Are Labour Market Institutions Endogenous? An Investigation of Unemployment, Unions and Wages*

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May 9, 2007

Abstract

We investigate the problem of the potential endogeneity of labour market institutions in single equation multi-country estimations by presenting an empirical analysis of unemployment, union density and wages in 20 OECD countries where these variables are jointly determined. When explicitly modelling endogeneity our results suggest that unions play a more relevant role in explaining unemployment than what previously thought. In addition, the impact of wages and unemployment in explaining union density is larger than what predicted by single equation estimates, and wages are shown to react more to changes in unemployment. Our analysis shows that country heterogeneity is relevant in such estimations. We classify OECD economies into three groups according to the feedbacks between unemployment and union density.

JEL codes: E24, J51, J31.

Keywords: unemployment, unions, wages, labour market institutions, system estimation, endogeneity.

*We wish to thank Christian Haefke and other participants to the IZA Workshop on Labour Market Institutions, to the EALE 2006 conference in Prague and to the EAEPE 2006 conference in Istanbul. Financial support from the Italian Ministry of Education and Research (COFIN project) is gratefully acknowledged. The usual disclaimer applies.

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1 Introduction

In recent years we have witnessed a growing literature on the impact of labour market institutions on labour market performance. This has resulted in a number of multi-country models aiming at estimating an empirical relationship between institutions and a labour market performance variable that has generally taken the form of the standardized unemployment rate[1]. The labour market institutions most widely studied in this setting are unemployment benefit provision, employment protection regulations, the tax wedge and trade union bargaining power[2], each measured by a number of aggregate variables and indicators produced by the OECD and other researchers. A recent literature review by Bassanini and Duval (2005) suggests that unemployment benefits and the tax wedge are the most significant institutions affecting unemployment, this result applying across alternative population groups. For what concerns trade unions, the literature does not seem to suggest an unemployment-enhancing role[3].

One possible limitation of previous studies in the literature is that all multi-country models estimating unemployment as a function of labour market institutions we are aware of, implicitly assume labour market institutions as super-exogenous[4]. This is to say that institutions do not depend on the state of the labour market and estimated parameters are independent of changes in policy. However this simplifying assumption is contradicted by our knowledge of how institutions are determined. If institutions are coordinating devices that are introduced and modified as optimal answers to market failures, they cannot be taken as fully exogenous to market outcomes. In general, changes in institutions respond to changes in political equilibria, to macroeconomic shocks, or a combination of the two. Botero et al (2004) suggest that the institutional framework of a country (including labour regulations such as employment protection, collective bargaining and social security) depends on the stage of development, as well as on the legal tradition of the country, while the political orientation of the government seems to play no role. Other authors have focused on the potential endogeneity of single institutions. Saint Paul (1996) explores the role of the median voter in determining the degree of employment protection while Di Tella and MacCulloch (2002) analyze the determinants

[1] See, for example, the justification of this choice given by Blanchard (2006). Alternative measures, like the employment to working age population ratio, suffer from being more sensible to the secular changes in participation patterns, and therefore are less likely to give a clear account of the problems in the labour market.

[2] See Nickell, Nunziata and Ochel (2005) for a description of each empirical indicator.

[3] The robustness of this finding had already been questioned by Baker et al (2004).

[4] See Engle et al (1983).

of unemployment benefits. Checchi and Lucifora (2002) treat union density as endogenous and analyse how other institutions play a role of union-complement or union-substitute across European countries. Bertola and Koeninger (2004) find that a more reduced dispersion and volatility of labor income (through employment protection, unemployment benefits and wage compression) is more prevalent in countries where inefficient legal systems restrict borrowing opportunities. In each of these frameworks, unemployment (or more precisely unemployment risk) is considered as one of the determinants of institutions.

More generally, under a political economy approach all institutions should be considered endogenous. Potentially, this may then result in biased and inconsistent estimates when endogeneity is not correctly modelled. Even if we were to give to the endogeneity problem an omitted variable interpretation, the inclusion of country fixed effects may account only for the omission of time invariant unobservable factors while some relevant omitted factor may actually vary over time.

A natural remedy would be to instrument institutions in the unemployment equation and apply 2SLS[5]. However this would still be an inefficient procedure because we would concentrate on a single equation when the true model is one where institutions and unemployment are simultaneously determined.

The approach of this paper is to investigate the problem of potential endogeneity of institutions through a multi-equation model of the labour market. In principle, all labour market institutions [union density (UD), the degree of coordination in wage bargaining (CO), employment protection regulations (EP), unemployment benefit replacement rates and duration (BRR, BD), the tax wedge (TW) and the minimum wage (MW)] are endogenous to changes in unemployment. A system of equations modelling the labour market should then incorporate an equation for each potentially endogenous institution. This would result in a system of unmanageable dimensions that would not be of much help in resolving the problem of biased and inconsistent estimates. In addition, it would be hard, if not impossible, to device appropriate identifying restrictions for each equation describing an institution.

In order to build a meaningful model, we need therefore to reduce the system to a manageable dimension, and one way of doing this is to select a (possibly not so large) subset of

[5]See Nunziata (2005) for a similar approach in analysing OECD wages. The instruments used in the paper are political variables such as government composition and percentage of left and right seats in parliament.

institutions that we reckon being more likely to be endogenous in an unemployment model. In order to do that we have to think more carefully about how institutions are determined, and possibly make some meaningful assumptions.

We can roughly select two groups of institutions:

1. institutions that are products of a political deliberation process,

2. institutions that are the result of decentralized decision making.

We can reasonably assume that the latter group respond more rapidly to changes in the labour market. Employment protection regulations, taxation, minimum wage and unemployment benefit policies are all determined inside national or regional parliaments and therefore are affected by political factors such as the timing of elections and political deliberations, voters' preference structure, the policy makers' agenda, the existence of stable political equilibria. They evolve at a slower pace than macroeconomic variables, being the product of political processes that do not necessarily (or directly) depend on the status of the economy only.

On the contrary, union membership rates in each country are indeed the product of the decision-making of each single worker, a process happening in real time and therefore more likely to be empirically correlated with the status of the economy or with the perception that each worker has of the benefits of joining a union in alternative economic environments. Concentrating on union density as the institutional variable most affected by endogeneity seems therefore a reasonable starting point.

2 Unemployment and Unions: What Direction of Causality?

The focus of our analysis are the 20 major OECD countries (Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States) observed over the period 1964 - 2000[6]. Figures 1 and 2 display the dynamics in union density (UD) and

[6] Our sample is unbalanced, with an average of 34 observations per country and a maximum of 38. Data on Portugal is only available since 1992 for some key variables, like the proportion of males in manual manufacturing jobs over total employment.

standardized unemployment rate[7] (UR) in our sample. Most countries have experienced a significant decline in union density in the last decades, often accompanied by an increase in unemployment. Notable exceptions are the Nordic countries, experiencing an upward trend in density rates, and the Anglo-Saxon countries, with no trend in unemployment (at least starting from the 1980s). The scatterplots in Figure 2 clearly indicate a wide heterogeneity in country experiences. In Belgium, Canada, Denmark, Finland, Norway and Sweden the rise of density goes hand in hand with unemployment, whereas we observe a negative association in Austria, France, Germany, Japan and Switzerland. In the case of Australia, Ireland, Italy, New Zealand and United Kingdom we notice an almost complete clock-wise loop: a rise of union density in the 1960s and 1970s was closely followed by an upsurge of unemployment, which halted the further increase in density. The ensuing rise in unemployment brought in a decline in union density, which has not yet ended in some countries. The remaining countries (Netherlands, Portugal, Spain and United States) do not exhibit apparent association between these two variables.

Figures 1 and 2 around here

There are several theoretical reasons accounting for positive as well as negative association between union density and unemployment. If we consider union density as predetermined, in an imperfect competition framework an increase in union membership raises union bargaining power and, as a consequence, their wage claims. A rise in the bargained wage yields an overall increase in unemployment, thus creating a positive correlation among the two variables (Nickell and Layard 1999). In addition, changes in union density may affect the quality of the relationship between employers and employees, therefore influencing unemployment through different channels than the wage[8]. Nickell et al (2005) show that labour market institutions explain a relevant portion of changes in OECD unemployment since the 1960s. However, considering the contribution of institutions and macroeconomic shocks, in a single equation model with an AR(1) error component, the role of union density is found marginal with respect to other dimensions such as taxation and unemployment benefits. In addition, higher coordination in wage bargaining seems to reduce the positive correlation between union density and unemployment.

