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Income inequality and inequality of opportunity in Europe. Are they on the rise?

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Income inequality and inequality of opportunity in Europe. Are they on the rise?

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Abstract

The aim of this paper is to shed some light on the behaviour of income inequality and Inequality of Opportunity over time for 26 European countries. The analysis is carried out using micro-data collected by the European Union Statistics on Income and Living Conditions (EU-SILC), which incorporate a wide variety of personal harmonised variables, allowing comparability between countries. The availability of this database for years 2004 and 2010 is particularly relevant to assess changes over time in the main inequality indices and the contribution of circumstances to inequality of opportunity. Furthermore, a bootstrap estimation is performed with the aim of testing if the differences between both years are statistically significant.

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1. INTRODUCTION AND CONCEPTUAL FRAMEWORK

This paper aims to contribute to the analysis of income inequality and inequality of opportunity in Europe, providing empirical evidence from a short term perspective. Despite the increasing attention devoted to both Income Inequality and Inequality of opportunity (IO henceforth), the analysis is usually carried out from a long-term perspective, without consideration of neither the shocks affecting individuals' welfare through their uneven opportunities nor the different effects circumstances may have in different periods of time.

According to the formalization by Roemer (1998), the analysis of Inequality of Opportunity requires distinguishing between "circumstances" and "efforts". Circumstances are understood as factors over which individuals have no control, and therefore cannot be held responsible of, while efforts can be attributed to individuals´ performance and commitment.

The theoretical basis for the study of IO can be found in Roemer (1993) and Van de Gaer (1993). Both authors express their concern about how society should compensate individuals for differences in outcome due to factors beyond its responsibility, while Fleurbaey (1994) and Bossert (1995) set the two fundamental ethical principles upon which the concept of Equality of Opportunity rests. According the *principle of compensation* (which is already mentioned in the studies by Roemer and Van de Gaer) inequalities attributable to circumstances should be removed while the *principle of reward* determines how to compensate efforts within individuals which share the same circumstances.

The idea behind the principle of compensation is becoming increasingly important when designing public policies, since according to this perspective public action should not be aimed at reducing inequalities in income, but at compensating the effect of circumstances in overall inequality. Experimental evidence provided by Almås, Cappelen, Lind, Sørensen, & Tungodden (2011) and attitude surveys (Gaertnertt & Schwettmannt, 2007; Schokkaert & Devooght, 2003) confirm that individuals distinguish between inequality due to the level of effort and due to circumstances, as suggested by the theory of equality of opportunity. This sort of inequality also affects preferences for redistribution (Alesina & La Ferrara, 2005), since people who believe that a high level of income or wealth is due to individuals own efforts and not to circumstances tend to prefer less redistributive policies.

Two main difficulties are found with respect to the empirical evidence in this field. First, studies are quite scarce due to the difficulties in measurement caused by the unobservability of opportunities. Furthermore, as result of the recent development of the empirical literature and the normative and methodological difficulties in the measurement of IO, the vast majority of studies have not followed a one-way road. Instead of that, different methodological approaches have been developed in this research area, in which a relationship between normative and theoretical

principles is not always observed, as described in Ferreira & Peragine (2015) and Ramos & Van De Gaer (2015), resulting in a lack of comparability between different empirical results.

Within the described framework, the aim of this paper is to fill the existing lack of comparative studies in this field of research and to put in the spotlight the short-term analysis on inequality of opportunity, since its implications are of great interest to shape public policy and correct disturbing imbalances on individuals' welfare. More precisely, the proposed paper is focused on the study of IO and its evolution in 26 European countries, using the EU-SILC database to compute measures which allow the estimation of inequality due to opportunities for years 2004 and 2010[1].

It is interesting to remark that the analysis of these two years is particularly relevant taking into account the economic crisis and its potential effects on inequality of opportunity. With the aim of testing if the differences between both years are statistically significant, inferential results are provided based on bootstrap techniques.

[1]This study also shows estimates for Bulgaria, Switzerland, Croatia, Malta, and Romania despite unfortunately information for these countries is only available for 2010.

2. DATABASE AND DATA DESCRIPTION

The analysis relies on the European Survey of Income and Living Conditions database (EU-SILC), in particular the surveys conducted in 2005 and 2011, which contain data for years 2004 and 2010 respectively and are the only ones with collected information on characteristics referred to the parents of respondents. These two years allow us to compare the economic situation in two different points of the economic cycle: before and after the recession.

To carry out this study the equivalised disposable income[2] of households is adopted as "advantage" variable, that is to say, the variable on which we measure inequality. The equivalised disposable income is used by EU-SILC in poverty analyses since it takes into account the structure of the households and therefore it is considered a good indicator of living conditions, well-being and quality of life. To perform the proposed analysis, the sample is restricted to individuals aged between 25 and 59 years and whose professional situation (or last main job in the case of unemployed individuals) is different from self-employed in order to ensure a level of reliability which cannot be guaranteed by the income declared by self-employed workers.

