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Income Mobility, Unemployment and GDP

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Abstract

This paper attempts to identify macroeconomic factors of income mobility. Explored is the relationship between biannual relative income mobility, the relative change in the unemployment rate and the relative change in GDP. A theoretical model is proposed which provides an explanation of the nature of this relationship. It is then verified using household budget data from the CHER database.
Keywords: income mobility, unemployment, GDP.
JEL Classification: D31, E24, E32, J60.

1 Introduction

The analysis of income mobility originates from the analysis of income inequality. The general question underlying income mobility is "do the poor stay poor, and the rich stay rich?". In the late 1970's several different approaches to this problem were proposed. Lillard and Willis [14] analyzed earnings mobility from an econometric - income dynamics - point of view. To Schiller [15] income mobility was the movement within the income distribution of individuals which occurs between two measurement periods. Shorrocks [16] viewed income mobility as a process of income inequality reduction resulting from lengthening of the accounting period. The amount of literature on income mobility is rapidly growing due to availability of new

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data from panel surveys. However recent articles do not always explicit it's relationship with income inequality - income mobility has become an independent area of economic interest.

This remains in accordance with a neutral definition of income mobility proposed by Fields and Ok [7] which states that it is simply a process of income distribution transformation taking place between two periods. As pointed out by Jarvis and Jenkins [13] such a distributional change can be perceived both positively (equality of opportunity) or negatively (economic instability).

Let us distinguish five potential sets of factors of individual income changes:

- life-event factors,
- individual factors,
- macroeconomic factors,
- socio-economic factors,
- transition factors.

The life-event set of factors (described in Hauser, Wagner [10]) includes changes of income due to labor market (e.g. losing a job, reaching retirement age), household (e.g. divorce, birth of a child) or accidental events. It should be stressed that the analysis of life events' impact on income has not yet received as much attention in income mobility literature as it has in poverty dynamics literature.

The individual set of factors encompasses changes of income related to such individual characteristics of recipients as: gender and age (see e.g.: Jarvis, Jenkins [13]) or human capital (see e.g.: Buchinsky, Hunt [3]).

Macroeconomic factors are those connected to the economy as a whole (e.g. GDP and unemployment). Wodon [17] explores this aspect of income mobility in a comparison of Argentinean and Mexican data. This set of factors is also implicitly considered by Fabig [6] where German, British and US mobility during the same phase of the economic cycle are compared. Moreover Bogomolova, Tapilina [4] analyze both individual and macroeconomic factors of income mobility in Russia.

Hauser and Wagner [10] argue that the features of the socio-economic system also play some role in the extent of income mobility although Headey, Muffels [11] show that three different types of 'welfare capitalism' states, Germany, The Netherlands and United States, experienced a similar amount of income mobility.

Factors related to the economic transition towards a free market constitute the last set. It has been shown that during the first half of the 1990's decade the magnitude of income mobility in transforming economies exceeded that of well-established ones: Polish and Hungarian mobility was higher than British mobility (Górecki, Kuhl [8]) and German mobility in the eastern states was higher than in the western states (Hauser, Fabig [9]).

The above mentioned distinction is but a rough one due to the existence of interactions between the sets of factors. To name some examples: individual characteristics influencing life-events, economic growth caused by system transformation, decline of the rate of unemployment resulting in someone finding a job, economic transition accompanied by reforms of the socio-economic system. But the purpose of identifying the sets of income mobility factors is to clear the operational field for the analysis presented here.

The aim of this paper is to explore macroeconomic factors of income mobility. Wodon [17] shows that the correlation between earnings mobility and economic growth depends on type of labor market adjustments: in quantity adjusting economies like Argentina, mobility is negatively correlated with economic growth, whereas in price adjusting economies like Mexico, this correlation is positive. Two issues are of interest here:

1. Would the results change if incomes instead of earnings were used?
2. Is there a 'universal' relationship between economic growth and income mobility once unemployment is taken into account?