[7] See the appendix for definitions, sources and some descriptive statistics.

[8] See Blanchard and Philippon (2004).

Similarly, Bassanini and Duval (2005) do not find any direct effect of unions' bargaining power (as proxied by union density) onto unemployment, whereas they find support for a significant role of various measures of corporativism and/or centralisation of the wage bargaining. When interacted with labour demand shocks, union density seems to exhibit a positive correlation with unemployment, despite the finding is not robust to alternative model specifications[9].

On the other hand, Checchi and Lucifora (2002)[10] treat unemployment as predetermined and explain the demand for union activity in terms of macroeconomic cyclical indicators (proxied by inflation and unemployment rates), compositional effects (gender, age and sector composition of the labour force) and other competing labour market institutions, discussing their potential complementarity/substitutability impact. They argue that whenever unions are perceived as providing workers' insurance against unemployment risk (Burda, 1990), higher unemployment has a positive impact on union density. This applies only in countries where unions provide effective insurance (as in the so called "Ghent countries" - Iceland, Finland, Belgium, Sweden and Denmark - where unions are involved in managing the unemployment benefit schemes - see Holmlund and Lundborg, 1999), whereas for all other institutional contexts, the correlation between the two variables is negative, because greater unemployment weakens the bargaining power of unions, thus reducing the incentives to join them[11]. More generally, unions have been proved able to adapt to different institutional environments, preserving their action in reducing competition among workers and rent extraction vis a vis the employers (Boeri et al, 2001).

In order to infer a meaningful causal interpretation from these studies we have to rely on the assumption of exogeneity of institutions on the one hand, and of unemployment on the other. However, if we are ready to believe that these empirical models are informative about the actual processes governing unemployment and union density, then we should also be ready to admit that estimating each of these models separately, or without explicitly modelling endogeneity, may result in a set of biased estimates. In other words, even admitting unemployment is one of the variables affecting institutional change, estimation of single institutional equations may

[9] This finding is sensitive to the different measures adopted for the other institutional variables (see Blanchard and Wolfers, 2000). When taking into account wage dispersion, the correlation is always statistically insignificant (see Bertola, Blau and Kahn, 2001). Blanchard (2006) provides a comprehensive survey of the recent literature on the relationship between institutional measures and unemployment.

[10] See also Checchi and Visser (2005).

[11] In the sociological literature Western (1997), Lange and Scrugg (1999) and Oskarsson (2005) find similar results, confirming a negative correlation between unemployment and union density. Finland is an interesting case, since the erosion of the Ghent system accounts for the decline in union membership rates, changing the sign of the correlation between unemployment and density into positive (see Böckerman and Uusitalo, 2006).

be affected by potentially relevant biases in the same way as unemployment equations are.

3 The Approach of the Paper

Our approach in what follows is to focus on a joint model of unemployment, union density and wages. In other words, we aim at explicitly constructing a system of equations in which unemployment and union density are endogenously determined and wages play a role. The inclusion of wages is motivated by the consideration that whatever the correlation between unemployment and union density may be, both variables are related to the wage bargaining process (Nunziata, 2005)[12]. Since we want to capture the wage bargaining process in a more detailed way, our system contains then a wage equation including both union density and unemployment. In this way we believe to provide a more general framework for modelling the labour market under a set of institutional contraints.

Let us denote unemployment, union density and labour cost in country i and year t, respectively, with u_{it}, m_{it} and w_{it}. Our strategy consists in estimating the following system:

$$\begin{cases} u_{it} = \beta_0^u + \beta_2^u m_{it} + \boldsymbol{\beta}_4^{u\prime}\mathbf{z}_{it} + \boldsymbol{\beta}_5^{u\prime}\mathbf{s}_{it} + \mu_i^u + \eta_t^u + \varepsilon_{it}^u \\ m_{it} = \beta_0^m + \beta_1^m u_{it} + \beta_3^m w_{it} + \boldsymbol{\beta}_4^{m\prime}\mathbf{z}_{it} + \boldsymbol{\beta}_5^{m\prime}\mathbf{n}_{it} + \mu_i^m + \eta_t^m + \varepsilon_{it}^m \\ w_{it} = \beta_0^w + \beta_1^w u_{it} + \beta_2^w m_{it} + \boldsymbol{\beta}_4^{w\prime}\mathbf{z}_{it} + \delta\pi_{it} + \mu_i^w + \eta_t^w + \varepsilon_{it}^w \end{cases} \tag{1}$$

where $\mathbf{z}$ is a vector of (assumed) exogenous labour market institutions, μ_i and η_t are respectively country and time fixed effects, and ε_{it} is the stochastic error term. The overidentifying restrictions consist of a set $\mathbf{s}$ of exogenous macroeconomic shocks affecting the system through the unemployment equation (labour demand, terms of trade and monetary shocks), a vector $\mathbf{n}$ of variables entering the system by affecting union density (male employment manufacturing share, educational attainment and strikes), and a productivity term π entering the system through the wage equation. Our assumptions are therefore that macroeconomic shocks are exogenous to the system and that productivity is mainly driven by exogenous factors such as technical change[13]. As regards male employment manufacturing share and educational attain-

[12] "For example, if a positive coefficient of a union density variable in an equation explaining the equilibrium unemployment rate is interpreted as union bargaining power having raised the aggregate wage relative to productivity, than it should be verified whether wage data are consistent with that interpretation." (OECD 2004b, p.166).

[13] See Nickell et al (2005) and Nunziata (2005).

ment, these two variables can be taken as exogenous since they depend on the development stage of each country which affects sector composition, gender differences in labour market participation rates and the participation to the educational system. A third variable entering the union density equation is the proportion of workers involved in strike actions[14]. In our view this variable proxies collective preferences towards egalitarism and collective action[15].

A detailed description of each variable, with data sources, is reported in the appendix in table 1.

4 The Empirical Analysis

4.1 Single Equation Estimations

We start our analysis with a set of single equation estimations where all institutions are considered exogenous. Table 2 reports separate estimates for unemployment, union density and wages. These equations can be considered as analogous to the ones previously estimated in the literature, for example respectively by Nickell et al (2005), Checchi and Lucifora (2002) and Nunziata (2005)[16]. The first column displays the unemployment equation, the second and the third columns display the union density estimations including and excluding wage feedbacks, while the fourth column displays the wage regression.

Our regressions are pretty much in line with previous studies. The benefit and taxation variables seem to play a role in the unemployment equation: higher labour taxes and generous benefits provided for a long duration are correlated with higher unemployment. Union density has a positive coefficient that is offset by the negative coefficient of coordination in wage bargaining. This is to say that stronger unions with a cooperative attitude in wage bargaining do not tend to raise unemployment. Employment protection is found to have a negative coefficient (whereas in most of the literature it is not statistically significant), the minimum wage is not significant while the macroeconomic shocks have expected signs.

[14] See, for example, Checchi and Visser (2005).

[15] One may argue that whenever conformist attitudes prevail among workers, strikes would depend on union density, and not the other way round. For example, Corneo (1995) presents a model where social participation (including union membership) depends on the share of population undertaking the same action. In this case strike participation would be affected by actual density rates.

[16] Here we adopt a static specification for the unemployment and the wage equation, differently from what done by Nickell et al. (2005) and Nunziata (2005).

The union density equations in columns 2 and 3 show that density is increasing in unemployment and wages. Generosity of benefits and employment protection legislation, which can be considered as "union substitutes" institutions (Checchi and Lucifora 2002), take opposite signs. The employment protection effect suggests that the more protected is a worker, the less perceived is the risk of unemployment, the lower is the demand for union insurance. The case of unemployment benefits can be rationalised by considering that unions usually aim at improving welfare provision by governments, and workers may express their support to these claims by joining the unions. Compositional effects, proxied by the share of male industrial employment, takes an expected positive sign. The proportion of workers involved in strikes, measuring workers attitude in following union leadership in industrial actions, exhibits a positive correlation with union density. Finally, the educational attainment of the population, proxied by the number of years of schooling, has a positive impact on union density[17].