Variables used as circumstances are *Gender*, *Immigrant*[3] *Density*[4], *Parental Education*[5], *Parental Occupation*[6] and *Age*[7]. *Gender*, *Immigrant* and *Density* are divided into two categories (male/female, immigrant/non-immigrant and low/medium and high respectively), whereas *Density*, *Parental Education* and *Parental Occupation* rely in three categories, the latter variable, *Age*, relies in five age cohorts. This classification results in a maximum of 360 types of individuals.

In Table I it can be observed the population share by circumstance's categories for each year. The major changes over time correspond to the circumstance *Parental Education*, where the share of population with low level of parental education experienced a decrease in favour of the categories

[2] The equivalence scale used by EU-SILC is: $e = 1 + 0.5(N_{14^+} - 1) + 0.3N_{13^-}$ where $N_{14^+}$is the number of household members with 14 yeras or more and N_{13^-} the number of members with 13 years or less.

3 Individuals who were born outside Spain are considered immigrants. EU-SILC distinguishes between persons born in Spain, in the EU-24, in the rest of Europe or other countries. However, further splits in this category would result in few observations on each type, thus affecting negatively the accuracy of the analysis.

4 The category "Medium and high" includes places with a high degree of urbanization (population density over 500pop./km2 and with more than 50,000 inhabitants) and with a medium degree (density over 100pop./km2 and more than 50,000 inhabitants or adjacent to a highly populated area), the category "Low" corresponds with a low degree of urbanization, includes areas in which the requirements for a medium degree of urbanization are not satisfied.

5 Parental education: Low, when both or one progenitor have a maximum degree of compulsory education; Medium, if both or one of them have a maximum of secondary education (high school or similar); High, if at least one of them holds a higher education degree.

6 Parental occupation is divided regarding the ISCO-88 jobs classification, the three categories are: low skilled (the two progenitors work in elementary occupations, two-digit groups 80 and 90 in ISCO-88 classification), medium skilled (when at least one of the progenitors works in an occupation within groups from 50 to 70 in ISCO-88), high skilled (at least one progenitor works in a high skill occupation within groups from 10 to 40 in ISCO-88).

[7] Individuals are divided into five age cohorts of six years from 25 to 59 years, this variable has been included since age has been proved to be a relevant circumstance (Suárez-Álvarez & López-Menéndez, 2016).

referred to medium and high levels of education. With regard to the circumstance *Immigrant* it can be observed an increase in the share of immigrant population from 2004 to 2010 for all countries except for Czech Republic, Estonia, France, Hungary, Lithuania, Latvia, Poland and Slovenia. In the remaining variables, we do not observe significant fluctuations over time.

Regarding changes in the share of categories and cross-country differences, we can see that for the variable *Parental Education* there is a group of 17 countries[8] with substantial prevalence of individuals with low-educated parents (Belgium, Bulgaria, Cyprus, Greece, Spain, Finland, France, Ireland, Italy, Lithuania, Luxembourg, Malta, Portugal, Romania, Sweden, Slovenia and UK) and another set of six countries where the same happens with the share of individuals whose parents have a middle educational level (Switzerland, Germany, Denmark, Iceland, Norway and Slovakia) while in the remaining countries there is no significant bias towards any category.

A similar analysis for *Parental Occupation* shows some coincidences with parental education. As shown in Figure 1-4, there is a moderate level of positive association between both characteristics when comparing its low and high levels for both years. However, this relationship is not observed for the intermediate categories, where the fitted line has an R^2 of 0.00045 for 2004 and of 0.0807 for 2010.

Figure 1: Population share corresponding to the "Low" category for Parents Education and Parents Occupation in 2004

