

WORKING PAPER

Income Inequality and Economic Freedom in the EU countries

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Abstract

Over the past decades there have been considerable changes in policies and institutions in favor of economic freedom in the EU countries. This trend coincides with widespread increases in income inequality in numerous member states. To what extent does economic freedom encourage inequality? This paper examines the relationship between economic freedom and income inequality in the EU countries using panel data for the 2000s. The empirical evidence suggests that economic freedom seems to entail greater income inequality. However, not all areas of economic freedom affect income distribution similarly. While government size and regulation appear to be robustly associated with income inequality, legal system and property rights, sound money, and freedom to trade internationally seem not to be significantly related with income distribution in the European context.

Keywords: Economic freedom; Income inequality; European Union

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I. Introduction

Economic freedom constitutes the essence of the market economy and of the power of Adam Smith's invisible hand in terms of economic prosperity for society as a whole. Nowadays there is great awareness of the importance for economic growth of institutional factors related to economic freedom, including the rule of law, security of property rights, openness of the political process, limitations on the power of the executive, monetary stability, liberal trade regimes, and civil liberties (see, e.g., Acemoglu *et al.*, 2005). However, economic freedom is not only an important element in terms of economic performance. It may also involve considerable repercussions on attaining other political objectives related to human well-being, such as income distribution (see Berggren, 2003, for a survey on the effects of economic freedom).

Since the 1980s most countries in the world have experienced notable increases in economic freedom, under the widely accepted belief that greater economic freedom fosters efficiency and economic growth (see, among others, Farr *et al.*, 1998; De Haan and Sturm, 2000; Adkins, *et al.*, 2002; Cole, 2003; Powel, 2003; Berggren and Jordahl, 2005; Doucouliagos and Ulubasoglu, 2006; Ashby and Sobel, 2008; Cebula, 2011; Compton *et al.*, 2011; Keseljevic and Spruk, 2013; Hall and Lawson, 2014). The European Union (EU) member countries have not been left out of this trend and over the last decades numerous changes have been made to their policies and institutions in favor of economic freedom.

Apart from economic growth, economic freedom may also be regarded as a significant explanatory factor for income distribution. There is, however, less certainty about the effects of the changes in economic freedom on income inequality. Theoretically, how the income of different individuals and groups are affected by an increase in economic freedom is an open question, and empirically the evidence is even relatively contradictory (Berggren, 1998, 1999; Scully, 2002; Carter, 2007; Ashby and Sobel, 2008; Bergh and Nilson, 2010; Bennett and Vedder, 2013; Apergis *et al.*, 2014). These studies focus on a set of countries, sometimes with considerably different development levels, or on states of the U.S., while there is no specific empirical evidence on the countries of the EU. Moreover, knowledge is quite limited concerning the extent to which the different areas of economic freedom influence income inequality.

In parallel with these changes in economic freedom, inequality in Europe has risen quite substantially since the mid-1980s. In fact, towards the end of the 2000s income distribution in Europe was more unequal than in the average OECD country, albeit notably less so than in the United States (Bonesmo Fredriksen, 2012). Obviously, inequality has followed different patterns across EU countries. After initial increases in the late 1970s and early 1980s in countries like the United Kingdom, starting in the mid-1980s the increase in income inequality became more widespread. The trends in the 2000s showed a widening gap between rich and poor, not only in some of the countries which already had high inequality, but also –for the first time– in traditionally low-inequality countries, such as Denmark, Germany, Slovenia and Sweden, where inequality grew considerably in the 2000s. Moreover, this climb of inequality seems to have strengthened since the onset of the Great Recession in the late 2000s (Eurostat, 2014).

This paper attempts to provide useful evidence concerning the potential impact of economic freedom on income inequality in the EU in the 2000s. It makes several contributions. First, it uses a panel data set for EU countries while existing papers largely address diverse developed and developing countries or within-country experience for the specific country being studied, particularly, the U.S.. This is the first attempt in the literature that deals with the extent to which income inequality may be connected to economic freedom in the context of the EU economy, which increasingly acts as a unified economy with a high number of common political and economic institutions. Second, we examine the relationship between economic freedom and inequality by using both major overall measures of economic freedom, the Fraser Institute index and the Heritage Foundation index, in order to compare them. Finally, the study looks at the various dimensions of economic freedom provided by the Fraser Institute. It should be expected that different major areas of economic freedom affect inequality differently. The remainder of the paper is as follows. Section 2 reviews the literature regarding the effect of economic freedom on income inequality. Section 3 describes variables and data used in our estimates. Section 4 discusses methodology and results. The final section presents some conclusions.

2. Review of literature

From a theoretical perspective, there is ambiguity concerning the effects of economic freedom on income distribution (see, e.g., Berggren, 1999, and De Soto, 1989, 2000). Economic freedom is negatively related to income equality if we focus on the partial, immediate effect of a policy change, and provided the lower taxes and welfare expenditures generally associated with more economic freedom are expected to be detrimental to low-income earners. In other words, economic freedom is usually identified with less redistribution via taxes, transfers, and regulations. On the contrary, increases in economic freedom may boost economic growth, and if low-income groups significantly improve their income and ascend their relative position as a result of greater economic freedom, a more equal income distribution may be reached. It also can be argued that economic freedom removes legal barriers that protect politically favored groups and opens economic opportunities to less privileged and lower-income individuals.

Such theoretical ambiguity also arises in the empirical field. To begin with, Berggren (1998, 1999) reveals in a pioneering empirical analysis that there is a positive relationship between changes in economic freedom and income equality (for a selection of countries ranging from 57 to 66). In particular, he finds that the more a country increased its economic freedom between 1975 and 1985, the higher the level of equality around 1985. However, he observes that the level of economic freedom in 1985 is negatively related to the level of equality around that year. Berggren (1999) also disaggregates the economic freedom measure into four categories, not all of which seem to be related to equality. In general, he argues that implementing policies favoring economic freedom may increase income inequality in the short run due to the redistribution benefiting the rich (e.g. lower redistributive taxes), but in the long run the relatively strong income-growth effect of poor people relative to rich people outweighs that increase in income inequality.

