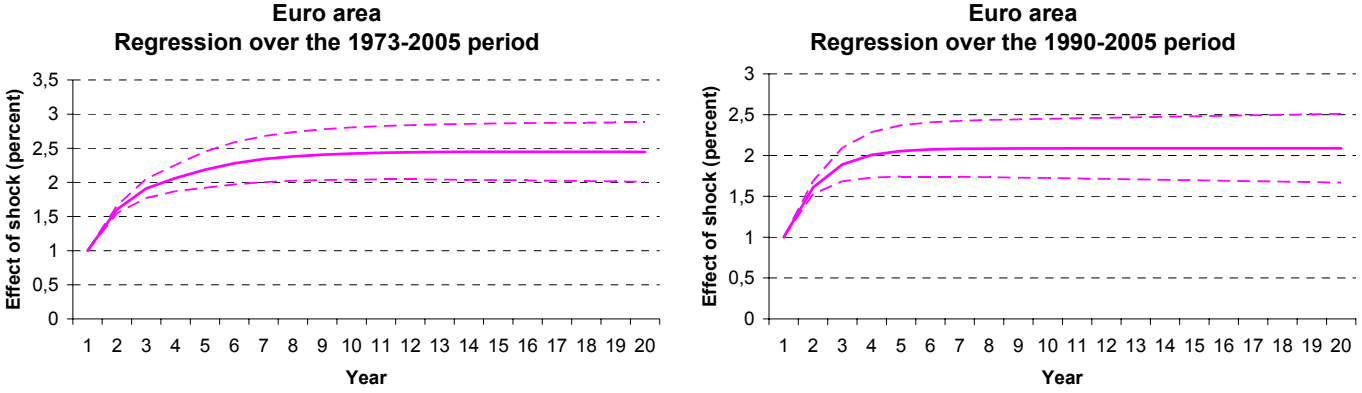
Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	0.44	0.67	12	378
Breitung t-stat	0.92	0.82	12	366
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	1.39	0.92	12	378
ADF - Fisher Chi-square	21.52	0.61	12	378
PP - Fisher Chi-square	20.08	0.69	12	384

Appendix 4:

Univariate models of relative employment growth, unemployment rates, participation rates and working-age population growth in the euro area.

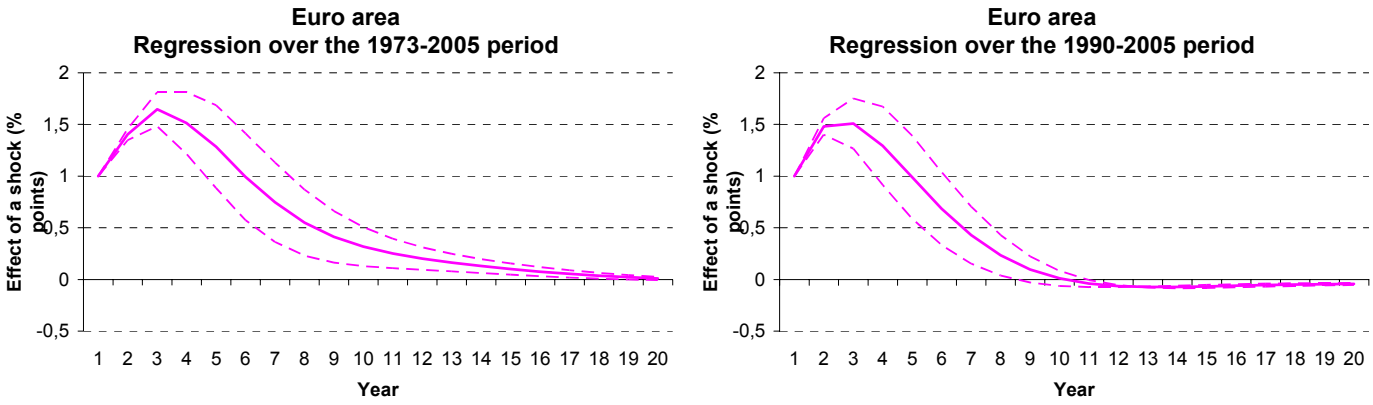
Estimated coefficients	*Relative employment growth* 1973-2005	*Relative employment growth* 1990-2005	*Relative unemploy-ment rate* 1973-2005	*Relative unemploy-ment rate* 1990-2005	*Relative participation rate* 1973-2005	*Relative participation rate* 1990-2005	*Relative working-age population growth* 1973-2005	*Relative working-age population growth* 1990-2005
1st lag	**0.60**	**0.61**	**1.41**	**1.49**	**1.15**	**1.15**	**0.81**	**0.86**
standard error	0.05	0.07	0.05	0.08	0.05	0.07	0.05	0.09
2nd lag	**-0.06**	**-0.09**	**-0.32**	**-0.69**	**-0.04**	**-0.27**	**-0.30**	**-0.38**
standard error	0.04	0.00	0.09	0.13	0.08	0.07	0.04	0.09
3rd lag	**---**	**---**	**-0.35**	**0.07**	**-0.18**	**---**	**0.28**	**0.31**
standard error	---	---	0.09	0.07	0.05	---	0.04	0.07
4th lag	**0.05**	**---**	**0.18**	**---**	**---**	**---**	**0.00**	**-0.11**
standard error	0.04	---	0.05	---	---	---	0.00	0.00
Implied Impluse responses								
Year 1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Year 2	1.60	1.61	1.40	1.48	1.16	1.16	1.79	1.85
Year 3	1.91	1.89	1.65	1.51	1.30	1.07	2.10	2.20
Year 4	2.06	2.01	1.51	1.29	1.27	0.93	2.38	2.47
Year 5	2.18	2.06	1.28	0.99	1.21	0.79	2.47	2.71
Year 10	2.42	2.09	0.32	0.01	0.69	0.35	1.73	2.89
Year 20	2.45	2.09	0.01	-0.04	0.21	0.12	1.29	2.63