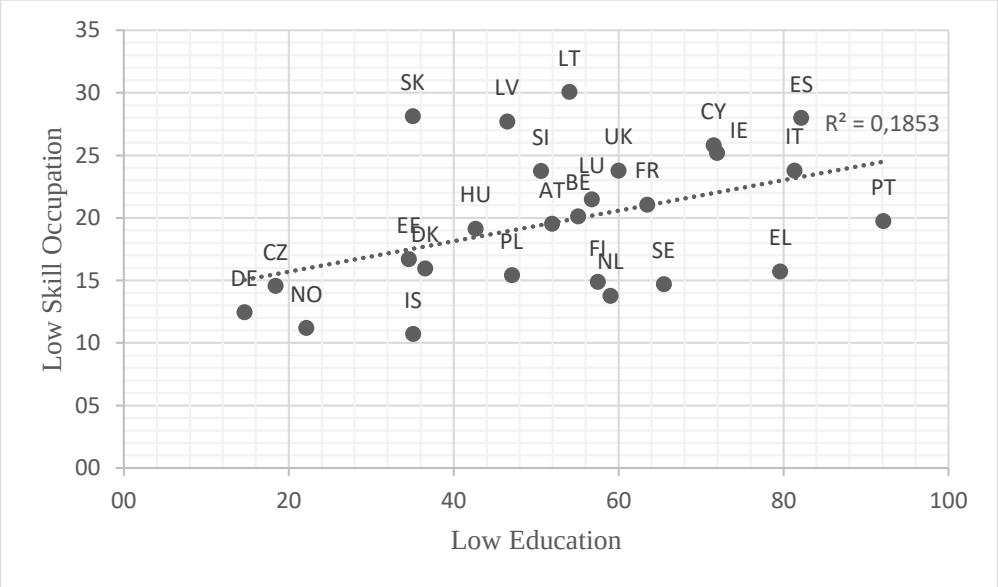


Figure 2: Population share corresponding to the "Low" category for Parents Education and Parents Occupation in 2010

[8] These countries are Belgium, Bulgaria, Cyprus, Greece, Spain, Finland, France, Ireland, Italy, Lithuania, Luxembourg, Malta, Portugal, Romania, Sweden, Slovenia and United Kingdom.

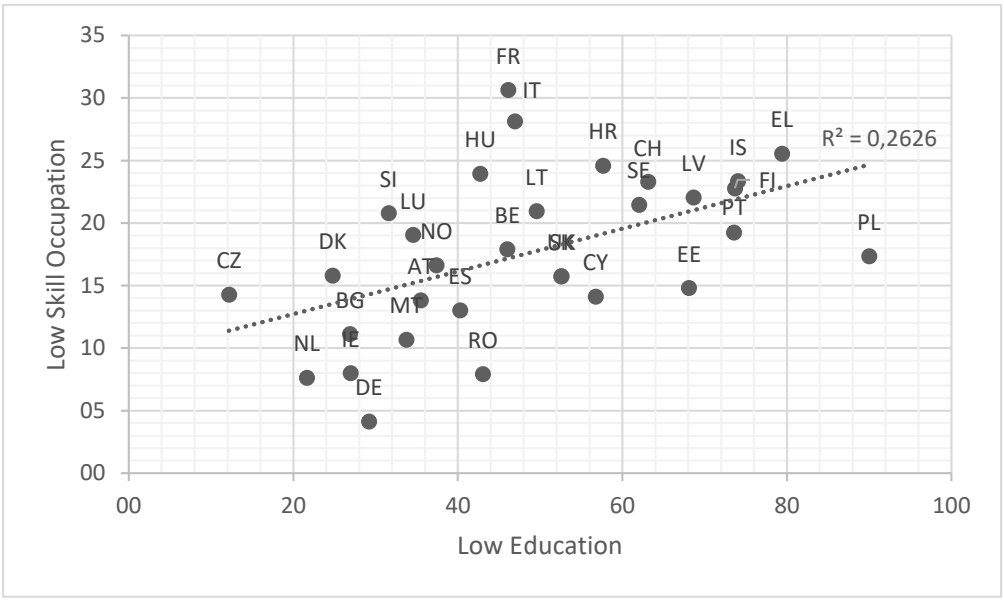


Figure 3: Population share corresponding to the "High" category for Parents Education and Parents Occupation in 2004