Scully (2002) bases his analysis on a three-equation model of economic freedom, growth and inequality, estimated for a pooled sample of 26 countries (advanced countries and some newly industrializing Asian nations) with a total of 86 observations taken as available for 1975, 1980, 1985, and 1990. He finds that higher levels of economic freedom reduce income inequality (i.e. lowers the Gini coefficient), contrary to Berggren's findings (for the level of freedom). In this direction, he also points out that

the share of income held by the lowest two quintiles is positively impacted, whereas the share held by the highest income quintile is lowered. Scully argues that these results differ from Berggren's because he fails to adjust for differences in the unit or basis of the sample upon which the inequality is measured.

In contrast with Berggren (1999) and Scully (2002), who used Gini coefficients drawn from the secondary database assembled by Deininger and Squire (1996), Carter (2007) takes Gini coefficients from the UNU/WIDER World Income Inequality Database Version 2.0a and points out some methodological weaknesses of previous studies. He applies panel-study methods and estimates for a fixed-effects model of country-level Gini coefficients as a function of economic freedom, including a number of control variables such as per capita income, political structure, education, demographics, and industrial composition. He considers that the potentially opposing effects of economic freedom on income inequality can generate a nonlinear relationship, and thus decides to use a quadratic specification, with all explanatory variables entered as both linear and squared terms. The fixed-effects estimates for the quadratic model based on a panel of 39 countries –most of which are OECD members– and 104 observations reveal that the relationship between economic freedom and income inequality is U-shaped and highly significant. However, most countries in the sample fall well to the right of the downward-sloping portion of the curve, with a positive but relatively inelastic relationship.

While previous studies examine the impact of economic freedom on income inequality at the international level by using the Economic Freedom of the World Index (EFI), Ashby and Sobel (2008) work with cross-sectional data for states of the U.S. and perform similar regressions using the Economic Freedom of North America Index (EFNA), both from the Fraser Institute. They warn that it is not clear that the smaller variation in institutions and policies related to economic freedom among U.S. states can have a measurable impact on income inequality. Nevertheless, they find that changes in economic freedom are associated with reductions in relative income inequality, though the level of economic freedom is generally insignificant. By components areas of the EFNA, the results suggest that reductions in both state minimum wages and tax burdens would be most positive for the lowest income quintile.

Bergh and Nilsson (2010) examine the impact of different dimensions of economic freedom and globalization on income inequality (with data from Standardized

World Income Inequality Database) using panel data covering 79 countries at different development levels over the period 1970-2005. Supported by a baseline model and a broad sensitivity analysis, they reveal a significant and positive EFI4 coefficient (freedom to trade internationally) in all specifications, as well as for the EFI5 (regulation) and aggregate EFI coefficients on most occasions. For the remaining economic freedom dimensions, reforms in the legal structure (EF2) and the monetary system (EF3) do not seem to entail significant effects on income inequality, whilst a smaller size of government (EF1) is linked to higher inequality only for the richest countries.

Bennett and Vedder (2013) apply fixed effects models to assess the dynamic relationship between economic freedom and income inequality in states of the U.S. over the period 1979-2004. They find robust evidence that increases in economic freedom are associated with lower income inequality, but this effect depends on the initial level of economic freedom. Therefore, contrary to Carter's (2007) interpretation at the international level, they argue that for U.S. states there is an inverted U-shaped relationship between economic freedom and income inequality.

In contrast with the aforementioned analyses which implicitly assume unidirectional causality from economic freedom to income inequality, Apergis *et al.* (2014) study the Granger-causal dynamics in both directions by using a panel error correction model framework. For U.S. states over the period 1981-2004, they find economic freedom has a negative impact on income inequality, though there is bidirectional causality between income inequality and economic freedom in the short and the long run. They interpret that high inequality may decrease economic freedom through implementation of redistributive policies, and lower economic freedom would increase income inequality even more.

Apart from studies using economic freedom indices, other authors particularly focus on the effects of certain phenomena related to economic freedom on income inequality. For instance, Jaumotte *et al.* (2013) study the effects of technological change and trade and financial globalization on income inequality in a panel of 51 developed and developing countries between 1981 and 2003. They find that the observed rise in inequality could be largely attributable to the impact of technological change. Regarding globalization, its contribution is relatively minor, with two offsetting effects: while trade tends to reduce income inequality, foreign direct investment tends to increase it.

As can be seen, previous literature examining the relationship between income inequality and economic freedom is inconclusive, although –apart from the studies focused on the U.S. states– overall recent international studies highlight that economic freedom tends to be associated with higher inequality in developed countries. Despite the EU economy has a similar size to that of U.S. and acts to an increasing extent as a unified economy, to the best of our knowledge, this is the first study that examines the impact of economic freedom on inequality in the EU member countries as a whole, analyzing also the particular effects of the respective dimensions of economic freedom provided by the Fraser Institute.

3. Data

In this paper we work with an imbalanced panel for the 28 EU member countries for the period 2000-2010, with statistical information on income inequality, economic freedom and a number of control variables, involving 258 observations.

Data on inequality of income distribution refer to the Gini coefficient of income and the income quintile share ratio (the S80/S20 ratio) from Eurostat³. In particular, we consider the Gini coefficient for income, defined as the relationship of cumulative shares of the population arranged according to the level of income to the cumulative share of the total income they receive. On the other hand, the income quintile share is calculated as the ratio of total income received by the 20 per cent of the population with the highest income (top quintile) to total income received by the 20 per cent of the population with the lowest income (lowest quintile).

Table 1 shows the Gini coefficient and S80/S20 ratio data in 2010 for the 28 EU member countries, as well as the percentage change of both variables in the period between 2000 and 2010. The countries that have the lowest inequality in 2010 are Slovenia, Hungary, Sweden, Czech Republic and Finland, both in respect to the Gini coefficient and the S80/S20 ratio, whereas the countries with the greatest inequality are Lithuania, Latvia, Spain, Portugal and Romania. Regarding the percentage change in 2000-2010, the countries with the greatest increase in their levels of income inequality

³ Income must be understood as equalized disposable income. It is the total income of a household, after tax and other deductions, that is available for spending or saving, divided by the number of household members converted into equalized adults; household members are made equivalent by weighting each according to their age, using the so-called modified OECD equivalence scale (Eurostat, 2014).

are Bulgaria, Denmark, Lithuania, Germany and Romania, while the countries that show the biggest reduction of inequality in the 2000s are Estonia, Netherlands, Belgium and Portugal, taking into account both inequality measures.