Figure 1: Euro area response of relative employment to a positive 1% asymmetric shock



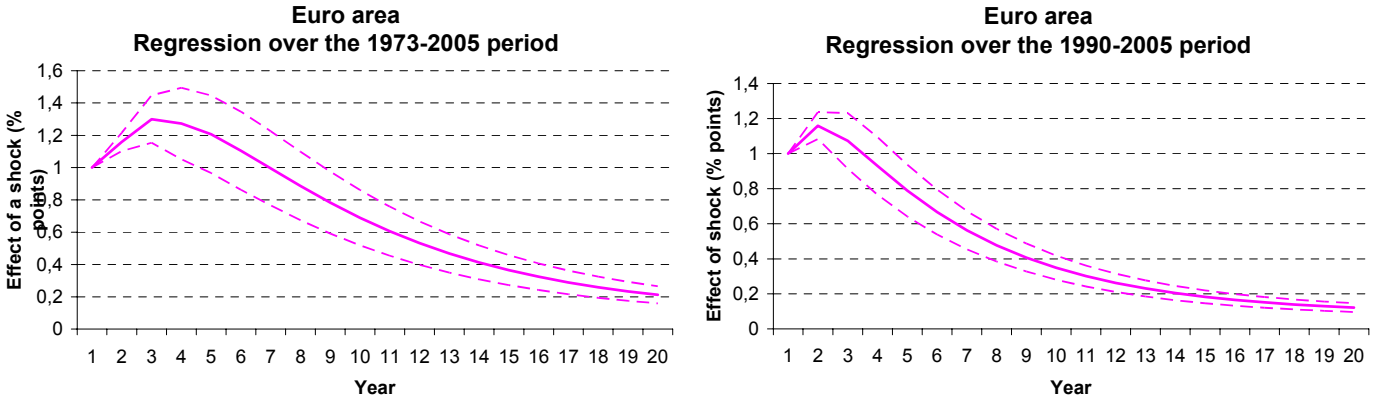
Bands of one standard error are represented by dotted lines

Figure 2: Euro area response of relative unemployment rates to a positive 1% asymmetric shock



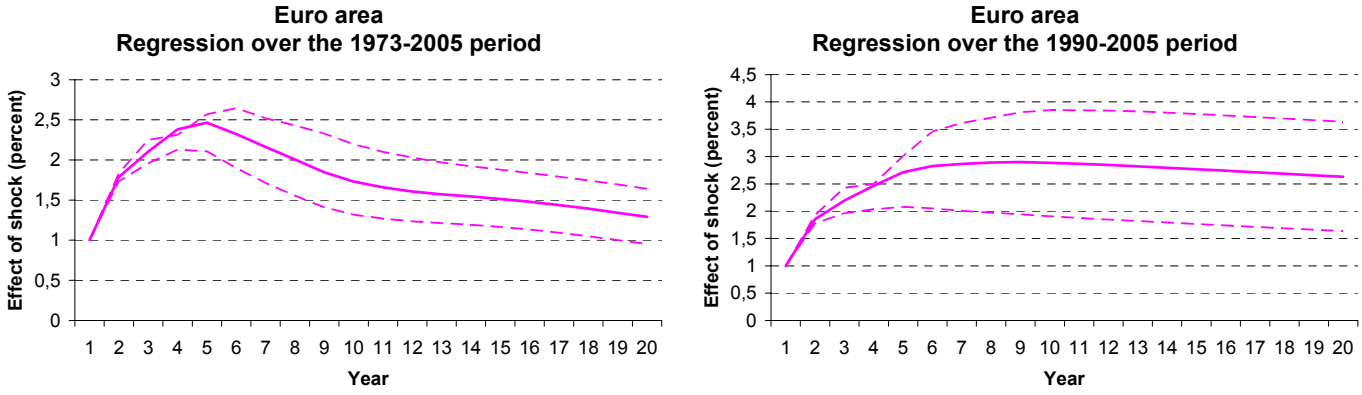
Bands of one standard error are represented by dotted lines

Figure 3: Euro area response of relative participation rates to a positive 1% asymmetric shock



Bands of one standard error are represented by dotted lines

Figure 4: Euro area response of relative working-age population to a positive 1% asymmetric shock