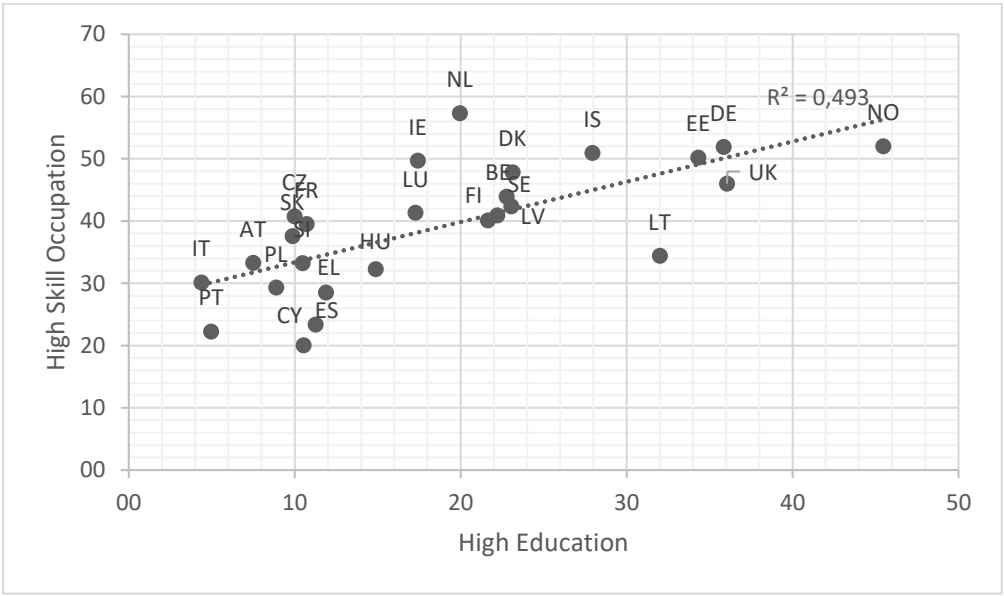
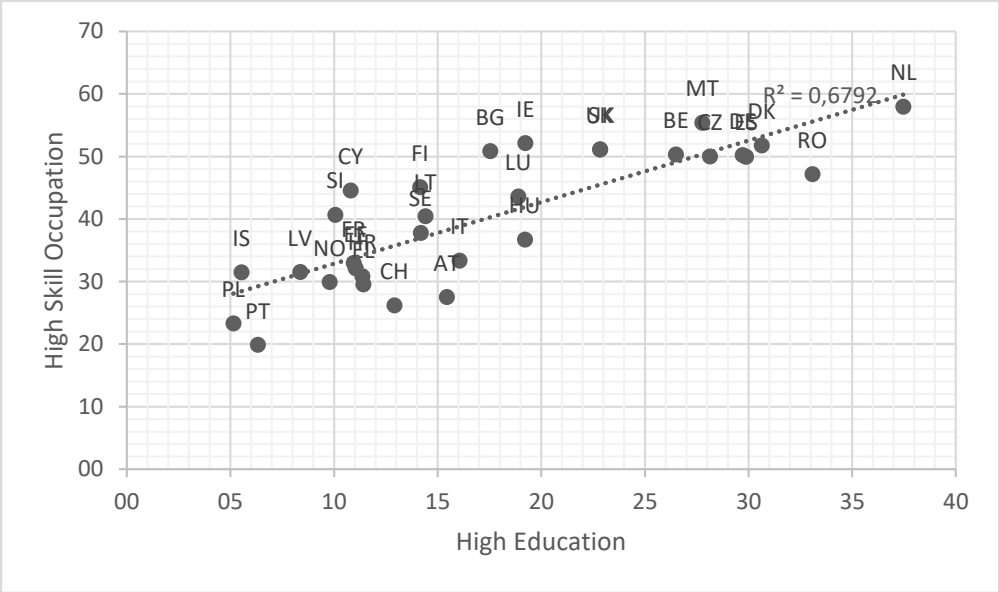


Figure 4: Population share corresponding to the "High" category for Parents Education and Parents Occupation in 2010



Nevertheless, in the case of the two extreme categories (Low and High) it can be seen that there is a clear correlation between having a low/high level of education and working in low/high skilled occupations. This correlation is more intense about the category "high" and increases from 2004 to 2010.

The circumstance *Immigrant* has a similar population share for most countries, lower than the 20% with the exceptions of Austria, Cyprus and Ireland, where the share of population exceeds this value in 2010 and Luxembourg, which can be considered as a special case due to its small size.

In the variable *Density* a similar pattern within countries is also observed, excluding Estonia and Greece in 2004, Finland and Latvia in 2010 and Lithuania in both years (the share of people living in low density areas is slightly higher than 50%), the share of population living in low density urban areas is considerably smaller than the share of people living in urban areas with medium or high density. The extreme case is Belgium, where only the 4% of the population lives in low density areas and only in Czech Republic, Croatia, Hungary, Poland, Romania and Slovakia this share is above the 40%. The two remaining circumstances, *Age* and *Gender* do not show any significant differences neither between years nor between categories.

TABLE I. Population share by circumstances (part 1)