Table 1: Income inequality in the EU member countries in 2010

Country	Gini coefficient in 2010	S80/S20 ratio in 2010	Percentage change of the Gini coefficient in 2000–2010 (*)	Percentage change of the S80/S20 ratio in 2000–2010(*)
Austria	26.1	3.7	8.8	8.8
Belgium	26.6	3.9	-11.3	-9.3
Bulgaria	33.2	5.9	32.8	59.5
Croatia	31.5	5.6	8.6	21.7
Cyprus	29.2	4.3	8.1	4.9
Czech Rep.	24.9	3.5	-0.4	2.9
Denmark	26.9	4.4	22.3	46.7
Estonia	31.3	5.0	-13.1	-20.6
Finland	25.4	3.6	5.8	9.1
France	29.8	4.5	6.4	7.1
Germany	29.3	4.5	17.2	28.6
Greece	32.9	5.6	-0.3	-3.4
Hungary	24.1	3.4	-7.3	3.0
Ireland	33.2	5.3	10.7	12.8
Italy	31.2	5.2	7.6	8.3
Latvia	36.1	6.9	6.2	25.5
Lithuania	36.9	7.3	19.0	46.0
Luxembourg	27.9	4.1	7.3	10.8
Malta	28.4	4.3	-5.3	-6.5
Netherlands	25.5	3.7	-12.1	-9.8
Poland	31.1	5.0	3.7	6.4
Portugal	33.7	5.6	-6.4	-12.5
Romania	33.3	6.0	14.8	33.3
Slovak Rep	25.9	3.8	-1.1	-2.6
Slovenia	23.8	3.4	8.2	6.2
Spain	33.9	6.9	5.9	27.8
Sweden	24.1	3.5	0.4	2.9
United Kingdom	33.0	5.4	3.1	3.8

(*) Gini coefficient and S280/S20 ratio data are not available for several countries in 2000, so we have considered the data of the first year available, which is indicated in parentheses: Croatia (2003), Cyprus (2003), Czech Republic (2001), Denmark (2001), Slovakia (2005) and Sweden (2001).

Concerning economic freedom, we primarily consider as an overall measure the Economic Freedom of the World index (EFI) reported annually by the Fraser Institute since 2000 in *Economic Freedom of the World* (EFW) (Gwartney *et al.*, 2013)⁴, the most extensively used reference in academic contexts in the recent years. The EFW data set provides a comprehensive measure of the degree to which countries rely on markets rather than political decision-making to allocate resources. In essence, as pointed out by

⁴ All the data and other information are available at <http://www.freetheworld.com>.

De Haan *et al.* (2006), this index is closely related to the so-called ‘Washington consensus’, according to the term coined in 1989 by John Williamson.

The cornerstones of economic freedom are (i) personal choice, (ii) voluntary exchange coordinated by markets, (iii) freedom to enter and compete in markets, and (iv) protection of persons and their property from aggression by others. In this scenario, the EFI measures the degree to which the policies and institutions of countries are supportive of economic freedom. It is a composite index that weighs five dimensions of economic freedom, EFI1-EFI5, which are in turn based on several components and sub-components: (i) Size of government (EFI1); (ii) Legal system and property rights (EFI2); (iii) Sound money (EFI3); (iv) Freedom to trade internationally (EFI4); (v) Regulation (EFI5). These five dimensions or major areas of the EFI, as well as their components and sub-components, are specified in Table A1 of the Appendix.

The composite index and the other indicators range from 0 to 10, 0 indicating the lowest and 10 the greatest economic freedom. When sub-components are present, the sub-component ratings are averaged to derive the component rating. The component ratings within each area are then averaged to derive ratings for each of the five areas. In turn, the five area ratings are averaged to derive the summary rating for each country. The composite EFI and their dimensions exist in a chain-linked version, suitable for analysis over time, which we use in our study as explanatory (or independent) variables⁵.

Table 2 presents the EFI values in 2010 for the 28 EU member countries, as well as the percentage change of the index since 2000. In absolute numbers, in 2010 United Kingdom, Denmark, Finland, Estonia and Ireland rank at the top –similar to 2000, in which the ranking was led by United Kingdom, Netherlands, Ireland, Luxembourg and Denmark–, while Slovenia, Italy, Greece, Latvia and Croatia are located at the bottom – in this case, quite unlike 2000, when it was Romania, Bulgaria, Slovak Republic, Poland and Croatia–. In respect to relative change, Romania, Bulgaria –both with growth rates higher than 34 per cent–, Slovak Republic, Cyprus and Malta stand at the top, whereas Italy, Netherlands, United Kingdom, Portugal and Ireland are the UE

⁵ Berggren (2003, 193) reminds that, in econometric analysis, economic freedom is usually an independent variable. However, economic freedom may also be affected by other variables and thereby constitute a dependent variable, possibly influenced by factors such as political freedom, wealth, or democracy. In any event, economic freedom also may have an intrinsic value; if so, the consideration of economic freedom as a dependent variable may likewise become more accurate.

member countries that have declined most in economic freedom in the 2000s –12 out of 28 UE member countries reduced their EFI during the decade–. More detailed data on the levels and the percentage change of the five dimensions of economic freedom are shown in Table A2 of the Appendix.

In addition to the Fraser Institute index, we take into consideration the Index of Economic Freedom provided by the Heritage Foundation (HFI), in association with the Wall Street Journal, which is also frequently used by scholars, policy-makers and international organizations. As explained by Miller *et al.* (2013), each country is assigned a rating on a 0–100 scale for each of the 10 components and then an average rating is given⁶. Even though some authors such as De Haan (2003) indicate that both indices are relatively similar, the existence of significant differences between them has been highlighted by others, such as Ram (2014), involving considerable differences in the country ranks and inferences on the basis of the ratings from either source. In our dataset, the discrepancies between such indices are also notable (Table 2). It would imply significant differences in the country ranks in absolute numbers and in relative changes. Thus, for the level of economic freedom in 2010, the rank difference is 9 for France, Malta (better rating according to HFI) and Czech Republic (better rating according to EFI), while in terms of percentage changes between 2000 and 2010, the rank difference becomes 16 for Belgium, 14 for Slovenia, 12 for Denmark and Germany (better rating according to EFI), and 12 also for Hungary and Cyprus (better rating according to HFI).

