# Government Social Expenditure and Income Inequalities in the European Union[*]

ÁNGELES SÁNCHEZ
*University of Granada*

ANTONIO L. PÉREZ-CORRAL
*University of Valladolid*

## Abstract

This paper analyzes the relationship between public social expenditure and income inequality distribution in the 28 Member States of the European Union, throughout the period 2005-2014. We estimate dynamic panel models. The results show the existence of a negative correlation between public social expenditure as a whole and income inequality. Distinguishing among different expenditure concepts, the association between social expenditure and income inequality may be different in the emerging Member States as compared to the rest of the States. In the emerging States, spending on health and spending on social protection are negatively associated with income inequality, and in the rest of States, this redistributive function is carried out only by spending on social protection. Spending on education is not significantly related to income inequality in any group of studied countries.

*Keywords*: Income inequality, government social expenditure, European Union, System GMM.

*JEL Classification*: D31, H51, H52, H53.

## 1. Introduction

The main goal of this study is to analyse the relationship between government social expenditure and income inequality in the 28 Member States of the European Union (EU) throughout the period 2005-2014.

During the last decades, inequality in income distribution has been rising in most countries of the world[1]. As a consequence of the economic crisis, the situation has worsened in several of the EU countries, and therefore income inequalities and poverty have reached very

high levels. The main explanations would be the greater reduction of the income of the population with lower incomes, due to the increase in the loss of relative weight of wages in the national income that had already been recorded since the 1980s, and also as a consequence of the policies of containment of public expenditure carried out in the EU[2].

Based upon Eurostat data (Income and Living Conditions) from 2007 to 2014, inequalities in disposable income of families in 18 of the Member States have increased. In Hungary, Spain, France, Denmark, Estonia and Sweden the Gini index of equivalent disposable income has increased between two and three percentage points in that period. This means that in such a short period of time, families with a disposable income below the median in the total distribution have transferred, approximately, between 4% and 6% of their income to the families above the median (Blackburn, 1989). The ratio of total income received by 20% of the population with the highest income to that received by 20% of the families with the lowest income (S80/S20) indicates that in nine Member States, in 2014, the richest families earned 5.2 times more than the poorest (5.2 is the EU's S80/S20 average in 2014); and in some countries this difference is: 7.2 times in Romania, 6.8 in Spain, 6.5 in Greece, Estonia and Latvia, and 6.2 in Portugal.

The increase in income inequalities has aroused great interest in the study of its consequences in different areas of well-being. Studies show that societies with less inequality in the income distribution enjoy larger life expectancy, as well as fewer rates of mortality, school dropout, mental illness and drug abuse (Babones, 2008; Elgar and Aitken, 2011; Wilkinson and Pickett, 2009). Furthermore, as Ostry, Berg and Tsangarides (2014) point out, attention must be paid to income inequality not only because it is socially or ethically undesirable, but also because it affects economic growth and economic stability. From a theoretical point of view, different theories predict both negative and positive effects of inequality in the distribution of income over economic growth[3]. Empirical works also state both kinds of relationship between income inequality and economy growth: negative (Dabla-Norris *et al.,* 2015; Ostry, Berg and Tsangarides, 2014), and positive (Forbes, 2000; Ortega-Díaz, 2006). Likewise, the effect of income inequality on economic growth can be positive if the part of the distribution with higher income is considered, and negative when the lowest income part is considered (Voitchovsky, 2005). It would also be necessary to differentiate among the types of inequality that are measured, since the inequality of opportunities is negatively associated with economic growth, and inequality of effort is associated in a positive way (Marrero and Rodríguez, 2013). In any case, inequality in the distribution of income could foster political instability and undermine the social consensus required to adjust to large shocks and, therefore, reduce the pace and durability of economic growth (Berg, Ostry and Zettelmeyer, 2012).

In this context, the reduction of income inequalities is among the priorities of the political agendas of many countries in order to curb social resentment, the outcrop of populism and protectionist sentiments that could lead to political instability (OECD, 2015). Taking into account, first, the increase in income inequalities registered in the last decade in the EU; second, that public spending programs seem more effective than progressive taxes in the goal

of reducing income inequalities[4]; and, third, that the conclusions on the contribution of each component of public social spending to the reduction of income inequalities differ according to the study, the analysis of the effects of public social spending on the distribution of income is very relevant. Likewise, and since the distributive incidence of public social spending is different depending on the type of economy analysed, recent studies reflect the relevance of distinguishing between groups of countries to analyse the effects of fiscal policy on income inequality, and also to deduce implications for public policies (IMF, 2014; Muinelo-Gallo and Roca-Sagalés, 2013).

In this study we analyse the association between public social spending -distinguishing the health, education and social protection programs- and the inequality in the distribution of income in the 28 Member States during 2005-2014. More specifically, we differentiate two groups of countries within the EU (emerging Member States[5] and the rest) and we study the possibility that the relationship between social spending and income is moderated by the characteristics of the countries. That is, we consider the possibility that the correlation between social spending and income inequality may be different in each of the two groups of countries studied. Despite their importance, these aspects have been scarcely studied so far.

The empirical strategy relies on dynamic econometric models. We use a homogeneous database provided by Eurostat. This aspect is key because the lack of homogeneity in the series, especially in inequality in the distribution of income, affects the results and makes comparison difficult (Galbraith, 2016; Doerrenberg and Peichl, 2014).

Our results show that public social spending correlates negatively with income inequality in the EU in the period of economic crisis, although not all expenditure components have the same incidence. One remarkable finding is that the incidence of public social spending and its components on income inequality is not the same in all countries. In the emerging states of the EU, spending on health and spending on social protection are negatively associated with income inequality, and in the rest of the EU countries, this redistributive function is carried out only by spending on social protection. Spending on education is not significantly related to income inequality.

