Income Inequality and Inflation in the EU

Eleftherios Thalassinos[1], Erginbay Uğurlu[2], Yusuf Muratoğlu [3]

Abstract:

The main aim of this research is to analyze the relationship between income inequality and inflation in 13 European countries for the period 2000 to 2009 using panel data methodology. The GINI coefficient has been used to measure the income inequality while the inflation rate, the growth rate, the employment level and the openness of the economies have been used as independent variables. The results support the hypothesis that inflation has a positive significant effect on income inequality.

Key Words: *Inflation, Gini Coefficient, Income Inequality, European Union, Panel Data*

JEL Classification*: O15, E31, C23*

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[1] *Professor, Department of Maritime Studies, University of Piraeus,Chair Jean Monnet, email: thalassic@unipi.gr*
[2] PhD, *Department of Economics, Faculty of Economics and Administrative Sciences, Hitit University, Corum, Turkey- email:erginbayugurlu@hitit.edu.tr*
[3] PhD, *Department of Economics, Faculty of Economics and Administrative Sciences, Hitit University, Corum, Turkey- email:yusufmuratoglu@hitit.edu.tr*

1. Introduction

There is extended research analyzing the relationship between income inequality and selected macroeconomic variables such as growth rate, inflation rate, openness etc. Azzoni (2001) has analyzed regional inequality in Brazil using data from the period 1939-1995. Barro (2000) has used a panel data approach to investigate 100 countries for the period 1960-1990. Bandelj and Mahutga (2010) have presented one of the cross-national analyses of the Central and Eastern European States after the fall of the communistic regimes.

While Azzoni (2001) and Barro (2000) have focused on the linkage of inequality and growth, Bandelj and Mahutga (2010) have assessed inequality and socio-economic changes. Beckfield (2009) has developed an argument that regional integration in Europe has affected economic inequality. Also Forbes (2000) has investigated the relationship between inequality and growth.

In this research data from 13 EU4 countries have been used from the period 2000-2009 in an attempt to investigate the relationship between income inequality and inflation.

The paper is organized as follows: Section 2 gives a brief introduction to income inequality and inflation and outlines some related theoretical and empirical literature. Section 3 presents the methodology and the results while section 4 concludes the research.

2. Inequality and Inflation

The GINI coefficient is a widely used statistic for measuring inequality. It is derived from the Lorenz curve and defined as the ratio of the area between the Lorenz curve and the perfect equality line. The Lorenz curve plots the relation between the cumulative percentage of the population and the proportion of total income earned by each cumulative percentage. The dependent variable is the GINI coefficient; a common measure of inequality that varies from 0 to 1, where 0 presents perfect equality and 1 perfect inequality. As it is stated in Duro (2004) "the GINI coefficient is more sensitive to the income changes occurred at the middle of the income distribution, treating symmetrically the lower and the upper tails of the incomes ranking".

Due to the fact that income distribution may have long run effects policy makers should be concerned with the distributional implications of government policies. Also the extent of the inequality-inflation link is important in the designing of stabilization programs as it is stated in Al-Mahrubi (2000). When unemployment rates increase it usually affect more people in the lower tail of the personal income

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[4] Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.

distribution, thus lowering average per capita income (Levernier, et al., 1995). Checchi and García-Peñalosa (2008) argue that when unemployment rate is not too high unemployment and inequality linkage is positive.

Beetsma and Van Der Ploeg (1996), Al-Mahrubi (1997), Romer and Romer (1998) and Albanesi (2001, 2007) have found a strong positive relation between inflation and inequality.

Cardoso (1992) has concluded that inflation shifts the wage profile. Bulif (1998) has used a cross-sectional approach regressing GINI coefficients and has found that higher inflation is associated with more inequality (Crowe, 2004).

Milanovic (1994) argues about the factors which determine income distribution. Factors are in the short run, from the point of view of policy makers or society as a whole "given" and by social (or public policy) choice. Milanovic (1994) tests the hypothesis according to which government policies can significantly change income distribution and Kuznet holds.

Al-Marhubi (1997) investigates the inflation-inequality link by using positive political-economy approach and finds that countries which have a greater inequality have a higher average rate of inflation.

The dependent variable which is used in Al-Mahrubi model is the average annual inflation rate in log form and independents are the GINI coefficient, openness, political instability, turnover of Central Bank Governors and legal Central Bank independence.

Dolmas et al., (2000) find that economies with high levels of income inequality tend to have higher levels of inflation and the direction of causality is from inequality to inflation.