⁶ The HFI measures 10 specific components of economic freedom that are classified in four categories: (i) rule of law (property rights, freedom from corruption), (ii) government size (fiscal freedom, government spending), (iii) regulatory efficiency (business freedom, labor freedom, monetary freedom) and (iv) market openness (trade freedom, investment freedom, financial freedom). As can be understood, the components of the HFI relatively differ from those of the EFI and there is not a direct correspondence, making complex an accurate comparison between them.

Table 2: Economic Freedom in the EU member countries in 2010

Country	EFI	HFI	Percentage change of the EFI in 2010-2000	Percentage change of the HFI in 2010-2000
Austria	7.60	71,9	0.7	5,6
Belgium	7.52	70,2	-4.7	10,0
Bulgaria	7.20	64,9	34.1	25,0
Croatia	7.05	61,1	11.0	20,5
Cyprus	7.65	73,3	17.4	3,2
Czech Rep.	7.13	70,4	9.2	0,3
Denmark	7.94	78,6	0.3	15,1
Estonia	7.80	75,2	2.5	-1,2
Finland	7.91	74	2.3	6,2
France	7.49	64,6	2.5	11,4
Germany	7.58	71,8	-1.2	3,3
Greece	6.88	60,3	-0.4	-4,9
Hungary	7.32	66,6	11.6	1,5
Ireland	7.78	78,7	-5.1	-3,1
Italy	6.79	60,3	-7.7	-4,3
Latvia	7.02	65,8	0.9	-0,9
Lithuania	7.14	71,3	8.1	8,9
Luxembourg	7.65	76,2	-4.6	-4,9
Malta	7.62	65,7	12.7	4,5
Netherlands	7.64	74,7	-6.9	2,3
Poland	7.11	64,1	12.1	3,7
Portugal	7.16	64	-5.1	-3,0
Romania	7.14	64,7	35.5	29,4
Slovak Rep	7.43	69,5	19.8	18,8
Slovenia	6.58	64,6	-2.1	4,5
Spain	7.32	70,2	-2.9	3,1
Sweden	7.73	71,9	1.5	8,0
United Kingdom	7.94	74,5	-6.6	-4,0

In addition, we include some control variables in our regression specifications to correct for the influence that factors other than economic freedom may have on income inequality. In this sense, Carter (2007) recalls the relevance of making use of a standard empirical model of inequality from which control variables could be drawn, although, unfortunately, no such model exists. In our case, taking as reference previous studies, we firstly consider three variables from Eurostat in our baseline model: gross domestic product (GDP) at market prices per inhabitant, in purchasing power standard (PPS); percentage of population from 15 to 64 years of age with upper secondary or tertiary education attainment; percentage of population aged 0-14 years. In addition we also use other indicators from Eurostat in our sensitivity analysis: (i) percentage of people with low educational attainment (people aged 25 to 64 with an education level ISCED – International Standard Classification of Education– of 2 or less); (ii) percentage of population aged 65 and more; (iii) age dependency ratio, defined as population aged 0-14 and 65 and more to population aged 15-64; (iv) unemployment rate (annual average); (v) long-term unemployment in percentage of active population (annual average); (vi)

share of employment in agriculture, industry and services, respectively. Besides, from Freedom House, two numerical ratings for civil liberties and for political rights are used, and from the World Bank, six indicators corresponding to different dimensions of governance: (i) voice and accountability, (ii) political stability and absence of violence, (iii) government effectiveness, (iv) regulatory quality, (v) rule of law, (vi) and control of corruption.

4. Empirical analysis

4.1. Model

We formulate the following panel data model to analyze the effect of economic freedom on inequality, where countries are represented by i and time by t :

$$y_{it} = \beta_0 + \beta_1 ef_{it} + \gamma x_{it} + \zeta_i + \omega_{it} \quad [1]$$

where y_{it} is the dependent variable of income inequality, ef_{it} is the respective index of economic freedom, x_{it} are the control variables, ζ_i is the time-constant intercept term for each country that captures individual-specific effects that are constant over time, and ω_{it} is a normally distributed error term.

Firstly, we consider the three main approaches to regression analysis with panel data: pooled regression, fixed effects model, and random effects model. In this direction, the null hypothesis of no country effects is rejected in all estimations, implying that a pooled regression model is inappropriate, as estimates made with pooled OLS would be biased (Breusch and Pagan, 1980). Thus, panel data models must be used, as they permit controlling for individual effects not controlled by the explanatory variables introduced in the models. Moreover, the random-effect model is rejected by the standard Hausman (1978) test in favor of the fixed-effects model, which supports the choice of assuming a fixed-effects regression method⁷.

We begin by estimating the panel data model conventionally with country fixed effects. The default standard errors assume that, after controlling for ζ_i , the error ω_{it} is identically distributed and independent. In order to test for homoscedasticity, following

⁷ Let us recall that in the fixed-effects model ζ_i is allowed to be correlated with the regressors, while continuing to assume that such regressors are uncorrelated with the idiosyncratic error ω_{it} .

Greene (2000, 598) we calculate a modified Wald statistic for groupwise heteroscedasticity in the residuals of a fixed effect regression model. Likewise, we implement a test for serial correlation in the idiosyncratic errors, in accordance with Wooldridge (2002).

As a consequence of the problems of heteroscedasticity and serial correlation detected, the estimated standard errors are incorrect. Thus, we estimate Driscoll and Kraay (1998) standard errors, which are robust to very general forms of cross-sectional and temporal dependence. This is a nonparametric technique of estimating standard errors that assumes that the error structure is heteroscedastic, autocorrelated up to some lag, and possibly correlated between the groups (Hoechle, 2007).

4.2. Baseline results

To analyze the impact of economic freedom on income inequality, we begin by estimating a baseline model with seven specifications, in which the Gini coefficient is the dependent variable. As explanatory variable of the degree of economic freedom, we introduce EFI (Fraser Institute index) and its five dimensions, EFI1-EFI5, as well as HFI (Heritage Foundation index)⁸. Adopting specifications similar to those used in previous studies, we begin by adding three control variables to our baseline regression to correct for distributional effects driven by the degree of economic development (log of GDP per capita), the education level (higher education attainment) and the demographic situation (population aged 0-14).