As regards the effect of the wage introduced in column 3, our estimates suggest that employees are more prone to join a union when monetary compensation is more generous[18]. Given the heterogeneity of the countries included in our sample, we may give to this finding a different interpretation according to the bargaining extension laws prevailing in each institutional system. In closed-shop systems, where only union members benefit of the collectively bargained wage (typical example being the US), this is partial evidence of private benefits from union membership. Alternatively, in open-shop contexts (like the European one, where coverage exceeds membership rates) the positive correlation between wages and union density can be explained by a sort of gift exchange between workers and unions. Whenever unions are successful in extracting a rent from the firm through a rise in the bargained wage, workers may reciprocate by supporting the unions through the payment of unions' dues.

Finally, the labour cost equation suggests that productivity is the key determinant of wages. Controlling for productivity, the tax wedge has a significant positive effect, suggesting (partial) wage resistance. We also find a positive effect of the oil price, which can be considered as representing increases in production costs and an inflation predictor. The unemployment rate

[17] This is only partially consistent with empirical evidence based on micro-data, where educational attainment has a negative correlation with union density in the private sector, and a positive correlation in the public sector (see Blanchflower, 2006).

[18] Many theoretical models of union density provide joint determination of union density and the equilibrium wage, either through a "public good" approach (Booth, 1995) or a social custom approach. See the discussion in Checchi and Lucifora (2002).

coefficient has the expected negative sign, suggesting a lower reservation wage when unemployment is higher. The implication of this finding is that a rise in unemployment triggers an adjustment in wages that brings unemployment back to the equilibrium level. Combined with the unemployment equation, these results are fully consistent with a non-competitive model of wage/employment determination (Nickell and Layard, 1999).

Table 2 around here

The last three columns of Table 2 display the same models estimated instrumenting the endogenous variables. In the unemployment equation union density is instrumented using the male industrial employment share, strike participation and the educational attainment variable. Here the union coefficient is more than doubled while the differences in the other coefficients are negligible apart from the tax wedge coefficient that is substantially lower.

In the union density equation we instrument the unemployment rate and the wage using the macroeconomic shocks, the Kaitz index (given by the proportion of minimum to median wage) and productivity as instruments. Again, the estimated model is pretty much similar to the OLS regression, apart from the unemployment effect onto density which is lower and less precisely estimated.

Finally, we instrument union density and unemployment in the wage equation using the male industrial employment share, strike participation, the educational attainment variable and the macroeconomic shocks as instruments. Here we experience the major differences, with union density becoming significant with expected sign, at the expenses of the tax wedge. The story suggested by the IV estimations is then quite different, suggesting that once we control for productivity wages are higher when unions are stronger rather than when taxation on labour is higher. As regards the effect of unemployment, the estimated coefficient is very close to the OLS one.

Despite observing substantial differences in the coefficients by simply instrumenting the endogenous variables, the methodology we are employing at this stage is still focusing on single equation estimation. This way we leave aside an important part of the information available to the researcher, i.e. that unemployment, wages and union density are jointly determined. The

single equation procedure is then still inefficient because we are concentrating on single equations when the true model is one where the variables of interest are simultaneously determined. A step further is therefore a joint estimation of the system composed of our three equations.

4.2 System Estimations

Table 3 display the joint estimates of the unemployment, union density and wage equations under alternative estimation methods. The techniques we use are SURE and 3SLS, with country and time fixed effects. In the case of SURE, all regressors are assumed exogenous and the equations are only related through the variance-covariance matrix, i.e. only contemporaneous correlations are modelled. The 3SLS estimator is instead a GMM estimator with a particular weighting matrix and better finite sample properties that allows for an explicit modelling of endogeneity.

Most of the single equations results still hold when the equations are jointly estimated. However, we notice that the 3SLS estimates suggest a much more relevant role of unions in explaining unemployment. The estimated coefficient is much larger than the one estimated by a single equation with fixed effects (0.149 versus 0.045) and it is highly significant. On the other side, the unemployment coefficient in the union density equation is more than doubled (0.911 versus 0.381). This suggests that single equations estimations, assuming exogeneity of the key variables, may be seriously downward biased. In other words unions play a more relevant role in explaining unemployment and unemployment is a more relevant factor explaining unions membership rates.

As regards the wage equation, the union density coefficient is significantly different from zero, in line with the single equation 2SLS estimates, while the unemployment coefficient is more than doubled (-0.010 versus -0.004). This is to say that the labour market adjustment mechanism is stronger than what predicted by single equation multi-country models. This finding is particularly relevant given that the theoretical expectation of institutions affecting equilibrium unemployment mostly relies on wages adjusting to changes in unemployment. If that was not the case then unemployment would be fully persistent[19], being the result of the cumulation of past shocks, and therefore uncorrelated with institutions. A larger negative coefficient of unemployment in the wage equation means therefore that wages adjust more than

[19] See Nickell (1998) for a theoretical discussion on this point.

what predicted by single equation estimates. The coefficient of wages in the union density equation is also much larger (17.082 versus 7.695), reinforcing the view that workers take into account the results of bargaining activity when deciding whether joining a union. Overall, our estimations show that once we model endogeneity, the relationships between our key variables become stronger. This is true both if we simply instrument the endogenous regressors as well as if we model a simultaneous system. In the latter case, we showed that the estimated coefficients can be more than twice as large than the ones obtained assuming exogeneity.

Table 3 around here

Figure 3 shows a graphical representation of the logic behind our estimated joint model. Unemployment and union density on one side, and wage and union density on the other, both represent a self-sustaining mechanism. They feed back positively, therefore depicting cumulative processes which induce unstable dynamics. An exogenous positive shock to density may activate a destabilising process, through progressive increases in wages and unemployment, both reinforcing the initial increase in union density. However, the system is stabilized by the negative impact of unemployment onto wages, which may soften (and even invert) the cumulative process of wage increases.

Figure 3 around here

4.3 Relaxing the Assumption of Homogeneous Coefficients

These results have been obtained imposing an homogeneous structure on the coefficients. In other words, we are assuming that the correlations between the variables are the same in every country in the sample. This is a very strong assumption, often implicit in multi-country estimations. However, many authors in the literature have stressed the importance of considering institutions as part of a comprehensive social model rather than single dimensions separated from the context. Assuming homogeneous coefficients may then give a misleading perception of a unique *modus operandi* of market economies, which is heavily disputed by some political economists. Hall and Soskice (2001) distinguish between *liberal market economies* (LME) and *coordinated market economies* (CME) according to the type of relationships between firms and

within each firm. Among the former group they list United States, United Kingdom, Australia, Canada, New Zealand and Ireland, while in the latter they include Germany, Japan, Switzerland, the Netherlands, Belgium, Austria and the Nordic countries (Denmark, Finland, Sweden and Norway).

Amable (2003) combines factor and cluster analysis in order to characterize alternative models of capitalism. When concentrating on a set of dimensions including product markets, labour markets, finance, welfare and education, five groups of countries are identified: *market-based economies* (akin to LMEs of Hall and Soskice: Australia, Canada, United Kingdom and United States), the *social-democratic model* (the Nordic countries except Norway), the *continental European model* (Switzerland, Netherlands, Ireland, Belgium, Norway, Germany, France and Austria), the *Mediterranean capitalism* (Greece, Italy, Portugal and Spain) and the *Asian capitalism* (Japan and Korea).

The OECD Economic Outlook (2004b) provides a classification of countries in terms of degree of coordination/centralisation of wage bargaining. According to this perspective, a vast group of countries exhibits high levels in coordination/centralisation (CC). This group includes Denmark, Finland, Norway, Portugal, Spain, Sweden, Australia, Austria and Ireland. Another group is characterized by an intermediate degree of CC (Belgium, Germany, New Zealand, Switzerland, Netherlands, United Kingdom, Japan). A final small group is decentralised (France, Italy, Canada, Korea and United States).