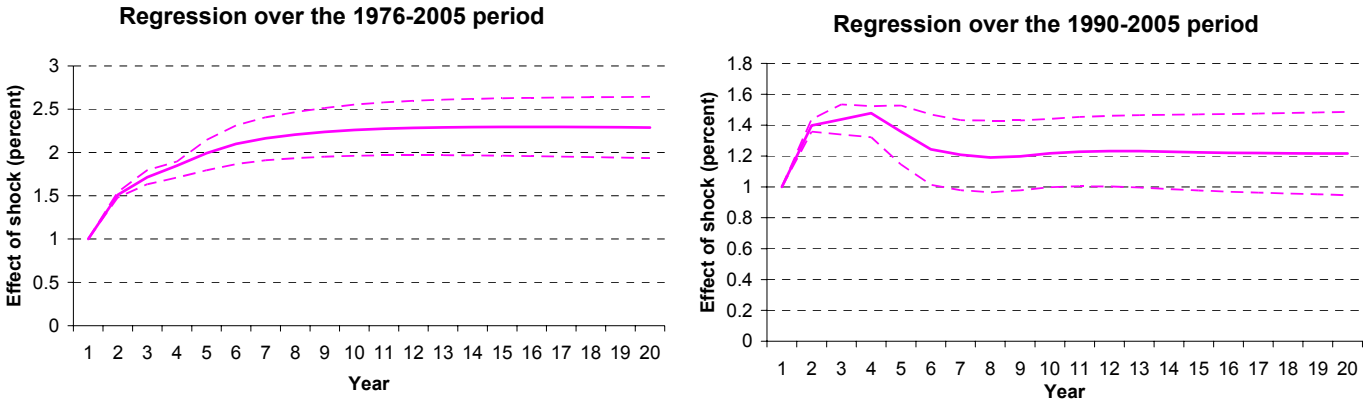
Bands of one standard error are represented by dotted lines

Appendix 5:

Univariate models of relative employment changes, relative unemployment rates and relative participation rates in the United States.

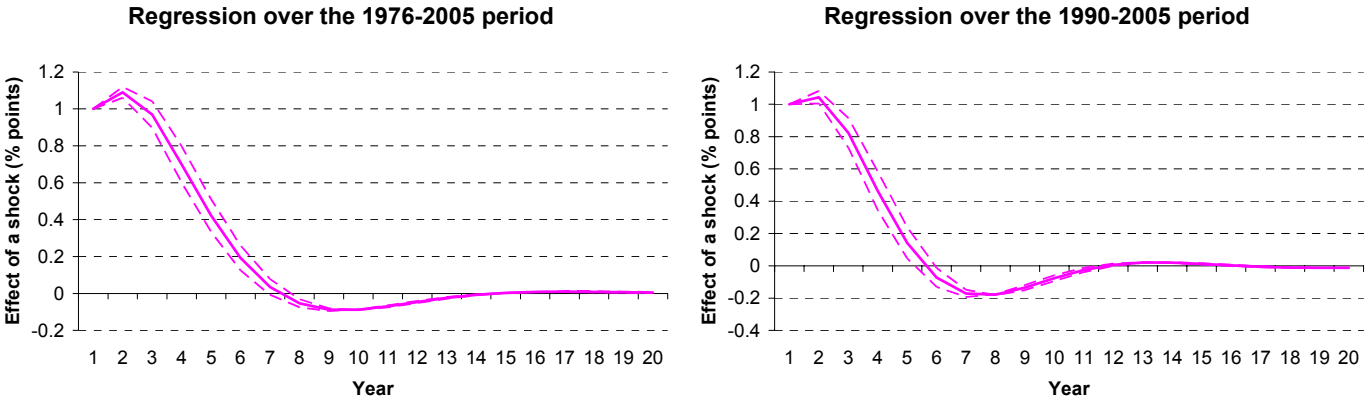
Estimated coefficients	*Relative employment growth* 1976-2005	*Relative employment growth* 1990-2005	*Relative unemploy-ment rate* 1976-2005	*Relative unemploy-ment rate* 1990-2005	*Relative participation rate* 1976-2005	*Relative participation rate* 1990-2005	*Relative working-age population growth* 1976-2005	*Relative working-age population growth* 1990-2005
1st lag	**0.51**	**0.40**	**1.09**	**1.05**	**1.09**	**0.95**	**0.40**	**0.20**
standard error	0.03	0.04	0.03	0.04	0.03	0.04	0.03	0.04
2nd lag	**-0.06**	**-0.12**	**-0.22**	**-0.27**	**-0.33**	**-0.33**	**0.09**	**0.06**
standard error	0.03	0.04	0.04	0.05	0.04	0.05	0.03	0.04
3rd lag	**---**	**---**	**-0.12**	**-0.12**	**0.09**	**---**	**-0.06**	**-0.05**
standard error	---	---	0.03	0.03	0.03	---	0.00	0.00
4th lag	**0.06**	**---**	**0.00**	**---**	**---**	**---**	**0.00**	**0.00**
standard error	0.03	---	0.00	---	---	---	0.00	0.00
Implied Impluse responses								
Year 1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Year 2	1.51	1.40	1.09	1.04	1.09	0.94	1.40	1.20
Year 3	1.71	1.44	0.97	0.82	0.85	0.55	1.64	1.29
Year 4	1.85	1.48	0.70	0.46	0.66	0.29	1.71	1.27
Year 5	1.99	1.36	0.42	0.14	0.54	0.17	1.74	1.26
Year 10	2.26	1.22	-0.09	-0.08	0.19	-0.01	1.72	1.23
Year 20	2.29	1.22	0.00	-0.01	0.00	-0.03	1.69	1.20