The first question is answered in a discussion and the second question is answered by means of data analysis. International income mobility data are used in an attempt to test a simple theoretical model and not for the purpose of comparison of mobility patterns across countries (see i.e.: Aaberge et al. [1]; Canto [5]).

The remaining parts are organized as follows. A model linking relative income mobility and macroeconomic output is presented in section 2. Section 3 contains a description of the data, briefly describes five measures of mobility, and presents the econometric setting of analysis along with estimation results. Section 4 provides conclusions.

2 Theoretical Model

Consider a simplified labor market model with two types of workforce participants: contract workers and non-contract workers. Contract workers have contracts which are independent of the macroeconomic situation. Those contracts regulate the duration of their employment and earnings. Employment conditions of the non-contract workers depend on the macroeconomic situation and on the labor market regulations which imply adjustments either through quantities or prices. In addition, assume that the average earnings are equal across both groups.

In an economy with price adjustments, earnings mobility is larger in the growth and recession phases than during stagnation. During the growth phase, earnings of the non-contract workers grow relatively to the earnings of the contract workers. The opposite occurs during recession. In a quantity adjusting economy, growth and recession affect the level of unemployment of the non-contract workers.

How does this translate into income mobility? What does income impose in a price adjusting economy? First, the number of individuals taken into account is increased by two major groups – dependants and pensioners. Dependants can be viewed as either contract or non-contract workers (according to the status of the household's main breadwinner). Pensioners can be viewed as non-contract workers since their pensions usually do not depend on state of the economy. Second, the social transfers (being the largest non-earnings income category) increase the total amount of income not affected by macroeconomic output. These two factors decrease mobility because both - the total amount of income affected by macroeconomic output and the relative number of people receiving such income - are smaller.

In a quantity adjusting economy the non-contract workers are affected by unemployment. Their incomes change from unemployment benefits to earnings and back depending on the macroeconomic situation. This results in income mobility provided that (at least on the average) unemployment benefits are lower than earnings. The rest of the argument (concerning additional groups of individuals and additional incomes in the form of social transfers) remains as above.

To sum up, the relationship between economic output and income mobility should be weaker than the relationship between economic output and earnings mobility. But it should not disappear. Naturally the real world is more complex than a simple model with such unrealistic assumptions: (1) the existence of two distinct groups of workers, (2) the existence of two distinct types of labor market adjustments, (3) the pattern of economic fluctuations, (4) the equality of average earnings and (5) the unspecified level of income redistribution. Nevertheless this model shows how income mobility can be related to economic output and unemployment.

Additionally, focusing on incomes rather than earnings provides a technical advantage. Earnings of workers who become unemployed during recession drop to zero thus limiting comparison between periods. In this aspect incomes are immune to unemployment (however at the cost of a distortion of the transition mechanism between output and mobility by taxes and transfers).

3 Verification

3.1 Data

The income data come from the CHER (*Consortium of Household Panels for European Socio-economic Research*) database which provides annual individual and household data from several European countries for the period 1990 – 2000. The household income analyzed is *net disposable income*. This income is divided by the square root of the number of household members (to take account of households' economies of scale) and assigned to each individual within the household. Considered in each country is the biannual relative mobility (between two consecutive years) of incomes of individuals with equivalized incomes larger than zero. As a consequence, the number of individuals in each country changes throughout the years (see Appendix B.1).

The macroeconomic data come from Eurostat and the International Labor Organization. The index of GDP change, provided by Eurostat, is the *Percentage change on previous period of the gross domestic product at market prices in constant terms*. The International Labor Organization reports two estimates of the rate of unemployment: the *Labor Force Survey rate* and the *National Employment Office rate*. Since in many cases the two figures differ and since neither source covers the entire time range, an arithmetic mean of the two is used.

As income mobility is a process which takes place between two periods, an inter-period measure for the macroeconomic variables was necessary. For each set of two years, the values of the indices of GDP and unemployment relative change were taken from the latter year as referring to the change that occurred during this period.