The level of economic development is a control variable widely used in this field. After decades of debates, its relationship with income inequality is still a widely discussed and controversial issue (see, e.g., Piketty, 2014). The theoretical literature offers a number of different explanations for potential links between development and inequality. Apart from the well-known hypothesis proposed by Kuznets (1955)⁹, a number of economic models argue that technological progress (arguably the major source of economic growth) may lead to higher inequality whenever it affects the productivity of different types of labor in different ways. For instance, if the

⁸ To express both indices in the same scale, the original HFI data have been divided by 10.

⁹ Basically, this hypothesis claims that growth and inequality are related in an inverted U-shaped curve: inequality would increase over the initial stages of development as an economy transforms from rural to urban and from agricultural to industrial and, subsequently, inequality would decrease as the labor force in the industrial sector expands and that of the agricultural sector falls (Kuznets, 1955).

introduction of new technologies increases the demand for skilled labor (relative to unskilled labor), inequality would likely increase (Lopez, 2004). In this direction, we expect inequality to follow a positive relationship over levels of GDP per capita.

The education level is also included as a control variable to correct for human capital effects. In fact, it is frequently emphasized that education is one of the major factors affecting inequality. However, theoretically there exists certain ambiguity about the impact of education on the degree of income inequality for a society as a whole. This ambiguity is present in both human capital and development economics literature (see De Gregorio and Lee, 2002). In this regard, Bergh and Nilsson (2010) emphasize that more people with higher education would imply a larger share of the population with a wage premium, although it may also serve to reduce the premium associated with higher education. Therefore, from a theoretical viewpoint, the relationship between education and income inequality does not seem clear.

The population age distribution is also considered as a control variable to correct for any distributional effects driven by demography. In principle, larger cohorts with low earning rewards should entail higher inequality. Among the different measures, we choose the share of the population aged 0-14, as it is well documented that children are much more likely to be poor than adults, including the elderly (Bradbury and Jäntti, 1999; Rainwater and Smeeding, 2003; Chen and Corak, 2008). Therefore, we can assume that a higher share of the population aged 0-14 is expected to be associated with higher income inequality.

In order to test the robustness of our results, we also consider other economic, social and political control variables in line with the existing literature, intending to capture some other key aspects of institutional and structural features of the countries that may potentially influence inequality.

Given the foregoing, we initially estimate conventionally the baseline specifications through a fixed-effects model. The estimates are presented in Table 3, as well as the p-values of the modified Wald test for groupwise heteroscedasticity and Wooldridge test for autocorrelation. Under the null hypothesis of homoscedasticity and no serial correlation respectively, both hypotheses are rejected for all the baseline specifications, suggesting that there are problems of heteroscedasticity and serial correlation in the idiosyncratic errors, and the estimates are invalid.

Table 3 also displays the estimates for the seven specifications by estimating fixed-effects regressions with Driscoll-Kraay standard errors, which are robust to heteroscedasticity and serial correlation. Overall, we find a significant positive relationship between economic freedom and income inequality, in line with Carter (2007) and Berg y Nilsson (2010), among others. However, not all indices of economic freedom affect inequality similarly. Firstly, both composite indices are statistically significant, although the HFI is only significant at the 10 per cent level, and the value of its coefficient is notably lower. It is consistent with Ram's (2014) findings, highlighting that the use of such indices may lead, to some degree, to different inferences in empirical applications. Moreover, regarding the particular areas of economic freedom, considerable divergences are also revealed, partly consistent with Berggren's (1999) and Berg and Nilsson's (2010) conclusions. The coefficients are significant and positive for EFI1 (Size of government), EFI5 (Regulation) and EFI3 (Sound money), although the latter is only slightly significant. It is worth pointing out that a negative relationship between inequality and EFI2 (Legal system and property rights) is estimated, even though it is not significant.

Given that EFI1 is coded so that bigger government entails a lower economic freedom value, the results reveal that bigger government seems to decrease income inequality. Although government size, as measured by EFI1, differs from the level of welfare state expenditure, both are usually closely correlated in developed countries. Our results would support that states with larger welfare systems have lower income inequality, as public sector transfers and noncash services (health, education and training, housing, etc.) has a considerable redistributive nature and encourages equality of opportunity (see, e.g., Esping-Andersen and Myles, 2011).

In the case of EFI5, greater economic freedom means less regulation of credit, labor, and product markets. The results suggest that less regulation tends to increase income inequality. This finding is consistent with previous studies, such as Calderón and Chong's (2009), who observe that labor market regulations seem to favor the reduction of income inequality, though different regulations have quite distinct effects. In respect to the financial scope, Ang (2010) highlights that while financial development helps reduce income inequality, financial liberalization seems to exacerbate it.

EFI3 quantifies the effect of large and unpredictable changes in inflation and money supply, so that the greater the unpredicted inflation, the lower the economic freedom value in this dimension. The results show a positive relationship, although only significant at the 10 per cent level, so that lower unpredicted inflation would imply higher inequality. Although apparently a negative relationship between inequality and EFI3 is expected, as it is assumed that inflation is relatively more harmful to low-income earners and may contribute to income inequality (Albanesi, 2007), in the interpretation of the results we should take into consideration that unpredicted inflation may be to a certain extent due to issues unrelated to monetary policy¹⁰, including institutional changes and the implementation of other policies, which in turn may have a direct or indirect influence on income inequality.

EFI2 assesses the quality and integrity of the legal system and the protection of property rights. The results show a negative relationship, although not significant. This negative sign would entail that a better legal system and protection of property rights are normally associated with lower inequality (Gradstein, 2007). Concerning EFI4, which measures freedom to trade internationally (trade taxes, tariff rates and trade barriers, and capital market controls), the relationship is positive but insignificant as well. In fact, the theoretical and empirical literature on the effects of trade openness on inequality is inconclusive, with numerous authors supporting divergent positions, as shown by Goldberg and Pavcnik (2007) in a literature review¹¹.