Figure 1: US response of relative employment to a positive 1% asymmetric shock



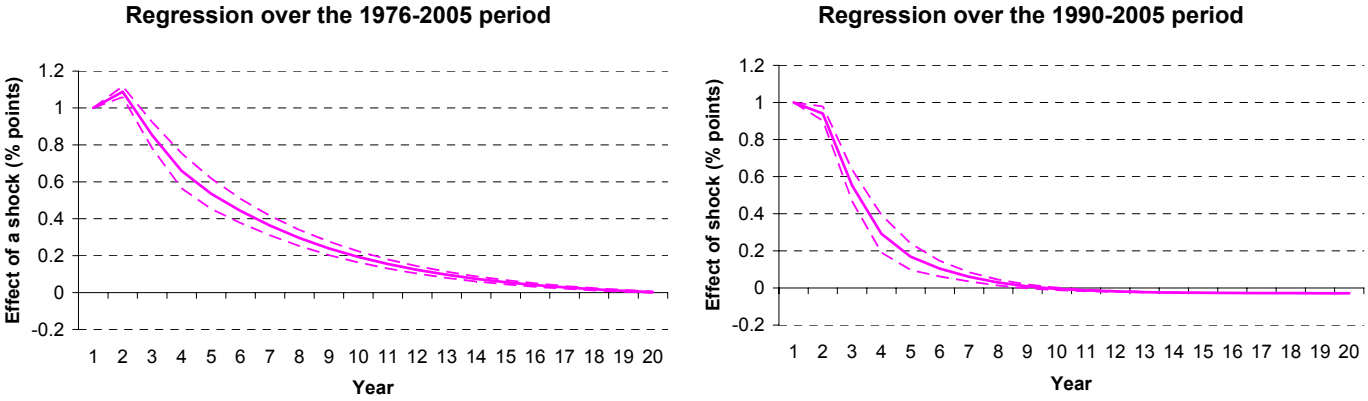
Bands of one standard error are represented by dotted lines

Figure 2: US response of relative unemployment rates to a positive 1% asymmetric shock



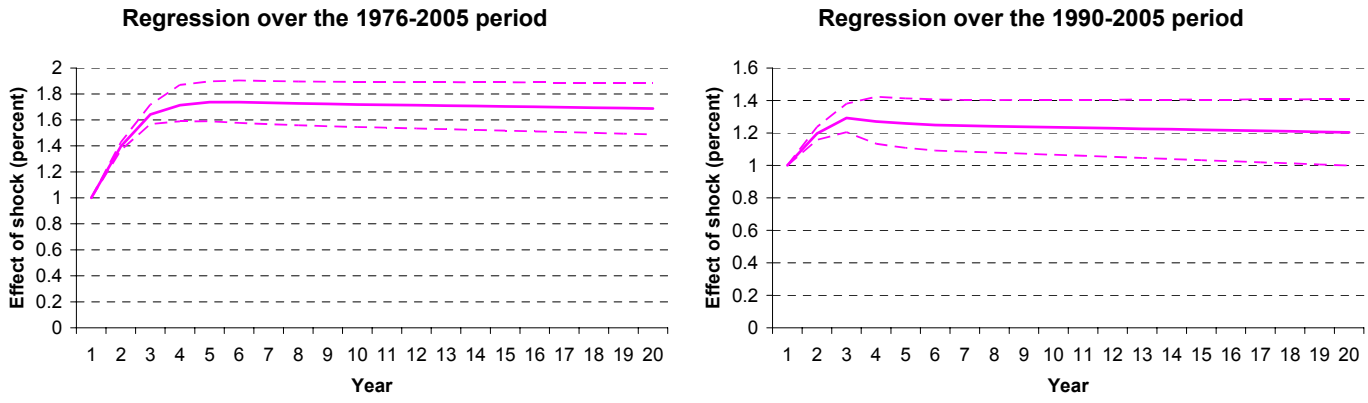
Bands of one standard error are represented by dotted lines

Figure 3: US response of relative participation rates to a positive 1% asymmetric shock



Bands of one standard error are represented by dotted lines

Figure 4: US response of relative working-age population to a positive 1% asymmetric shock



Bands of one standard error are represented by dotted lines

Appendix 6

Simple stylized facts on labor force and working-age population growth rates within the euro area:

(100 = labor force and working-age population level in the euro area).