4.3.1 Identifying Country Heterogeneity Using Perturbation Methods

Our next step is to generalize our system allowing for some heterogeneity in the feedbacks between variables, letting the impact of institutions varying across countries. This is to say that similar regulations may differently affect economic performance, because of alternative combinations with the other institutional dimensions. This way we are able to identify alternative social systems as suggested by the data. This exercize can be viewed as a further robustness check, evaluating the restrictions imposed by a single equation - homogeneous coefficients model. We are particularly interested in assessing whether the data suggest some degree of heterogeneity in the correlations between unemployment and union density. We therefore retain the assumption of homogeneous coefficients in the wage equation in order to keep the problem to a manageable dimension. Our first step in this direction is to estimate our system using

SURE, i.e. maintaining the assumption of exogenous regressors, and just including interactions of union density and unemployment with country dummies, respectively in the unemployment and union density equation. Figure 4 display the scatter plot of the impact of unemployment on density against the impact of density on unemployment[20]. What we infer from this graph is that the degree of heterogeneity in the coefficients may be relevant, especially for what concerns the feedback of unemployment on union density. Despite the majority of countries are located in the North-East quadrant, some are characterized by a negative impact of density on unemployment and some by a negative impact of unemployment on density. No country is in the South-West quadrant except France, whose feedback coefficients are however negligible.

How much can we trust these results depends on how much we are ready to believe that neglecting endogeneity is not affecting the spatial distribution of countries in the graph. However, in the previous section we have shown that endogeneity significantly affect the size (if not the sign) of the feedback mechanism. Therefore modelling endogeneity could have a significant impact on the estimated heterogeneity.

Our next step is therefore to produce an analogous picture estimating our system using 3SLS, i.e. modelling endogeneity. Our task is complicated by the fact that we would need to estimate 20 coefficients for union density in the unemployment equation plus 20 coefficients for unemployment in the union density equation, all of them being potentially endogenous. This would result in the impossibility to identify such a large system. In order to solve this problem, our strategy is to estimate the system recursively, assuming both union density and unemployment as endogenous but imposing a set of perturbations in the coefficients that allow some degree of heterogeneity across countries. More specifically, we estimate the model in its simplest form adding a set of 19 interactions between union density and the country dummies in the unemployment equation, excluding one country chosen from our sample, say, Australia. Similarly, in the union density equation we add 19 interactions between unemployment and the country dummies, once again excluding Australia. In this case we retain the assumption of endogeneity (for Australia), but the coefficient is perturbed by the set of interactions (the remaining 19 countries) that are assumed exogenous. We repeat this procedure recursively for all countries, excluding one country at a time from the interactions and we end up having

[20] We exclude Portugal because the estimated coefficients are too volatile. This is due to the limited number of available observations (10 or so).

20 coefficients for union density and 20 coefficients for unemployment, estimated under the assumption of endogeneity. Finally, we plot the estimated coefficients in order to detect possible patterns in the mutual influence of union density and unemployment. Figure 5 displays the estimated coefficients (excluding Portugal), suggesting a distribution along a negatively sloped, slightly non-linear, relationship. The comparison of Figures 4 and 5, with specific attention to the size of the coefficients, indicates that modelling endogeneity amplifies country differences. The picture of the previous section, where unemployment and density sustain each other, comes out just as an average behaviour.

In terms of the Hall and Soskice classification, looking at the spatial distribution in Figure 5 we notice that most of the liberal market economies (LME) are in the south-east quadrant and the majority of coordinated market economies (CME) are in the north-west one. Canada is an exception for the first group, and, for what concerns the second group, Japan, Netherlands and Austria are wrongly located. According to Amable's classification, we can read our graph by placing market-based economies in the south-east quadrant and the social-democratic economies in the north-west one, whereas all the other types would we indistinguishable around the origin. However, once again, we are left puzzled by the position of Canada on one side and Netherlands and Austria on the other. The country grouping suggested by the OECD Economic Outlook (2004b) provides a rather different clustering which does not superimpose to our graph.

In terms of the relationship between unemployment and union density we can identify two groups of countries in Figure 5. In the south-east quadrant we have what could be described as the "union decline" scenario: unions producing high unemployment, and by doing so eroding their base of support. This union type is what Burda (1990) termed the "Cheshire cat" union. The United States are a typical example of this occurrence. Other countries in the quadrant are New Zealand, Japan and the Netherlands, with Ireland and France being close. Surprisingly, Austria, a typical corporatist country, lies in this portion of the plane. On the contrary, in the north-west region of the graph, we have the "union rise" scenario. In this case an increase in unemployment has a positive impact on union density, either through appropriate institutional arrangements (like the unemployment benefit system managed by unions - the so-called 'Ghent' system) or by affecting the union attitude in the bargaining process. At the same time, unions are sufficiently coordinated and/or centralised to exert a negative impact onto unemployment (other things remaining constant). The quadrant includes the Nordic economies (Denmark,

Finland, Sweden and Norway) plus Canada, with Belgium, Spain, Italy and Germany being close.

In the case of the homogeneous coefficients model, the stability of the system is assured by the negative unemployment coefficient in the wage equation. When allowing for heterogeneous coefficients, the two scenarios depicted above are characterized by an additional stability mechanism. For example, in the "union rise" world, an expansion of union density reduces unemployment, which in turn diminishes the incentive to become union member. In the "union decline" scenario a stronger union keeps unemployment high, which in turn reduces the support for union membership.

As regards the rest of the countries, the United Kingdom lies around the origin of Figure 5, suggesting that unemployment and union density are rather independent. Switzerland is an outlier the figure: it remains the only country characterized by the positive feed-backs story previously described for the entire sample.

If we go back to the actual countries' experiences, we notice that the "union rise" countries are characterized by a positive density and unemployment growth. Our findings suggest that without the rise in union density the increase in unemployment could have been higher, depending on the magnitude of the heterogeneous estimated effect. On the contrary, the "union decline" countries experienced a decline in density with different trends in unemployment. This may be the result of weaker unions preventing unemployment from rising.

Figures 4 and 5 around here

4.3.2 Estimating an Heterogeneous System Using The Indications in the Literature

The attractiveness of Figure 5 is that it is totally driven by the data, i.e. without imposing any ex-ante belief on each country characteristics. Its limit is that it does not highlight a perfect identification device for country heterogeneity . Our next step si then to match the numerical indications of the figure with our knowledge of the characteristics of each country. We identify three country groups on which we can replicate the joint model of unemployment, union density and labour cost. These are:

1. Scandinavian + Belgium,

2. Continental Europe + United Kingdom and Ireland,

3. Non European + Switzerland.

The first group includes the *social-democratic* group of Amable (2003). Belgium is added taking into account its similarity with Nordic countries in terms of unemployment benefits managed by unions (the so-called Ghent system). The third group captures the *market economies*[21]. The second group of continental European countries, lies somewhere in between.

Once we have identified the three country groups we can estimate our system on each subsample, in order to check the impact of endogeneity and heterogeneity in detail. Table 4 presents two alternative heterogeneous models estimated, respectively, by simple OLS and 3SLS. This way we are able to identify the effect of heterogeneity and endogeneity within the same table. Both set of estimates confirm a relevant degree of heterogeneity between country groups. However, only if we model endogeneity we are able to replicate the scenario suggested by Figure 5. Heterogeneity survives even if we include an interaction term between union density and an indicator for bargaining coordination or centralization, suggesting that there may be something more to it. For example, centralisation may explain why in Scandinavian countries union density exerts a positive impact on unemployment (through the internalisation of negative spillover effects associated with real wage increases), but it does not necessarily explain the implications in terms of the unemployment effect on union density. Blanchard and Philippon (2004) suggest that the quality of labour relations may account for the perception of the role of unions, and therefore their "credibility" in offering a sort of employment protection to workers. While this promise is recognised as credible in countries characterised by better labor relations (limited resort to industrial conflict), the same promise is discarded in more flexible economies, where unions do not play any significant role. As a consequence, in that case unions are only able to exert a wage pressure strategy. According to our grouping of countries, continental Europe lies in between: workers still rely on unions for obtaining some employment protection, but unions are unable (or unwilling) to provide any significant wage

[21] One question is whether the United Kingdom and Ireland should belong to the market economy group. We chose this classification since our sample period extends back to the 1970s, a period when the industrial relations in those countries resembled continental Europe (Flanagan, 2003). However, estimating the model including United Kingdom and Ireland in group three, has only a minor numerical impact on the estimated coefficients, and the implications of our analysis are unaltered.

moderation, thus being irrelevant with respect to employment determination. Our empirical results confirm and qualify previous findings by Nickell (1997) and Layard and Nickell (1999): union support per se does not necessarily have a positive impact onto unemployment, especially when accounting for the wage impact. On our sample period, this effect is limited to the group of flexible economies, located in North-America and in the Pacific area, while it is reversed in Nordic countries.