The remainder of this work is structured as follows. The literature on government expenditures and income inequality is reviewed in section 2. The dataset and variables used in the analysis are presented in section 3. The empirical strategy to study the relationship between government expenditures and income inequality is described in section 4. In section 5 we provide the main results of our analysis. Finally, we discuss the conclusions in section 6.

## 2. Literature Review

In order to study the distributive incidence of government social expenditure, two methodological approaches are distinguished: partial equilibrium analysis of incidence, and regres-

sion analysis. In the first one, using some inequality indexes (for example, Gini or Theil), the household income inequality is compared before and after applying public social expenditure (cash transfers and in-kind public expenditure). If the index of inequality after public social spending is lower, it implies that the expenditure programs analysed have contributed to reduce inequalities in the distribution of income. Under this approach and in the context of the EU countries, the results of the empirical studies confirm that the different social public programs reduce income inequality, albeit with different intensity. For example, Calero and Gil (2014), in the case of Spain in 2010, analyse the redistributive incidence of government expenditure on health (in-kind) and education (in-kind and in cash), concluding that in-kind health and education expenditures have an identical redistributive capacity and higher than the in cash expenditure on education. Likewise, for the case of Spain, Goerlich (2016) analyses the redistributive impact of in-kind health and education expenditures over the period 2003-2013, showing that these two types of expenditure contribute to reducing income inequality. For the EU countries in 2007, Verbist and Matsaganis (2012) study the redistributive effect of in-kind health and education expenditures for people under 65 years old and in cash social benefits (old age pensions are not included). These authors show that these expenditures reduce income inequality. In addition, they conclude that the in-kind expenditures on health and education considered together have a greater redistributive capacity than social benefits. For the OECD countries, in 2000 Marical *et al.* (2008) and in 2007 OECD (2011) hold that expenditure on health and education have the greatest redistributive capacity.

With regard to the second approach, regression analysis is used and the estimation method varies depending on the nature of the studied data. As we briefly review below, literature consider three ways of dealing with public social spending: as a whole, distinguishing the components of social spending, and focusing on any of those components. In the first block, Doerrenberg and Peichl (2014), for the OECD countries over 1981-2005, analyse the relationship between government social expenditure and three measures of inequality, obtained from different databases[6]. They conclude that government social expenditure reduces the income inequality measured by the LIS Gini index, but they do not obtain significant results with the other data sources. For the authors, these results indicate that data on income inequality provided by different databases are hardly comparable. Muinelo-Gallo and Roca-Sagalés (2013), for 21 high-income countries of the OECD over 1972-2006, consider the Gini index of disposable income as a dependent variable and find a negative association between social expenditure and income inequality. It is worth noting that they detect a different performance in the use of social expenditure policies between richer and less rich countries: the richer use social expenditure more intensely than the less rich. Therefore, this would be pointing out the existence of an interaction between social expenditure and the characteristics of the country.

In the second block, in which the incidence of public social expenditure has been studied in a disaggregated way, Martínez-Vázquez, Vulovic and Moreno (2012), for a sample of developed and developing countries over 1970-2009, show that when they analyse each of the four components of social expenditure individually (social protection, education, health and housing), and without taking into account the tax structure, there is a negative relationship with income inequality. However, when they consider the four items of social expendi-

ture and the tax structure, only social protection expenditure correlates negatively with income inequality. Holzner (2011) in a sample of Central, Eastern and Southeast European countries over 1996-2005, analyses the relationship between public social expenditure on health, education, and social protection and income inequality. The results of this paper show that health and social protection expenditures are negatively related to income inequality, not finding any association for education expenditure. Marrero and Rodríguez (2012), for 23 European countries in 2005, use correlations to analyse the impact of different items of social expenditure on income inequality (measured by the Theil index) and inequality of opportunities. Specifically, the items analysed are expenditures on unemployment benefits, old age pensions, childcare, disability, health care and social exclusion. These authors find that all expenditure items analysed are negatively correlated with both inequality measures.

Lastly, in the third block, where the incidence of a single concept of social expenditure on income inequality has been analysed, we would highlight the following papers. In the EU Member States for the period 1993-2007, Niehues (2010) shows that expenditures on social benefits as a whole, are negatively associated with income inequality (measured by the Gini index of disposable income). When the expenditure on social benefits is disaggregated, only expenditures on unemployment, old age pensions and disability have a negative correlation with income inequality. For the regions of some European countries in the years 1995 and 2000, Perugini and Martino (2008) conclude that social protection expenditure is negatively associated with income inequality, measured in 1995 by the Gini index of disposable income and in 2000 by the P90/P10 ratio.

To sum up, the literature shows a negative association between public social expenditure as a whole and income inequality. Differentiating by components of expenditure, social benefits also correlate negatively with income inequality, but the studies are inconclusive with respect to the relationship between other components of social expenditure and income inequality.

Another noteworthy aspect is that the relationship between government social expenditure and income inequality may depend on the type of economy analysed, that is, there could be an interaction between government expenditure and the characteristics of the country analysed. For the specific case of the EU, Wan (2002) highlights the convenience of taking into account the presence of countries with transitional or emerging economies, in the studies on distributive incidence of public spending. This fact would be justified because in the years prior to the transition process, emerging countries shared the same levels of income inequality and the same redistributive policies and, in addition, their development mechanisms and reform strategies of their economies are similar.

## 3. Data and Variables

In this study, we used highly balanced panel data on income inequality, government social expenditure and other control variables of the 28 Members States of EU, over 10 years

(2005-2014)[7]. Appendix 1 contains the description of variables analysed and Eurostat database from which the statistical information comes. An important aspect is that our data have been obtained with homogeneous methodological criteria.