Figure 1: Cumulative relative labor force growth rates in the euro area

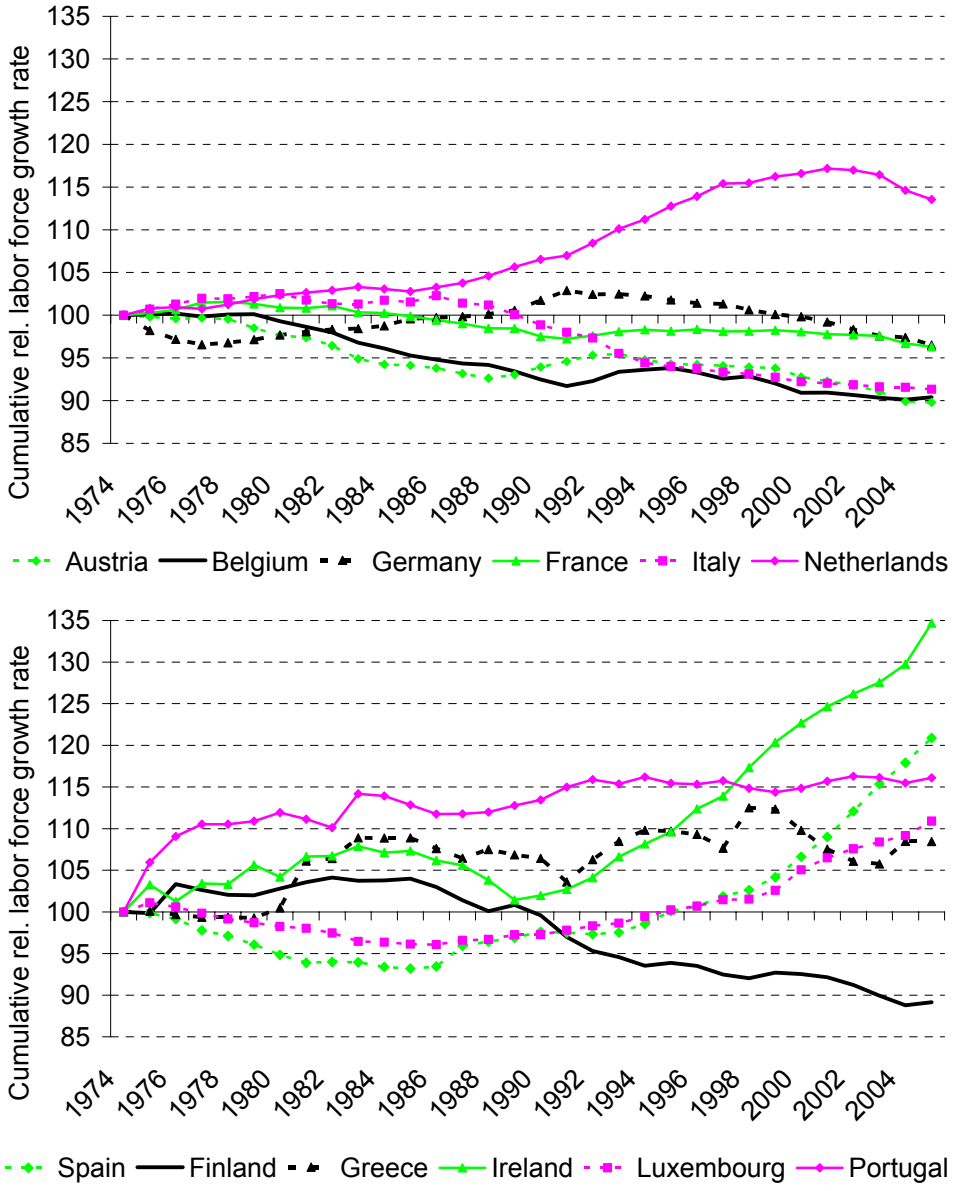


Figure 2: Cumulative relative working-age population growth rates in the euro area

