

# **Shaping persistent earnings inequality: labour market policy and institutional factors**

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# Shaping persistent earnings inequality: labour market policy and institutional factors\*

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## Abstract

This paper explores the role of labour market policy and institutional factors in explaining cross-national differences in persistent earnings inequality in Europe. Using non-linear least squares we reveal a complex framework, where institutions and their systemic interactions play a decisive role in shaping persistent inequality. "Piece-meal" reforms appear more effective in reducing persistent inequality than comprehensive policy packages: a substitution effect in reducing persistent inequality emerges between labour market deregulation, deunionization, the transition from a decentralized to a corporatist economy, increasing tax wedge, product market deregulation, increasing active labour market policies, and decreasing generosity of the unemployment benefit. Under special conditions, however, some complementarity effects do emerge. Moreover, the effect of each reform depends on the institutional mix. High corporatism emerges as the most effective tool in reducing the adverse effects of macroeconomic shocks on persistent inequality.

*Keywords:* inequality, permanent earnings inequality, labour market institutions; labour market policies

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# 1 Introduction

The rise in earnings inequality experienced by many developed countries during the 1980s and 1990s triggered a strong debate with respect to the driving factors behind individual earnings dynamics and the implications of this increase. The empirical literature has covered extensively the driving factors behind the increase in cross-sectional earnings inequality. Factors like economic growth (“Kuznetz hypothesis”); the shift in demand away from unskilled labour in favour of skilled workers under the impact of trade liberalization, skill-biased technological change and organizational change; the role of changes in the labour market institutions, such as unionization and centralized bargaining, macroeconomic volatility, are among the main possible drivers of income inequality as identified by the empirical literature (Atkinson, 1996; Aghion and Williamson, 2001; Fortin and Lemieux, 1997; Gottschalk and Smeeding, 1997; Katz and Autor, 1999).

Notwithstanding this, the empirical literature has neglected the driving factors behind the components of earnings inequality. There are diverse ways to decompose inequality. Starting with the US and Canada, followed by UK and Europe, recent studies on earnings dynamics have stressed the importance of decomposing the growth in earnings inequality into permanent and transitory components, due to their implications for long-run differentials (Gottschalk and Moffit, 1994; Moffitt and Gottschalk, n.d.; Dickens, 2000; Haider, 2001; Baker and Solon, 2003; Baker, 1997; Kalwij and Alessie, 2003; Cappellari, 2003; Ramos, 2003; Daly and Valletta, 2005). This terminology originates in Friedman and Kuznets (1954), which argue that individual earnings are composed from a permanent and a transitory component, assumed independent of each other (Weizsacker, 1993). The permanent component of earnings reflects personal characteristics, education, training and other systematic elements. The transitory component captures both individual random factors (e.g. illness and accident) and random changes in the market conditions in a particular period and is expected to average out over time, with no influence on permanent earnings. In general terms, these are factors which are random to the individual perception. Following the structure of individual earnings and the independence assumption, overall inequality at any point in time is composed from permanent inequality and transitory inequality. This paper focuses only on persistent inequality.

Identifying persistent inequality is useful in evaluating the welfare implications of the evolution in cross-sectional earnings inequality. An increase in cross-sectional earnings inequality triggered by an increase in the permanent component, e.g. an increase in the returns to education and other persistent characteristics, signals an increase in lifetime

earnings differentials, meaning that individuals with relatively high lifetime earnings are earning relatively even more. Increasing inequality in lifetime earnings has negative welfare implications. Permanent or lifetime earnings is a measure of long-term resources, thus it reflects individual consumption (Friedman, 1957; Cutler and Katz, 1992; Attanasio and Davis, 1996). Individual or household consumption (expenditure) has been increasingly used in the measurement of individual or household welfare (Blundell and Preston, 1998). Thus increasing persistent differentials imply increasing consumption differentials, which has a negative impact on social welfare for most social welfare functions (Haider, 2001). Moreover, the increase in persistent inequality has implications for another distributional aspect - earnings mobility: the larger is the contribution of permanent inequality in the overall inequality, the higher is the correlation of individual earnings over time, and the lower is the year-to-year mobility (Katz and Autor, 1999). Thus increasing inequality triggered by an increase in persistent differential implies both a worsening of the relative lifetime earnings position of the chronically poor and a decrease in the year-to-year mobility (Baker and Solon, 2003).

The empirical literature has neglected the driving factors behind persistent earnings inequality. This paper attempts to fill part of the gap in the literature by exploring the role of labour market policy and institutional factors in explaining cross-national differences in the evolution of persistent inequality across 14 EU countries, topic unexplored so far in a comparative setting at the EU level. Understanding the driving forces behind this labour market outcomes is important from a welfare perspective, particularly given the large variation in the evolution of cross-sectional wage inequality. Sologon and O'Donoghue (2010) and Sologon (2010) addressed a number of questions in relation to the contribution of permanent and transitory earnings inequality to changes in earnings inequality. This paper represents a natural extension of the questions raised by Sologon and O'Donoghue (2010) and Sologon (2010). Understanding the driving factors behind the changes in permanent inequality represents a step towards designing policies and labour market institutions that enable low-wage workers to escape low-wage jobs and improve their position in the distribution of lifetime earnings.

This question is relevant given the economic reality of the 1990s in Europe: the implementation of the single market (1992) and the preparation of the single currency (Maastricht criteria adopted in 1993) increased the pressure on the European labour markets to change. Since the early 1990s, influenced by the 1994 OECD Job Strategy, Europe has been moving towards more flexible labour markets, from labour shedding to employment-friendly reforms, expected to worsen the trade-off between a strong employment performance and

a more equal distribution of earnings (OECD, 2004). But the pace of change was different across Europe (Palier, 2010) supporting the expectation of increased country heterogeneity with respect to the labour market structure and the distribution of labour market income across the EU, both in an annual and a lifetime perspective. We investigate how the heterogeneity in the main labour market policy and institutional factors translates itself in the cross-country heterogeneity in the evolution of persistent inequality.

Using OECD data on institutional factors for 14 EU countries and the predicted permanent inequality from Sologon and O'Donoghue (2010) and Sologon (2010) - we apply a non-linear least squares method to explore the complex relationship between this unobserved labour market outcome and labour market policy and institutional factors.

## **2 Linking labour market policies and institutions with outcomes - permanent and transitory inequality**

Undertaking the first initiative of its kind, we explore the links between the persistent inequality and labour market policy and institutional factors. Our challenge is the lack of a specific theory explaining this link. We attempt to build the link based on existing labour market theories and empirical findings on the impact of these factors on earnings inequality. Considering their interconnections, the influencing institutional and policy factors of earnings inequality are expected to influence its components.

### **2.1 Determinants of wage differentials**

The existing literature on earnings dynamics is predominantly based on US data. Atkinson et al. (1992) provide a comprehensive survey of the literature on earnings dynamics until 1992. The most representative contributions using US or Canadian data are Lillard and Willis (1978), Lillard and Weiss (1979), MaCurdy (1982), Abowd and Card (1989), Moffitt and Gottschalk (n.d., 1998, 2002, 2008), Baker and Solon (2003). For Europe, the most representative papers are Dickens (2000), Ramos (2003), Kalwij and Alessie (2003), Cappellari (2003), Gustavsson (2004), Sologon and O'Donoghue (2010) and Sologon (2010). Sologon and O'Donoghue (2010) and Sologon (2010) used ECHP for 14 EU countries to explore the dynamic structure of individual earnings and the extent to which changes in cross-sectional earnings inequality reflect transitory or permanent components of individual life cycle earnings variation. These studies primarily focus on the descriptive analysis of the two components of earnings inequality, without explaining the impact of the labour market

policy and institutional driving factors. In this paper we attempt to fill part of this gap by using the predicted persistent inequality from Sologon and O'Donoghue (2010) and Sologon (2010) and the OECD data.

Labour market policy and institutional factors as determinants of wage differentials originate in the supply-demand-institutions framework (SDI) (Freeman and Katz, 1994), which provides a three-part explanation for wage structure changes: shifts in the demand and supply of skills, and labour market institutions. Sources of shifts in the relative demand among skill groups include skill-biased technological change and a complementary increase in the prices of other inputs, and forces of globalization (trade and outsourcing). Sources of shifts in relative supply include cohort size variation, changes in access to education, immigration. Supply and demand factors are expected to have their largest effect on young workers as opposed to experienced workers with substantial work tenure (Freeman, 1976).

Since most advanced countries operate in the same world markets, with similar technology, industry and occupation mixes, demand and supply factors cannot by themselves explain all the different changes in inequality among these countries. The missing piece is the institutional framework (Freeman and Katz 1994). Shocks in demand and supply have different effects on wages and employment, depending on wage-setting mechanisms and other labour market institutional factors. The stronger the wage-setting mechanism is, meaning the higher trade union density, the higher the union coverage and the higher the centralisation/co-ordination of wage bargaining, the less impact these shocks have on wages (OECD, 2004; Aidt and Tzannatos, 2001; Blau and Kahn, 1999; OECD, 1997). The OECD countries, where unions, wage bargaining structure play a larger role, are found to record smaller increases in inequality (Katz and Autor, 1999). However, it is the erroneous assumption that institutional change is exogenous, as in reality institutions are influenced by labour market forces. Freeman and Gibbons (1993) found that shifts in supply and demand that raise relative wage differentials are expected to reduce the strength of the centralized collective bargaining and lower union influence on the wage setting mechanism.

## **2.2 Determinants of permanent inequality**

To understand cross-national differences in persistent earnings inequality at the EU level, we relate to the institutional factors from the “SDI explanation of change”. The rise of permanent earnings inequality may be consistent with increasing returns to education, on-the-job training and other persistent abilities that are among the main determinants of the permanent component of earnings, meaning enhanced relative earnings position of the

highly skilled individuals (Mincer, 1957, 1958, 1962, 1974; Hause, 1980). Thus the increase in permanent differentials may be driven by an increase in the relative demand for high-skilled labour which has outstripped the rise in supply.

Among the factors that determine shifts in the relative demand are the skill-biased technological changes, which enhance the relative earnings position of the highly-skilled workers, the increase in prices of the other products, which implies changes in product demands, and the forces of globalization, such as the reduction in trade barriers and outsourcing (Fortin and Lemieux, 1997; Topel, 1997). A possible solution to the economic and social problem of rising permanent earnings differentials is to enhance the supply of high-skill labour through investment in human capital to match the rise in the demand (Topel, 1997). Shifts in the supply are determined by cohort variations, changes in access to education and immigration.