	AT		BE		BG	CH	CY		CZ		DE		DK		EE		EL		ES		FI		FR		HR	HU		IE	
	2004	2010	2004	2010	2010	2010	2004	2010	2004	2010	2004	2010	2004	2010	2004	2010	2004	2010	2004	2010	2004	2010	2004	2010	2010	2004	2010	2004	2010
Income																													
Average	20995	25899	20361	24620	3911	42667	16575	21699	5058	8897	20825	23073	26478	31085	4120	7293	12604	14381	14204	18159	21539	26315	19507	24830	6993	4170	5439	2694	26248
Std. Dev	10579	13776	8990	10930	2726	26920	10970	15788	2456	4568	12137	12511	9619	16866	2774	4370	7231	9385	7891	12163	24419	14239	10445	19520	3857	2924	2968	233	14469
SHARE OF NDIVIDUALS																													
Gender																													
Female	50.6	51.0	49.3	50.3	50.0	49.7	51.0	52.7	52.7	59.1	53.5	51.0	48.8	51.1	53.8	54.1	47.5	49.8	48.3	49.6	51.0	49.6	51.8	51.7	50.5	54.3	52.2	59.0	59.9
Male	49.4	49.0	50.7	49.7	50.0	50.3	49.0	47.4	47.3	40.9	46.5	49.0	51.2	48.9	46.2	45.9	52.5	50.2	51.7	50.4	49.0	50.4	48.2	48.3	49.5	45.8	47.8	41.0	40.1
Parents education																													
Low	51.9	35.5	55.1	46.0	43.5	26.9	71.5	63.1	18.4	56.7	14.6	12.2	36.5	29.2	34.6	24.8	79.6	68.1	82.1	79.4	57.5	40.3	63.5	73.7	46.1	42.7	57.6	71.3	42.7
Medium	40.6	49.1	22.2	27.5	41.8	55.6	18.0	24.0	71.6	32.5	49.5	59.7	40.4	41.1	31.1	44.6	8.5	20.9	6.6	9.2	20.9	29.9	25.8	12.2	42.9	42.5	31.0	10.7	38.1
High	7.5	15.4	22.8	26.5	14.8	17.5	10.5	12.9	10.0	10.8	35.8	28.1	23.1	29.7	34.3	30.6	11.9	11.0	11.3	11.4	21.6	29.9	10.7	14.2	10.9	14.9	11.4	17.4	19.2
Parents occupation																													
Low	19.5	13.8	20.1	17.9	19.8	11.1	25.8	23.3	14.6	14.1	12.5	14.3	16.0	4.1	16.7	15.8	15.7	14.8	28.0	25.6	14.9	13.0	21.1	22.8	30.6	19.1	24.6	25.2	24.0
Medium	47.2	58.6	36.0	31.7	47.7	38.0	54.2	50.5	44.7	41.3	35.7	35.7	36.3	45.6	33.1	32.4	55.8	53.0	48.6	44.8	45.0	37.0	39.4	32.1	36.4	48.6	44.6	25.1	39.3
High	33.3	27.6	43.9	50.4	32.6	50.9	20.0	26.2	40.7	44.6	51.9	50.0	47.8	50.3	50.2	51.8	28.5	32.2	23.4	29.6	40.1	50.0	39.5	45.1	33.0	32.3	30.9	49.7	36.7
Density																													
Low	39.6	34.5	4.1	4.0	45.9	12.8	27.5	26.3	42.2	39.7	17.6	15.5	32.6	23.5	51.0	48.0	51.0	35.2	24.0	24.3	49.5	51.9	15.6	16.8	46.3	45.4	47.6	32.0	34.5
Medium & high	60.4	65.5	95.9	96.0	54.2	87.2	72.5	73.7	57.8	60.4	82.5	84.5	67.4	76.5	49.0	52.0	49.0	64.8	76.0	75.7	50.5	48.1	84.4	83.2	53.7	54.6	52.4	68.0	65.5
Immigrant																													
Yes	13.3	21.0	11.2	15.2	0.5	31.6	17.2	22.9	3.5	3.4	10.3	11.5	3.7	6.2	17.1	13.3	10.1	12.6	6.6	16.2	2.3	4.6	11.4	9.8	10.9	2.4	1.1	13.8	22.4
No	86.7	79.0	88.8	84.8	99.5	68.4	82.8	77.2	96.5	96.6	89.7	88.5	96.4	93.8	82.9	86.7	89.9	87.4	93.5	83.8	97.7	95.4	88.6	90.2	89.1	97.6	98.9	86.2	77.6
Age cohorts																													
53-59	15.6	18.1	17.0	17.8	19.9	16.0	15.3	15.4	21.5	21.0	16.7	20.1	17.1	21.7	17.8	19.3	14.1	15.6	12.8	14.5	21.3	21.8	18.2	19.7	19.8	17.9	24.8	15.2	17.2
46-52	19.4	23.2	20.8	21.9	19.2	21.5	18.2	19.6	18.9	17.8	20.7	22.8	17.6	18.2	20.6	19.3	17.7	16.7	17.0	18.9	20.2	18.6	18.8	19.8	20.8	22.9	19.0	23.4	19.7
39-45	23.5	23.8	22.5	21.1	19.7	23.9	21.4	19.2	17.3	19.1	25.9	24.0	22.9	20.8	20.7	19.5	20.0	21.6	21.6	22.0	20.4	16.6	21.5	21.0	20.0	16.8	18.8	20.5	18.7
32-38	23.2	17.1	21.3	20.1	22.6	20.3	22.4	21.1	18.4	23.6	22.5	16.6	23.8	21.7	20.6	19.8	24.6	24.2	23.7	25.1	18.7	17.7	21.3	20.5	19.9	19.2	20.7	21.8	25.4
25-31	18.3	17.8	18.4	19.2	18.7	18.4	22.8	24.7	23.9	18.5	14.2	16.5	18.6	17.7	20.4	22.1	23.6	21.9	24.8	19.6	19.4	25.3	20.1	19.0	19.6	23.2	16.7	19.2	19.0
Sample Size	4874	5519	3992	4672	5920	5978	4200	4274	4306	6122	10969	10434	2814	2360	4365	4824	3895	3513	12721	11929	4440	2602	9200	9729	4860	6700	12130	2738	2572