5 Conclusions

We presented an empirical analysis of unemployment, union density and wages in 20 OECD countries. We showed that when each of these key labour market variables is estimated by means of a single equation multi-country model the estimated coefficients may be seriously biased, confirming that endogeneity may be a relevant issue. Instrumenting the endogenous variables partially solves the problem but it is still an inefficient procedure. We present then a set of system estimations where unemployment, union density and wages are jointly determined. When explicitly modelling endogeneity our results suggest that unions play a more relevant role in explaining unemployment than what predicted by single equation estimates. In addition, the impact of wages and unemployment in explaining union density is much larger and wages are shown to react more to changes in unemployment. Furthermore, we generalize our model allowing for heterogeneity in the feedbacks between variables, therefore identifying alternative social systems as suggested by the data. Our empirical analysis confirm a relevant degree of heterogeneity in the unemployment-union density relationship. A scatter plot of the impact of unemployment on density on the impact of density onto unemployment suggests that the coefficients are distributed along a negatively sloped, slightly non-linear, relationship. We then identify a set of alternative scenarios: one is the "union decline" scenario, with unions producing high unemployment, and by doing so eroding their base of support. On the opposite, we identify a "union rise" scenario where an increase in unemployment has a positive impact on union density, either through appropriate institutional arrangements (like the unemployment benefit system managed by unions) or through a different attitude of the union. Modelling endogeneity and heterogeneity, according to some stylized facts upon which we can classify each country in our sample, we find a confirmation of these findings. As such, these results could also be

taken as guidelines for union managers: whenever unions are viable to contain unemployment, their prospects are not necessarily gloom as it may be expected, and better prospects can be envisaged.

References

[1] Amable, Bruno (2003). *The diversity of modern capitalism*. Oxford University Press.

[2] Baker, D., A. Glyn, D. Howell and J. Schmitt (2004), "Labor Market Institutions and Unemployment : A Critical Assessment of the Cross-Country Evidence", in D.Howell (ed.), *Fighting Unemployment: The Limits of Free Market Orthodoxy*, Oxford, Oxford University Press.

[3] Bassanini, A. and R. Duval. (2005). Employment patterns in OECD countries: reassessing the role of policies and institutions. *OECD Economic Department working paper* n.486.

[4] Belot, M. and J. C. van Ours, (2001). Unemployment and labor market institutions: an empirical analysis. *Journal of the Japanese and International Economics*, 15, pp. 403–418.

[5] Bertola, G., F.D. Blau, and L.M. Kahn, (2001). Comparative Analysis of Labor Market Outcomes: Lessons for the US from International Long-Run Evidence. in A.Krueger and R.Solow eds., *The Roaring Nineties: Can Full Employment Be Sustained?*, 2001.

[6] Bertola, G. and W.Koeninger, (2004) Consumption Smoothing and Income Redistribution. *European Economic Review*, forthcoming.

[7] Blanchard, O. (2006), European Unemployment: the Evolution of Facts and Ideas, *Economic Policy*, vol.21(45), 7-59.

[8] Blanchard, O., and J. Wolfers, (2000).The Role of Shocks and Institutions in the Rise of European Unemployment: the Aggregate Evidence. *The Economic Journal*, 110(462).

[9] Blanchard, O., and T. Philippon, (2004). The Quality of Labor Relations and Unemployment, *NBER WP*.10590.

[10] Blanchflower, D. (2006). A cross-country study of union membership. IZA Discussion Paper n.2016.

[11] Böckerman, P. and R. Uusitalo, (2006). Erosion of the Ghent System and Union Membership Decline: Lessons from Finland. *British Journal of Industrial Relations* 44(2): 283-303.

[12] Boeri, T., A. Brugiavini and L.Calmfors (eds.), with A. Booth, M. Burda, D. Checchi, B. Ebbinghaus, R. Freeman, P. Garibaldi, B. Holmlund, R. Naylor, M. Schludi, T. Verdier, and J. Visser (2001). *The future of collective bargaining in Europe.* Oxford: Oxford University Press.

[13] Booth, A.(1995). *The economics of the trade union.* Cambridge University Press 1995

[14] Botero, J., S. Djankov, R. La Porta, F. Lopez-de-Silanes and A. Shleifer, (2004), The Regulation of labor, *Quarterly jounral of Economics* Vol. 119, No. 4, November.

[15] Burda, M. (1990). Membership, Seniority and Wage-Setting in Democratic Labour Unions. *Economica,* 57/228: 455-66.

[16] Checchi, D. and C. Lucifora. (2002). Unions and labour market institutions in Europe. *Economic Policy,* vol.17(2): 362-401.

[17] Checchi, D. and J. Visser. (2005). Pattern persistence in European trade union density. *European Sociological Review* 21(1): 1-22

[18] Cohen, D. and M. Soto. (2001). Growth and human capital: good data, good results. OECD Development Centre Technical paper n.179.

[19] Corneo, G. 1995. Social custom, management opposition and trade union membership, *European Economic Review* 39: 275-292.

[20] Di Tella R. and R. MacCulloch. (2002) The Determination of Unemployment Benefits, *Journal of Labor Economics,* April, 20(2): 404-34.

[21] Engle, R. F., Hendry, D. F., and Richard, J.-F. (1983). Exogeneity. *Econometrica*, 51, 277–304.

[22] Flanagan, R. (2003). Collective bargaining and macroeconomic performance. in J. Addison and C. Schnabel (2003) (eds). *International handbook of trade unions.* Edward Elgar, 172-196.

[23] Hall, P. and D. Soskice (2001). *Varieties of capitalism: the institutional foudations of comparative advantage.* Oxford University Press

[24] Holmlund, B. and P. Lundborg, (1999). 'Wage bargaining, union membership, and the organization of unemployment insurance'. *Labour Economics*, 6: 397–415.

[25] Lange, Peter and Lyle Scruggs (1999). Where have all members gone? Union density in an era of globalization. *Stato e Mercato*, Vol. 55, pp. 39-75.

[26] Nickell, S. (1997). Employment and labor market rigidities: Europe versus North America, *Journal of Economic Perspectives*, 11/3: 55-74.

[27] Nickell, S. (1998). Unemployment: Questions and Some Answers, *The Economic Journal*, 108, (448), 802-16.

[28] Nickell, S. and R. Layard. (1999). Labour market institutions and economic performance, in O. Ashenfelter and D. Card,(eds) *Handbook of labor economics*, vol3c, North Holland 1999

[29] Nickell, S., L. Nunziata and W. Ochel, (2005) Unemployment in the OECD since the 1960s. What do we know?, *The Economic Journal*, Vol. 115, 1-27, January.

[30] Nicoletti, G., S. Scarpetta and O. Boylaud, (2000), "Summary indicators of product market regulation with an extension to employment protection legislation", OECD, Working Papers n. 226.

[31] Nunziata, L. (2005). Institutions and Wage Determination: a Multi-Country Approach, *Oxford Bulletin of Economics and Statistics*, Vol. 67, Issue 4, 435-466, August.

[32] OECD (2004a), Employment protection regulation and labour market performance, *Economic Outlook*, Chapter 2, Paris.

[33] OECD (2004b), Wage setting institutions and outcomes, *Economic Outlook*, Chapter 3, Paris

[34] Oskarsson, S. (forthcoming). "Class struggle in the wake of globalization – union organization in an era of economic integration". In L. Magnussen and J. Ottosson (eds.), *Europe: One Labour Market?* Brussels: Peter Lang.

[35] Saint-Paul G. (1996), Exploring the political economy of the labour market institutions, *Economic Policy* 23, 263-31.