Albanesi (2001) investigates strong positive cross-country correlation between average inflation and measures of income inequality. He uses 51 industrialized and developing countries, averaged over the time period from 1966 to 1990 and finds that inflation is positive in equilibrium while larger inequality corresponds to higher equilibrium inflation.

Bulir (2001) studies that do inflation and inequality have a nonlinear relationship. He has used dummy variables for countries which are characterized by hyperinflation, high inflation and low inflation and the results have shown that the relationship between inflation and inequality is nonlinear.

Galli and Hoeven (2001) explore effects of monetary policy and inflation on income inequality for USA by using a time series approach and another research with 15 OECD countries by using a panel data approach. Equation 1 shows the core model which is used in this paper:

$$G_{it} = \alpha_i + \beta_1 \pi_{it} + \beta_2 \pi_{it}^2 + \gamma y_{it} + \varepsilon_{it} \tag{1}$$

where Git is the Gini index in country i at time t, i a is a country-specific fixed effect, π_{it} it is long-run inflation, yit is long-run real GDP growth, and it e is a standard normal error.

Bulir (2001) follows Milanovic (1994) and augments Kuznet hypothesis of income inequality by incorporating inflation by using Milanovic (1994)'s original data . The data set consist of 80 countries over period 1970-1991. Dependent variable of the model is Gini coefficient and independent variables are quadratic expression for GDP per capita to capture the nonlinearity of the Kuznets hypothesis, state employment, transfers as a percentage of GDP, and either three or four measures of inflation. Main conclusion of the paper is inflation increases income inequality and the impact is strongest in hyperinflation countries.

Desai et al. (2003) concerns political structure for 120 countries over the period 1960-2000 and shows that the competitiveness of the political system is central to the widely reported positive correlation between inflation and inequality. Duro (2004) uses Theil population-weighted index to investigate the relationship by using decomposition technique.

As pointed out by Amornthum (2004) the effects of inflation is distinguished between long run and short run. Because of inflation has no effect on the real economy in the long run it is generally agreed that link between inflation and inequality exist on in the only in the short run. The estimated model in the paper is below

$$I_{it} = a_0 + a_1 y_{it} + a_2 y_{it}^2 + a_3 \pi_{it} + a_4 \pi_{it}^2 + \mathbf{b} \mathbf{X_{it}} + e_{it} \tag{2}$$

where I is the measure of income inequality, y is the income, π is the inflation rate, and X is a set of control variables. The subscript i and t denote country and time, respectively.

Crowe (2004) reviews of theories about inflation and income inequality and offers a political economy explanation for the relationship. Cysne et. al. (2005) studies heterogeneous agent shopping-time economy to investigate inflation and income inequality link. Based on the model it is theoretically proved that the formal link between inflation and the Gini coefficient of income distribution. One another research Beckfield (2006) shows that regional integration explains nearly half of the increase in income equality in Western Europe.

Bertola (2010) finds unemployment is negatively related to income inequality and also finds Gini coefficients and income quintile ratios are negatively related to per capita income.

Bouvet (2010a) examines distribution of per capita income inequality among European regions by using panel data analysis for 1977-2003 period. In the paper many inequality measures are used which are 1.Gini Index, 2.General Entropy measure with parameter 3.General Entropy measure with parameter 0, 4.Coefficient of Variation (COV), 5.Standard Deviation of the logs (SDL), 6.Gibrat Index, 7. Pareto index respectively.

Bouvet (2010a) plots inequality measures against time for several countries showing different trend shapes. The shapes can be classified in five categories; a

downward inequality trend, an upward inequality trend, a U-shape trend, an inverted U shape trend and a no clear trend shape.

The author estimates inequality as a function of growth rate of real GDP (*Growth*), the inflation rate (*Inflation*) and the unemployment rate (*Unempl*), social transfers as a percentage of GDP (*Social*) as a policy variable, share of intra-EU trade (*EUtrade*) in total trade and dummy variables "Maastricht"5 and "SGP"6. The demographic variables are the percentage of the national population that less than 15 year-old (Young) and over 65 year-old (Old), the female labor force participation rate (FLFPR), the share of employment in agriculture16 (Agri), the share of employment in manufacture (Manuf).