3.2 Income Mobility Measures

An income mobility concept which can be used in the theoretical model outlined above must be free of all aspects of total income growth. The concept based on the change of individual shares (of total income) or individual ranks (within an income distribution), i.e. 'relative income mobility' (see Fields, Ok [7]) satisfies this condition. Such mobility also possesses a virtue in respect of international comparison - it is immune to problems related to currency conversion and inflation. Five measures of relative income mobility are used - all being normalized to the (0,1) interval. Appendix A contains a presentation of their formulas and estimated values are presented in tables B.2 to B.6.

Although the income mobility measures applied are bounded by 0 and 1, the levels of particular indices differ. For example in Poland, the values of income mobility indices for the transition between years 1994 and 1995 were following: $M_S = 0.3611$, $M_{GS} = 0.0809$, $M_{PS} = 0.7084$, $M_{NB} = 0.5155$, $M_C = 0.6324$. Therefore only the values of the corresponding indices can be compared. During the years for which data are available, Poland and Ireland are the countries with highest income mobility. Both countries enjoyed high growth rates in the 1990's which would remain in accordance with the presented model. It could be argued that Poland's income mobility results mainly from the socio-economic transformations. If this was true then a similar pattern would appear in the Hungarian data, but that is not the case - Hungary had a similar level of income mobility as EU countries. This could mean that the macroeconomic set of factors has greater impact on income mobility. France and Portugal were the countries with the lowest levels of mobility. Data from Germany (the longest panel) reveal a slight downward trend, which is also (according to the proposed model) in line with the increase in the level of unemployment and the macroeconomic performance in the 1990's.

3.3 Estimation

In the model of Section 2 a higher absolute value of change of GDP (either growth or recession) should imply more mobility. The absolute value can be omitted because the relative change of GDP is rarely negative (at least in the examined countries). This amounts to a positive correlation between relative income mobility and relative change of GDP. The relative change of the rate of unemployment, according to the model should also be positively correlated with relative income mobility since it is unemployment which decreases incomes turning earnings into unemployment benefits. This means that $\beta > 0$ and $\gamma > 0$ in the following equation:

$$M_{it} = \alpha + \beta \Delta GDP_{it} + \gamma \Delta U_{it} + \epsilon_{it} \tag{1}$$

where i denotes the country, t denotes the period, M_{it} is a mobility measure, $\Delta GDP_{it} = (GDP_{it} - GDP_{it-1})/GDP_{it-1}$ is the relative change of GDP in constant prices, $\Delta U_{it} = (U_{it} - U_{it-1})/U_{it-1}$ is the relative change of the rate of unemployment and ϵ_{it} is an error term. The periods differ for most countries so the panel is not a balanced one. Three econometric panel settings are used to verify the theoretical model:

1. Classical regression. The equation remains as is with the error term having a normal distribution $\epsilon_{it} \sim N(0, \sigma_\epsilon)$.

2. Fixed effects regression. The error term has a normal distribution $\epsilon_{it} \sim N(0, \sigma_\epsilon)$ and the fixed term varies between countries:

$$M_{it} = \alpha_i + \beta \Delta GDP_{it} + \gamma \Delta U_{it} + \epsilon_{it} \tag{2}$$

3. Random effects regression. The error term is a sum of the country error term ($\nu_i \sim N(0, \sigma_\nu)$) and the common error term ($\epsilon_{it} \sim N(0, \sigma_\epsilon)$).

$$M_{it} = \alpha + \beta \Delta GDP_{it} + \gamma \Delta U_{it} + \nu_i + \epsilon_{it} \tag{3}$$

Tables in Appendix C contain the estimation results. The exploratory character of this study justifies the estimation of 15 regressions (5 mobility measures x 3 econometric models) and the simultaneous inspection of their results (which leads to a decrease in the level of significance of the jointly applied tests).

Some remarks are necessary before discussing the results. There is a large difference between the values of ΔGDP (mean value across all countries and years: 2.639) and ΔU (mean value across all countries and years: 0.070) which influences the values of regression coefficients - the coefficients of ΔGDP are smaller than the coefficients of ΔU. There are also differences in the levels of mobility indices resulting in different regression coefficients across models for various income mobility measures.