[36] Western, Bruce (1997). *Between class and market – Post-war unionization in the capitalist democracy*. Princeton University Press.

Appendix: Variable Definitions and Sources

Standardised unemployment rate (UN): OECD standardised unemployment rate.

Net Union Density (UD): this variable is constructed as the ratio of total reported union members (gross minus retired and unemployed members), as reported in Visser (1996) and Ebbinghaus and Visser (2000).

Labour cost ($WAGE$): Labour cost is defined as $w - p = \log(IE) - \log(ET) - \log(P_{GDP})$, where IE are compensations of employees by resident producers, namely wages, salaries and social security contributions, ET is total employment and P_{GDP} is GDP deflator at factor cost. All data is from CEP - OECD database, updated by authors using the same criteria, except for P_{GDP} that is calculated from GDP at factor cost, current and constant prices, from OECD Business Sector Database.

Tax Wedge (TW): the tax wedge is equal to the sum of the employment tax rate, the direct tax rate and the indirect tax rate: $TW = t_1 + t_2 + t_3$. The employment tax rate t_1 is calculated as $t_1 = EC/(IE - EC)$, where EC denotes the employers' total contributions and IE denotes wages, salaries and social security contributions. The direct tax rate is defined as $t_2 = DT/HCR$ where DT is the amount of direct taxes and HCR is the amount of households' current receipts. The indirect tax rate is defined as $t_3 = (TX - SB)/CC$ where TX are total indirect taxes, SB subsidies, and CC private final expenditures. All data come from London School of Economics CEP - OECD data base, updated using the same criteria.

Benefit Replacement Ratio (BRR): the data is provided by the OECD with one observation every two years for each country in the sample. The data refer to the first year of unemployment benefits, averaged over family types of recipients, since in many countries benefits depend on family composition. The benefits are measured as a proportion of average earnings before tax.

Benefit Duration (BD): we constructed this index as a difference between the unemployment benefit replacement rate received during the second and third year of unemployment and the unemployment benefit replacement rate received during the first year of unemployment, normalized so that the maximum is 100.

Permanent Employment Protection (EP): the OECD provides a time-varying employment protection indicator for the time period 1989-99[22] containing information on legislation changes occurred in European countries in the same period. This piece of information is chained with the cross sectional indicators on permanent employment protection provided by the OECD[23]. The legislation changes occurred before 1989 are

[22] See Nicoletti et al. (2000).

[23] See the OECD Employment Outlook (1999) and (2004a).

taken into account using the information provided by Nickell et al. (2005). Their series is built using an interpolation of the data provided by Blanchard and Wolfers (2000), readjusted in the mean with range {0,4} increasing with strictness of employment protection. The latter is constructed chaining OECD data with data from Lazear (1990). Notice that the OECD data, used from 1985 onwards, is constructed on the basis of a more extensive collection of employment protection dimensions compared with data used by Lazear.

Bargaining Coordination ($COORD$): this is an index with range $\{1, 3\}$ constructed as an interpolation of OECD data on bargaining coordination. It is increasing in the degree of coordination in the bargaining process on the employers' as well as on the unions' side and it is provided by Nickell et al. (2005).

Minimum wage ($KAITZ$): it is defined as the ratio of the minimum wage to the median wage. The data source is OECD Labour force statistics - Indicators (downloadable at **??**). For countries/years where minimum wage provisions do not exist, this indicator is set to zero.

Real oil price in dollars in logs ($LROIL$): Spot Oil Price: West Texas Intermediate, provided by Dow Jones Energy Service.

Labour Demand Shock ($LD\ SHOCK$). This series consists of the residuals $\hat{\varepsilon}_t$ of the following 20 by country regressions:

$$\log(ET_t) = \beta_0 + \beta_1 \log(ET_{t-1}) + \beta_2 \log(ET_{t-2}) + \beta_3 \log(ET_{t-3}) + \beta_4 \log(YQ_t) + \beta_5 \log(WTP_t) + \varepsilon_t$$

where ET is total employment and YQ and WTP are respectively real GDP and real labour cost at 1990 prices.

Terms of Trade Shock ($TRADE\ SHOCK$). This series is equal to $IMP = \frac{MC}{YC}\Delta\left\{\log\left(\frac{P_m}{P_G}\right)\right\}$, where MC are imports at current prices, YC is GDP at current prices, P_m is import price deflator and P_G is GDP deflator at market prices, both with 1990 as base year.

Real Interest Rate ($RIRL$). Long term real interest rate, constructed using long term nominal interest rate and inflation from OECD Economic Outlook Database.

Male industrial employment share (MMM): the share of male dependent employment in industry over total employment intends to capture the labour force component that is more prone to join unions (indicated

in the sociological literature as "*male, manual, manufacturing*"). From OECD Labour Force Statistics. When non available, we have resorted to national sources, as computed in Checchi and Visser (2005).

Strike participation ($STRIKE$). This variable captures the support to industrial actions called for by unions. It is computed as the ratio between workers involved in strikes and dependent employment. The data source for the numerator is ILO, while the denominator comes from OECD Labour Force Statistics.

Human capital ($TY25$). It corresponds to the years of schooling of population aged 25 and over, whether studying or not. The data source is Cohen and Soto (2001).

Labour productivity ($PROD$): the Hodrick Prescott trend of log real GDP minus the log of total employment.

Variable	Description	Obs	Mean	Std.	Min	Max
UR	unemployment rate (percentage)	680	5.99	4.34	0.00	24.17
UD	union density (percentage)	680	42.29	19.29	8.30	88.60
WAGE	log(labour cost)	680	3.68	1.54	-0.33	7.04
TW	tax wedge (proportion)	680	0.47	0.13	0.17	0.83
BRR	benefit replacement ratio (percentage)	680	42.78	20.44	1.04	88.75
BD	benefit duration (index, 0 - 100)	680	77.94	19.11	18.25	100
EP	employment protection (index, 0 - 4)	680	1.97	1.14	0.00	4.00
COORD	wage bargaining coordination (index, 1 - 3)	680	2.11	0.60	1.00	3.00
KAITZ	minimum to median wage (proportion)	680	0.20	0.24	0.00	0.65
LROIL	log real oil price	680	2.46	0.95	0.75	3.60
LD SHOCK	labour demand shock	680	0.00	0.01	-0.05	0.10
TRADE SHOCK	term of trade shock	680	0.00	0.02	-0.09	0.17
RIRL	real interest rate	680	0.03	0.03	-0.11	0.14
MMM	male manual manufacturing employment share	680	0.23	0.05	0.14	0.37
STRIKES	strikes, workers involved (proportion of employees)	680	0.06	0.10	0.00	0.79
TY25	average years of education	680	9.75	1.80	5.34	12.88
PROD	productivity	680	4.33	1.52	0.53	7.83
TREND	linear trend	680	0.74	10.50	-19.00	18.00

Table 1: List of variables

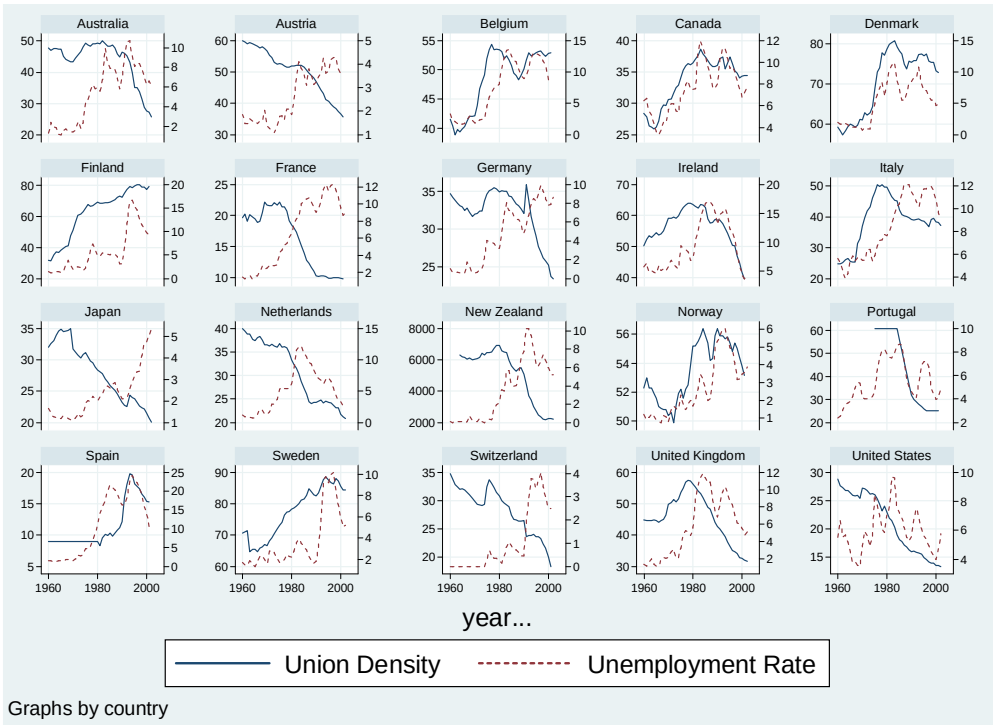

Figure 1: Union density and unemployment rate in 20 OECD countries from 1960 to 2000 (percentage)