### 3.1. Income Inequality and Explanatory Variables

The dependent variable in this study is the income inequality measured by the Gini index of equivalent disposable income, which is the most used inequality index in this type of studies[8]. The explanatory variables of government social expenditure are health, education, social protection, and the sum of these three items (see Appendix 2). Next, we briefly describe the rest of explanatory variables and justify their inclusion in the models.

The study of the distributive incidence of public expenditure must be done in conjunction with the study of the tax structure -or relationship between direct and indirect taxes-, since the effects of public expenditure policies on the economy may be different depending on how they are financed (Burgess and Stern, 1993; Marrero, 2010; Marrero and Novales, 2007). To consider the effects of the tax structure, we include the variable *Tax structure.*

According to recent literature, the growth rate of GDP per capita (*GDPpc growth*) is introduced in the model to take into account the influence of economic growth on income inequality (Chan, Zhou and Pan, 2014; Kus, 2012, Muinelo-Gallo and Roca-Sagalés, 2011, 2013).

In connection with Becker's theory of human capital (1965), several studies conclude that increases in educational level are associated with reductions in income inequality (De Gregorio and Lee, 2002; Larionova and Varlmova, 2015). The justification would be that the more a worker is trained, the more opportunities he/she has for employment and it is more likely for him/her to opt to a higher remuneration, which tends, in turn, to reduce wage differences. Following González and Martner (2012), the *Human capital index* has been included as a variable that reflects the educational level of a country.

Female unemployment is one of the social conditions most strongly correlated with income inequality (Albrecht and Albrecht, 2007; Kollmeyer, 2013). In fact, it has a stronger negative correlation with income inequality and poverty than male unemployment (Burniaux, Padrini and Brandt, 2006; European Commission, 2013). Following Marrero, Rodríguez and van der Weide (2016), we incorporate the female unemployment rate (*Female unemployment*) in our models.

The aging of the population and income inequality may be related, since, in general, the older people who have left the labour market have lower average incomes and are more exposed to poverty than the rest of population (Guerin, 2013; Marical *et al.,* 2008; Peichl, Pestel and Schneider, 2012). In order to control for aging of the population, we incorporate the variable *Population aged 64.*

### 3.2. A First Approach to Data: Two Groups of Member States

Table 1 shows the descriptive statistics of the studied variables. Given that with panel data the objective is to explain the greater proportion of the variance in all possible directions (between and within), the information in Table 1 allows us to deduce that most of the variability in our database has a cross-section nature. As observed, except for the variable *GDPpc growth*, in all the others the standard deviation between countries is greater than within countries.

**Table 1**
**DESCRIPTIVE STATISTICS, 28 MEMBER STATES OF EUROPEAN UNION (2005-2014)**

| Variable | | Mean | Standard deviation | Minimum | Maximum | Observations Number countries Number year |
|---|---|---|---|---|---|---|
| Gini | Total | 29.75 | 3.91 | 22.70 | 38.90 | 272 |
| | Between | | 3.77 | 23.75 | 36.29 | 28 |
| | Within | | 1.19 | 26.69 | 35.90 | 9.71[a] |
| G.E. Social | Total | 27.81 | 5.37 | 16.90 | 40.90 | 280 |
| | Between | | 5.11 | 19.12 | 38.50 | 28 |
| | Within | | 1.89 | 23.41 | 34.42 | 10 |
| G.E. Health | Total | 6.20 | 1.44 | 2.60 | 8.90 | 280 |
| | Between | | 1.39 | 2.88 | 8.21 | 28 |
| | Within | | 0.46 | 4.30 | 7.28 | 10 |
| G.E. Education | Total | 5.31 | 0.98 | 2.80 | 7.60 | 280 |
| | Between | | 0.94 | 3.62 | 6.78 | 28 |
| | Within | | 0.32 | 4.49 | 6.64 | 10 |
| G.E. Social Protection | Total | 16.29 | 3.96 | 7.90 | 25.40 | 280 |
| | Between | | 3.77 | 10.36 | 23.60 | 28 |
| | Within | | 1.39 | 13.04 | 20.69 | 10 |
| Tax structure | Total | 1.69 | 0.46 | 0.80 | 2.80 | 280 |
| | Between | | 0.45 | 0.85 | 2.62 | 28 |
| | Within | | 0.11 | 1.40 | 2.13 | 10 |
| GDPpc growth | Total | 1.30 | 4.12 | -14.60 | 12.90 | 280 |
| | Between | | 1.70 | -1.95 | 4.73 | 28 |
| | Within | | 3.77 | -17.33 | 10.31 | 10 |
| Human capital index | Total | 2.89 | 1.37 | 0.40 | 7.10 | 280 |
| | Between | | 1.32 | 0.52 | 5.87 | 28 |
| | Within | | 0.43 | 1.86 | 4.13 | 10 |
| Female unemployment | Total | 9.25 | 4.40 | 3.70 | 31.40 | 280 |
| | Between | | 3.56 | 5.10 | 19.46 | 28 |
| | Within | | 2.66 | 1.29 | 21.19 | 10 |

(*Continued*)

| Variable | | Mean | Standard deviation | Minimum | Maximum | Observations Number countries Number year |
|---|---|---|---|---|---|---|
| People aged 64 | Total | 16.49 | 2.28 | 10.80 | 21.40 | 280 |
| | Between | | 2.18 | 11.40 | 20.43 | 28 |
| | Within | | 0.75 | 14.67 | 19.27 | 10 |

*Note: G.E.= Government Expenditure. ªNumber of average observations per country. Government expenditure data in percentage of GDP. Adapted from Eurostat: Income and Living Conditions, Government Finance Statistics, Annual National Accounts, Labour Force Survey, Education and Training, and Population.*