The model is below:

$$inequality_{i,t} = \beta_0 + \beta_1 Growth_{i,t} + \beta_2 Manuf_{i,t} + \beta_3 Agri_{i,t} + \beta_4 FLPR_{i,t} + \beta_5 Unempl_{i,t}$$
$$+ \beta_6 Inflation_{i,t} + \beta_7 Young_{i,t} + \beta_8 Old_{i,t} + \beta_9 Social_{i,t} + \beta_{10} EMU_{i,t} + \beta_{11} Maastricht_t$$
$$+ \beta_{12} SGP_t + EUtrade_{i,t} + u_{i,t}$$

$$(3)$$

The paper concludes that inequality across regions also decreases with price stability. A 1% decrease in the inflation rate is associated with a 0.0003 point decrease in inequality, which corresponds to 1.2% of the average GE(1) index. Unemployment and GDP growth do not have a significant impact on inequality.

Bouvet (2010b) has a nearly similar model and empirical application with Bouvet (2010a) initially excludes interaction terms with the Cohesion dummy variable and The Structural Funds and Cohesion Fund variables. He also finds positive relationship with income inequality and inflation.

3. Empirical Application

The main aim of this study is to assess the relationship between income inequality and inflation. There are different approaches to explain link between inequality and inflation (Al-Mahrubi, 2000). A first approach related to Dornbusch and Edwards (1989) is known as economic populism. Economic populism is "an approach to economics that emphasizes growth and income redistribution and de-emphasizes the risk of inflation …" The main argument of this approach is that inequality provides fertile grounds for populist policies that fuel the inflation. In

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[5] Takes a value of 1 from 1993 to 2003 (and 0 otherwise), to capture the effect of the Treaty of the European Union which entered into force in 1993 and started the negotiations on monetary union.

[6] Capture the effect of the Stability and Growth Pact (SGP) that was adopted in 1997 to ensure that countries would keep respecting the convergence criteria before and after adopting the common currency.

another approach inequality in the distribution of income may have a key role to play in securing commitment to stabilization as it has been developed by Kaminsky and Pereira (1996) and Alesina and Drazen (1991). Beetsma and Van Der Ploeg (1996) claims that inequality and inflation link based on the distributive asymmetries of the inflationary process. In a third approach Haggard and Webb (1993) conclude that sharply unequal income distribution may lead to high inflation through the mechanism which is discussed in this article below.

In order to determine the inflation Dolmas et al, (2000) mentions two empirical strategies. In the first strategy a long time period is needed in order to examine the pattern of inflation in a single country. In the second a shorter time can be used to compare the experiences of a number of different countries over that period.

Due to the fact that the present study is based on data from the EU countries the second strategy has been selected to analyze panel data using the most appropriate methodology in an attempt to determine the income inequality among the EU countries.

3.1 Data

The data set consists of annual data for a sample of 13 EU countries in the period 2000-2009. The countries which are used extracted from the EU15 except Ireland and Luxembourg. As it is stated in Bouvet (2010a) each one of these countries is categorized as one single region; thus, it is impossible to calculate within-country inequality.

The dependent variable in this analysis is the inequality index which is named gini. The value of 0 represents absolute equality, while the value of 100 represents absolute inequality. Independent variables are the employment rate (empl), the price level of private consumption (inf), the openness of the country (open) and the GDP (gdp). The data set is collected from different sources. The source for the inequality index and the employment index is from Eurostat, while the inflation rate, the openness and the GDP from the OECD. A more detailed description of the data is provided in Table 1.

Table 1. Data Description

Data	Description and Source
gini	The Gini coefficient is defined as the relationship of cumulative shares of the population arranged according to the level of equivalised disposable income-Eurostat.
inf	Price Level of Government Consumption.- Penn World Table 7.0.
empl:	Employment (main characteristics and rates). Total employment (resident population concept - LFS)- Eurostat.
open	Exports plus Imports divided by GDP is the total trade as a percentage of GDP.- Penn World Table 7.0.
gdp	Gross domestic product (income approach-OECD.Stat

Although the inequality rate, the openness of the economy and the inflation rate variables are calculated as a ratio to GDP, the employment variables are not rational variables. The descriptive statistics of the variables are summarized in Table 2.

Table 2. Years Not Included In The Analysis by Country

Country	Number	Years
Austria	1	2002
Belgium	1	2002
Denmark	2	2000, 2002
Gemany	3	2002, 2003, 2004
Greece	1	2002
Italy	2	2002, 2003
Portugal	2	2002, 2003
Sweeden	2	2000, 2003
United Kingdom	1	2004

It can be seen from Table 2 that the variation of the GDP variable is greater than in the other variables leading to the decision of the logarithmic form of this variable in the model. The data form which is used in this paper is an unbalanced panel data with countries contributing different numbers of observations depending on data availability as it is shown in Table 3.