Another factor is the change in the interest rate. Weizsacker (1993) analysed its influence on permanent inequality and concluded that an increase in the interest rate leads to a decrease in permanent inequality within the younger cohort and to a rise in permanent inequality in the older cohorts.

These factors stemmed from the considerable progress that has been made towards understanding the increase in wage inequality in the U.S. and Europe. The economic literature, however, still lacks a consensus on why skill premia increased much less in continental Europe than in the US, despite the same technological developments. Three possible explanations emerge: first, the relative supply of skills increased faster in Europe than in the US (Freeman and Katz, 1994; Acemoglu, 2002), second, the European wage-setting institutions prevented inequality from increasing (Freeman and Katz, 1994; Acemoglu, 2002), and third, Europe faced a less skill-biased technological change due to the labour market institutions which compressed wages and encouraged more investment in technologies, increasing the productivity of less-skilled workers (Acemoglu, 2002). Thus the institutional setting is expected to be a main determinant of persistent inequality.

Economic theory and previous empirical studies have identified a number of relevant policy and institutional factors in the determination wages, and implicitly inequality, expected to extend over persistent inequality. These include inter alia: (i) Trade unions and the structure of collective bargaining; (ii) Employment protection legislation (EPL); (iii) Tax wedge (the sum of the personal income tax and all social security contributions as a percentage of total labour cost); (iv) Product market regulation (PMR); (v) Active labour market policies (ALMPs); (vi) Unemployment benefit replacement rate (URR). Based on the standard wage-setting/price-setting (WS/PS) model (Layard et al., 1991), any factor

that affects the slope of the wage-setting curve - the elasticity of wage claims to employment (e.g. unemployment benefits, unionization, degree of corporatism, PMR) and/or the slope of the price-setting curve - the elasticity of labour demand to the bargaining wage (e.g. EPL, PMR, tax wedge) - may be expected to interact with policies and institutions that affect the level of the wage-setting - level of wage claims (e.g. unemployment benefits) - and the level of the price-setting curve - the level of labour demand (e.g. PMR) (Bassanini and Duval, 2006a,b). In line with Bassanini and Duval (2006a, 2006b), the overall lesson is that, in theory, all possible interactions across policies and institutions can affect permanent inequality, and which policies complement/substitute each other should be established empirically.

Nevertheless, institutional factors do not exist in a vacuum. They are expected to interact with external factors, such as macroeconomic shocks.

Across age groups, as postulated by Freeman (1975)'s "active labour market hypothesis", similarly with overall income, supply and demand factors together with the other macroeconomic shocks are expected to have the largest effect on the youngest generations of workers, as they have a weaker attachment to the labour market and a lower labour protection compared with senior workers.

To sum up, persistent inequality is the result of interactions between ability distributions, life-cycle decisions, economic structures, labour market policy and institutions, and the sensitivity of wages to shocks in market conditions.

### 3 Data

Data on permanent inequality is taken from Sologon and O'Donoghue (2010) and Sologon (2010). They used the ECHP<sup>1</sup> over the period 1994-2001 for 14 EU countries to estimate the covariance structure of earnings, decompose inequality into its permanent and transitory components. Luxembourg and Austria are observed between 1995 and 2001 and Finland between 1996 and 2001. Following the tradition of previous studies, the analysis focuses only on men. The inequality measure is based on real log hourly wage adjusted for CPI of workers aged 20 to 57, born between 1940 and 1981. Only observations with hourly wage lower than 50 Euros and higher than 1 Euro were considered in the analysis. The working sample for each country was an unbalanced panel. The choice of using unbalanced panels for estimating the covariance structure of earnings was motivated by the need to mitigate the potential overestimation of earnings persistence that would arise from balanced

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<sup>1</sup>The European Community Household Panel provided by Eurostat via the Department of Applied Economics at the Université Libre de Bruxelles.

panels where the estimation is based only on people that have positive earnings for the entire sample period. Permanent and transitory inequality are estimated by four cohorts (1940-1950, 1951-1960, 1961-1970 and 1971-1981). For the data description and summary statistics see Sologon and O'Donoghue (2010) and Sologon (2010).

The link between the evolution of persistent inequality (aggregated at the population level) and labour market policies and institutions is investigated using the OECD data on labour market indicators, which is a combination of two datasets: Bassanini and Duval (2006*a,b*)<sup>2</sup> dataset. The institutional variables included in the study are: the employment protection legislation (EPL), trade union density, product market regulation (PMR), the tax wedge, the degree of corporatism, the average unemployment benefit replacement rate and the spending on active labour market programmes (ALMPs). The macroeconomic shock variables included are: labour demand shock, terms of trade shock, total factor production shock, and the real interest shock. These variables are observed at the country level, over the period 1994-2001. A description of the variables is included in Table 1.<sup>3</sup> The summary statistics of the institutional and shock variables are illustrated in Table 2. Luxembourg and Greece have some missing institutional and shock variables and they are dropped from the final estimations. Portugal, Denmark and Ireland record some missing values for labour demand shock.

## 4 Methodology

### 4.1 Permanent Inequality

Permanent inequality is not observed in reality. We use the predicted persistent inequality obtained by Sologon and O'Donoghue (2010) and Sologon (2010), which used ECHP to estimate the covariance structure of earnings by four birth cohorts for each country and decompose earnings inequality into a permanent and a transitory component using equally weighted minimum distance methods. The predictions used in this paper are based on the specification that fits the data the best for each country. The aggregation to obtain the overall inequality (equation (1)) from the within-cohort inequalities for each country follows

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<sup>2</sup>The data was provided by email from the authors.

<sup>3</sup>For a more detailed description, please refer to Bassanini and Duval (2006*a,b*).

the Shorrocks sub-group inequality decomposition (Shorrocks 1984; Chakravarty 2001):

$$I = \sum_{k=1}^4 (n_k/n)(PV_k + TV_k) + \sum_{k=1}^4 (n_k/n)(\mu_k - \mu)^2, (1)$$

where  $n_k$ ,  $PV_k$ ,  $TV_k$ ,  $\mu_k$  stand for the population size, permanent variance, transitory variance and mean of ln hourly earnings of cohort  $k$ , and  $n$ ,  $\mu$  stand for the whole population. The first term accounts for the aggregated within-cohort inequality and the second for the between-cohort inequality. Our dependent variable - overall persistent inequality - is:  $PV = \sum_{k=1}^4 (n_k/n)PV_k$

## 4.2 Estimation of the link between policy, institutions and permanent inequality

The relationship between labour market policy and institutional factors and persistent inequality is estimated using non-linear least squares, for all countries pooled together. The unit of analysis is the country observed between 1994 and 2001.<sup>4</sup>

In looking more formally at the data, we proceed in two steps. First, we test whether policies interact with the overall institutional framework in shaping the pattern of persistent inequality, and we attempt to identify potential policy complements or substitutes in reducing persistent inequality. Second, we test whether institutions interact with the macroeconomic shocks in shaping the patterns of permanent inequality. Macroeconomic shocks are treated initially as unobservable but common to all countries - as time effects -, and lastly as observable and country-specific.

### 4.2.1 Systemic Interactions

The purpose here is to identify whether comprehensive policy packages are likely to be more effective at reducing persistent differentials than "piece-meal" labour market reforms. In other words, we investigate the potential policy complements and substitutes in reducing persistent inequality.

In macroeconomic equations interactions between institutions are usually specified in a multiplicative form between deviations of institutions from their sample mean, which enables the interpretation of the marginal effect of each institution when the others are kept constant at the sample mean. Undertaking a systematic analysis of policy interactions is not

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<sup>4</sup>Exceptions are Luxembourg and Austria observed between 1995 and 2001, and Finland between 1996 and 2001.

straightforward, given that a model with seven policies and institutions implies incorporating a total of 21 cross-interactions in the model, thereby inducing a substantial loss of degrees of freedom. As a work-around, we estimate systemic interactions, meaning interactions between each policy and institution and the overall institutional setting - defined as the sum of the direct effects of institutions. The model specification is displayed in equation (2):

$$Y_{it} = \left[ \sum_{k=1}^K v_k X_{kit} + \sum_{k=1}^K \varphi_k (X_{kit} - \bar{X}) \left( \sum_{k=1}^K v_k (X_{kit} - \bar{X}_k) \right) \right] + u_{it} \quad (2)$$

where  $i$  is the country index,  $t$  is the period index,  $k$  is the institution index.  $Y_{it}$  denotes the dependent variable - permanent variance - of country  $i$  in year  $t$ . The parameters  $v_k$  and  $\varphi_k$  are estimated simultaneously using non-linear least squares.  $v_k$  denotes the direct effect of institution  $X_k$  on  $Y_t$  for a country with an average mix of policies and institutions.  $\varphi_k$  indicates the strength of the interaction between the institution/policy  $X_k$  and the overall institutional framework, expressed as the sum of direct effect of policies and institutions (expressed in deviation form in the interaction).

This framework allows the identification of potential systemic reform complementarities and substitutes in reducing persistent earnings inequality. Our assessment of potential complements and substitutes considers combinations of only two policy dimensions, whereas the others are set at the average value. Following the standard definition of policy complementarity, two policies are complementary if each of them is more effective in reducing persistent inequality when the other one is also implemented. By contrast, two policies are substitutes if implementing any of them decreases the effectiveness of the other one (Amable and Gatti, 2006).

The partial derivatives of (2) with respect to each policy/institution indicate which of them has the potential to reduce persistent inequality. Evaluated for a country with an average mix of policies, the partial derivative of  $Y$  with respect to each institution is  $v_k$ . The partial derivative of  $Y$  with respect to policy  $X_k$  for a country with a mix of institutions different from the average is:

$$\frac{\partial Y}{\partial X_k} = v_k + 2\varphi_k v_k (X_k - \bar{X}_k) + \left( \sum_{j \neq k}^J \varphi_k v_j + \varphi_j v_k \right) (X_j - \bar{X}_j) \quad (3)$$

Setting all institutions, except two  $X_k$  and  $X_j$ , at the average, this becomes:

$$\frac{\partial Y}{\partial X_k} = v_k + 2\varphi_k v_k (X_k - \bar{X}_k) + (\varphi_k v_j + \varphi_j v_k) (X_j - \bar{X}_j) \quad (4)$$

Evaluated at the average  $\bar{X}_k$ , this becomes:

$$\frac{\partial Y}{\partial X_k} = v_k + (\varphi_k v_j + \varphi_j v_k)(X_j - \bar{X}_j) \quad (5)$$

The sign of the partial derivative depends on the direct and interaction effects of the interacting institution and its deviation from the average.