The classical regression models show that both β and γ are positive although the positive values of γ are insignificant. The regressions are significant in terms of the general F statistic. The fixed effects regressions reveal that both β and γ are insignificant and that the β's are negative. The regressions' overall F statistics show the models to be insignificant, however the F statistics of the test for jointly significant individual effects show such effects significant. The random effects regressions not only give insignificant β's and γ's, they are also insignificant in terms of the overall Wald's χ^2 statistic. None of the analyzed mobility measures seems to outperform the others in the analysis of regressions.

A comparison of the three econometric settings gives better insight into the nature of the relation between income mobility and GDP and unemployment. The fixed effects models' results imply that the variation of the levels income mobility indices between countries is large enough to screen this relation.

4 Conclusions

Examined data do not support the proposed model. Macroeconomic factors of income mobility - economic output and unemployment - are insignificant. This is a counterintuitive result, as it seems natural to relate changes in household disposable income to the performance of the economy as a whole. The lack of relation is most likely caused by the income concept used. Equivalized household disposable income is less variable than individual earnings determined by the labor market. One of the reasons for this is the existence of social transfers which greatly distort the model. This is confirmed by the econometric results - individual country effects (and thus institutional arrangements of the welfare regimes) are dominant. The main conclusion of the study is therefore following: since macroeconomic factors of income mobility are insignificant, the remaining sets of factors must be examined in greater detail.

A Income mobility measures

A comment on short-term mobility is necessary before introducing the indices. Generally, income mobility increases as the period over which it occurs is extended. Put the other way round, for a given population, income mobility between two consecutive years will be the smallest (assuming that a year is the shortest income accounting period). This finding is of great importance as it changes mathematical features of some mobility measures. Fabig [6] argues that "in the present context (of income mobility), it is safe to assume that it (Pearson's correlation coefficient between relative income positions) takes on values between 0 and 1: i.e. it has the desired property of normalization". Similar argumentation is extensively used in this section.

The formulas of the mobility indices follow. Consider a population of n individuals and two income distribution vectors at periods t and $t+1$ respectively: $x = (x_1, x_2, ..., x_n)$ and $y = (y_1, y_2, ..., y_n)$. Assuming (for the sake of the argument) no ties, it is possible to order the incomes in each vector lowest thru highest and to assign ranks to them: $r_x = (r_{x1}, ..., r_{xn})$ and $r_y = (r_{y1}, ..., r_{yn})$.

By taking the Spearman's rank correlation coefficient of incomes at periods t and $t+1$ and subtracting it from unity we derive the Spearman's mobility index:

$$M_S = 1 - \frac{\mathrm{Cov}(r_x, r_y)}{\sqrt{\mathrm{Var}(r_x)\mathrm{Var}(r_y)}} \tag{4}$$

Under the assumption of short-term mobility this index is normalized. If the ranks of income in two periods are perfectly correlated then M_S takes the value of 0 (perfect immobility). If no correlation exists - M_S takes the value of 1 (perfect mobility).

An index proposed by Shorrocks [16] compares short-term inequality (the average inequality of incomes across some periods) with long-term inequality (the inequality of the total income from these periods). Since aggregated incomes are more equally distributed, the reduction of inequality can be a measure of mobility. In order to be able to aggregate incomes from the different periods, current incomes have to be transformed into real ones. This can be done by dividing incomes by the mean income of each period: $\dot{x} = x/\bar{x}$, $\dot{y} = y/\bar{y}$. The total income for two consecutive years is thus: $z = \dot{x}+\dot{y}$ and the corresponding ranks are: $r_z = (1, ..., n)$. The Gini-Shorrocks mobility index uses the Gini coefficient G as a measure of inequality. It can be calculated using the covariance formula. Noticing that $\bar{\dot{x}} = \bar{\dot{y}} = 1$, $\bar{\dot{z}} = 2$ and $r_{\dot{x}} = r_x$

the mobility index is defined as:

$$M_{GS} = 1 - \frac{G_z}{\frac{G_{\dot{x}} + G_{\dot{y}}}{2}} = 1 - \frac{\mathrm{Cov}(z, r_z)}{\mathrm{Cov}(\dot{x}, r_x) + \mathrm{Cov}(\dot{y}, r_y)} \qquad (5)$$