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TABLE I. Population share by circumstances (part 2)

	IS		IT		LT		LU		LV		MT	NL		NO		PL		PT		RO	SE		SI		SK		UK	
	2004	2010	2004	2010	2004	2010	2004	2010	2004	2010	2010	2004	2010	2004	2010	2004	2010	2004	2010	2010	2004	2010	2004	2010	2004	2010	2004	2010
Income																												
Average	27201	20578	18682	19975	2858	4893	33511	38166	2980	5490	13971	21417	23941	31134	40828	3445	6494	10656	11490	2981	20016	24965	9918	13524	3424	7717	26563	24135
Std. Dev	17990	10831	11414	11814	2077	3146	17725	20390	2412	3736	7067	10784	11928	40870	18383	2809	4388	8984	7688	1683	7117	10185	4724	6434	2059	3899	18591	21802
SHARE OF INDIVIDUALS																												
Gender																												
Female	52.05	51.54	48.40	49.44	52.70	53.86	49.45	50.10	54.49	54.20	50.74	49.11	51.11	48.92	47.47	51.78	53.98	50.84	51.06	46.20	49.00	50.29	50.02	50.04	54.18	53.51	54.47	54.35
Male	47.95	48.46	51.60	50.56	47.30	46.14	50.55	49.90	45.51	45.80	49.26	50.89	48.89	51.08	52.53	48.22	46.02	49.16	48.94	53.80	51.00	49.71	49.98	49.96	45.82	46.49	45.53	45.65
Parents education																												
Low	35.08	26.97	81.30	74.03	54.03	46.93	56.75	49.56	46.47	34.53	68.65	59.00	33.72	22.12	21.63	47.04	37.37	92.08	89.98	73.54	65.46	43.05	50.59	62.01	35.03	31.59	59.96	52.56
Medium	36.98	53.81	14.34	20.44	13.98	37.02	25.98	36.04	31.34	46.59	22.99	21.06	38.51	32.42	40.91	44.09	52.85	2.96	4.88	20.16	11.49	23.88	38.94	23.81	55.10	58.35	4.00	24.60
High	27.94	19.22	4.36	5.53	31.99	16.05	17.27	14.40	22.19	18.88	8.36	19.94	27.77	45.46	37.46	8.87	9.78	4.96	5.14	6.31	23.05	33.08	10.46	14.18	9.86	10.06	36.04	22.84
Parents occupation																												
Low	10.72	8.01	23.79	23.35	30.09	28.14	21.48	20.95	27.71	19.06	22.05	13.78	10.68	11.21	7.64	15.43	16.62	19.75	17.34	19.24	14.72	7.94	23.77	21.47	28.14	20.80	23.79	15.75
Medium	38.32	39.81	46.07	45.13	35.51	38.49	37.18	38.58	31.38	37.34	46.39	28.92	33.88	36.78	34.38	55.27	53.41	57.98	59.35	60.87	42.92	44.84	42.98	40.72	34.26	38.51	30.21	33.09
High	50.96	52.18	30.13	31.52	34.40	33.37	41.34	40.47	40.90	43.60	31.56	57.30	55.44	52.01	57.98	29.30	29.96	22.26	23.31	19.89	42.36	47.22	33.25	37.81	37.60	40.69	45.99	51.16
Density																												
Low	32.48	33.50	16.27	14.22	54.34	54.56	18.67	21.61	51.01	48.41	N.A	N.A	N.A	30.38	28.03	40.71	41.81	21.52	20.57	47.78	68.88	63.23	N.A	N.A	41.30	42.74	3.69	12.80
Medium & high	67.52	66.50	83.73	85.78	45.66	45.44	81.33	78.39	48.99	51.59				69.62	71.97	59.29	58.19	78.48	79.43	52.22	31.12	36.77			58.70	57.26	96.31	87.20
Immigrant																												
Yes	5.81	11.46	7.65	12.85	6.07	5.68	44.36	52.11	14.81	12.30	5.03	5.62	11.43	7.25	9.11	0.50	0.09	3.78	9.52	0.17	8.83	10.67	10.95	12.43	1.81	1.04	9.94	13.31
No	94.19	88.54	92.35	87.15	93.93	94.32	55.64	47.89	85.19	87.70	94.97	94.38	88.57	92.75	90.89	99.50	99.91	96.22	90.48	99.83	91.17	89.33	89.05	87.57	98.19	98.96	90.06	86.69
Age cohorts																												
53-59	15.60	16.11	17.06	16.54	16.43	18.04	15.46	15.99	16.51	19.87	16.38	18.47	17.39	16.25	17.27	17.97	21.04	14.96	17.16	16.73	17.10	18.99	17.14	17.25	18.93	20.51	19.69	16.06
46-52	16.01	17.73	19.73	21.59	19.04	24.19	21.50	21.62	21.23	21.56	20.47	17.18	19.99	16.97	17.56	22.27	18.63	17.27	19.72	17.92	17.73	17.16	18.93	20.13	22.00	20.71	19.00	21.75
39-45	21.31	18.89	20.00	23.64	23.63	21.10	21.83	22.42	21.75	20.88	17.14	21.11	22.66	20.27	24.48	18.47	17.11	20.59	20.48	21.47	19.31	19.02	19.81	20.20	21.05	20.02	21.43	23.26
32-38	24.00	23.43	23.80	21.97	21.70	18.68	24.47	22.06	20.49	18.95	24.66	23.18	19.83	24.31	20.65	18.65	21.10	22.24	22.55	23.95	22.06	21.31	26.15	25.33	16.93	19.89	21.87	20.40
25-31	23.09	23.85	19.41	16.25	19.21	18.00	16.74	17.91	20.03	18.74	21.36	20.06	20.13	22.20	20.04	22.64	22.12	24.93	20.10	19.94	23.81	23.52	17.98	17.10	21.09	18.87	18.01	18.53
Sample Size	1380	1502	17472	13547	4666	4580	4043	6280	3598	5886	3320	4047	4770	2962	2471	15977	11650	4245	4987	4251	943	600	3950	4218	6521	6335	6432	5279