Turning briefly to control variables, the influence of GDP per capita on income inequality is always significant and positive, consistent with some influential theoretical arguments of the literature discussed above. However, for the share of the population that has a higher education, the results are never significant and with variable signs depending on the specifications, which confirms the ambiguity pointed out previously from a theoretical perspective. Finally, for the share of the population aged 0-14, as expected, the relationship is positive and significant in all cases except for HFI (positive, insignificant), reflecting that a greater proportion of child population seems to involve higher overall income inequality.

¹⁰ Let us recall in this context that over half of the EU countries are members of the euro area and share a common monetary policy. In particular, in 2010, 16 out of 27 EU countries were part of this economic and monetary union.

¹¹ In addition, we should take into account that the EU countries follow a common policy on international trade.

4.3. Sensitivity analysis

In order to assess the robustness of the baseline models, we introduce several variations in the baseline specifications, in accordance with the literature. Table 4 summarizes the results. Firstly, the sensitivity analysis reveals a significant and positive relationship between economic freedom and income inequality for both composite indices of economic freedom in all specifications, except HFI in one case (the specification that includes regulatory quality), which continues to be only slightly significant in most variations. In particular, the coefficient for HFI shows higher significance replacing the Gini coefficient by the S80/S20 ratio, including in our specifications a crisis dummy variable that equals 1 for the years 2008-2010, including civil liberties and political rights as explanatory variables, and including as well the share of employment in agriculture, industry and services separately.

Secondly, we check that in all specifications the coefficients for EFI1 (Size of government) and for EFI5 (Regulation) are significant and positive, while for EFI3 (Sound money) they are significant only in some cases. This reinforces the previous results, according to which the major areas of economic freedom that affect income distribution are size of government and regulation.

Finally, the variations introduced in the baseline specifications confirm that the coefficients for EFI2 (Legal system and property rights) and for EFI4 (Freedom to trade internationally) are not practically significant in any case, so that both dimensions of economic freedom seem not to influence income inequality in the EU countries.

Table 3. Gini coefficient and the measures of economic freedom, fixed effects (FE) and fixed effects with Driscoll-Kraay standard errors (DKSE FE)

	FE	DKSE FE	FE	DKSE FE	FE	DKSE FE	FE	DKSE FE	FE	DKSE FE	FE	DKSE FE	FE	DKSE FE
GDP per capita	45.694*** [14.615]	45.694*** [5.331]	60.732*** [14.868]	60.732*** [6.449]	49.163*** [14.678]	49.163*** [4.855]	61.269*** [14.661]	61.269*** [3.822]	48.669*** [14.398]	48.669*** [5.211]	40.440*** [14.524]	40.440*** [7.182]	43.509*** [15.682]	43.509*** [6.832]
Upper secondary or tertiary education	-1.496 [4.399]	-1.496 [3.563]	-3.097 [4.546]	-3.097 [3.304]	-1.900 [4.439]	-1.900 [2.447]	0.033 [4.779]	0.033 [4.257]	-0.747 [4.407]	-0.747 [3.159]	2.184 [4.448]	2.184 [3.261]	-1.652 [4.474]	-1.652 [2.507]
Population aged 0-14	23.263 [24.291]	23.263* [11.105]	25.034 [24.973]	25.034** [10.656]	37.546 [24.991]	37.546** [12.696]	30.029 [25.152]	30.029*** [9.074]	37.849 [24.529]	37.849*** [7.197]	42.303* [24.268]	42.303*** [7.786]	16.993 [24.840]	16.993 [10.591]
EFI1	0.705*** [0.195]	0.705*** [0.114]												
EFI2			-0.301 [0.337]	-0.301 [0.288]										
EFI3					0.583*** [0.202]	0.583* [0.280]								
EFI4							0.499 [0.316]	0.499 [0.406]						
EFI5									1.296*** [0.346]	1.296*** [0.227]				
EFI											2.117*** [0.468]	2.117*** [0.510]		
HFI													1.274** [0.536]	1.274* [0.600]
Constant	-23.099 [17.453]	-23.099*** [7.121]	-31.492* [17.765]	-31.492*** [6.484]	-30.366* [17.480]	-30.366*** [4.659]	-41.267** [18.784]	-41.267*** [6.972]	-34.356** [17.287]	-34.356*** [5.051]	-35.429** [17.065]	-35.429*** [4.508]	-24.811 [17.789]	-24.811*** [5.406]
Number of countries	28	28	28	28	28	28	28	28	28	28	28	28	28	28
Observations	258	258	258	258	258	258	258	258	258	258	258	258	258	258
Modified Wald test	0.0000		0.0000		0.0000		0.0000		0.0000		0.0000		0.0000	
Wooldridge test	0.0067		0.0073		0.0082		0.0078		0.0081		0.0079		0.0067	