If incomes at period $t + 1$ are rescaled incomes from period t (i.e.: $y = \alpha x, \quad \alpha > 0$) then all Gini coefficients are equall ($G_x = G_y = G_z$) and M_{GS} takes the value of 0 (perfect immobility). Otherwise it is larger than 0. It never reaches the value of 1 (perfect mobility), but the larger are the inequalities in each period and the degree of reranking, the larger M_{GS}.

The next three relative income mobility measures are based on transition matrices (see e.g.: Bogomolova, Tapilina [4]; Fabig [6]; Hungerford [12]; Schiller [15]). Let q denote the number of income intervals used. Define the $q \times q$ transition matrix $\mathbf{P}$ with elements p_{ij} being the probabilities of transition from i^{th} income group at period t to the j^{th} income group at period $t + 1$. If quantiles (fractiles) are the income brackets, then the (quantile) transition matrices are bistochastic, i.e. $\forall j = 1, ..., q \quad \sum_{i=1}^{q} p_{ij} = 1$ and $\forall i = 1, ..., q \quad \sum_{j=1}^{q} p_{ij} = 1$. In this analysis quintile transition matrices are used ($q = 5$).

How do transition matrices help judge the extent of mobility? Defining what is to be understood as 'perfect immobility' is fairly easy. If nobody has changed their quantile group between periods, then main diagonal of the transition matrix contain ones, i.e.: $\mathbf{P} = \mathbf{I}$. 'Perfect mobility' is not so obvious as the following example shows (see: Bartholomew [2]). Consider two tercile ($q = 3$) transition matrices $\mathbf{P}_1$ and $\mathbf{P}_2$:

$$\mathbf{P}_1 = \begin{pmatrix} \frac{1}{3} & \frac{1}{3} & \frac{1}{3} \\ \frac{1}{3} & \frac{1}{3} & \frac{1}{3} \\ \frac{1}{3} & \frac{1}{3} & \frac{1}{3} \end{pmatrix} \qquad \mathbf{P}_2 = \begin{pmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{pmatrix}$$

Which one represents more mobility? Indeed, hard to decide. Fortunately it is possible to rule out a process resulting in matrix $\mathbf{P}_2$ on the ground of short-term income mobility. It is possible to restrict the feasible transition matrices only to those possessing a maximal diagonal, i.e. $\forall i \neq j, \ p_{ij} \leq p_{ii}$. In other words the matrices considered are those 'between' $\mathbf{P}_3 = \mathbf{I}$ and $\mathbf{P}_1$. If the former represents perfect immobility, then it is tempting to consider the latter representing perfect mobility. This corresponds to viewing income mobility as independence of income between two periods. An inspection of data proved that the calculated (biannual) quintile transition matrices have a maximal diagonal.

The Prais-Schorrocks mobility index is focused on the probabilities of staying in the same quantile which form the main diagonal. It is derived by modifying the trace of the transition matrix in order to obtain a normalized measure:

$$M_{PS} = \frac{q - \mathrm{tr}(\mathbf{P})}{q - 1} = \frac{1}{q-1}\sum_{j=1}^{q}(1 - p_{jj}) \tag{6}$$

This value of this index ranges from 0 in the case of perfect immobility to 1 in the case of perfect mobility.

An assessment of the degree of mobility based solely on the main diagonal of the transition matrix results in a loss of information. The idea of Bartholomew [2] was to calculate the average absolute change of class (here – the quantile group) using a special set of weights $\dot{p}_i$:

$$M_B = \sum_{i=1}^{q}\sum_{j=1}^{q} p_{ij}|i - j|\dot{p}_i \tag{7}$$

In the original setting the weights $\dot{p}_i$ were steady state probabilities of a Markovian process. For quantile transitions matrices they are all equal (i.e.: $\forall ii = 1, ..., q \quad \dot{p}_i = 1/q$). It can be shown that the value of this index ranges from 0 (perfect immobility) to $\frac{q^2-1}{3q}$ (perfect mobility defined as above). Normalization is achieved by dividing (7) by this factor:

$$M_{NB} = \frac{3}{q^2 - 1}\sum_{i=1}^{q}\sum_{j=1}^{q} p_{ij}|i - j| \tag{8}$$

The values of this index range from 0 (perfect immobility) to 1 (perfect mobility).