Focusing on the mean values by country of the variables G.E. Social and Gini, in the period analysed, Denmark registers the highest mean government expenditure (38.50) and Romania the lowest (19.12). The mean Gini index of Denmark (25.93) is below the mean of all observations (29.75) and the mean Gini index of Romania (34.91) is above it. In general, there is a negative relationship between these two variables, since the countries with the highest values in government social expenditure have the lowest values in income inequality (for example: Denmark, Sweden, Finland, Austria, Belgium and France). It is also observed that the countries with the lowest values in government social expenditure report the highest levels of income inequality (for example: Romania, Latvia, Bulgaria, Lithuania, Estonia, Poland and Spain). As a first overview, the Pearson correlation coefficient between *G.E. Social* and *Gini* indicates the existence of a negative and statistically significant correlation (coefficient = -0.4595, $p < 0.001$, N = 272). Figure 1 shows this inverse relationship.
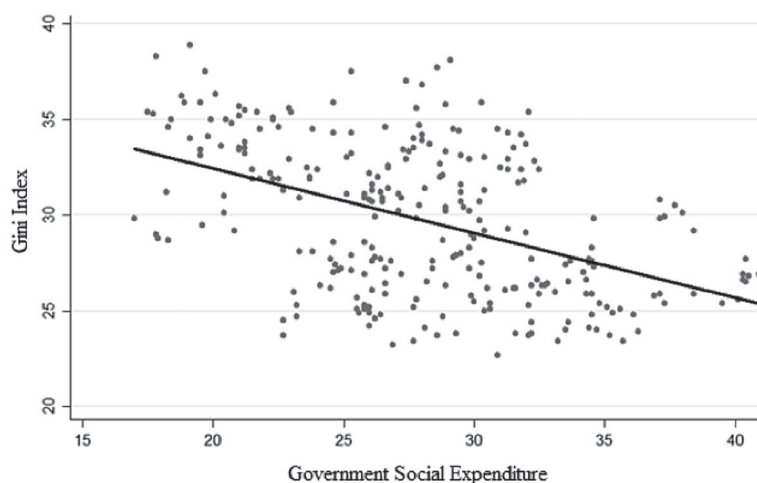


**Figure 1: Scatter plot of Gini Index of equivalesed disposable income and Government Social Expenditure in 28 Member States of European Union, 2005-2014 (n = 272). Government expenditure measured as a percentage of GDP. Adapted from Eurostat: Income and Living Conditions, and Government and Finance Statistics**

In addition to the negative correlation between the Gini index and government expenditure, these findings indicate a different performance between the emerging Member States or countries with economies in transition[9] and the rest. The results in Table 2 show that there are statistically significant differences in the Gini index of equivalent disposable income, in the levels of public social expenditure and in the tax structure between the group of 11 emerging Member States and the group of the 17 remaining Member States. Specifically, in the emerging Member States the income inequality in average terms is greater, the social expenditure is lower in all its items, and the tax structure is less progressive. Thus, as several reports point out, part of the income inequality in the emerging Member States could be explained by these differences in fiscal policy (Bastagli, Coady and Gupta, 2012; IMF, 2014).

**Table 2**
**DIFFERENCES BETWEEN THE MEMBER STATES OF EUROPEAN UNION, 2005-2014**

| Variables | Mean | | Mann-Whitney test |
|---|---|---|---|
| | Emerging States[a] | Rest States[b] | Z (p-value) |
| Gini[c] | 30.52 | 29.29 | -2.115 (0.0344) |
| G.E. Social[d] | 24.26 | 30.11 | 9.286 (0.0000) |
| G.E. Health[d] | 5.43 | 6.70 | 7.813 (0.0000) |
| G.E. Education[d] | 5.13 | 5.44 | 2.300 (0.0215) |
| G.E. Social Protection[d] | 13.70 | 17.97 | 9.009 (0.0000) |
| Tax structure[d] | 1.40 | 1.87 | 8.647 (0.0000) |

*Note: G.E.= Government Expenditure. [a] Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. [b] Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Holland, Ireland, Italy, Luxembourg, Malta, Portugal, Spain, Sweden and United Kingdom. [c] n = 272.*
*[d] n = 280.*

In order to contrast this possibility, we include the variable *Emergent* that takes the value "1" if the country belongs to the group of emerging Member States, and "0" otherwise. This variable is included to capture the common causes of income inequality in the group of countries with emerging economies that cannot be captured with the other explanatory variables, and allows us to contrast the interaction with government social expenditure[10]. That is, we contrast the hypothesis that the relationship between government social expenditure and income inequality could be conditioned by the fact that a country is an emerging economy. In other words, we study whether the correlation between public expenditure and income inequality is different in the emerging Member States compared to the rest of the Member States.

## 4. Empirical Strategy

An advantage of panel data is that they allow us to analyse dynamic relationships. This is the case of a large number of economic relationships, including income inequality (Belke

and Wernet, 2015; Claus, Martínez-Vázquez and Vulovic, 2013; Martínez-Vázquez *et al.*, 2012; Niehues, 2010). Dynamic relationships are characterized by the presence of a lagged dependent variable among the explanatory variables (Baltagi, 2014; Hsiao, 2003). In our case, income inequality in a current year depends on its level in the previous year, the government social expenditure and a set of variables analysed in a previous section.

Equation (1) shows the specification of the model:

$$I_{it} = \omega_0 + \rho' I_{it-1} + \gamma' G_{it-1} + \lambda' E_i + \eta' G_{it-1} \times E_i + \beta' X_{it-1} + \mu' TD_t + \alpha_i + u_{it} \qquad (1)$$

where $i$ denotes the country and $t$ the year. $I_{it}$ is the income inequality in the country $i$ in the year $t$; $I_{it-1}$ is the one-year lagged income inequality; $G_{it-1}$ represents the one-year lagged variables of government social expenditure; $E_i$ is the variable dummy, to be emergent Member State; $G_{it-1}xE_i$ is the interaction term that reflects the effect of being an emergent Member State on the distributive incidence of government social expenditure; $X_{it-1}$ is a set of one-year lagged socio-economic variables where tax structure is included; $TD_t$ is a time dummy which account for yearly changes that are the same for all countries in order to contrast the existence of an effect common to all countries changing over time; $\alpha_i$ is the individual effect of each of the countries invariant in time; and $u_{it}$ is the error term.