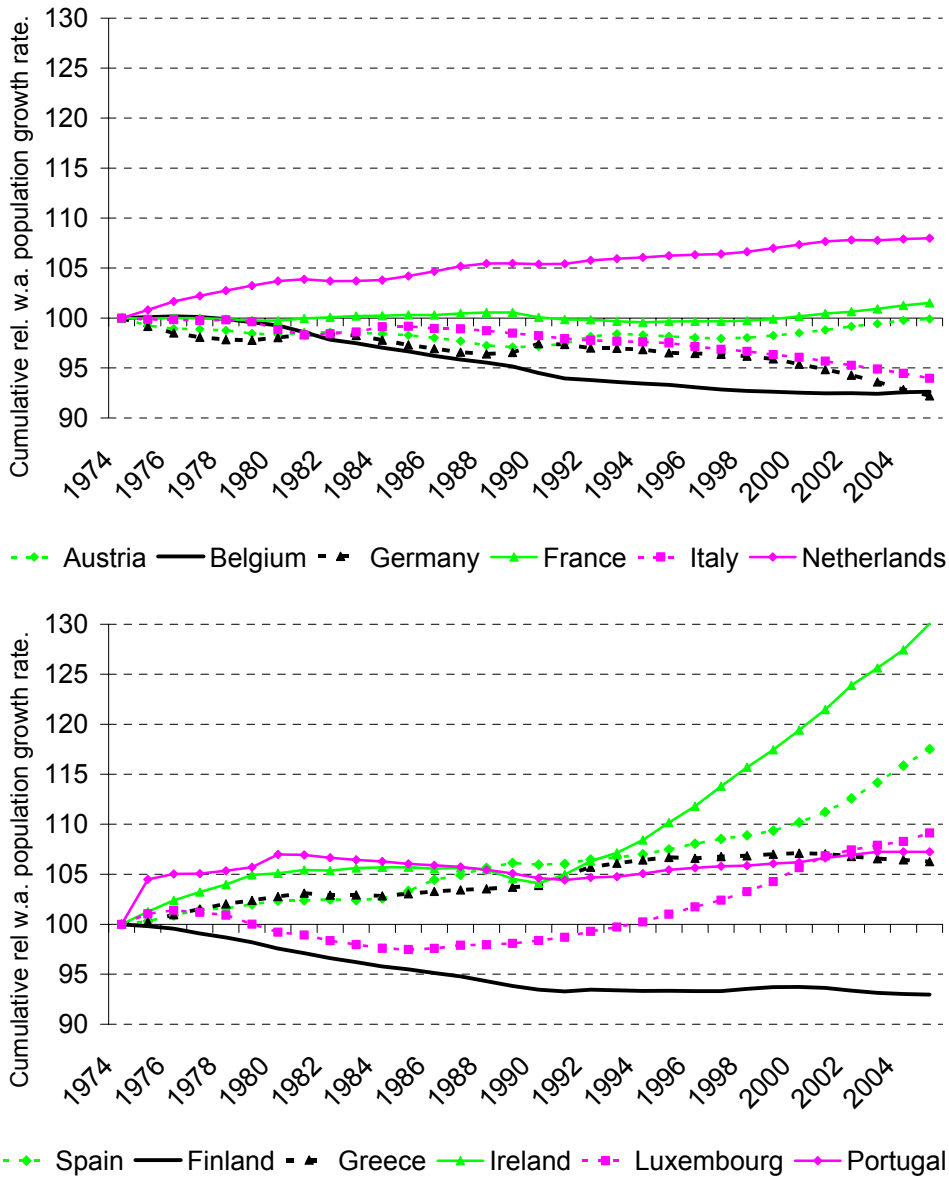
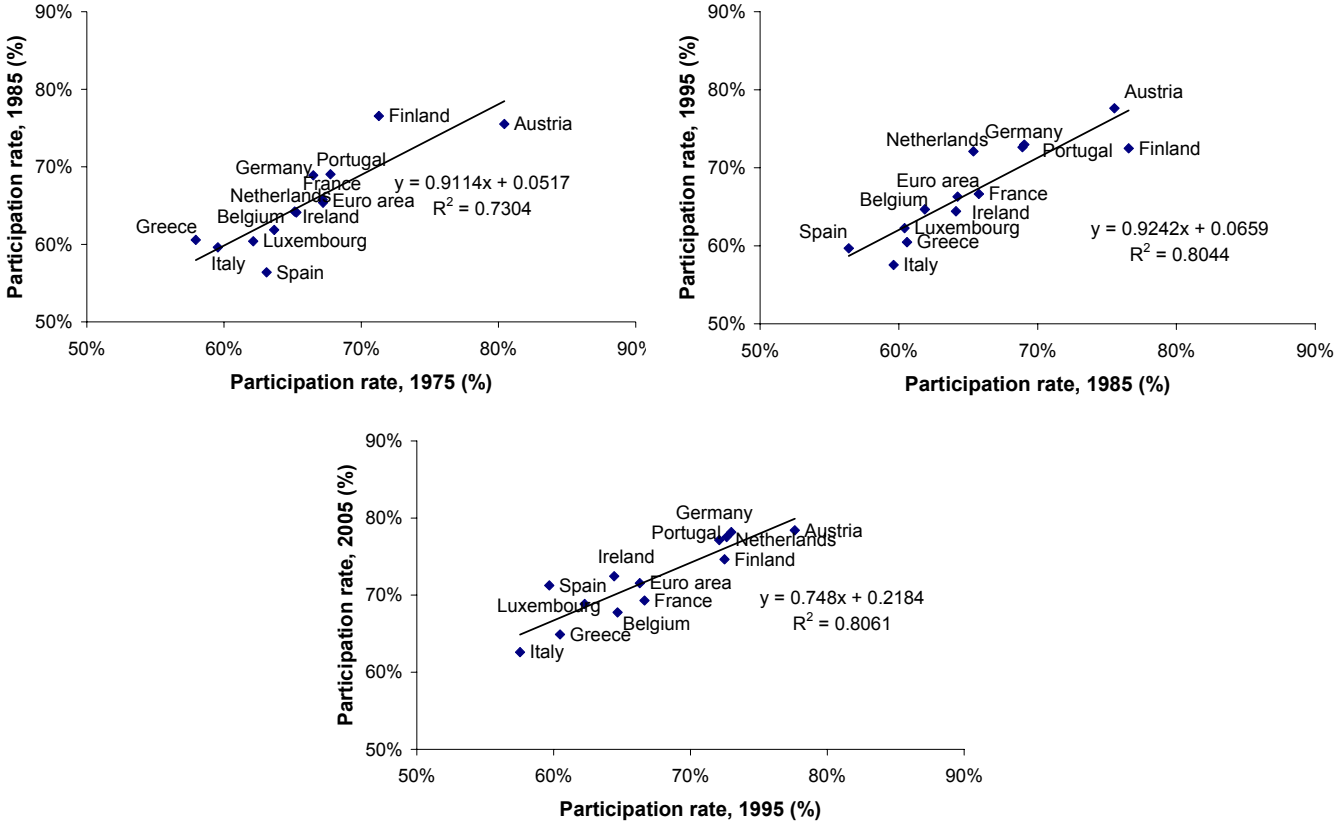


Figure 3: Stability of national participation rate trends across the euro area



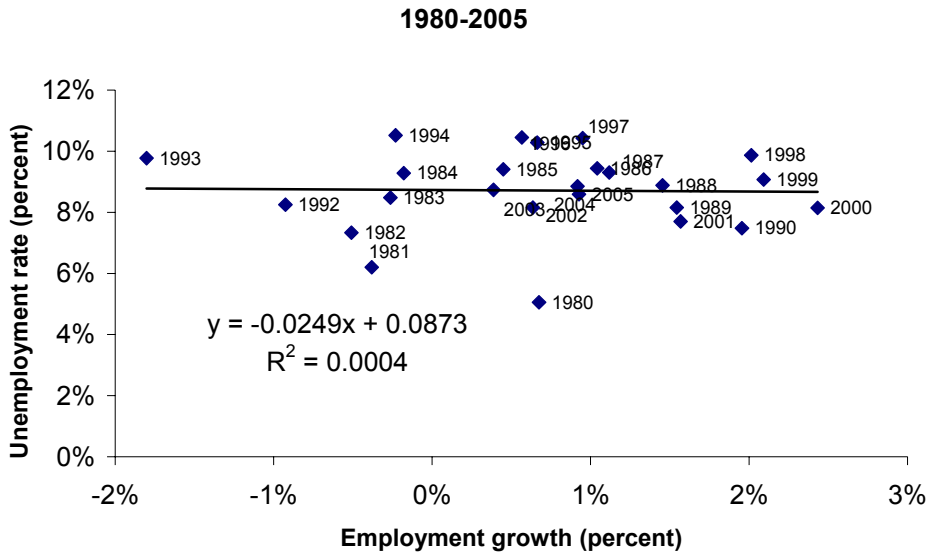
Appendix 7:

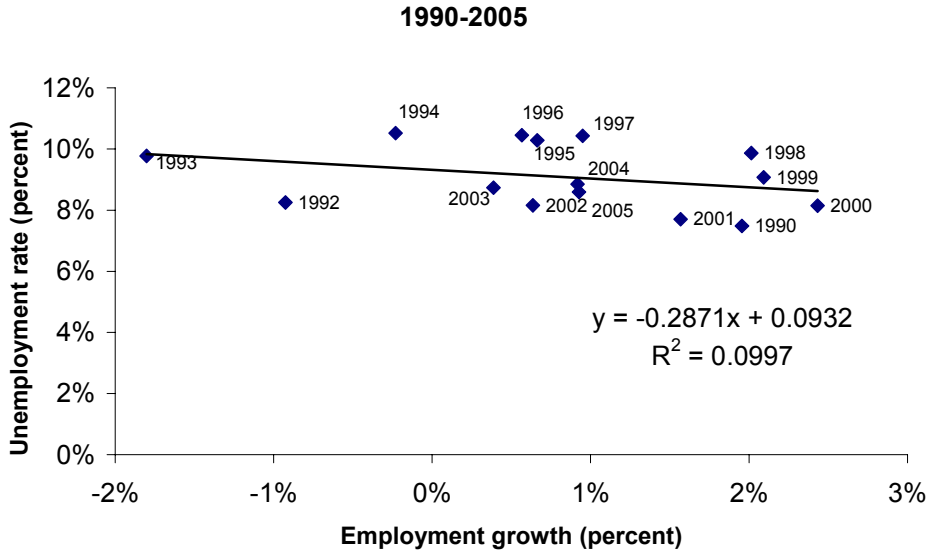
Some insight on the source of labor market shocks.

In Blanchard and Katz's theoretical model, the correlation between mean unemployment rates and employment growth rates depends on the relative importance of the underlying sources of growth. If growth comes from labor demand, a negative correlation should occur between average unemployment and employment growth; the opposite should hold if growth comes from labor supply caused by workers' migration.

Of course, reality is far more complex, and results must therefore be interpreted with caution.

The following figures plot annual euro area unemployment rates against annual euro area employment growth rates for the 1980-2005 period and for the 1990-2005 period.





Although no clear pattern emerges, as in Blanchard and Katz, the slope of the regression line is slightly negative, which appears to suggest that growth comes mainly from labor demand. Therefore, following Blanchard and Katz, it seems relatively plausible to associate unexpected changes in national relative employment within the year to changes in labor demand since the

figures suggests that only a small fraction of these changes is due to exogenous changes in labor supply or migrations.

Appendix 8:

VAR: Estimated coefficients

We estimate the following VAR, between 1973 and 2005:

$$\begin{cases} \Delta n_{it} = \lambda_{i,0} + \lambda_1(L)\Delta n_{i,t-1} + \lambda_2(L)le_{i,t-1} + \lambda_3(L)lp_{i,t-1} + \varepsilon_{i\lambda t} \\ e_{it} = \mu_{i,0} + \mu_1(L)\Delta n_{i,t} + \mu_2(L)le_{i,t-1} + \mu_3(L)lp_{i,t-1} + \varepsilon_{i\mu t} \\ p_{it} = \nu_{i,0} + \nu_1(L)\Delta n_{i,t} + \nu_2(L)le_{i,t-1} + \nu_3(L)lp_{i,t-1} + \varepsilon_{i\nu t} \end{cases}$$

Table 1: Estimated coefficients for the euro area, regression over the 1973-2005 period:

Coefficient	ΔEmployment		Employment rate		Participation Rate	
	Coeff	*St. Error*	*Coeff*	*St. Error*	*Coeff*	*St. Error*
dni t	---	---	0.41	0.03	0.57	0.04
dni t-1	1.21	0.11	---	---	-0.60	0.13
dni t-2	---	---	-0.06	0.04	0.05	0.05
dni t-3	---	---	---	---	---	---
dni t-4	0.12	0.03	---	---	---	---
lei t-1	-0.50	0.13	1.12	0.04	0.45	0.14
lei t-2	0.36	0.14	---	---	-0.55	0.16
lei t-3	---	---	-0.34	0.07	0.29	0.09
lei t-4	0.05	0.03	0.12	0.06	-0.12	0.06
lpi t-1	-0.84	0.12	---	---	1.57	0.12
lpi t-2	0.80	0.12	0.05	0.02	-0.61	0.13
lpi t-3	---	---	---	---	---	---
lpi t-4	---	---	---	---	---	---

Table 2: Estimated coefficients for the euro area, regression over the 1990-2005 period:

Coefficient	ΔEmployment		Employment rate		Participation Rate	
	Coeff	*St. Error*	*Coeff*	*St. Error*	*Coeff*	*St. Error*
dni t	---	---	0.39	0.05	0.58	0.05
dni t-1	1.67	0.16	---	---	-0.33	0.09
dni t-2	---	---	0.14	0.06	-0.14	0.06
dni t-3	---	---	---	---	---	---
dni t-4	0.12	0.05	---	---	---	---
lei t-1	-1.09	0.17	1.15	0.08	0.18	0.05
lei t-2	0.87	0.16	-0.35	0.09	---	---
lei t-3	---	---	---	---	---	---
lei t-4	---	---	0.09	0.05	-0.09	0.05
lpi t-1	-1.31	0.16	---	---	1.29	0.10
lpi t-2	1.32	0.17	---	---	-0.35	0.10
lpi t-3	-0.30	0.10	---	---	---	---
lpi t-4	0.24	0.07	---	---	---	---

Table 3: Estimated coefficients for the United States, 1976-2005 period:

Coefficient	ΔEmployment		Employment rate		Participation Rate	
	Coeff	*St. Error*	*Coeff*	*St. Error*	*Coeff*	*St. Error*
dni t	---	---	0.25	0.02	0.42	0.02
dni t-1	0.40	0.03	-0.12	0.03	-0.07	0.03
dni t-2	0.03	0.03	-0.06	0.02	---	---
dni t-3	0.06	0.02	---	---	---	---
dni t-4	-0.08	0.02	---	---	0.04	0.02
lei t-1	0.24	0.05	1.04	0.04	0.07	0.03
lei t-2	-0.19	0.07	-0.17	0.06	---	---
lei t-3	0.09	0.06	-0.08	0.05	---	---
lei t-4	-0.18	0.04	-0.05	0.04	0.06	0.02
lpi t-1	-0.06	0.04	0.13	0.02	1.00	0.03
lpi t-2	-0.19	0.05	---	---	-0.20	0.04
lpi t-3	0.14	0.04	-0.10	0.02	0.04	0.04
lpi t-4	---	---	---	---	0.04	0.03

Table 4: Estimated coefficients for the United States, 1990-2005 period:

Coefficient	ΔEmployment		Employment rate		Participation Rate	
	Coeff	*St. Error*	*Coeff*	*St. Error*	*Coeff*	*St. Error*
dni t	---	---	0.41	0.03	0.41	0.03
dni t-1	0.25	0.03	---	---	---	---
dni t-2	---	---	0.06	0.03	0.06	0.03
dni t-3	0.10	0.03	---	---	---	---
dni t-4	-0.10	0.03	---	---	---	---
lei t-1	0.44	0.06	---	---	---	---
lei t-2	-0.43	0.09	---	---	---	---
lei t-3	0.22	0.09	---	---	---	---
lei t-4	-0.18	0.06	0.15	0.03	0.15	0.03
lpi t-1	---	---	0.85	0.03	0.85	0.03
lpi t-2	-0.33	0.03	-0.17	0.04	-0.17	0.04
lpi t-3	0.16	0.03	---	---	---	---
lpi t-4	---	---	0.08	0.02	0.08	0.02

Appendix 9:

Comparison of the response of employment, unemployment, participation and implied out-migration in the United States and the euro area.

Results are reported in terms of change in the number of workers

1) Change in the number of workers in the United States

Blanchard and Katz 1978-1990	**After 1 year**
Decrease in employment	-1.00
Reflected in:	
Increase in unemployment	-0.30
Decrease in participation	-0.05
Increase in net out-migration	-0.65

2) Change in the number of workers in the euro area

	After 1 year	**After 3 years**	**After 10 years**	**After 15 years**
Var 1970-2005	**Workers**			
Decrease in employment	-1.00	-1.76	-1.38	-0.79
Reflected in:				
Increase in unemployment	-0.37	-0.61	-0.33	-0.10
Decrease in participation	-0.67	-0.86	-0.72	-0.38
Increase in net out-migration	0.04	-0.29	-0.33	-0.31

	After 1 year	**After 3 years**	**After 10 years**	**After 15 years**
Var 1990-2005	**Workers**	**Upper band**	**Lower band**	**Lower band**
Decrease in employment	-1.00	-1.68	-1.02	-1.00
Reflected in:				
Increase in unemployment	-0.35	-0.61	-0.10	-0.04
Decrease in participation	-0.68	-0.78	-0.46	-0.33
Increase in net out-migration	0.03	-0.28	-0.46	-0.62

2) Change in the number of workers in the United States

	After 1 year	**After 3 years**	**After 10 years**	**After 15 years**
Var 1976-2005	**Workers**			
Decrease in employment	-1.00	-1.55	-0.90	-0.93
Reflected in:				
Increase in unemployment	-0.21	-0.22	0.09	-0.01
Decrease in participation	-0.10	-0.11	-0.02	-0.01
Increase in net out-migration	-0.69	-1.22	-0.96	-0.91

	After 1 year	**After 3 years**	**After 10 years**	**After 15 years**
Var 1990-2005	**Workers**	**Upper band**	**Lower band**	**Lower band**
Decrease in employment	-1.00	-1.27	-0.86	-0.91
Reflected in:				
Increase in unemployment	-0.13	-0.10	0.03	0.00
Decrease in participation	-0.10	-0.09	0.00	0.00
Increase in net out-migration	-0.77	-1.08	-0.89	-0.91