For further illustration of the data, Table II provides the share of individuals within each category of circumstance who have a disposable income below the median, and therefore, are in an unfavourable (disadvantaged) situation.

Results are very intuitive, showing the important role of the circumstance *Parental Education* in reducing inequalities. As it can be seen in Table I, the higher the educational level, the lower the share of disadvantaged individuals. More specifically, for individuals whose progenitors have a low educational level the proportion of disadvantaged exceeds the 50% of the population, with the exceptions of Denmark, Finland and Sweden in both years and Iceland and Netherlands in 2010. On the other side, the share of disadvantaged for individuals with middle-educated parents is around the 50% while in the case of highly educated parents is always less than the 50%.

The same occurs for *Parental Occupation*: the higher the qualification, the lower the share of disadvantaged. As in the previous case, when the parental occupation is classified in the low category, the share of individuals in an unfavourable situation is greater than the 50% except for a few countries which are roughly the previously identified for the educational level[9].

The circumstance *Immigrant* clearly affects the percentage of population in disadvantage, except for the cases of Lithuania in both years, Poland and Slovakia in 2005 and Portugal in 2010. With regard to the circumstance *Density*, it can be observed that those who live in urban areas of low density experienced a higher ratio of disadvantaged individuals, except for Luxembourg and UK, Table II as well as Table I allow us to see that, as expected, the circumstances *Parental Education and Occupation* are closely related in both level and evolution.

Circumstances *Age* and *Gender* do not show any significant bias towards a category, although for the variable *Age* it seems that there is a smaller share of disadvantaged individuals in the elder cohort (aged between 53 and 59 years) while middle cohorts (32-38 and 39-45) tend to have more individuals in an unfavourable situation.

The described variables and their categorisation allow us to consider the main circumstances of individuals. It can be argued that we do not take into account the innate intelligence, which is approached by Björklund, Jäntti, & Roemer (2012) using the IQ coefficient at 18 years old and seems to be a very influential circumstance. However, the EU-SILC database does not provide that information and, furthermore, it is questionable if it is a circumstance, since individuals' IQ grows due to different stimulus, circumstances (e.g. family background) but also efforts (e.g. time dedicated to study or read) and despite individuals in their childhood should not be held responsible of their choices, the situation is quite different at an older age (16 to 18).

[9] In this case the set of countries includes Denmark and Finland in both years, and Iceland, Netherland, Sweden and Norway in 2010.