The independent variables are lagged one year because, according to the literature, their effects are not contemporaneous. Likewise, the use of the $TD_t$ time dummy and the individual effects $\alpha_i$ allows dealing with the bias due to omission of variables (see Afesorgbor and Mahadevan, 2016; Muinello-Gallo and Roca-Sagalés, 2013).

In the estimation of equation (1) may arise several econometric problems (namely, endogeneity and unobservable heterogeneity) that should be addressed. With reference to the first, the variables representing government social expenditures –among others– are likely to be endogenous due to reverse causality. In that case, the strict exogeneity of the regressors is not observed and the regressors may be correlated with the error term. The second problem is the unobservable heterogeneity which is referred to the fact that each country has individual characteristics invariant in time but not independent of the explanatory variables. These situations could lead to biased an inconsistent estimates (Hsiao, 2003; Wooldridge, 2010).

The System Generalized Method of Moments (System GMM) allows us to make consistent estimates that address problems of endogeneity and unobservable heterogeneity (Baltagi, 2014). The System GMM estimator, developed by Arellano and Bover (1995) and Blundell and Bond (1998), jointly estimates a system that includes equations with the variables in levels and in first differences. More specifically, to deal with the problems of endogeneity, System GMM uses the differences of the lags and the lags in levels of the variables as instruments. Likewise, System GMM eliminates the effect of the individual characteristics of the countries (unobservable heterogeneity) by using first differences[11]. In addition, System GMM preserves cross-section variability (Bond, Hoeffler and Temple, 2001).

The validity of the System GMM estimator is subject to two conditions: the absence of second-order autocorrelation in the error term, and the validity of the instruments, which should not be correlated with the error term. To test the first condition, the Arellano-Bond AR test (2) is used, which contrasts the null hypothesis "there is no second order autocorrelation"[12]. The second check refers to the instruments used. The over identifying restrictions test of Hansen (1982) allows us to contrast the absence of correlation between the instruments and the error term. The null hypothesis is that the instruments are exogenous, which would indicate that they are valid since they are not correlated with the error term. Additionally, Roodman (2009b) shows that the use of too many instruments can cause over estimation of the endogenous variables and weaken the ability of the Hansen's test to detect the instruments' validity. In order to avoid these problems we use as few instruments as possible, thus we limit the number of lags to two and use the collapsed instrument matrix[13].

## 5. Results

Table 3 shows the results of the models estimated with System GMM, considering the total government social expenditure (model 3) and its components (model 6). In order to give more robustness to the results, four additional models have been included in which no distinction is made between emerging countries and the rest (models 1, 2, 4 and 5). Models 1 and 4 are reduced models that only include social expenditure variables, *Tax structure* and *GDPpc growth.* Models 2 and 5 incorporate all the control variables, in addition to the variables of the reduced model. The results of these models will serve us as a comparison to the results of the full models (models 3 and 6).

**Table 3**
**REGRESSION ANALYSIS: GOVERNMENT SOCIAL EXPENDITURE AND INCOME INEQUALITY IN THE MEMBER STATES OF EUROPEAN UNION, 2005-2014. SYSTEM GMM ESTIMATION**

| Dependent variable: Gini | System GMM | | | | | |
|---|---|---|---|---|---|---|
| | **(1)** | **(2)** | **(3)** | **(4)** | **(5)** | **(6)** |
| $Gini_{(t-1)}$ | 0.635*** | 0.565*** | 0.581*** | 0.755*** | 0.504*** | 0.636*** |
| | (0.086) | (0.083) | (0.100) | (0.121) | (0.134) | (0.093) |
| G.E. Social$_{(t-1)}$ | -0.270** | -0.164 | -0.208** | | | |
| | (0.130) | (0.111) | (0.082) | | | |
| G.E. Social$_{(t-1)}$*Emerging | | | -0.240* | | | |
| | | | (0.135) | | | |
| G.E. Health$_{(t-1)}$ | | | | -0.395 | 0.017 | 0.313 |
| | | | | (0.415) | (0.431) | (0.317) |

(*Continued*)

| Dependent variable: Gini | System GMM | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| G.P. Health$_{(t-1)}$*Emerging | | | | | | -1.314*** |
| | | | | | | (0.489) |
| G.P. Education$_{(t-1)}$ | | | | -0.822 | -0.547 | -0.330 |
| | | | | (0.774) | (0.564) | (0.464) |
| G.P. Education$_{(t-1)}$ *Emerging | | | | | | -0.315 |
| | | | | | | (0.579) |
| G.P. Social Protection$_{(t-1)}$ | | | | -0.321 | -0.468* | -0.391** |
| | | | | (0.217) | 0.244 | (0.161) |
| G.P. Social Protection$_{(t-1)}$* Emerging | | | | | | 0.057 |
| | | | | | | (0.250) |
| Tax structure$_{(t-1)}$ | 0.928 | -0.367 | -0.061 | 2.163 | 0.915 | 0.480 |
| | (1.146) | (1.329) | (1.097) | (1.580) | (1.410) | (0.810) |
| GDPpc growth$_{(t-1)}$ | -0.066 | -0.042 | -0.116** | 0.090 | -0.092 | -0.117** |
| | (0.048) | (0.043) | (0.045) | (0.070) | (0.057) | (0.058) |
| Human capital index$_{(t-1)}$ | | -0.119 | 0.095 | | -0.494 | 0.172 |
| | | (0.294) | (0.348) | | (0.379) | (0.275) |
| Female unemployment $_{(t-1)}$ | | 0.098*** | 0.098** | | 0.079* | 0.126*** |
| | | (0.036) | (0.040) | | (0.047) | (0.045) |
| People aged 64$_{(t-1)}$ | | 0.004 | 0.047 | | 0.239 | 0.130 |
| | | (0.290) | (0.217) | | (0.415) | (0.228) |
| Emerging | | | -1.602** | | | -1.761** |
| | | | (0.806) | | | (0.848) |
| Observations (countries) | 244 (28) | 244 (28) | 244 (28) | 244 (28) | 244 (28) | 244 (28) |
| Number instruments | 17 | 23 | 26 | 21 | 27 | 34 |
| Hansen test (p-value) | 0.117 | 0.240 | 0.219 | 0.151 | 0.425 | 0.881 |
| AR(1) (p-value) | 0.001 | 0.001 | 0.000 | 0.001 | 0.003 | 0.000 |
| AR(2) (p-value) | 0.488 | 0.377 | 0.483 | 0.487 | 0.369 | 0.637 |
| Wald (p-value) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