**Table 3. Years Not Included In The Analysis by Country**

Variable	Obs	Mean	Std. Dev.	Min	Max
gini	114	28.98509	3.960295	22	38.1
inf	130	119.625	23.32973	68.72388	180.6908
empl	130	12787.12	11444.48	2336.3	38879.7
open	130	81.22269	30.09644	48.0422	170.5258
gdp	130	1019667	845194.5	127007.5	3204320

There is a one problem which is arise from small size of the sample is having a insufficient degrees of freedom to estimate coefficients for all the controls variables that have used previous researches.

Figure 1 and Figure 2 show gini coefficients line graph and scatter graph respectively. Graphs represent 13 EU countries which are used in this paper for 2000-2009. Levels of inequality vary significantly from one country to another. Portugal is the country that has consistently experienced the highest levels of inequality. Sweden has the lowest levels of inequality based on the Gini indices (see Appendix B for country by country graphs).

Figure 1. Gini Indices for 13 EU countries
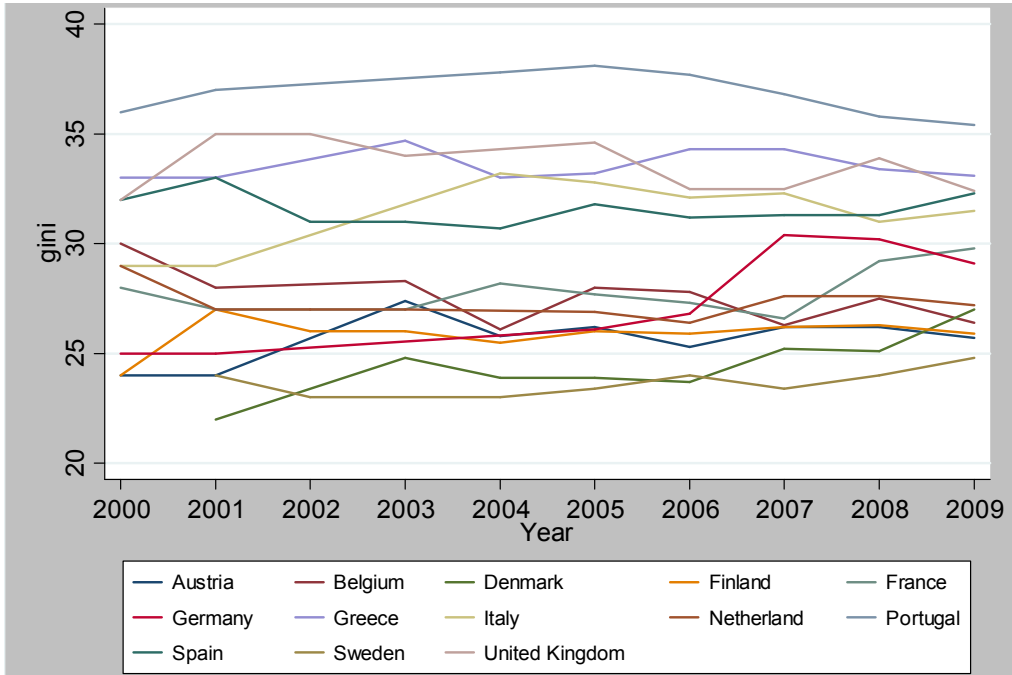
Figure 2. Gini Indices-Heterogeneity across countries
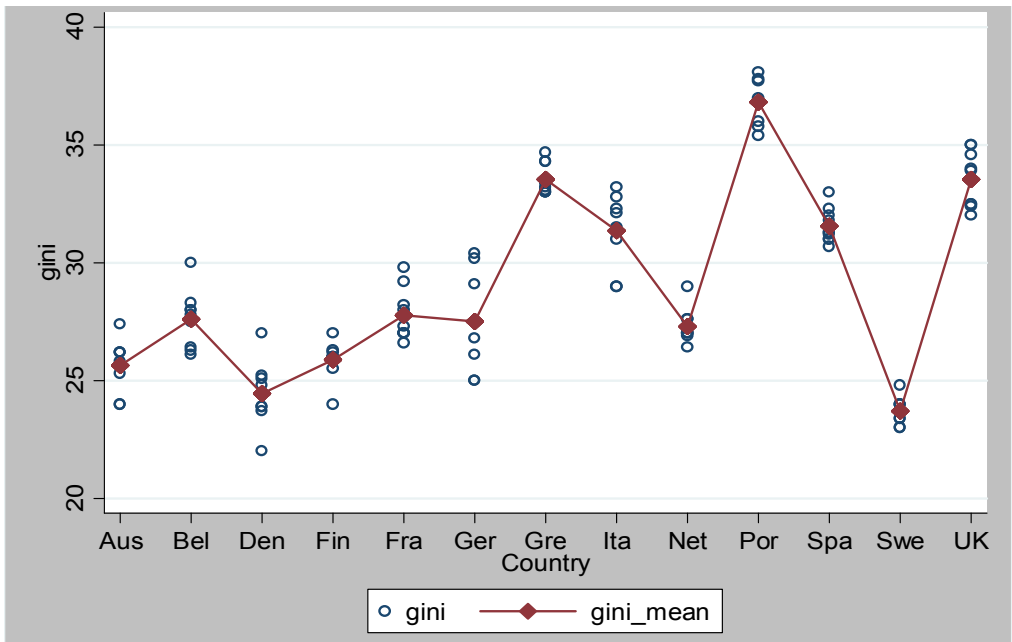
3.2 Estimation and Results