To identify a set of complementary policies within our model, we need to assess the sign of the cross-derivatives of  $Y$  in (2) with respect to two policies/institutions  $X_j$  and  $X_k$ , when all the other policies/institutions are set equal to the average, as follows:

$$\frac{\partial^2 Y}{\partial X_k \partial X_j} = \varphi_k v_j + \varphi_j v_k \quad (6)$$

Taking into account the sign of the partial derivatives,  $\frac{\partial Y}{\partial X_j}$  and  $\frac{\partial Y}{\partial X_k}$ , and the sign of the cross-derivatives,  $\frac{\partial^2 Y}{\partial X_k \partial X_j}$ , two configurations emerge. Assuming that  $\frac{\partial Y}{\partial X_j} < 0$  (the increase in  $X_j$  is the desired policy to decrease persistent inequality) and :

- (1)  $\frac{\partial Y}{\partial X_k} < 0$  (the increase in  $X_k$  is the desired policy to decrease PV) and  $\frac{\partial^2 Y}{\partial X_k \partial X_j} < 0$ , implies that the decrease in  $Y$  due to the increase in  $X_k$  is larger in absolute magnitude the larger  $X_j$ , suggesting the  $X_k$  and  $X_j$  are policy complements in reducing persistent inequality.
- (2)  $\frac{\partial Y}{\partial X_k} < 0$  and  $\frac{\partial^2 Y}{\partial X_k \partial X_j} > 0$ , implies that the negative effect  $X_k$  on  $Y$  is counteracted when  $X_j$  is increased, indicating that  $X_j$  and  $X_k$  are policy substitutes in reducing persistent inequality.

#### 4.2.2 Interactions between institutions and shocks

To explore the role of labour market policy and institutional factors in shaping the impact of macroeconomic shocks on permanent inequality, two steps are envisaged, in the tradition of Blanchard and Wolfers(1999).

##### Common unobservable shocks and interactions with institutions

First we treat shocks as unobservable but common to all countries. Thus we treat macro shocks as time effects. The specification is displayed in equation (7).

$$y_{it} = [\tau_t(1 + \sum_{k=1}^K \gamma_k(X_{kit} - \bar{X}_k))] + u_{it} \quad (7)$$

where the notation is the same as before, except  $\tau_t$  which is the time effect for period  $t$ , and  $\gamma_k$  which is the interaction effect between the institution/policy  $X_k$  and the overall

unobserved shock captured by  $\tau_t$ . Thus the specification allows the common time effects on permanent inequality to depend on the country-specific set of labour market policy and institutions, captured by  $\gamma_k$ . The specification of equation (7) represents more a description of the data, rather than the outcome of a tightly specified theory of interactions. However, it captures the basic hypothesis that given the same shocks, countries with worse institutions are expected to experience worse labour market outcomes.

### Country specific observable shocks and interactions with institutions

Second, the unobservable common shocks are replaced by a set of country-specific observable shocks (equation (8)).

$$y_{it} = [\sum_{s=1}^S \zeta_s Z_{sit} (1 + \sum_{k=1}^K \gamma_k (X_{kit} - \bar{X}_k))] + u_{it} \quad (8)$$

$\sum_{s=1}^S \zeta_s Z_{sit}$  is a set of observed macroeconomic shocks, which are interacted with policy and institutional factors.  $\zeta_s$  captures the direct effects of shocks and  $\gamma_k$  the interaction effects between the institution/policy  $X_k$  and the aggregate effects of macroeconomic shocks.

Another problem is the endogeneity between institutions and overall inequality that is expected to be transferred to the estimation of persistent inequality. The lack of good instruments prevented the establishment of causality. Hence, our estimates reflect the complex controlled associations that exist within the institutional framework, and between the institutional framework and the macroeconomic shocks, but not causal relationships.

## 5 Patterns in permanent and transitory inequality and policy and institutional factors across the EU

### 5.1 The evolution of permanent and transitory inequality

Table 3 summarizes the evidence obtained by Sologon and O'Donoghue (2010) and Sologon (2010) regarding the evolution of earnings inequality and its components. The exacerbation of overall inequality is the result of increasing permanent differentials and between-cohort differentials in Greece, of increasing permanent differentials in Finland, Italy and Luxembourg, and of increasing transitory differentials in Netherlands and Portugal. The increase in overall inequality is accompanied by an increase in the share of the permanent inequality, except in Netherlands and Portugal, where the opposite holds.

The decrease in overall inequality reflects a decrease in all components in Austria and UK, a decrease in permanent and between-cohort inequality in Belgium, Germany, Denmark and Spain, and a decrease in transitory and between-cohort inequality in Ireland. Even if inequality didn't change in France, there has been a decrease in earnings instability and a big increase in between-cohort inequality, thus a rise in the relative difference between cohorts. Austria, France, UK and Ireland experience an increase in the share of permanent inequality, whereas the other four countries experience the opposite.

## 5.2 The evolution of labour market policy and institutional factors

Figure 1 offers an insight into how much labour market institutions vary across the 14 EU countries and how they evolved over time. There is a substantial heterogeneity across the 14 EU countries, which has the potential to explain the differences in persistent earnings inequality across the EU. Over the period 1994-2001, the labour markets became more deregulated in most countries. Exceptions are Austria, France, Ireland and Greece, where the same regulatory level was maintained, and the UK, where regulation increased. Union density decreased in all countries, except Belgium. The degree of corporatism was stable across the EU. The largest decline in the tax wedge is observed in the Anglo-Saxon countries, followed by Nordic and Mediterranean countries. Exceptions are Austria, Belgium, Denmark and France, where the tax wedge increased. The product market became more deregulated in most countries. Active labour market policies (ALMP) developed in all countries, except Germany, where they decreased. The largest increases were recorded in Netherlands, Denmark and Ireland. Unemployment benefits replacement rates rose in all countries, except Denmark, Finland and UK.

The possible static effects of these policies are raising employment and reducing productivity, whereas the possible dynamic effects are raising investment following the raise in employment and raising incentives for adoption of new technologies, which implies a shift in the demand for skills (Dew-Becker and Gordon 2008). Hence all these are expected to influence persistent earnings inequality.

Nevertheless, institutional factors do not exist in a vacuum. They are expected to interact with macroeconomic shocks. The evolution of some macroeconomic shocks is illustrated in Figure 2. Changes in labour demand factors, in technology, in terms of trade, in real interest do not differ significantly among countries, hence they cannot by themselves explain the changes in persistent inequality. These trends are not surprising, given that all these countries operate in the same world markets, with similar technology, industry and occupa-

tion mixes. One country stands out with respect to its evolution in total production factors shock: Ireland. It records a sharp increase until 1997, followed by stabilization towards 2001; similarly, the real interest shock drops towards 1998 and stabilizes afterwards. These trends are most likely related to the Celtic Tiger. Given that all countries face similar shocks, the difference in institutions can potentially explain the differences in outcomes across countries.

These labour market policy and institutional factors are expected to interact significantly with each other and with the macroeconomic shocks in shaping persistent inequality.

## 6 Estimation results

### 6.1 Direct effects and systemic interactions

According to Table 4, most of the direct effects and systemic institutional interactions are significant and have a high explanatory power. Thus the complex institutional framework plays a significant role in shaping persistent differentials. The direct effects indicate that for a country with an average mix of policies (and a low corporatism), increasing labour market and product market regulation, unionization (albeit insignificant), and increasing generosity of the unemployment benefit has a positive effect on persistent differentials. Mainly these policies increase labour market rigidity with an adverse effect on inequality in long-term earnings. Adversely, for the average country, increasing corporatism, the tax wedge and active labour market policies reduce persistent disparities equivalent with reducing labour market rigidity.

In order to get a grasp on the magnitude of these effects, we simulate the change in the institutional variables (evaluated at their sample averages), which implemented separately, reduce persistent inequality by 1% relative to the average country (a country with an average mix of policies and low corporatism) (Table 5 ). A labour market deregulation of 4.5% or a decrease in union density of 10.91% or an increase of 4.16% in the tax wedge or a product market deregulation of 2.28% or an increase of 7.07% in ALMPs or a decrease of 1.58% in the average unemployment benefit replacement rate from their respective sample averages lead to a decrease of 1% in persistent inequality relative to the average country. Thus, except for corporatism, ranking the absolute magnitude of these changes indicates the rank in efficiency of the reforms leading to a decrease of 1% in persistent inequality relative to the average country: decreasing the generosity of the unemployment benefit replacement rate is the most efficient, whereas the decrease in union density the least efficient.

In order to gauge the shape of the relationship between persistent inequality and each

institution for a country with an average institutional mix (except the institution under focus), we evaluate the first derivative (evaluated at the min, mean, and max values of the respective institution) and the second derivative. All partial derivatives (main diagonal of Table 6) have the same sign indicating a monotonic relationship. Coupling with the sign of the second derivative, we conclude that: labour and product market regulations, union density, and the generosity of the unemployment benefit (URR) have a positive effect on persistent inequality, which becomes stronger the higher value of the respective institutions. The tax wedge and ALMPs have a negative effect on persistent inequality, which becomes less strong the higher value of the respective institution.

Excluding PMR and corporatism, the effect of each institutions, however, depends on institutional mixes, as indicated by the variation in the sign of the partial derivatives within each column of Table 6. For example, increasing labour market regulation decreases persistent inequalities in corporatist economies, whereas the opposite is observed in decentralized ones, *ceteris paribus* at the average. Opposite effects are observed when ALMPs are high (negative effect) as opposed to when ALMPs are low; when URR is low (negative effect) as opposed to when URR is high, *ceteris paribus* at the average. The same dependence is observed for union density. An increase in tax wedge/ALMPs/URR has the opposite effects in corporatist versus decentralized countries, *ceteris paribus* at the average.

So far, we investigated the impact of implementing each of these reforms separately. What happens, however, when 2 of these reforms are implemented simultaneously? Are "piece-meal" labour market reforms more effective at reducing persistent earnings differentials than comprehensive policy packages? Table 6 allows identifying the potential policy complements and/or substitutes in reducing persistent inequality. Following the intuition presented in the methodology section, we find evidence that the following policies/institutions, in combinations of two, are substitutes in reducing persistent inequality, meaning that the increase in one reduces the effectiveness of the other policy in reducing persistent inequality:

- Labour market deregulation (decrease in EPL from the average)
- De-unionization (decrease in Union density from the average)
- Increasing corporatism (from low to high)
- Increasing tax wedge (from the average)
- Product market deregulation (decrease in PMR from the average)
- Increasing ALMPs (from the average)
- Decreasing generosity of the unemployment benefit (decreasing URR from the average).