Quantile transition matrices, after dividing each element by the number of quantiles ($c_{ij} = \frac{1}{q}p_{ij}$), become contingency tables for quantile groups. One of the measures of association - the Cramér's V index - has the desired property of normalization and thus a small modification of the formula permits using it as an income mobility measure;

$$M_C = 1 - C_V = 1 - \sqrt{\frac{\sum_{i=1}^{q}\sum_{j=1}^{q}(c_{ij} - q^{-2})^2}{n(q-1)q^{-2}}} \tag{9}$$

This mobility index takes the value of 1 under perfect mobility (perfect independence of quantile groups) and the value of 0 under perfect immobility (perfect association of quantile groups). Theoretically perfect association does not necessarily imply no mobility. But this is the case under the assumption of a maximal diagonal in the transition matrix.

B Tables

B.1 Sample Sizes

	1990-1991	1991-1992	1992-1993	1993-1994	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000
Austria	–	–	–	–	–	8128	7784	7383	–	–
Denmark	–	–	–	–	6295	5853	5430	4978	–	–
Finland	–	–	–	–	–	–	8862	–	–	–
France	–	–	–	–	14965	14116	13741	12545	–	–
Germany	8914	9124	12677	12847	13009	12651	12564	13913	13489	13064
Greece	–	–	–	–	13534	12750	12072	11490	–	–
Hungary	–	–	5992	5708	5146	4557	3942	–	–	–
Ireland	–	–	–	–	10493	8970	7888	7213	–	–
Italy	–	–	–	–	18881	18736	18474	17604	–	–
The Netherlands	–	–	–	–	10075	9925	9943	9852	–	–
Poland	–	–	–	–	12401	12341	–	8077	8060	8045
Portugal	–	–	–	–	12524	12600	12434	12398	–	–
Spain	–	–	–	–	18928	17476	16875	15641	–	–
UK	–	11138	10709	8992	8219	8660	8900	8380	–	–

Source: *CHER*, own calculations.

B.2 Spearman's mobility index M_S

	1990-1991	1991-1992	1992-1993	1993-1994	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000
Austria	–	–	–	–	–	.2421	.2063	.1975	–	–
Denmark	–	–	–	–	.2200	.2266	.2143	.2400	–	–
Finland	–	–	–	–	–	–	.2714	–	–	–
France	–	–	–	–	.1348	.1389	.1304	.1472	–	–
Germany	.2177	.2055	.2031	.2017	.1882	.2160	.1980	.1989	.1948	.1844
Greece	–	–	–	–	.2770	.2269	.1929	.2296	–	–
Hungary	–	–	.3374	.3372	.3100	.3071	.3042	–	–	–
Ireland	–	–	–	–	.4938	.4196	.4324	.4030	–	–
Italy	–	–	–	–	.2526	.2396	.2183	.2268	–	–
The Netherlands	–	–	–	–	.2010	.1610	.1698	.2031	–	–
Poland	–	–	–	–	.3611	.3575	–	.3699	.3233	.2773
Portugal	–	–	–	–	.1957	.1998	.1839	.1668	–	–
Spain	–	–	–	–	.2543	.2371	.2421	.2425	–	–
UK	–	.3035	.4180	.4051	.2023	.2783	.3060	.2112	–	–

Source: *CHER*, own calculations.