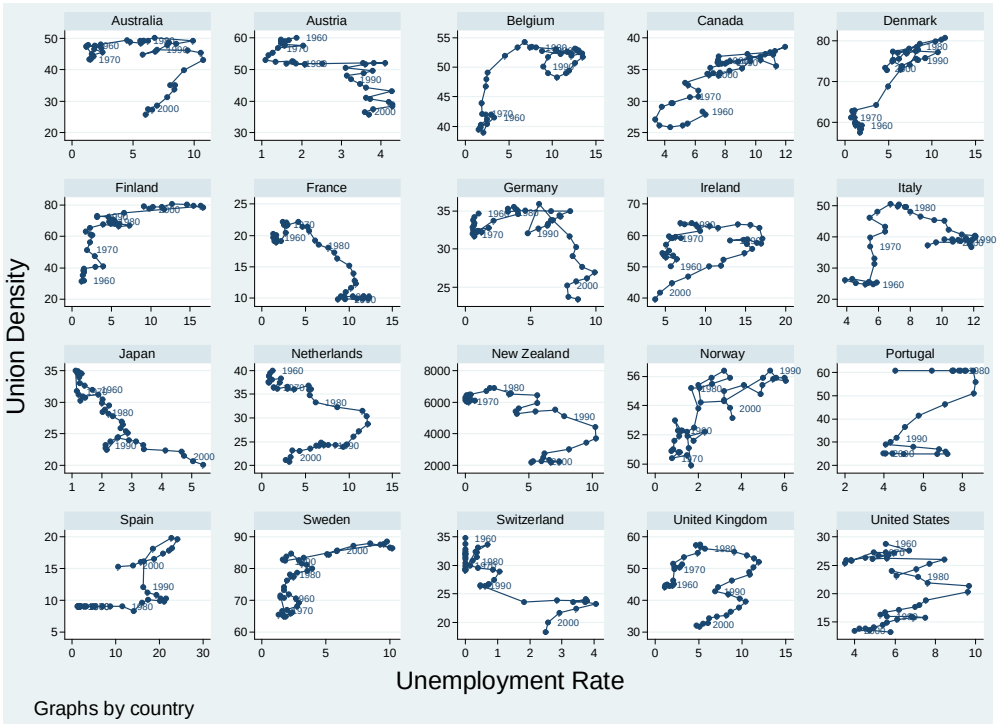

Figure 2: Connected scatterplot of union density and unemployment rate in 20 OECD countries from 1960 to 2000

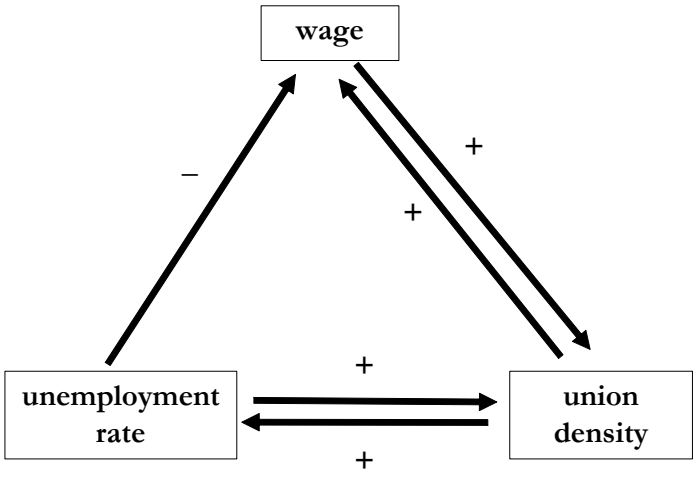

Figure 3: A sketch of the feedbacks modelled in our 3SLS estimation

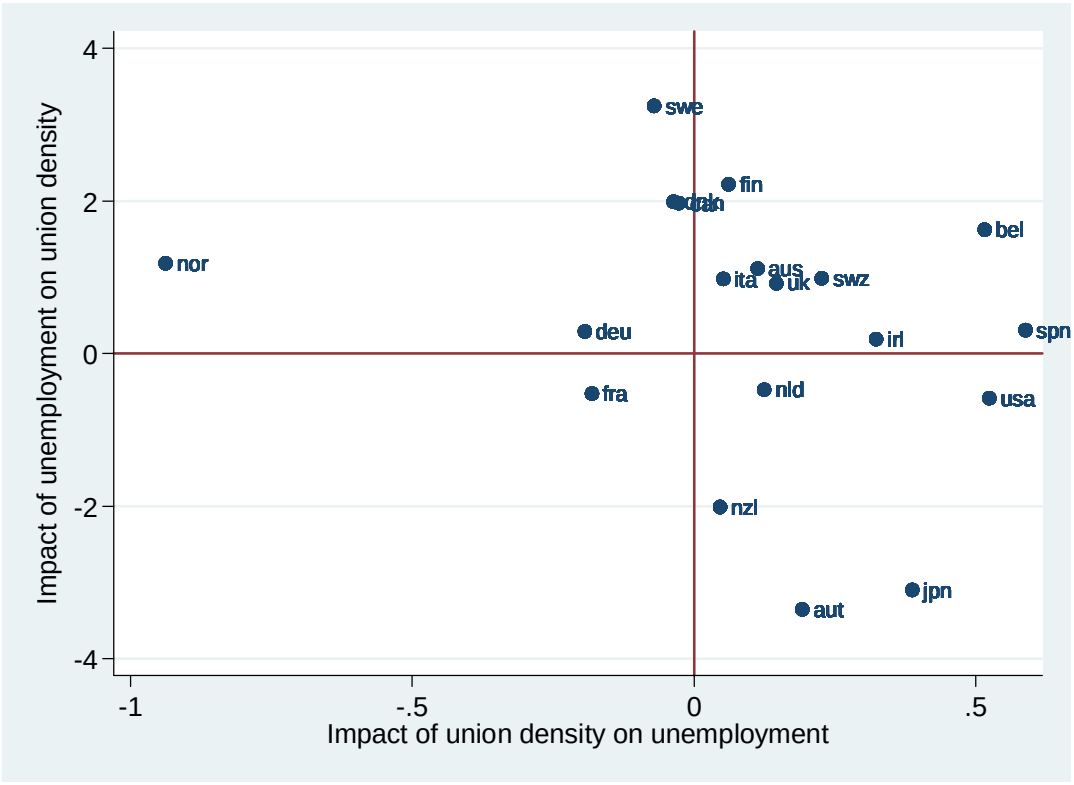

Figure 4: SURE heterogeneous system with perturbations: union density and unemployment coefficients