*Note: G.E.= Government Expenditure; GMM= Generalized Method of Moments. Standard errors in parentheses. A constant term and time dummies are included in all models. The collapse instrument matrix is used in all models. In the models with interaction term, the government expenditure variables are centered with respect to their means.*
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.*

The results of the last rows of Table 3 indicate that the estimated models verify the validity conditions of the System GMM method, namely there is no second order autocorrelation

and the instruments used are valid (results of the Hansen's test). Likewise, the results of the Wald's test of all the models allow us to reject the hypothesis that the parameters of the explanatory variables as a whole are zero.

Table 4 shows the effect of total government social expenditure and its items on income inequality, ceteris paribus, in the emerging Member States and in the group of the remaining 17 Member States. Following the recommendation of Wooldridge (2010), to analyse if the interaction effect between government expenditure and being an emerging Member State is statistically significant, we analyse the joint significance of their corresponding estimated parameters. The right column of Table 4 shows the results of the Wald test of joint significance of the parameters of the social expenditure variables and of the interaction variables. For emerging Member States, the marginal effect of a variable is equal to the estimated coefficient of the variable plus the estimated coefficient of the interaction variable with the Emerging dummy variable.

**Table 4**
**MARGINAL IMPACT OF GOVERNMENT SOCIAL EXPENDITURE ON INCOME INEQUALITY IN THE MEMBER STATES OF EUROPEAN UNION, 2005-2014**

|  | Emerging States[a] | Rest States[b] | P-value of Wald Test |
|---|---|---|---|
| G.E. Social | -0.449 | -0.208 | 0.002 |
| G.E. Health | -1.000 | 0.313 | 0.025 |
| G.E. Education | -0.641 | -0.330 | 0.292 |
| G.E. Social Protection | -0.334 | -0.391 | 0.043 |

*Note: G.E.= Government Expenditure. [a] Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. [b] Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Holland, Ireland, Italy, Luxembourg, Malta, Portugal, Spain, Sweden and United Kingdom.*

With regard to the variables of government expenditure, a negative relationship is observed between government social expenditure as a whole and the Gini coefficient. That is, a greater effort in social expenditure could be associated with a reduction in income inequality. The marginal impact analysis (Table 4) indicates that the redistributive capacity of government social expenditure in the emerging states is greater than in the rest of the Member States. More specifically, for each percentage point of increased government social expenditure in the emerging Member States above the EU mean (27.81% of GDP), a reduction of 0.45 points in the Gini index would be expected. However, in the rest of the 17 Member States the reduction in the Gini index would be 0.21 points. Nevertheless, taking into account that the average social expenditure in the emerging Member States is 24.26% of GDP, a large budgetary effort in the emerging economies would be necessary to reduce income inequalities at the predicted level.

As we expected, the results for government social expenditure items are different from the results for social expenditure as a whole. Health expenditure is negatively related to income inequality in the emerging Member States and positively in the rest of the States. In

addition, health expenditure is the social expenditure with the greatest distributive capacity in the emerging states. Education expenditure does not affect income inequality. Lastly, social protection expenditure correlates negatively with income inequalities in both groups of countries.

Focusing on the additional models in which there is no distinction between emerging Member States and the rest (Table 3, models 1, 2, 4, and 5), some findings could be extracted that add robustness to our results. The reduced model 1 indicates a negative relationship between government social expenditure and income inequality. When the control variables are incorporated into the reduced model, the relation between total social expenditure and income inequality ceases to be significant (model 2) and, if we differentiate by expenditure items, only social protection expenditure correlates negatively with income inequality (model 5). These results show the convenience to differentiate between emerging Member States and the rest of States, in order to identify the existence of correlations between social expenditure and income inequality. That is, if we ignore the existence of this interaction effect, we would be generating deceptive results that could lead to misleading implications for public policies.

As another studies have shown (Belke and Wernet, 2015; Claus, Martínez-Vázquez y Vulovic, 2013), the high significance and the large coefficient of the Gini index of the previous year, show a great persistence of inequality in the distribution of income in the short term. In quantitative terms, the increase in the Gini index in the previous period in a standard deviation would be associated with an increase in the Gini index of the following period between 2.27 and 2.49 points (depending on whether public social expenditure as a whole –model 3– or by components -model 6- is considered). In addition, the value of the estimated coefficient (less than one) would indicate the existence of convergence in income inequality within the Member States.