Based on the analysis the panel data set the present study incorporates both between- and within-country variation. The Ordinary Least Squares (OLS) estimation is an inappropriate method with panel data. The errors are likely to be correlated within panels and the unmeasured heterogeneity that causes this correlation may affect with significant bias the parameter estimates (Greene, 2000).

Different estimation techniques can be used for this set of data. Among them are the fixed effects (FE) and the random effects (RE) methods which can place different assumptions for each subset of data participating in the model. Although the fixed effects method (FE) allowed for correlation between the unobserved effect and the explanatory variables, the random effects method (RE) requires these effects to be uncorrelated (Ugurlu, 2010).

Hausman (1978) proposed a test in order to choose between (FE) and (RE) models. The null hypothesis is that the unobserved effect is uncorrelated with the explanatory variables. If the null hypothesis is rejected this means that the (FE) model is valid. In this research the Hausman test has been used rejecting the null hypothesis that the unobserved effect is uncorrelated with the explanatory variables, therefore the (FE) model has been used.

Based on recent literature the empirical evidence on the relationship between inflation and inequality is not clear. There is a controversy with examples of both positive and negative correlation. According to Albanesi (2001 and 2007), Amornthum (2004) and Bouvet (2010a, 2010b) inflation rate has a positive effect on inequality. Amornthum (2004) and Beckfield (2011) claim that unemployment has a negative effect on income inequality by shifting the wage earners toward the bottom of income distribution. Finally there are also some controversial results on the effect of GDP and openness as in White and Anderson (2001), Dollar and Kray (2002), Edwards (1997) and Higgins and Williamson (1999). These papers have found that openness by itself is associated with higher inequality. Bandelj and Mahutga (2010) get negative value for unemployment and GDP in logarithmic terms as a coefficient against inequality for Post-Socialist Countries[7].

The results of this research are reported in Table 4. The positive and significant coefficient of inflation shows that inflation has positive impact on income inequality. The relation with the log of GDP is negative, openness and employment has a positive coefficient. All variables and the overall model are statistically significant and the overall explanation ratio is 24%.

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[7] Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia.

Table 4. Fixed Effect Model Estimation

Dependent variable: Gini

Variable	Coef.	Std. Err.	t	
Inf	0.0264344	0.0118161	2.24	***
Empl	0.0005456	0.0002219	2.46	***
Open	0.0379633	0.0186417	2.04	***
Lgdp	-4.614954	1.999749	-2.31	***
F (4,97)	3.70***			
R square within		0.1325		
R square between		0.2537		
R square overall		0.2401		

*** Denotes significance at the 1 percent level;

The link between inequality and inflation is an issue of major concern with important policy implications. The findings of positive relationship would imply that policy makers should be concerned with the distributional implications of government policies.

4. Conclusions

The present research has considered the problem of relationship between income inequality and inflation for 13 EU countries by using a date set for the period 2000-2009. Using panel data estimation techniques such as the fixed effect and the random effect the study has constructed a fixed effect model based on a Hausman test which is consistent with previous studies and it has found that there is a positive relationship between income and inflation rate for the countries in question.

In addition some macroeconomic variables have been used such as the employment rate, the openness of the economy and the GDP as control variables which have been obtained theoretical and empirical support and applications from recent literature. The conclusion from the proposed model, which is consistent with other studies, is that all control variables increase the income inequality except GDP.

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Appendix 1. Gini Indices for 13 EU countries