Each of these policies, implemented separately, reduces persistent inequality. Implemented in combinations of two, the efficiency of each policy is reduced. For example, an increase in labour market deregulation decreases persistent inequality, but its effectiveness is reduced if accompanied by an increase in deregulation in the product market.

Some complementarity effects, however, emerge at other points of the distribution (until now we evaluated them at the average). For example, the partial derivative of persistent variance with respect to EPL evaluated at sample average EPL and the highest sample ALMPs is negative. This suggests that for very developed ALMPs, the increase in labour market regulation is the desired policy to decrease persistent inequality. Given the negative sign of the partial derivative of permanent variance with respect to ALMPs evaluated at the highest ALMPs and the average EPL, and the negative sign of the cross-derivative with respect to EPL and ALMPs, a policy complementarity emerges between increasing EPL from the average and increasing ALMPs from the highest value. Thus increasing ALMPs from high values should be accompanied by increasing labour market regulation from the average for maximum effectiveness of each reform. In a similar fashion, more complementarity effects in reducing persistent inequality emerges:

- (i) increasing labour market regulation from the average when the average unemployment benefit replacement rate is low and decreasing;
- (ii) increasing unionization from the average when ALMPs are high and increasing;
- (iii) increasing unionization from the average when URR is low and decreasing.

Thus we conclude that at the EU level "piece-meal" labour market reforms are more effective at reducing persistent earnings differentials than comprehensive policy packages, but under special condition some complementarity effects can occur.

This model specification does a good job at explaining between-country differentials in persistent inequality as displayed in column 1 of Figure 3. Our next question is how well does it explain the the evolution in permanent inequality over time across the 14 EU countries? The correlations between the change in the predicted outcomes and the actual outcomes are significant, positive and strong, indicating that the model does a good job at explaining the evolution over time.

## 6.2 Macroeconomic shocks and interactions

Is the institutional explanation enough? Given that labour market institutions do not exist in a vacuum, they are expected to interact with the macroeconomic shocks. Thus it is tempting to look for explanations of the differential evolution of permanent inequality across Europe

based on the interaction between shocks and institutions. In this section we explore the role of labour market policy and institutional factors in shaping the impact of the macroeconomic shocks on persistent inequality.

For each labour market outcome in turn, first we treat shocks as unobservable but common to all countries. Our basic hypothesis is that, given the same shocks, countries with worse institutions experience higher persistent differentials. Second, the unobservable common shocks are replaced by a set of country-specific observable shocks. We consider four sources of shocks: the labour demand shift, the rate of TFR growth, the terms of trade and the real rate of interest. Due to some missing data for some countries, the panel is slightly unbalanced. Moreover, for Portugal, the information on shocks is missing in all years, restraining the estimation sample to 80 observations.

### **Common unobservable shocks and interactions**

The estimation of model (7)(Table 7) has high explanatory power and gives the following description of the data. The estimated time effects account for a decrease in persistent inequality equal to 0.0058, implying that for a country with an average mix of institutions (and low corporatism), persistent inequality decreased by 4.71%. The sign of the significant coefficients of the institutions are, except for the unemployment replacement rate, consistent with the previous model: a more regulated labour market and product market lead to a larger effect of shocks on persistent inequality; a high corporatism, a higher tax wedge and more generous unemployment benefits lead to a smaller effect.

To give a sense of magnitudes, column (2) gives the range of each institutional variable (in deviation from the sample mean). Column (3) shows the effect of a given shock on persistent inequality for the lowest and the highest value of the corresponding institution. The way to read column (3) is as follows. Take an adverse shock which would raise permanent inequality by 1% for a country with an average mix of policies (and low corporatism) and an average shock. The same shock will decrease permanent inequality by 40,07% in a country with high corporatism. The same shock will have an effect of -13,91% in the country with the most deregulated labour market and of +12,72% in the country with the most regulated labour market. Overall, considering only significant effects, we conclude from column (3) that the range of the effects of institutions on the impact of a given shock on persistent inequality varies across institutions: the same shock will have the strongest negative impact on persistent inequality in the country with high corporatism, followed by the highest average replacement rate, the most deregulated product market, the highest tax wedge, and the most

deregulated labour market, with the least strong negative impact. This ranks descendently the efficiency of each factor in reducing the adverse effects of shocks. The strongest positive impact is obtained for the lowest tax wedge, followed by the most regulated product market, the lowest average replacement rate and the most regulated labour market.

Whereas this model does a good job at explaining cross-country differences in persistent inequality, it does not perform so well in predicting accurately the change in persistent inequality over time, as displayed in Figure 3 and illustrated by the insignificant correlation between actual and predicted change. Thus, interactions between common shocks and different institutions cannot account for much of the difference in the evolution of permanent inequality across countries between 1994 and 2001 in Europe.

### **Country specific observable shocks and interactions**

Replacing the time effects by country-specific observable shocks (Table 8) leads to a slightly lower explanatory power compared with the previous models, suggesting that the heterogeneity in the magnitude of shocks explains part of the cross-country heterogeneity in persistent inequality (Figure 3). Whereas three out of four shocks are significant, only two institutions appear to significantly affect the impact of these shocks. Consistent with the previous model, high corporatism is an efficient tool in reducing the adverse effects of these shocks on persistent inequality. Additionally, union density appears to act as a filtering mechanism against the adverse effects of these shocks. For a country with an average mix of institutions a positive labour demand shift and an increase in the real interest rate are associated with an increase in persistent inequality. An increase in the terms of trade is associated with a decrease in persistent inequality.

This specification however fails to explain the cross-country heterogeneity in the evolution of persistent inequality in the EU between 1994 and 2001, indicated both by Figure 3 (Model 3, column 2) and the insignificant correlation between the actual and predicted change in persistent inequality.

Overall, we conclude that the models with shocks perform well in explaining the cross-country heterogeneity in persistent differentials, but poorly in explaining the cross-country variation in the evolution of persistent inequality over time. Thus, institutions play the decisive role in shaping the pattern of persistent inequality.

## 7 Discussion and concluding remarks

The literature on earnings inequality has explored the factors behind the increasing differentials observed in most OECD countries over the last decades. The literature, however, has ignored the driving factors behind the components of earnings inequality. We dedicated our attention to one of the unobserved components of earnings inequality, namely persistent inequality, given its welfare implications. Increasing persistent inequality implies increasing inequality in long-term recourses equivalent with increasing inequality in consumption, which has negative welfare consequences. Additionally, increasing persistent inequality may signal increasing labour market rigidity. Our paper attempts to set the first steps towards understanding the main labour market policy and institutional factors that shape persistent earnings inequality, as this represents a step towards designing policies and labour market institutions that enable low-wage workers to escape low-wage unstable jobs and improve their position in the distribution of lifetime earnings. This is extremely relevant in the context of the labour market reforms aimed to increase labour market flexibility observed across the EU starting starting mid 1990s.

The estimation results reveal a highly complex framework, where institutions and their systemic interactions play a decisive role in shaping persistent earnings inequality. The complexity is enhanced by the endogeneity bias affecting this framework, which in the absence of reliable instruments prevents the establishment of causality.

For a country with an average mix of policies and low corporatism, we bring evidence of a monotonic relationships between persistent inequality and labour market policy and institutional factors.

### Employment protection legislation

For a country with an average mix of policies and low corporatism, an increase in labour market regulation is found to increase persistent inequality. This is consistent with our a priori expectations stemming from existing evidence. Following Cazes and Nesporova (2004), the argument against a strict employment protection legislation (EPL) is its key role in generating labour market rigidity as it increases the cost of hiring and of layoffs, and consequently lowers labour turnover (Blanchard and Wolfers, 1999). The low turnover is expected to affect mainly workers with temporary contracts, as they have a weaker protection in the labour market. Thus, the potential "cost" of a stricter EPL is the widening persistent differentials between those covered by the EPL who enjoy regular jobs and those non-covered who have irregular jobs, unemployed job-seekers: the former benefit from tenure increases with age and thus decreasing likelihood of job loss, whereas the latter experience the opposite.

Additionally, we bring evidence that the "cost" of EPL is augmented by adverse shocks, consistent with the fact that during periods of high economic volatility irregular jobs tend to increase at the expense of regular jobs, which in turn increase the "cost" of EPL, meaning they increase persistent differentials between covered and non-covered workers. This effect, however, changes sign across different institutional mixes. The "cost" of increasing EPL from the average is mitigated: in corporatist economies/by developed ALMPs/by low unemployment benefits, *ceteris paribus* at the average.

#### Union density

For a country with an average mix of policies and low corporatism, an increase in unionization is found to increase persistent inequality (albeit insignificant). This result is surprising, given that the stated purpose of unions is to reduce earnings disparities which results from claims for high wages and earnings stability for covered workers OECD (2004). Our findings, however, may suggest that in the EU context of the 1990s, the "cost" of unionization outweighs its "benefit". The benefit of unionization stems indirectly from its impact on training and minimum wage. By forcing employers to provide training to their employees, they increase the employees' human capital and adaptability to new technologies (Aghion and Williamson, 2001). Thus unionization stimulates earnings mobility and increases employees' opportunity to improve their position in the distribution of permanent earnings. Hence persistent inequality can be reduced at any given rate of technical change (Aghion and Williamson, 2001). In conclusion, unionization could be expected to lower persistent inequality. However, even if unions decrease within-group earnings disparities, they may still increase both overall permanent inequality by increasing between-group wage differentials, meaning between those unionized and non-unionized, which appears to be the case in the EU context. Additionally, unionized workers are better at capturing rents compared with non-unionized workers, expected to worsen between-group differentials.

The effect of unionization depends on the mix of policies in place, sign that the "cost" of increasing unionization from the average is mitigated when coupled with the right policies. For example, consistent with the literature, we bring evidence that the effect of unionization depends on corporatism: increasing unionization in corporatist economies decreases persistent inequality, whereas in decentralized ones the opposite is observed. This is consistent with the evidence that unions in decentralized economies push towards claiming a larger share of the surplus, effect mitigated in corporatist economies (Teulings and Hartog, 2008). Also very developed ALMPs and low unemployment benefits appear to mitigate the "cost" of unionization.

In the presence of adverse shocks, however, unionization appears to be an effective tool in reducing the adverse effects on persistent inequality.