B.3 Gini-Shorrocks mobility index M_{GS}

	1990-1991	*1991-1992*	*1992-1993*	*1993-1994*	*1994-1995*	*1995-1996*	*1996-1997*	*1997-1998*	*1998-1999*	*1999-2000*
Austria	–	–	–	–	–	.0581	.0496	.0482	–	–
Denmark	–	–	–	–	.0578	.0595	.0546	.0589	–	–
Finland	–	–	–	–	–	–	.0626	–	–	–
France	–	–	–	–	.0284	.0290	.0277	.0319	–	–
Germany	.0514	.0478	.0471	.0463	.0424	.0490	.0440	.0452	.0433	.0415
Greece	–	–	–	–	.0626	.0498	.0432	.0493	–	–
Hungary	–	–	.0799	.0751	.0679	.0707	.0673	–	–	–
Ireland	–	–	–	–	.1148	.0953	.1017	.0949	–	–
Italy	–	–	–	–	.0581	.0565	.0510	.0532	–	–
The Netherlands	–	–	–	–	.0495	.0403	.0422	.0532	–	–
Poland	–	–	–	–	.0809	.0801	–	.0816	.0770	.0629
Portugal	–	–	–	–	.0395	.0404	.0359	.0326	–	–
Spain	–	–	–	–	.0515	.0500	.0515	.0534	–	–
UK	–	.0748	.0877	.0883	.0481	.0663	.0743	.0503	–	–

Source: *CHER*, own calculations.

B.4 Prais-Shorrocks mobility index M_{PS}

	1990-1991	*1991-1992*	*1992-1993*	*1993-1994*	*1994-1995*	*1995-1996*	*1996-1997*	*1997-1998*	*1998-1999*	*1999-2000*
Austria	–	–	–	–	–	.5824	.5034	.4936	–	–
Denmark	–	–	–	–	.5065	.5284	.5281	.5554	–	–
Finland	–	–	–	–	–	–	.5597	–	–	–
France	–	–	–	–	.4344	.4435	.4481	.4488	–	–
Germany	.5671	.5320	.5534	.5305	.5327	.5387	.5264	.5271	.5021	.4945
Greece	–	–	–	–	.6212	.5629	.5506	.5688	–	–
Hungary	–	–	.6589	.6755	.6188	.6277	.6452	–	–	–
Ireland	–	–	–	–	.6382	.6060	.6214	.5806	–	–
Italy	–	–	–	–	.5407	.5615	.5205	.5226	–	–
The Netherlands	–	–	–	–	.5717	.4941	.5031	.5319	–	–
Poland	–	–	–	–	.7084	.6997	–	.6875	.6695	.6230
Portugal	–	–	–	–	.5136	.4955	.5036	.4805	–	–
Spain	–	–	–	–	.5369	.6148	.5910	.5967	–	–
UK	–	.5629	.6445	.6553	.5181	.5512	.5840	.5180	–	–

Source: *CHER*, own calculations.

B.5 Normalized Bartholomew's mobility index M_{NB}

	1990-1991	1991-1992	1992-1993	1993-1994	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000
Austria	–	–	–	–	–	.3986	.3441	.3351	–	–
Denmark	–	–	–	–	.3403	.3585	.3522	.3787	–	–
Finland	–	–	–	–	–	–	.4026	–	–	–
France	–	–	–	–	.2698	.2752	.2728	.2800	–	–
Germany	.3801	.3578	.3642	.3521	.3466	.3601	.3489	.3507	.3428	.3288
Greece	–	–	–	–	.4413	.3814	.3584	.3862	–	–
Hungary	–	–	.4858	.4929	.4516	.4535	.4655	–	–	–
Ireland	–	–	–	–	.5628	.5062	.5195	.4869	–	–
Italy	–	–	–	–	.3925	.3888	.3571	.3588	–	–
The Netherlands	–	–	–	–	.3670	.3104	.3184	.3487	–	–
Poland	–	–	–	–	.5155	.5085	–	.5123	.4781	.4374
Portugal	–	–	–	–	.3472	.3430	.3383	.3121	–	–
Spain	–	–	–	–	.3919	.4164	.4050	.4045	–	–
UK	–	.4125	.5069	.5044	.3407	.3984	.4267	.3472	–	–

Source: *CHER*, own calculations.