Lastly, with regard to the control variables, although initially a more equitable distribution of income requires a more progressive tax system, the empirical evidence is inconclusive (see the review of Martínez-Vázquez and Vulovic, 2014). In our case, the tax structure is not statistically correlated with income inequality[14]. Another remarkable result of our study is that, in line with Muinelo-Gallo and Roca-Sagalés (2011 and 2013), in the EU economic growth and income inequality are inversely related. Thus, the crisis context with low growth rates of GDP per capita, even with economic recession in several Member States, would help to explain the increase in income inequality in a large part of the EU. Likewise, in our models, the increase in female unemployment correlates positively with an increase in income inequality, as the studies of Albrecht and Albrecht (2007) and Kollmeyer (2013) have shown. Therefore, as OECD (2015) concludes, social policies should promote public expenditure programs aimed to reduce the female unemployment rate and to increase the presence of women in the labour market. The variables *Human Capital index and People aged 64* are not statistically significant, probably because their effect on income inequality is picked up by the Gini index of the previous year.

## 6. Conclusions and Discussion

In this study we analyse the incidence of government social expenditure and its items (health, education, and social protection) on income inequality in the EU28, over 2005-2014. We also analyse whether the redistributive capacity of government social expenditure can be different depending on the group of EU countries: 11 emerging Member States and the remaining 17 States.

Our results indicate that total government social expenditure correlate negatively with income inequality. That is, given the EU context of economic crisis and the policies to ensure sustainability of public finance displayed for most of the studied time period, reductions in social expenditure and increases in income inequality could be associated. However, the components of the government social expenditure show different relationship with income inequality. Likewise, our findings lead us to argue the existence of an interaction effect, so that the association between social expenditure and income inequality may be different in the emerging Member States as compared to the rest of the States.

More specifically, government social expenditure as a whole could have greater capacity to reduce income inequality in the emerging Member States than in the rest of the countries. Nevertheless, taking into account that in emerging economies the mean of social expenditure is almost 4 percentage points lower than the EU28 mean, a large budgetary effort would be necessary. Although these countries have reduced their differences in terms of macroeconomic indicators with the rest of the Member States, they have not yet finalized their convergence process in their welfare states (Caminada, Goudswaard and Koster, 2012; Roaf, Atoyamn, Joshi and Krogulski, 2014).

Distinguishing by components of government social expenditure, expenditure on health programs has the highest negative correlation with income inequality in the emerging Member States. Conversely, in the rest of the economies it is associated with greater income inequality. This performance could be justified, to a large extent, by the fact that health expenditure affects the entire population regardless of their income level, so that it benefits the lowest income Member States to a greater extent (among which emerging states are) and, within them, the lowest income strata (Goerlich, 2016; Smeeding, Tsakloglou and Verbist, 2008). In other words, improvements in health benefits in countries that have lower standards are more efficient in reducing income inequality. However, in the Member States with the highest income, the reduction of income inequality is not the principal objective of expenditure on health, but the provision of a merit good (Niehues, 2010).

The results indicate that social expenditure on education does not have a statistically significant influence on income inequality in the EU (neither in the emerging group nor in the rest). This finding could be due to the composition of expenditure on education, in-kind or cash transfers, as well as to the distribution of expenditure between the different levels of education (Manzano and Salazar, 2009; Zhang, 2008). In this line, as several reports of the European Commission have explained, the educational changes that have taken place in the

EU in the last decades are associated with a polarization of wages, thus the European education system could contribute in the future to the increase of income inequalities[15].

According to the literature, in our study, expenditure on social protection plays a redistributive role in all the economies analysed. However, in the emerging Member States there is a weaker relationship with income inequality compared to the rest of the Member States. As several studies have shown, the explanation could be in the difference in the systems of conditional transfers and benefits, since, in general, in the emerging Member States both benefits and average transfers, as well as the number of beneficiaries, are lower (Bastagli, Coady and Gupta, 2012; Ferrarini and Sjöberg, 2010; Roaf *et al.*, 2014). In fact, it is the item with the greatest difference in average expenditure between the emerging Member States (13.70% of GDP) and the remaining 17 Member States (17.97% of GDP). Therefore, it could be inferred that the emerging Member States have room for improvement in their public expenditure policies on social protection and achieve similar levels of redistribution to the remaining 17 countries of the EU.

Lastly, it is worth noting that the multivariate regression analysis developed to study the distributive incidence of social expenditure should be considered as complementary to other methodological approaches (Claus, Martínez-Vázquez and Vulovic, 2013). Additionally, future research could analyse the impact of government social expenditure on income inequality, distinguishing between public expenditure programs (for example, primary, secondary and tertiary education; pensions and unemployment, etc.), and the implementation method of the programs (in-kind or in cash transfers) in the two groups of analysed countries.

# Appendix

**Appendix 1**
**DESCRIPTION AND SOURCE OF THE VARIABLES**

| Variable | Description | Eurostat Database |
|---|---|---|
| Gini | Gini index of equivalent disposable income. Disposable household income includes income from employment and self-employment, capital income and public social benefits in cash after deducting taxes and social security contributions paid by family members. Income is adjusted according to OECD modified equivalence scale. | Income and Living Conditions |
| G.E. Social | Government social expenditure. Sum of public expenditure on health, education and social protection of the General Government of each country (Central Government, State Government, Local Government and Social Security Funds) as percentage of GDP. | Government and Finance Statistics |
| G.E. Health | Government expenditure on health of the General Government of each country (Central Government, State Government, Local Government and Social Security Funds) as percentage of GDP. | Government and Finance Statistics |
| G.E. Education | Government expenditure on education of the General Government of each country (Central Government, State Government, Local Government and Social Security Funds) as percentage of GDP. | Government and Finance Statistics |
| G.E. Social Protection | Government expenditure on social protection of the General Government of each country (Central Government, State Government, Local Government and Social Security Funds) as percentage of GDP. | Government and Finance Statistics |
| Tax structure | According to Martínez-Vázquez and Vulovic (2014), the tax structure is the total of direct taxes (as a percentage of GDP) divided by the total of indirect taxes (as a percentage of GDP). | Government and Finance Statistics |
| GDPpc growth | Annual growth rate of GDP per capita. | Annual National Accounts |
| Human capital index | According to González and Martner (2012) the index of human capital is the sum of the percentage of people with educational levels 3 and 4 (Middle Education) and the percentage of people with educational level from 5 to 8 (Higher Education), divided by the percentage of people with a level from 0 to 2 (Lower Education)[a]. | Education and Training |
| Female unemployment | Percentage of unemployed women in the labour force. | Labour Force Survey |
| People aged 64 | Percentage of population over 64 years of age. | Population |