***Significant at 1% level; ** Significant at 5% level; * Significant at 10% level.

Table 4. Summary of sensitivity tests

	EFI1	EFI2	EFI3	EFI4	EFI5	EFI	HFI
Baseline	0.705*** [0.114]	-0.301 [0.288]	0.583* [0.280]	0.499 [0.406]	1.296*** [0.227]	2.117*** [0.510]	1.274* [0.600]
Replacing Gini coefficient by S80/S20 ratio	0.167*** [0.034]	-0.074 [0.062]	0.203 [0.117]	0.208 [0.130]	0.401*** [0.088]	0.652** [0.209]	0.519** [0.202]
Replacing upper secondary or tertiary education attainment by low education attainment	0.706*** [0.112]	-0.308 [0.297]	0.580* [0.282]	0.504 [0.460]	1.293*** [0.225]	2.127*** [0.538]	1.269* [0.606]
Replacing population aged 0-14 by population aged 65 and more	0.699*** [0.120]	-0.235 [0.266]	0.581* [0.268]	0.739 [0.420]	1.229*** [0.240]	2.295*** [0.554]	1.287* [0.601]
Replacing population aged 0-14 by age dependency ratio	0.713*** [0.118]	-0.327 [0.250]	0.524* [0.249]	0.479 [0.396]	1.229*** [0.226]	2.010*** [0.501]	1.317* [0.604]
Including crisis dummy (1 for years 2008-2010)	0.699*** [0.127]	-0.344 [0.259]	0.565* [0.280]	0.457 [0.399]	1.280*** [0.219]	2.214*** [0.555]	1.372** [0.604]
Including unemployment rates	0.702*** [0.119]	-0.310 [0.286]	0.586* [0.288]	0.477 [0.435]	1.289*** [0.261]	2.122*** [0.556]	1.263* [0.607]
Including long-term unemployment rates	0.699*** [0.108]	-0.300 [0.285]	0.591* [0.280]	0.475 [0.439]	1.283*** [0.260]	2.103*** [0.532]	1.255* [0.589]
Including civil liberties	0.760*** [0.162]	-0.301 [0.308]	0.588* [0.283]	0.553 [0.439]	1.330*** [0.218]	2.117*** [0.513]	1.283* [0.579]
Including political rights	0.742*** [0.117]	-0.253 [0.341]	0.664** [0.256]	0.477 [0.408]	1.298*** [0.225]	2.281*** [0.485]	1.614* [0.744]
Including civil liberties and political rights	0.789*** [0.163]	-0.246 [0.361]	0.676** [0.256]	0.540 [0.442]	1.325*** [0.220]	2.280*** [0.484]	1.642** [0.715]
Including voice and accountability	0.747*** [0.123]	-0.296 [0.337]	0.561* [0.253]	0.558 [0.340]	1.497** [0.496]	2.116*** [0.423]	1.013* [0.536]
Including political stability and absence of violence/terrorism	0.770*** [0.131]	-0.378 [0.309]	0.515 [0.288]	0.493 [0.458]	1.458** [0.463]	2.088*** [0.513]	1.091* [0.543]
Including government effectiveness	0.792*** [0.127]	-0.258 [0.301]	0.608* [0.281]	0.743 [0.436]	1.667*** [0.463]	2.361*** [0.517]	1.091* [0.574]
Including regulatory quality	0.719*** [0.131]	-0.326 [0.271]	0.427 [0.293]	0.445 [0.411]	1.454** [0.477]	1.966*** [0.523]	0.521 [0.652]
Including rule of law	0.772*** [0.134]	-0.137 [0.237]	0.573* [0.294]	0.762* [0.394]	1.572*** [0.429]	2.241*** [0.504]	1.124* [0.572]
Including control of corruption	0.787*** [0.132]	-0.289 [0.293]	0.592* [0.275]	0.687 [0.386]	1.600*** [0.471]	2.331*** [0.483]	1.087* [0.565]
Including share of employment in agriculture	0.667*** [0.147]	-0.209 [0.371]	0.486 [0.306]	0.439 [0.487]	1.254*** [0.212]	2.075*** [0.588]	1.332** [0.522]
Including share of employment in industry	0.655*** [0.143]	-0.210 [0.367]	0.528 [0.297]	0.464 [0.475]	1.256*** [0.204]	2.153*** [0.625]	1.541** [0.574]
Including share of employment in services	0.691*** [0.151]	-0.192 [0.367]	0.573* [0.286]	0.566 [0.447]	1.315*** [0.236]	2.160*** [0.579]	1.548** [0.548]

***Significant at 1% level; ** Significant at 5% level; * Significant at 10% level

5. Conclusions

After decades in which income inequality tended to fall as European economies grew, since 1980s, however, inequality has increased in numerous EU member states, coinciding with a general trend toward greater economic freedom. Do institutions and policies favoring

economic freedom matter for inequality? This paper examines the extent to which economic freedom affects income inequality in the EU in the 2000s, providing new evidence from a panel data approach.

Previous literature examining the relationship between economic freedom and income inequality has been inconclusive. Both theoretical and empirical contributions are ambiguous. Consistently with a significant part of the literature, our results would support the existence of a positive relationship in the EU countries, so that higher economic freedom seems to imply greater income inequality by using both major overall measures of economic freedom, the Fraser Institute index and the Heritage Foundation index, especially for the former, which is the most used in the literature.

Examining the impact of the different areas of economic freedom provided by the Fraser Institute, our baseline models and sensitivity analysis clearly reveal a significant effect of the size of government on income inequality. This can be construed, to a large extent, as an indication of welfare state generosity, taking into account the redistributive effects of social transfers and public services such as health care, education, and social services to vulnerable populations. In this context, lower levels of government spending as a share of the total and lower marginal tax rates, among other indicators, involve greater economic freedom and would tend to increase inequality. This finding enhances the role of the so-called European social model in order to reduce economic and social inequalities. Nonetheless, beyond that, this evidence should be complemented at national and regional levels, as welfare systems – including tax systems– and their effectivity to reduce inequality and poverty considerably differ across EU countries.

In addition, deregulation in credit, labor, and product markets also seems to significantly affect income distribution. This area covers a wide range of aspects. Among other things, it would reflect the impact of labor market regulations, such as minimum wages and dismissal regulations, so that higher economic freedom seems to encourage inequality. However, in contrast to government size and regulation, legal system, access to sound money, and freedom to trade internationally, all of them areas where the EU countries have important points in common, seem not to be associated with income inequality.

Given that results are based upon an unbalanced panel data set and the estimation may suffer from the usual endogeneity criticisms, it is worth noting that our findings should not be interpreted as definitive. This study constitutes a first attempt in the literature to analyze the

relationship between economic freedom and income inequality in the EU countries. However, our results may not be generalized internationally or particularized in each of the European countries. Moreover, this work focuses on the short term, and in the long term the relationship between economic freedom and income distribution may considerably differ, taking into account that both issues are in turn linked to economic growth. Further research, therefore, is needed to better understand the particular links of such a relationship, dealing in addition with the diverse components and sub-components of economic freedom in order to provide detailed guidance to policy makers.

Apart from that, in Europe the Great Recession that began in the late 2000s has entailed a long, unprecedented slowdown of economic activity, dramatic growth of unemployment, substantial increases in public debt in most countries, and a crisis of its currency union, among other consequences. This extraordinary environment has led to significant political and institutional changes, with notable distributional implications. Although it is beyond the scope of this study, these special circumstances should be taken into consideration in a challenging and promising extension of this paper that analyzes in depth the relationship between economic freedom and income inequality during this crisis period.

From a policy perspective, what emerges from the results is essentially the challenge of making progress in improving economic freedom, as a central aspect of human liberty that favors economic growth, compatible with a more equitable economic performance. In this sense, institutions and policies should be evaluated jointly from efficiency and equity perspectives. Beyond dogmas in favor of or against economic freedom, ideal economic governance should not be assessed merely by its degree of intervention, but by its results in terms of economic prosperity and quality of life of all individuals.