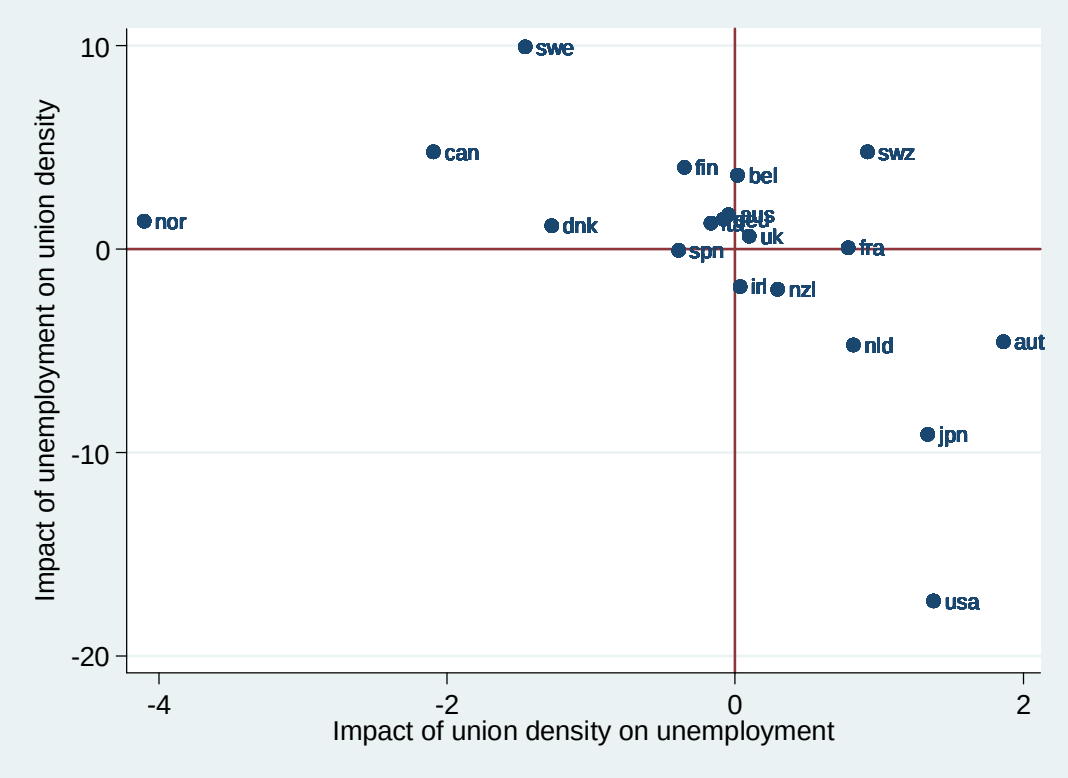

Figure 5: 3SLS heterogeneous system with perturbations: union density and unemployment coefficients

	(1) UR OLS	(2) UD OLS	(3) UD OLS	(4) WAGE OLS	(5) UR 2SLS	(6) UD 2SLS	(7) WAGE 2SLS
UR		0.452	0.381	-0.004		0.331	-0.007
		(0.097)**	(0.100)**	(0.001)**		(0.291)	(0.003)**
UD	0.045			0.000	0.103		0.005
	(0.015)**			(0.000)	(0.049)*		(0.002)**
WAGE			7.695			11.353	
			(2.552)**			(4.385)**	
TW	10.073			0.262	5.872		0.010
	(2.367)**			(0.059)**	(4.125)		(0.116)
BRR	0.012	0.200	0.193	-0.000	0.004	0.190	-0.001
	(0.011)	(0.027)**	(0.027)**	(0.000)	(0.012)	(0.028)**	(0.000)
BD	0.060	0.005	-0.002	0.000	0.059	-0.004	0.000
	(0.012)**	(0.033)	(0.033)	(0.000)	(0.012)**	(0.037)	(0.000)
EP	-0.752	-1.987	-2.158	-0.005	-0.538	-2.250	0.012
	(0.221)**	(0.577)**	(0.576)**	(0.006)	(0.281)	(0.626)**	(0.009)
COORD	-1.202				-1.460		
	(0.275)**				(0.347)**		
KAITZ	-0.690			0.028	-0.696		0.042
	(0.830)			(0.021)	(0.840)		(0.025)
LD SHOCK	-26.977				-26.185		
	(6.190)**				(6.292)**		
TRADE SHOCK	-4.312				-4.272		
	(4.483)				(4.534)		
RIRL	21.660				22.887		
	(3.436)**				(3.610)**		
MMM		93.565	68.566			56.466	
		(12.890)**	(15.258)**			(21.041)**	
STRIKES		14.556	14.934			15.128	
		(3.499)**	(3.480)**			(3.506)**	
TY25		4.044	3.678			3.511	
		(0.606)**	(0.615)**			(0.623)**	
PROD				0.927			0.873
				(0.025)**			(0.038)**
LROIL				0.023			0.022
				(0.006)**			(0.007)**
Country dummies	yes	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes	yes
Observations	680	680	680	680	680	680	680
Countries	20	20	20	20	20	20	20
R-squared	0.80	0.92	0.92	0.99	0.66	0.40	0.95
RMSE	2.00	5.46	5.43	0.05	2.03	5.44	0.06

Standard errors in parentheses
* significant at 5%; ** significant at 1

Table 2: Single equation estimations

	(1) UR SURE	(2) UD SURE	(3) WAGE SURE	(4) UR 3SLS	(5) UD 3SLS	(6) WAGE 3SLS
UR		0.662	-0.004		0.911	-0.010
		(0.096)**	(0.001)**		(0.229)**	(0.002)**
UD	0.091		0.001	0.149		0.005
	(0.015)**		(0.000)**	(0.047)**		(0.001)**
WAGE		11.921			17.082	
		(2.449)**			(3.571)**	
TW	9.187		0.250	11.963		0.218
	(2.278)**		(0.057)**	(3.755)**		(0.091)*
BRR	0.003	0.177	-0.000	-0.014	0.161	-0.001
	(0.010)	(0.027)**	(0.000)	(0.012)	(0.027)**	(0.000)*
BD	0.057	-0.031	0.000	0.049	-0.046	0.000
	(0.012)**	(0.032)	(0.000)	(0.013)**	(0.035)	(0.000)
EP	-0.614	-2.043	-0.001	-0.478	-2.054	0.006
	(0.214)**	(0.561)**	(0.006)	(0.281)	(0.596)**	(0.008)
COORD	-1.195			-0.701		
	(0.265)**			(0.318)*		
KAITZ	-0.719		0.031	-1.173		0.030
	(0.799)		(0.021)	(0.748)		(0.021)
LD SHOCK	-25.945			-21.857		
	(5.954)**			(5.477)**		
TRADE SHOCK	-5.070			-7.848		
	(4.313)			(3.931)*		
RIRL	21.697			18.119		
	(3.307)**			(3.266)**		
MMM		59.708			19.746	
		(14.591)**			(16.152)	
STRIKES		14.307			10.872	
		(3.326)**			(2.925)**	
TY25		3.648			2.911	
		(0.587)**			(0.516)**	
PROD			0.908			0.865
			(0.024)**			(0.032)**
LROIL			0.022			0.018
			(0.006)**			(0.006)**
Country dummies	yes	yes	yes	yes	yes	yes
Time dummies	yes	yes	yes	yes	yes	yes
Observations	680	680	680	680	680	680
Countries	20	20	20	20	20	20
R-squared	0.80	0.92	0.99	0.77	0.92	0.99
RMSE	1.97	5.34	0.05	2.07	5.53	0.06

Standard errors in parentheses
* significant at 5%; ** significant at 1

Table 3: SURE and 3SLS System Estimations

	(1) UR	(2) UD	(3) UR	(4) UD	(5) UR	(6) UD	(7) UR	(8) UD
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
UR		0.452		1.065		0.442		-0.711
		(0.097)**		(0.112)**		(0.084)**		(0.332)*
UD	0.045		0.164		0.034		0.054	
	(0.015)**		(0.034)**		(0.027)		(0.021)*	
	3SLS	3SLS	3SLS	3SLS	3SLS	3SLS	3SLS	3SLS
UR		0.911		0.674		0.523		-4.710
		(0.229)**		(0.197)**		(0.107)**		(0.880)**
UD	0.149		-0.137		-0.073		0.433	
	(0.047)**		(0.058)*		(0.048)		(0.129)**	
	Pooled		Scandinavia +Belgium		Cont. Europe +UK+Ireland		Non-European +Switzerland	

Standard errors in parentheses
* significant at 5%; ** significant at 1

Table 4: Estimations by country groups