#### Corporatism

For a country with an average mix of policies, the transition from a decentralized to a corporatist economy is found to decrease persistent inequality. Additionally, consistent across models, a high corporatism is found to be an effective tool in reducing the adverse effects of aggregate shocks on persistent inequality. This is consistent with the evidence stemming from recent research on the impact of corporatism on wage structures (Teuling and Hartog, 2008). The literature agrees that corporatism reduces wage dispersion: a decentralized wage bargaining at the firm level implies that wages are less uniformly distributed, that there is a higher dispersion in the returns to skills and in earnings variability (Bassanini and Duval, 2006*a,b*); a centralized and coordinated bargaining system is associated with a compressed wage structure across qualification levels (Calmfors, 1993; Teulings and Hartog, 2008). A disagreement, however, emerges regarding the source of this compression. Those opposing corporatism argue this reduction results from suppressing the price mechanism and increasing wage rigidities. Those in favour, argue this compression results from reducing non-competitive differentials (aggressive local rent sharing) (Teulings and Hartog, 2008). Opposite to the traditional view that corporatism is associated with labour market rigidity, Teuling and Hartog (2008) argue that corporatist systems could be very flexible, even more than decentralized ones. Corporatist systems offer a solution to the fundamental contradiction that renegotiation of contracts in response to aggregate shocks cannot be done by third parties at the micro level as this contradicts the reason for writing nominal contracts. Corporatist systems deal with the adjustment to aggregate shocks, thus they increase flexibility. Additionally, corporatism does not appear to frustrate the price mechanism in determining returns to education. Our findings strengthen the "pro corporatism" view, more so given the robustness of this effect across different institutional mixes.

#### Tax wedge

For a country with an average mix of policies and low corporatism, an increase in the tax wedge is associated with a decrease in persistent inequality. Additionally, the tax wedge is an effective tool for reducing the adverse effects of macro shocks on persistent inequality. This finding is consistent with our expectation stemming from labour market theories. An increase in the tax wedge results in employers paying more and employees receiving less. The resulting impact on permanent inequality is twofold. On the one hand, tax wedge influences permanent inequality through its influence on human capital price. An increase in the tax

wedge lowers human capital price. Weizsacker (1993) proved within the context of an explicit comparative dynamic inequality analysis that a decrease in human capital price results in a decrease in permanent inequality within age groups. On the other hand, an increase in the tax wedge suggests that the cost to employers increases to a larger extent than the increase of the wage offered. This has detrimental effects especially for employment, pushing minimum wage workers, for which the rise in payroll taxes cannot be shifted onto, into unemployment (Bassanini and Duval, 2006*a,b*). Thus an increase in the tax wedge is expected to push low wage workers into unemployment and to decrease permanent earnings inequality for the working population. This effect is robust to different institutional mixes, with one exception: an increase in the tax wedge from the average increases persistent inequality in corporatist economies with an average mix of policies.

#### Product market regulation

For a country with an average mix of policies and low corporatism, more regulation in the product market is found to be associated with a higher persistent inequality. Additionally, regulated labour markets appears to exacerbate the adverse effects of macro shocks on persistent inequality. This result is surprising given that more regulated sectors display more compressed earnings structures than non-regulated ones. Deregulation in the product market is expected to determine an increase in competition in the previously regulated sectors, and consequently lower market rents, which in turn determine lower wage claims aimed to close the gap between productivity and real wages that generates unemployment (Fortin and Lemieux, 1997). Therefore a decrease in product market regulation is expected to shift labour demand, increase its elasticity to wages, increase the returns to skills, and consequently increase permanent differentials in the previously regulated sectors. Hence, we expect highly regulated sectors to display reduced permanent differentials. Our findings, however, suggest that in the EU context of the 1990s the "cost" of product market regulation outweighs its "benefit". Whereas the "benefit" emerges when looking only within regulated sectors, the "cost" emerges when taking a larger perspective by including also non-regulated sectors: the potential "cost" of a stricter product market regulation is widening persistent differentials between workers in regulated sectors and those in non-regulated sectors.

#### Active Labour Market Programs (ALMPs)

For a country with an average mix of policies and low corporatism, more developed ALMPs are associated with lower persistent differentials. This finding is consistent with our expectations. ALMPs, which typically consist of job placement services and labour market programs such as job-search, vocational training or hiring subsidies can reduce permanent

earnings differentials by improving the efficiency of the job matching process and by enhancing the work experience and skills of the unemployed. Thus by increasing human capital of low wage individuals, permanent wage differentials may decrease.

The effect of ALMPs is robust to different institutional mixes. One exception is the corporatist economy which accommodates an increasing persistent inequality with increasing ALMPs.

#### Average unemployment benefit replacement rate

For a country with an average mix of policies and low corporatism, generous unemployment benefits are associated with increasing persistent differentials. Moreover, generous unemployment benefits are found to be an effective tool in limiting the adverse effect of shocks on persistent differentials. These findings are largely in line with our expectations. Generous unemployment benefits have both "costs" and "benefits" associated to them. The "cost" is that they are expected to weaken the job-search intensity and decrease the employability and human capital for the unemployed, thus increase permanent differentials. Moreover, generous unemployment benefits are expected to increase the economic cost of employment, which in turn may put an upward pressure on worker's wage claims and exacerbate permanent earnings dispersion. Their "benefit" is that longer and more generous unemployment benefits represent incentives not to accept low-paid jobs and thus they improve job-matching. Better job-matching leads to an increased likelihood of more stable employment and earnings patterns (Bassanini and Duval, 2006*a,b*). Thus in the long-run persistent differentials may be reduced.

The effect is robust to different institutional mixes, except for the average country with a corporatism economy, where the relationship reverses.

#### Policy complements/substitutes

We bring evidence of a complex system of interactions within the institutional framework affecting persistent inequality. From a policy perspective it is useful to explore whether comprehensive policy packages are more effective than "piece-meal" reforms in reducing persistent inequality. The evidence shows that, evaluated at the average, "piece-meal" reforms appear to be more effective in shaping persistent inequality than comprehensive policy packages: a substitution effect in reducing persistent inequality emerges between labour market deregulation, deunionization, product market deregulation, decreasing generosity of the unemployment benefit, increasing corporatism, increasing tax wedge, or increasing ALMPs, meaning the effectiveness of each reform is reduced when accompanied by another reform.

Some complementarity effects in reducing persistent inequality, however, do emerge. For

example, increasing ALMPs, when ALMPs are already very developed, should be accompanied by increasing labour market regulation when a mean level of regulation is in place for increased effectiveness of both reforms. A similar complementarity is found between ALMPs and unionization. Very developed ALMPs imply many reintegrated workers in the labour market, which need protection in order to capitalize on the investment in ALMPs. Increased protection stemming either from increasing labour market regulation or increasing unionization (from their respective averages) favors the increase in their human capital, with reducing effects on persistent differentials.

The best performing country in terms of reduced persistent differentials is Denmark. The outstanding performance of the Danish labour market may be due to the "flexicurity approach" (OECD, 2004), which represents an interesting combination of high labour market dynamism and a relatively high social protection. It is a mix of flexibility (a high degree of job mobility thanks to low employment protection legislation), social security (a generous system of unemployment benefits), developed active labour market programs, a deregulated product market, a medium high tax wedge, in the context of a corporatist and highly unionized labour market. This mix appears to assure a small persistent earnings inequality, thus a high opportunity for low wage individuals to improve their position in the distribution of lifetime earnings. At the opposite pole we find Portugal, with the highest persistent inequality and an opposite mix of institutions.

Our findings are relevant in the context of the EU labour market reforms started around the 1990s aimed to increase employment and labour market flexibility. Eight countries managed to reduce persistent differentials in 2001 compared with early 1990s, signaling an increase in labour market flexibility. In most countries, however, this trend is accompanied by an increase in earnings instability signaled by the increase in transitory inequality. This raises the question of a possible trade-off between labour market flexibility and earnings instability, worth to be tackled by future research. This may be the case as these reforms target re-integrating vulnerable groups in the labour market, which are more prone to job and earnings instability. Thus the institutional framework in place needs to be adapted to reintegrate these workers, favour their investment in human capital for future stable careers, enabling them to close the gap in permanent earnings.

**Table 1:** Description of OECD Variables.

|                                                                 |                                                                                                                                                                                                                                                           |
|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Source: Bassanini and Duval (2006 <i>a,b</i> )                  |                                                                                                                                                                                                                                                           |
| EPL= Employment Protection Legislation                          | OECD summary indicator of the stringency of Employment Protection Legislation. EPL ranges from 0 to 6.                                                                                                                                                    |
| EPLR = Employment Protection Legislation for regular contracts  | OECD summary indicator of the stringency of Employment Protection Legislation for regular contracts                                                                                                                                                       |
| EPLT= Employment Protection Legislation for temporary contracts | OECD summary indicator of the stringency of Employment Protection Legislation for temporary contracts                                                                                                                                                     |
| Union Density                                                   | Trade union density rate, i.e. the share of workers affiliated to a trade union, in %.                                                                                                                                                                    |
| Union Coverage                                                  | Collective bargaining coverage rate, i.e. the share of workers covered by a collective agreement, in %.                                                                                                                                                   |
| Degree of Corporatism                                           | Indicator of the degree of centralisation/coordination of the wage bargaining processes, which takes values 1 for decentralised and uncoordinated processes, and 2 and 3 for intermediate and high                                                        |
| Tax Wedge                                                       | The tax wedge expresses the sum of personal income tax and all social security contributions as a percentage of total labour cost.                                                                                                                        |
| PMR= Product Market Regulation                                  | OECD summary indicator of regulatory impediments to product market competition in seven non-manufacturing industries. The data used in this paper cover regulations and market conditions in seven energy and service industries. PMR ranges from 0 to 6. |
| ALMPs = Public expenditures on active labour market policies    | Public expenditures on active labour market programmes per unemployed worker as a share of GDP per capita, in %.                                                                                                                                          |
| Average unemployment benefit replacement rate                   | Average unemployment benefit replacement rate across two income situations (100% and 67% of APW earnings), three family situations (single, with dependent spouse, with spouse in work)                                                                   |
| Labour Demand Shock                                             | Logarithm of the labour share in business sector GDP purged from the short-run influence of factor prices.                                                                                                                                                |
| Terms of Trade Shock                                            | Logarithm of the relative price of imports weighted by the share of imports in GDP                                                                                                                                                                        |
| Total Factor Productivity Shock                                 | Deviation of the logarithm of Total Factor Productivity (TFP) from its trend calculated by means of a Hodrick-Prescott (HP) filter (smoothing parameter $\lambda = 100$ )                                                                                 |
| Real Interest Shock                                             | Difference between the 10-year nominal government bond yield (in %) and the annual change in the GDP deflator (in %).                                                                                                                                     |