B.6 Cramér's mobility index M_C

	1990-1991	1991-1992	1992-1993	1993-1994	1994-1995	1995-1996	1996-1997	1997-1998	1998-1999	1999-2000
Austria	–	–	–	–	–	.5312	.4690	.4584	–	–
Denmark	–	–	–	–	.4643	.4849	.4823	.5058	–	–
Finland	–	–	–	–	–	–	.5222	–	–	–
France	–	–	–	–	.3979	.4044	.4061	.4114	–	–
Germany	.5151	.4851	.4998	.4843	.4805	.4898	.4804	.4813	.4660	.4552
Greece	–	–	–	–	.5690	.5139	.4954	.5188	–	–
Hungary	–	–	.5994	.6096	.5704	.5747	.5838	–	–	–
Ireland	–	–	–	–	.6140	.5781	.5949	.5600	–	–
Italy	–	–	–	–	.5119	.5206	.4851	.4867	–	–
The Netherlands	–	–	–	–	.5071	.4493	.4578	.4836	–	–
Poland	–	–	–	–	.6324	.6283	–	.6286	.6053	.5696
Portugal	–	–	–	–	.4682	.4606	.4579	.4416	–	–
Spain	–	–	–	–	.5038	.5495	.5342	.5363	–	–
UK	–	.5286	.5905	.5817	.4730	.5149	.5446	.4763	–	–

Source: *CHER*, own calculations.

C Estimation Results

C.1 Classical models

$$M_{it} = \alpha + \beta \Delta GDP_{it} + \gamma \Delta U_{it} + \epsilon_{it}$$

	α	s.e.	β	s.e.	γ	s.e.	R^2	$\Pr > F$
M_S	.179	.018	.023	.005	.142	.096	.303	.000
M_{GS}	.041	.004	.005	.001	.023	.022	.299	.000
M_{PS}	.515	.015	.014	.004	.117	.083	.163	.007
M_{NB}	.331	.015	.019	.004	.138	.084	.276	.000
M_C	.468	.013	.017	.004	.111	.073	.214	.001

$N = 58$, $\Pr > F$ – *p-value* of the overall F statistic.
Source: *CHER*, *EUROSTAT*, *ILO*, own calculations.

C.2 Fixed effects models

$$M_{it} = \alpha_i + \beta \Delta GDP_{it} + \gamma \Delta U_{it} + \epsilon_{it}$$

	β	s.e.	γ	s.e.	R^2	$\Pr > F_1$	$\Pr > F_2$
M_S	-.009	.005	.010	.064	.266	.099	.000
M_{GS}	-.002	.001	-.000	.013	.287	.050	.000
M_{PS}	-.005	.005	.030	.054	.099	.189	.000
M_{NB}	-.007	.005	.016	.056	.222	.108	.000
M_C	-.005	.004	.017	.044	.159	.109	.000

$N = 58$, unbalanced panel (14 countries), $\Pr > F_1$ – *p-value* of the overall F statistic, $\Pr > F_2$ – *p-value* of the F statistic testing $\forall i, j\ \alpha_i = \alpha_j$.
Source: *CHER*, *EUROSTAT*, *ILO*, own calculations.

C.3 Random effects models

$$M_{it} = \alpha + \beta \Delta GDP_{it} + \gamma \Delta U_{it} + \nu_i + \epsilon_{it}$$

	α	s.e.	β	s.e.	γ	s.e.	R^2	$\Pr > \chi^2$
M_S	.240	.023	.003	.005	.075	.070	.118	.559
M_{GS}	.057	.005	.000	.001	.011	.014	.013	.652
M_{PS}	.559	.020	-.000	.004	.055	.054	.004	.422
M_{NB}	.387	.021	.001	.005	.061	.058	.009	.521
M_C	.516	.018	-.001	.004	.041	.045	.037	.399

$N = 58$, unbalanced panel (14 countries), $\Pr > \chi^2$ – *p-value* of the Wald's χ^2 statistic.
Source: *CHER*, *EUROSTAT*, *ILO*, own calculations.

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