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Appendix

Table A1: Areas, Components, and Sub-components of the EFI

<p>1. SIZE OF GOVERNMENT</p> <ul style="list-style-type: none"> A. Government consumption B. Transfers and subsidies C. Government enterprises and investment D. Top marginal tax rate <ul style="list-style-type: none"> (i) Top marginal income tax rate (ii) Top marginal income and payroll tax rate 	<p>5. REGULATION</p> <ul style="list-style-type: none"> A. Credit market regulations <ul style="list-style-type: none"> (i) Ownership of banks (ii) Private sector credit (iii) Interest rate controls/negative real interest rates B. Labor market regulations <ul style="list-style-type: none"> (i) Hiring regulations and minimum wage (ii) Hiring and firing regulations (iii) Centralized collective bargaining (iv) Hours regulations (v) Mandated cost of worker dismissal (vi) Conscription C. Business regulations <ul style="list-style-type: none"> (i) Administrative requirements (ii) Bureaucracy costs (iii) Starting a business (iv) Extra payments/bribes/favoritism (v) Licensing restrictions (vi) Cost of tax compliance
<p>2. LEGAL SYSTEM AND PROPERTY RIGHTS</p> <ul style="list-style-type: none"> A. Judicial independence B. Impartial courts C. Protection of property rights D. Military interference in rule of law and politics E. Integrity of the legal system F. Legal enforcement of contracts G. Regulatory restrictions on the sale of real property H. Reliability of police I. Business costs of crime 	
<p>3. SOUND MONEY</p> <ul style="list-style-type: none"> A. Money growth B. Standard deviation of inflation C. Inflation: most recent year D. Freedom to own foreign currency bank accounts 	
<p>4. FREEDOM TO TRADE INTERNATIONALLY</p> <ul style="list-style-type: none"> A. Tariffs <ul style="list-style-type: none"> (i) Revenue from trade taxes (% of trade sector) (ii) Mean tariff rate (iii) Standard deviation of tariff rates B. Regulatory trade barriers <ul style="list-style-type: none"> (i) Non-tariff trade barriers (ii) Compliance costs of importing and exporting C. Black-market exchange rates D. Controls of the movement of capital and people <ul style="list-style-type: none"> (i) Foreign ownership/investment restrictions (ii) Capital controls (iii) Freedom of foreigners to visit 	

Table A2: Dimensions of Economic Freedom in the EU member countries in 2010

Country	EF11 in 2010	EF12 in 2010	EF13 in 2010	EF14 in 2010	EF15 in 2010	Percentage change of the EF11 in 2000–2010	Percentage change of the EF12 in 2000–2010	Percentage change of the EF13 in 2000–2010	Percentage change of the EF14 in 2000–2010	Percentage change of the EF15 in 2000–2010
Austria	4.90	8.42	9.64	7.83	7.20	76.6	-9.9	0.2	-14.0	4.1
Belgium	3.99	8.05	9.69	8.22	7.61	-12.6	-2.9	0.8	-11.6	-0.5
Bulgaria	6.46	4.85	9.51	7.80	7.40	43.2	-10.3	194.1	6.5	16.2
Croatia	5.15	7.67	8.42	6.65	7.56	28.0	1.2	6.9	8.0	23.6
Cyprus	7.20	8.41	9.44	7.22	5.79	16.4	5.5	37.2	20.4	4.9
Czech Rep.	3.87	6.74	9.45	7.77	7.70	23.8	-2.2	16.2	-6.2	23.8
Denmark	4.28	9.12	9.60	8.51	8.14	23.1	-4.4	-1.2	-9.5	9.2
Estonia	5.94	7.39	9.43	8.58	7.70	-7.6	9.7	8.9	-5.1	7.5
Finland	4.98	9.09	9.62	8.10	7.71	66.1	-4.2	0.7	-12.5	5.0
France	4.66	7.96	9.67	8.10	7.00	81.6	-1.6	0.8	-9.9	-4.2
Germany	5.46	8.28	9.59	7.86	6.70	37.8	-9.4	0.5	-16.3	5.9
Greece	6.51	5.75	9.67	7.46	5.06	31.6	0.8	3.7	-17.5	-8.2
Hungary	4.94	6.56	9.60	7.90	7.63	28.3	-6.4	34.1	4.2	6.3
Ireland	4.77	8.85	9.48	8.81	7.08	-22.3	-1.4	0.6	-4.0	-3.1
Italy	3.68	5.95	9.66	7.85	6.68	-20.3	-22.4	2.1	-12.9	10.8
Latvia	5.22	6.46	8.93	7.74	6.77	0.7	-3.1	4.5	-0.8	2.4
Lithuania	5.62	6.24	9.37	7.21	7.24	3.1	-3.7	32.1	-8.5	18.5
Luxembourg	4.03	8.96	9.35	8.42	7.52	-15.7	3.9	-4.1	-11.0	0.1
Malta	5.80	8.60	9.54	7.30	6.80	-3.4	2.7	36.4	17.3	9.1
Netherlands	3.36	9.08	9.56	8.71	7.53	-24.6	-5.7	-0.2	-8.9	-4.0
Poland	5.35	6.67	9.39	7.18	6.98	25.9	2.6	25.4	-0.9	12.6
Portugal	5.02	7.05	9.75	7.99	6.05	-4.7	-7.6	2.5	-10.7	-5.3
Romania	6.29	5.97	9.10	7.53	6.80	25.3	-3.0	235.7	12.5	17.6
Slovak Rep	6.29	5.67	9.71	8.39	7.10	111.1	-10.0	22.9	6.0	20.1
Slovenia	4.29	6.88	8.30	7.33	6.20	-12.9	-5.6	10.8	-4.6	0.3
Spain	5.65	6.79	9.67	7.77	6.82	19.1	-9.9	2.5	-13.5	-2.6
Sweden	3.72	9.20	9.64	8.18	7.90	17.4	2.0	-2.0	-7.9	10.2
United Kingdom	5.18	8.74	9.58	8.75	7.48	-15.5	-5.9	2.9	-7.0	-10.6