**Table 2:** Institutional Variables - Summary Statistics.

| Variable                      |         | Mean   | Std. Dev. | Min    | Max    | Observations |
|-------------------------------|---------|--------|-----------|--------|--------|--------------|
| EPL                           | overall | 2.423  | 0.956     | 0.600  | 3.854  | N = 101      |
|                               | between |        | 0.944     | 0.621  | 3.739  | n = 13       |
|                               | within  |        | 0.251     | 1.537  | 3.211  | T = 7.769    |
| Union Density                 | overall | 0.371  | 0.191     | 0.096  | 0.794  | N = 108      |
|                               | between |        | 0.201     | 0.098  | 0.779  | n = 14       |
|                               | within  |        | 0.017     | 0.302  | 0.429  | T = 7.714    |
| Degree of Corporatism         | overall | 2.570  | 0.649     | 1.000  | 3.000  | N = 93       |
|                               | between |        | 0.669     | 1.000  | 3.000  | n = 12       |
|                               | within  |        | 0.000     | 2.570  | 2.570  | T = 7.75     |
| Tax Wedge                     | overall | 0.326  | 0.068     | 0.128  | 0.449  | N = 93       |
|                               | between |        | 0.067     | 0.219  | 0.404  | n = 12       |
|                               | within  |        | 0.022     | 0.234  | 0.390  | T = 7.75     |
| PMR                           | overall | 3.394  | 1.015     | 1.133  | 5.236  | N = 93       |
|                               | between |        | 0.871     | 1.454  | 4.415  | n = 12       |
|                               | within  |        | 0.563     | 2.155  | 4.459  | T = 7.75     |
| ALMPs                         | overall | 0.301  | 0.209     | 0.048  | 1.261  | N = 93       |
|                               | between |        | 0.188     | 0.094  | 0.750  | n = 12       |
|                               | within  |        | 0.101     | -0.035 | 0.812  | T = 7.75     |
| Unemployment Benefit RR       | overall | 0.360  | 0.117     | 0.166  | 0.649  | N = 93       |
|                               | between |        | 0.115     | 0.174  | 0.599  | n = 12       |
|                               | within  |        | 0.030     | 0.271  | 0.451  | T = 7.75     |
| Labour demand shock           | overall | 0.062  | 0.062     | -0.075 | 0.167  | N = 85       |
|                               | between |        | 0.063     | -0.068 | 0.147  | n = 11       |
|                               | within  |        | 0.013     | 0.028  | 0.099  | T = 7.727    |
| Terms of Trade Shocks         | overall | -0.094 | 0.040     | -0.178 | -0.027 | N = 93       |
|                               | between |        | 0.035     | -0.146 | -0.042 | n = 12       |
|                               | within  |        | 0.022     | -0.142 | -0.041 | T = 7.75     |
| Total Factor Production Shock | overall | 0.007  | 0.016     | -0.058 | 0.047  | N = 85       |
|                               | between |        | 0.007     | -0.001 | 0.019  | n = 11       |
|                               | within  |        | 0.015     | -0.056 | 0.049  | T = 7.727    |
| Real Interest Shock           | overall | 0.039  | 0.018     | -0.016 | 0.080  | N = 93       |
|                               | between |        | 0.007     | 0.023  | 0.045  | n = 12       |
|                               | within  |        | 0.017     | -0.001 | 0.088  | T = 7.75     |

**Table 3:** Evolution of the overall inequality and its components - permanent inequality, transitory inequality and between inequality between the 1st and last wave.

| Country |          | Overall Inequality |       | Permanent Inequality    |       | Transitory Inequality |       | Between Inequality |       |
|---------|----------|--------------------|-------|-------------------------|-------|-----------------------|-------|--------------------|-------|
|         |          | 1st Wave           | 2001  | 1st Wave                | 2001  | 1st Wave              | 2001  | 1st Wave           | 2001  |
| AUT     | Level    | 0.137              | 0.101 | Level                   | 0.060 | 0.046                 | 0.067 | 0.046              | 0.012 |
|         | Boot. SE | 0.002              | 0.002 | % of Overall Inequality | 43%   | 46%                   | 48%   | 46%                | 9%    |
| BEL     | Level    | 0.121              | 0.103 | Level                   | 0.057 | 0.041                 | 0.047 | 0.050              | 0.017 |
|         | Boot. SE | 0.001              | 0.001 | % of Overall Inequality | 47%   | 39%                   | 39%   | 48%                | 14%   |
| DEU     | Level    | 0.176              | 0.170 | Level                   | 0.116 | 0.103                 | 0.039 | 0.051              | 0.022 |
|         | Boot. SE | 0.002              | 0.002 | % of Overall Inequality | 66%   | 60%                   | 22%   | 30%                | 12%   |
| DNK     | Level    | 0.091              | 0.069 | Level                   | 0.041 | 0.025                 | 0.039 | 0.040              | 0.011 |
|         | Boot. SE | 0.001              | 0.001 | % of Overall Inequality | 45%   | 36%                   | 43%   | 57%                | 12%   |
| ESP     | Level    | 0.243              | 0.205 | Level                   | 0.155 | 0.102                 | 0.056 | 0.079              | 0.033 |
|         | Boot. SE | 0.002              | 0.002 | % of Overall Inequality | 63%   | 50%                   | 23%   | 39%                | 13%   |
| FRA     | Level    | 0.233              | 0.231 | Level                   | 0.123 | 0.123                 | 0.085 | 0.066              | 0.025 |
|         | Boot. SE | 0.003              | 0.003 | % of Overall Inequality | 53%   | 54%                   | 37%   | 29%                | 11%   |
| GBR     | Level    | 0.189              | 0.171 | Level                   | 0.099 | 0.097                 | 0.069 | 0.058              | 0.022 |
|         | Boot. SE | 0.002              | 0.002 | % of Overall Inequality | 52%   | 55%                   | 36%   | 34%                | 11%   |
| IRL     | Level    | 0.249              | 0.164 | Level                   | 0.105 | 0.105                 | 0.091 | 0.045              | 0.055 |
|         | Boot. SE | 0.003              | 0.004 | % of Overall Inequality | 42%   | 64%                   | 36%   | 27%                | 22%   |
| FIN     | Level    | 0.100              | 0.110 | Level                   | 0.040 | 0.062                 | 0.052 | 0.036              | 0.008 |
|         | Boot. SE | 0.002              | 0.002 | % of Overall Inequality | 40%   | 58%                   | 52%   | 34%                | 8%    |
| GR      | Level    | 0.179              | 0.205 | Level                   | 0.066 | 0.097                 | 0.078 | 0.063              | 0.034 |
|         | Boot. SE | 0.002              | 0.002 | % of Overall Inequality | 37%   | 46%                   | 44%   | 30%                | 19%   |
| ITA     | Level    | 0.118              | 0.123 | Level                   | 0.059 | 0.069                 | 0.044 | 0.036              | 0.018 |
|         | Boot. SE | 0.001              | 0.001 | % of Overall Inequality | 49%   | 56%                   | 36%   | 29%                | 15%   |
| LUX     | Level    | 0.214              | 0.233 | Level                   | 0.096 | 0.144                 | 0.074 | 0.045              | 0.040 |
|         | Boot. SE | 0.003              | 0.003 | % of Overall Inequality | 45%   | 63%                   | 34%   | 20%                | 21%   |
| NLD     | Level    | 0.119              | 0.152 | Level                   | 0.058 | 0.053                 | 0.027 | 0.071              | 0.035 |
|         | Boot. SE | 0.002              | 0.002 | % of Overall Inequality | 49%   | 35%                   | 22%   | 46%                | 29%   |
| PRT     | Level    | 0.250              | 0.266 | Level                   | 0.181 | 0.153                 | 0.040 | 0.098              | 0.029 |
|         | Boot. SE | 0.003              | 0.004 | % of Overall Inequality | 72%   | 57%                   | 16%   | 37%                | 12%   |

Source: Sologon and O'Donoghue (2010)

**Table 4:** Persistent Inequality - Systemic interactions across institutions.

| Direct effect of institutions | Estimate   | t       |
|-------------------------------|------------|---------|
| EPL                           | 0,011 **   | 2,260   |
| Union density                 | 0,029      | 0,540   |
| High Corporatism              | -0,130 *** | -3,040  |
| Tax wedge                     | -0,088 **  | -2,220  |
| PMR                           | 0,015 ***  | 3,610   |
| ALMPs                         | -0,056 **  | -2,130  |
| Average replacement rate      | 0,209 ***  | 4,560   |
| Systemic interactions         |            |         |
| EPL                           | 0,159 ***  | 2,740   |
| Union density                 | 0,621 ***  | 3,790   |
| High Corporatism              | -0,592 *** | -11,720 |
| Tax wedge                     | -0,285     | -0,700  |
| PMR                           | 0,047 *    | 1,750   |
| ALMPs                         | -0,279     | -1,540  |
| Average replacement rate      | 2,123 **   | 2,560   |
| Adjusted $R^2$                | 0,977      |         |
| Observations                  | 93         |         |

**Table 5:** Persistent Inequality - Simulated relative reforms resulting in 1% decrease in PV relative to the average country.

| Change in institutions relative to their average | Change in PV relative to the average country |
|--------------------------------------------------|----------------------------------------------|
| EPL                                              | -4,57%                                       |
| Union density                                    | -10,91%                                      |
| Tax wedge                                        | 4,16%                                        |
| PMR                                              | -2,28%                                       |
| ALMPs                                            | 7,07%                                        |
| Average replacement rate                         | -1,58%                                       |