*Note: [a] The educational levels are based on the International Standard Classification of Education (ISCED) of UNESCO.*

**Appendix 2**
**CONCEPTS OF GOVERNMENT SOCIAL EXPENDITURE**

| Type of government social expenditure | Concepts |
|---|---|
| 07. Health | 07.1 Medical products, appliances and equipment |
| | 07.2 Outpatient services |
| | 07.3 Hospital services |
| | 07.4 Public health services |
| | 07.5 R&D Health |
| | 07.6 Health n.e.c. |
| 09. Education | 09.1 Pre-primary and primary education |
| | 09.2 Secondary education |
| | 09.3 Post-secondary non-tertiary education |
| | 09.4 Tertiary education |
| | 09.5 Education not definable by level |
| | 09.6 Subsidiary services to education |
| | 09.7 R&D Education |
| | 09.8 Education n.e.c. |
| 10. Social protection | 10.1 Sickness and disability |
| | 10.2 Old age |
| | 10.3 Survivors |
| | 10.4 Family and children |
| | 10.5 Unemployment |
| | 10.6 Housing |
| | 10.7 Social exclusion n.e.c. |
| | 10.8 R&D Social protection |
| | 10.9 Social protection n.e.c. |

*Note: The educational levels are based on the International Standard Classification of Education (ISCED) of UNESCO.*

## Notes

1.  See Galbraith (2012), IMF (2014), Immervoll and Richardson (2011), OECD (2015), Piketty (2014), Sjoberg (2009).

2.  See Agnello and Sousa (2014), De Beer (2012), Fredriksen (2012), Immervoll, Peichl and Tatsiramos (2011), OECD (2011), Piketty and Sáez (2013).

3.  See the review carried out in OECD (2015, chapter 2), as well as the explanations that justify these relationships.

4.  See, for instance, Capó Parrilla (2008), Claus, Martínez-Vázquez and Vulovic (2013), Goerlich (2016), OECD, (2008), Wang and Caminada (2011).

5.    Eleven countries in Central East and Southeast Europe that joined the EU from 2004.

6.    The inequality measures have been prepared by the Luxembourg Income Study (LIS), United Nations World Income Inequality (WIID) and University of Texas Inequality Project (UTIP).

7.    Because 11 of the Member States that make up the current EU have joined since 2004, there is no previous statistical information for the variables analysed. In addition, for some countries, information on some variables is not available in 2005.

8.    See for instance Holzner (2011), Huber, Mustillo and Stephens, (2008), González and Martner (2012), Muinelo-Gallo and Roca-Sagalés (2013), Niehues (2010), OECD (2015), Ospina (2010), Ostry, Berg and Tsangarides (2014), and Perugini and Martino (2008).

9. "  According to Bastagli, Coady and Gupta (2012) the following countries are emerging economies of the EU: Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. Together with Cyprus and Malta, the emerging Member States have been the last to join the EU since 2004.

10.    The government expenditure variables are centered with respect to the mean (to each value of the variable has been subtracted the mean value of all the observations). This allows us to interpret the estimated coefficients in a simple way, in terms of the mean values of government expenditure, and also avoids to work with a variable interaction that would be redundant with the other two variables from which it was obtained.

11.    Given that $\alpha_i$ is the individual effect of each of the countries invariant in time, the first difference is equal to zero: $\Delta\alpha_i = \alpha_i - \alpha_i = 0$.

12.    By definition, first-order autocorrelation must always exist due to the application of first differences, otherwise it would mean that there are no dynamic effects.

13.    We perform the estimation with Stata xtabond2 command, which has been developed by Roodman (2009a) for the System GMM estimator.

14.    A model that takes into account the interaction between the tax structure and being an emerging Member State has also been estimated. The results show that there is no interaction effect. In addition, the estimated parameters and level of significance of the government expenditure variables remain practically unchanged, and the results of the Hansen test and the number of instruments worsen. For the sake of clarity, the results of these models have not been included in the results table.

15.    See Perrons and Plomien (2010) where they analyse the results of the research projects INEQ, RESIST, LoWER3 and EQUALSOC promoted by the European Commission, Directorate-General for Research, Socio-Economic Sciences and Humanities.

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**Resumen**

Este artículo analiza la relación entre gasto público social y la desigualdad en la distribución del ingreso en los 28 Estados miembros de la Unión Europea, a lo largo del periodo 2005-2014. Estimamos modelos de panel dinámicos. Los resultados muestran la existencia de una correlación negativa entre el gasto púbico social en conjunto y la desigualdad de ingresos. Distinguiendo entre los diferentes conceptos de gasto, la asociación entre gasto social y desigualdad puede ser distinta en los Estados miembros emergentes en comparación con el resto de Estados. En los Estados emergentes, el gasto en salud y en protección social se asocia negativamente con la desigualdad, y en el resto de Estados la función redistributiva solo es llevada a cabo por el gasto en protección social. El gasto en educación no está significativamente relacionado con la desigualdad en ingresos en ninguno de los dos grupos de países estudiados.

*Palabras clave:* Desigualdad de ingresos, gasto público social, Unión Europea, System GMM.

*Clasificación JEL*: D31, H51, H52, H53