**Table 6:** Persistent Inequality - Policy complements and policy substitutes.

| Institution $X_j$        | Institution $X_k$ |                                   |                                                  |                                   |                                     |                                                  |                                   |                                     |                                                  |                                   |                                     |                                                  |                                   |                                                  |
|--------------------------|-------------------|-----------------------------------|--------------------------------------------------|-----------------------------------|-------------------------------------|--------------------------------------------------|-----------------------------------|-------------------------------------|--------------------------------------------------|-----------------------------------|-------------------------------------|--------------------------------------------------|-----------------------------------|--------------------------------------------------|
|                          | EPL <sup>1</sup>  |                                   |                                                  | High corporatism                  |                                     |                                                  | Tax wedge                         |                                     |                                                  | PMR                               |                                     | ALMPs                                            |                                   | Average replacement rate                         |
|                          | $X_j^*$           | $\frac{\partial Y}{\partial X_k}$ | $\frac{\partial^2 Y}{\partial X_k \partial X_j}$ | $\frac{\partial Y}{\partial X_k}$ | $\frac{\partial^2 Y}{\partial X_k}$ | $\frac{\partial^2 Y}{\partial X_k \partial X_j}$ | $\frac{\partial Y}{\partial X_k}$ | $\frac{\partial^2 Y}{\partial X_k}$ | $\frac{\partial^2 Y}{\partial X_k \partial X_j}$ | $\frac{\partial Y}{\partial X_k}$ | $\frac{\partial^2 Y}{\partial X_k}$ | $\frac{\partial^2 Y}{\partial X_k \partial X_j}$ | $\frac{\partial Y}{\partial X_k}$ | $\frac{\partial^2 Y}{\partial X_k \partial X_j}$ |
| EPL                      | min               | 0,0045                            |                                                  | 0,0087                            | -0,0808                             | -0,0570                                          | -0,0570                           | 0,0100                              | -0,0345                                          |                                   |                                     |                                                  | 0,1071                            |                                                  |
|                          | mean              | 0,0108                            | 0,0034                                           | 0,0293                            | -0,1300                             | -0,0270                                          | -0,0880                           | 0,0154                              | 0,0029                                           | -0,0562                           | -0,0119                             | 0,2093                                           | 0,0561                            |                                                  |
|                          | max               | 0,0157                            |                                                  | 0,0456                            | -0,1687                             | -0,1124                                          | -0,1124                           | 0,0196                              | -0,0732                                          |                                   |                                     | 0,2896                                           |                                   |                                                  |
| Union density            | min               | 0,0076                            |                                                  | 0,0193                            | -0,1029                             | -0,0706                                          | -0,0706                           | 0,0124                              | -0,0443                                          |                                   |                                     | 0,1561                                           |                                   |                                                  |
|                          | mean              | 0,0108                            | 0,0113                                           | 0,0293                            | -0,1300                             | -0,0981                                          | -0,0880                           | 0,0154                              | 0,0109                                           | -0,0562                           | -0,0431                             | 0,2093                                           | 0,1922                            |                                                  |
|                          | max               | 0,0155                            |                                                  | 0,0447                            | -0,1713                             | -0,1146                                          | -0,1146                           | 0,0200                              | -0,0743                                          |                                   |                                     | 0,2902                                           |                                   |                                                  |
| High corporatism         | min               | 0,0108                            | -0,0270                                          | 0,0293                            | -0,1300                             | 0,1538                                           | -0,0880                           | 0,0154                              | -0,0152                                          | 0,0695                            | 0,0695                              | 0,2093                                           | -0,3997                           |                                                  |
|                          | max               | -0,0163                           |                                                  | -0,0688                           | -0,1300                             | 0,0011                                           | 0,0011                            | 0,0002                              | 0,0133                                           | -0,0133                           |                                     | -0,1905                                          |                                   |                                                  |
| Tax wedge                | min               | 0,0141                            |                                                  | 0,0418                            | -0,1476                             | -0,0979                                          | -0,0979                           | 0,0171                              | -0,0642                                          |                                   |                                     | 0,2580                                           |                                   |                                                  |
|                          | mean              | 0,0108                            | -0,0170                                          | 0,0293                            | -0,1300                             | 0,0892                                           | -0,0880                           | 0,0154                              | -0,0085                                          | -0,0562                           | 0,0406                              | 0,2093                                           | -0,2465                           |                                                  |
|                          | max               | 0,0087                            |                                                  | 0,0215                            | -0,1190                             | -0,0818                                          | -0,0818                           | 0,0144                              | -0,0512                                          |                                   |                                     | 0,1789                                           |                                   |                                                  |
| PMR                      | min               | 0,0041                            |                                                  | 0,0046                            | -0,0956                             | -0,0688                                          | -0,0688                           | 0,0122                              | -0,0405                                          |                                   |                                     | 0,1132                                           |                                   |                                                  |
|                          | mean              | 0,0108                            | 0,0029                                           | 0,0293                            | -0,1300                             | -0,0152                                          | -0,0880                           | 0,0154                              | 0,0014                                           | -0,0562                           | -0,0069                             | 0,2093                                           | 0,0425                            |                                                  |
|                          | max               | 0,0162                            |                                                  | 0,0495                            | -0,1579                             | -0,1037                                          | -0,1037                           | 0,0181                              | -0,0689                                          |                                   |                                     | 0,2874                                           |                                   |                                                  |
| ALMPs                    | min               | 0,0138                            |                                                  | 0,0402                            | -0,1475                             | -0,0982                                          | -0,0982                           | 0,0172                              | -0,0641                                          |                                   |                                     | 0,2540                                           |                                   |                                                  |
|                          | mean              | 0,0108                            | -0,0119                                          | 0,0293                            | -0,1300                             | 0,0695                                           | -0,0880                           | 0,0154                              | -0,0069                                          | -0,0562                           | 0,0313                              | 0,2093                                           | -0,1776                           |                                                  |
|                          | max               | -0,0007                           |                                                  | -0,0121                           | -0,0632                             | -0,0490                                          | -0,0490                           | 0,0088                              | -0,0261                                          |                                   |                                     | 0,0386                                           |                                   |                                                  |
| Average replacement rate | min               | -0,0001                           |                                                  | -0,0080                           | -0,0523                             | -0,0401                                          | -0,0401                           | 0,0072                              | -0,0217                                          |                                   |                                     | 0,0366                                           |                                   |                                                  |
|                          | mean              | 0,0108                            | 0,0561                                           | 0,0293                            | -0,1300                             | -0,3997                                          | -0,0880                           | 0,0154                              | 0,0425                                           | -0,0562                           | -0,1776                             | 0,2093                                           | 0,8883                            |                                                  |
|                          | max               | 0,0270                            |                                                  | 0,0849                            | -0,2456                             | -0,1593                                          | -0,1593                           | 0,0277                              | -0,1075                                          |                                   |                                     | 0,4661                                           |                                   |                                                  |

<sup>1</sup> e.g.  $X_k = \text{EPL}$  in columns 1-2 (EPL) and  $X_j = \text{Union density}$  in row 2 (Union density):

(i) the sign of the partial derivative of PV (for a country with an average mix of policies, except Union density and EPL) with respect to EPL (evaluated at average EPL) is evaluated at the minimum, mean and maximum value of Union density to check if it is changing; (ii) the sign of the cross-derivative with respect to EPL and Union density is evaluated for an average mix of policies, except EPL and Union density.

<sup>2</sup>evaluated at  $X_j = X_j^*$

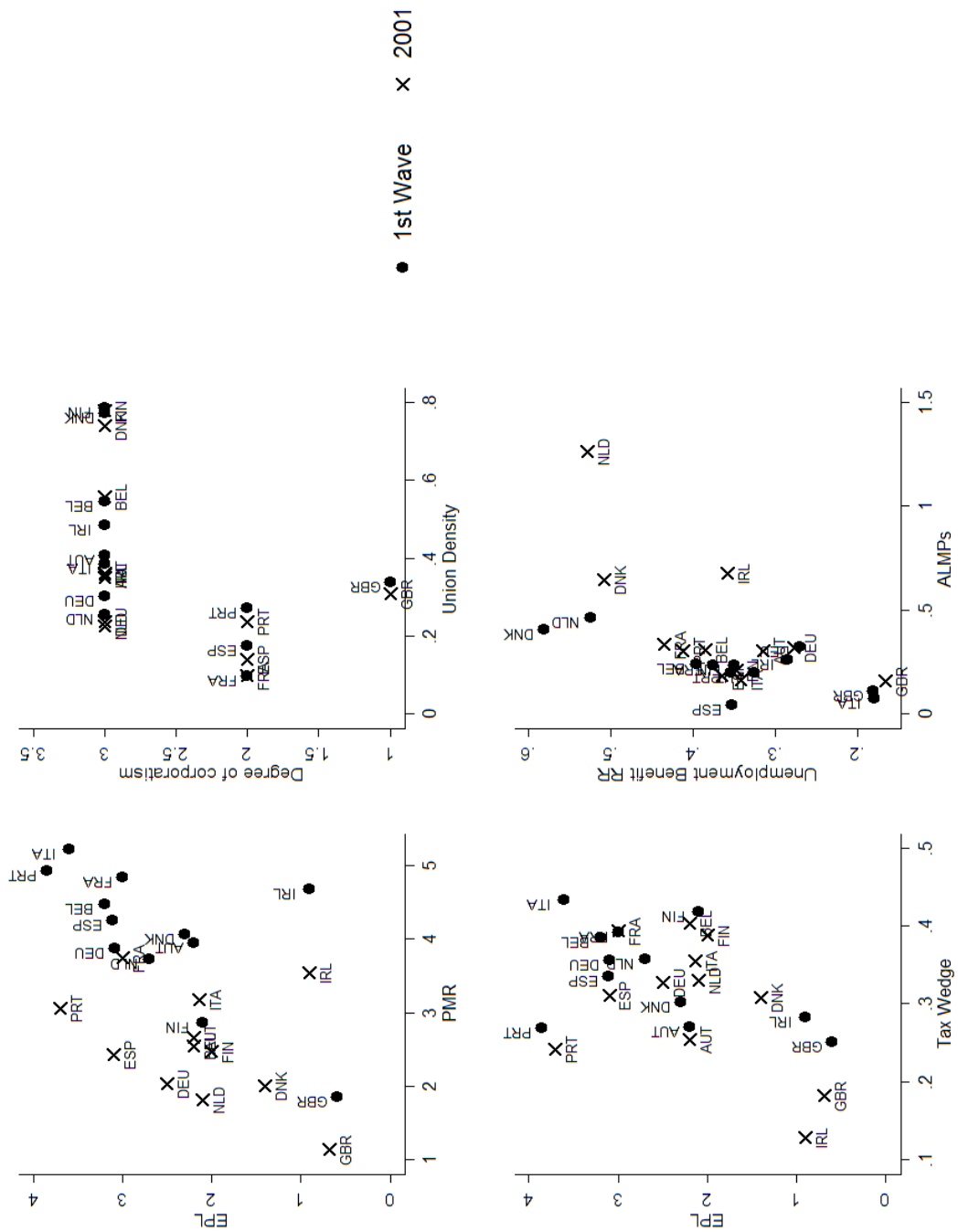
**Table 7:** Permanent Inequality - Time effects interacted with institutions.

|                          | [1]<br>Estimates |      | [2]<br>Range of<br>institutions/<br>policies |        | [3]<br>Implied relative change in PV<br>due to an adverse shock<br>which increases PV by 1%<br>for the average country<br>(PV for mean institutions<br>and shocks = 0,1229 ) |         |
|--------------------------|------------------|------|----------------------------------------------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
|                          |                  | t    | Min                                          | Max    | Min                                                                                                                                                                          | Max     |
| Time effects*            | -0,0058          |      |                                              |        |                                                                                                                                                                              |         |
| EPL                      | 0,0810**         | 2,46 | -1,8217                                      | 1,4325 | -13,91%                                                                                                                                                                      | 12,72%  |
| Union density            | -0,2524          | -1,6 | -0,2763                                      | 0,4212 | 8,04%                                                                                                                                                                        | -9,74%  |
| High corporatism         | -0,4067***       | -8,8 | 0                                            | 1      | 1,00%                                                                                                                                                                        | -40,07% |
| Tax wedge                | -1,4143***       | -3,7 | -0,1977                                      | 0,1232 | 29,25%                                                                                                                                                                       | -16,60% |
| PMR                      | 0,0923***        | 3,51 | -2,2625                                      | 1,8403 | -20,08%                                                                                                                                                                      | 18,15%  |
| ALMPs                    | 0,2494           | 1,64 | -0,2519                                      | 0,9610 | -5,35%                                                                                                                                                                       | 25,21%  |
| Average replacement rate | -0,7883***       | -3,2 | -0,1944                                      | 0,2892 | 16,48%                                                                                                                                                                       | -22,03% |
| Adj. $R^2$               | 0,9536           |      |                                              |        |                                                                                                                                                                              |         |
| Obs.                     | 93               |      |                                              |        |                                                                                                                                                                              |         |

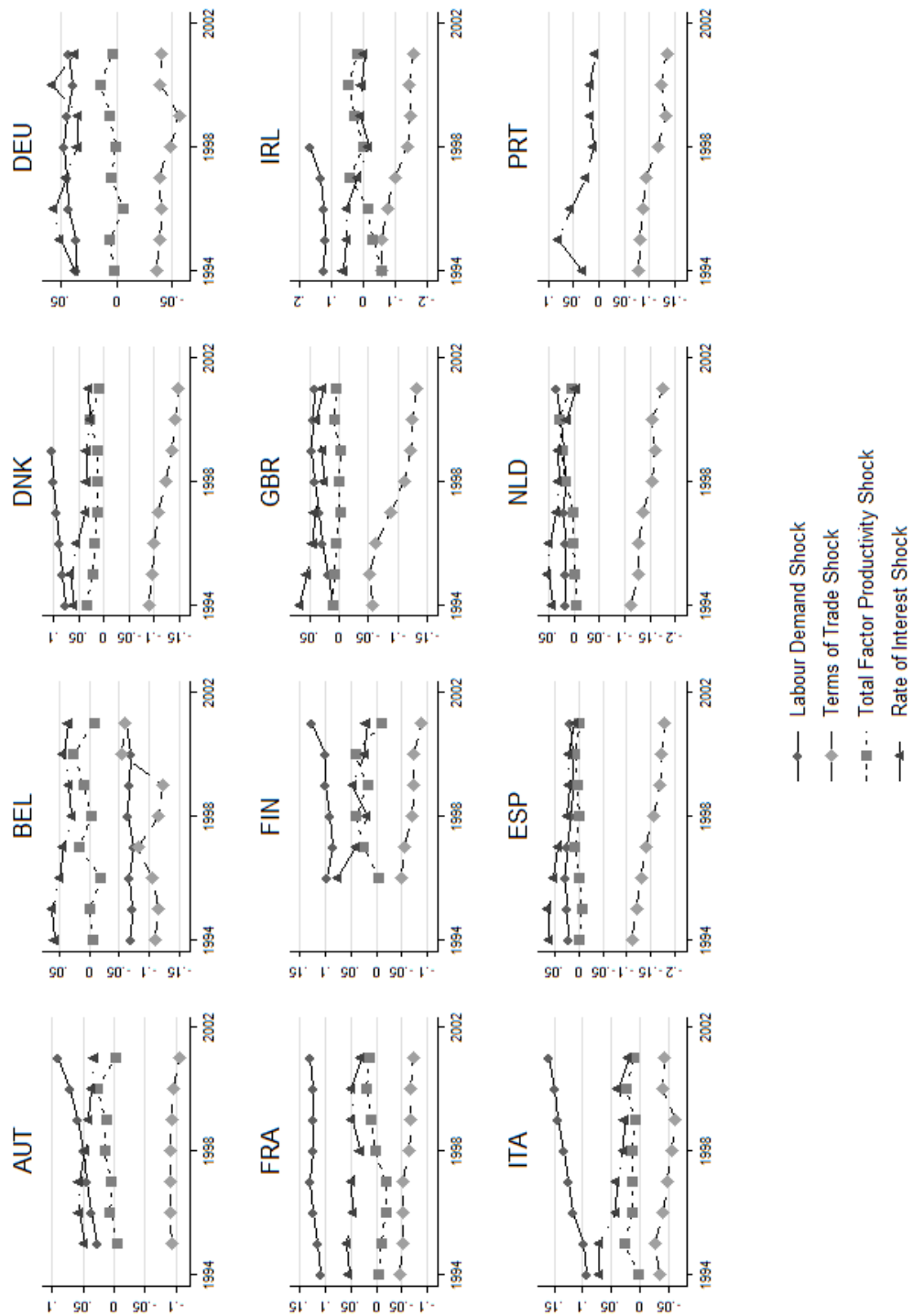
**Table 8:** Persistent Inequality - Observed shocks interacted with institutions.

|                          | Estimates  | t     |
|--------------------------|------------|-------|
| EPL                      | -0,0587    | -0,6  |
| Union density            | -0,8906**  | -2,2  |
| High corporatism         | -0,2350**  | -2,27 |
| Tax wedge                | 0,5701     | 0,52  |
| PMR                      | 0,0061     | 0,13  |
| ALMPs                    | -0,1479    | -0,47 |
| Average replacement rate | -0,5375    | -1,27 |
| LD shift                 | 0,3083***  | 4,33  |
| Terms of trade           | -0,4282*** | -6,02 |
| TFP growth               | -0,2379    | -0,88 |
| Real interest rate       | 0,9830***  | 5,55  |
| Adj. $R^2$               | 0,9240     |       |
| Obs.                     | 80         |       |

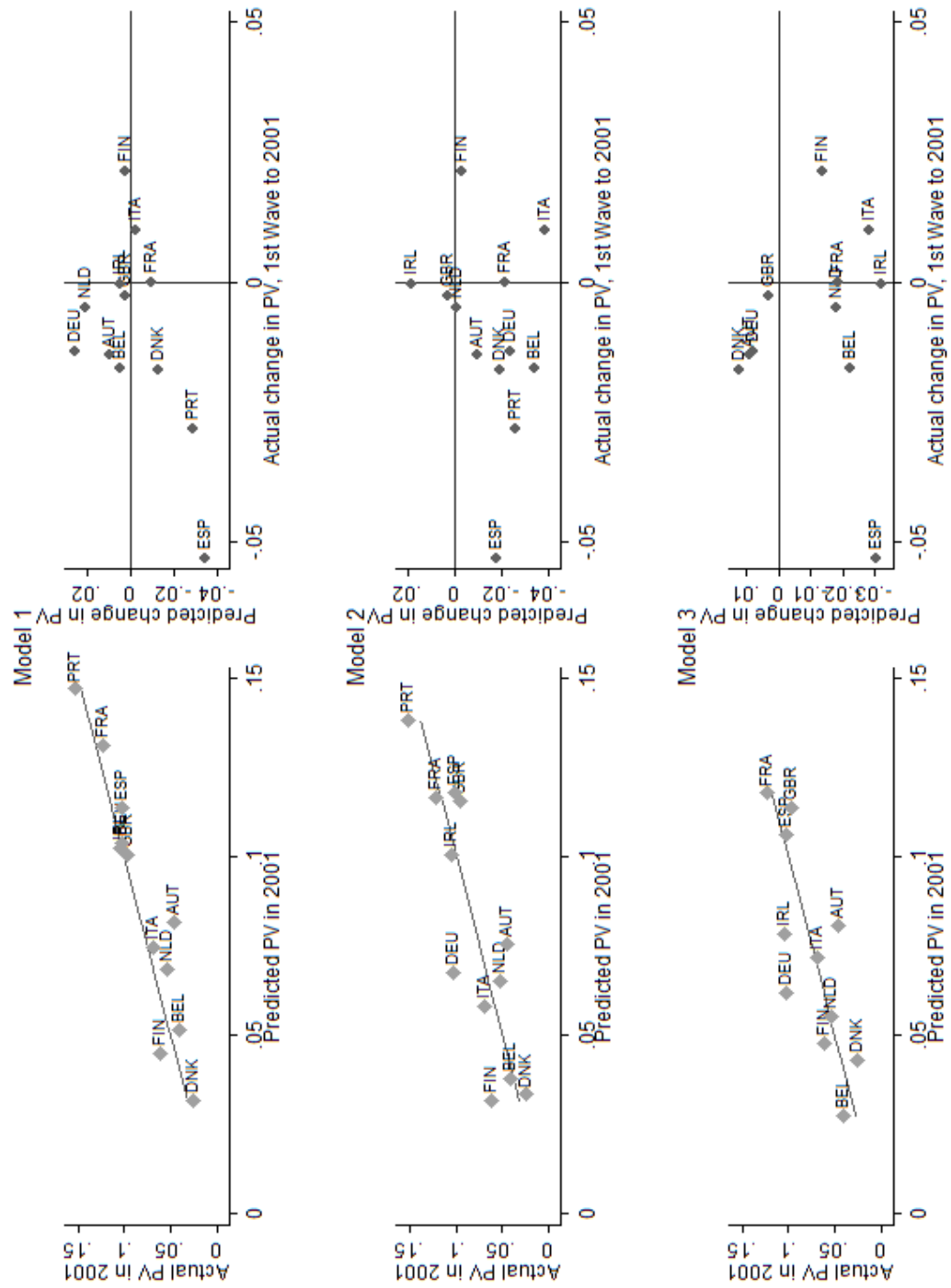
**Figure 1:** Labour Market Evolution: EPL, PMR, Degree of Corporatism, Union Density, Tax wedge, Unemployment benefit replacement rate, ALMPs.



**Figure 2:** Evolution of macroeconomic shocks.



**Figure 3:** Actual vs Predicted Persistent Inequality – Models 1, 2, 3.



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