TABLE II. Share of individuals with an equivalent disposable income below the median (part 1)

	AT		BE		BG	CH	CY		CZ		DE		DK		EE		EL		ES		FI		FR		HR	HU		IE	
	2004	2010	2004	2010	2010	2010	2004	2010	2004	2010	2004	2010	2004	2010	2004	2010	2004	2010	2004	2010	2004	2010	2004	2010	2010	2004	2010	2004	2010
Income																													
Median	19194	23817	19265	23326	3399	38198	14523	19003	4629	8106	18666	21285	25258	29326	3527	6505	11200	13080	12736	15774	19453	24500	17492	21570	6192	3662	4801	24242	23548
Gender																													
Female	0.53	0.50	0.53	0.51	0.51	0.48	0.52	0.51	0.52	0.52	0.52	0.48	0.43	0.39	0.59	0.57	0.49	0.53	0.54	0.49	0.45	0.48	0.50	0.50	0.51	0.50	0.52	0.47	0.54
Male	0.51	0.46	0.48	0.48	0.52	0.44	0.51	0.47	0.47	0.48	0.46	0.45	0.43	0.36	0.53	0.56	0.54	0.54	0.52	0.48	0.44	0.44	0.49	0.47	0.54	0.49	0.52	0.47	0.48
arents education																													
Low	0.57	0.56	0.59	0.60	0.66	0.58	0.58	0.55	0.62	0.58	0.56	0.57	0.44	0.40	0.67	0.68	0.55	0.59	0.57	0.53	0.47	0.49	0.55	0.54	0.62	0.61	0.63	0.57	0.60
Medium	0.47	0.46	0.45	0.47	0.43	0.45	0.37	0.41	0.50	0.44	0.49	0.49	0.45	0.37	0.56	0.57	0.35	0.42	0.38	0.34	0.46	0.45	0.44	0.40	0.46	0.45	0.40	0.36	0.49
High	0.36	0.37	0.35	0.34	0.25	0.35	0.29	0.29	0.28	0.30	0.47	0.39	0.38	0.35	0.40	0.40	0.38	0.30	0.29	0.26	0.36	0.42	0.31	0.31	0.25	0.29	0.24	0.35	0.36
rents occupation																													
Low	0.64	0.59	0.61	0.62	0.63	0.58	0.62	0.59	0.64	0.60	0.56	0.52	0.50	0.51	0.65	0.64	0.61	0.55	0.62	0.56	0.48	0.54	0.62	0.62	0.61	0.61	0.68	0.65	0.66
Medium	0.53	0.50	0.57	0.57	0.58	0.53	0.53	0.52	0.56	0.59	0.52	0.53	0.46	0.40	0.63	0.64	0.56	0.59	0.57	0.53	0.48	0.48	0.54	0.53	0.57	0.56	0.57	0.55	0.55
High	0.42	0.38	0.40	0.41	0.32	0.40	0.32	0.34	0.38	0.39	0.46	0.41	0.38	0.34	0.47	0.47	0.36	0.40	0.35	0.33	0.38	0.42	0.38	0.39	0.37	0.32	0.31	0.41	0.39
Density																													
Low	0.58	0.51	0.50	0.51	0.65	0.59	0.61	0.61	0.55	0.56	0.59	0.57	0.52	0.44	0.61	0.60	0.58	0.59	0.66	0.60	0.49	0.51	0.61	0.58	0.58	0.61	0.64	0.61	0.59
ledium and high	0.47	0.46	0.50	0.50	0.38	0.44	0.48	0.45	0.46	0.47	0.47	0.45	0.38	0.35	0.45	0.49	0.45	0.48	0.48	0.44	0.39	0.39	0.47	0.47	0.46	0.40	0.39	0.47	0.47
Immigrant																													
Yes	0.70	0.71	0.64	0.67	0.55	0.52	0.61	0.62	0.61	0.55	0.60	0.59	0.56	0.56	0.65	0.66	0.75	0.79	0.70	0.77	0.64	0.58	0.65	0.61	0.62	0.49	0.50	0.49	0.61
No	0.50	0.43	0.49	0.46	0.51	0.45	0.49	0.46	0.50	0.50	0.49	0.46	0.42	0.36	0.55	0.55	0.49	0.50	0.52	0.45	0.44	0.45	0.48	0.48	0.51	0.50	0.52	0.51	0.48
Age cohorts																													
53-59	0.44	0.41	0.50	0.47	0.49	0.35	0.46	0.45	0.47	0.48	0.42	0.43	0.23	0.25	0.58	0.61	0.50	0.47	0.51	0.40	0.51	0.39	0.41	0.39	0.52	0.45	0.51	0.50	0.50
46-52	0.45	0.42	0.51	0.51	0.49	0.45	0.50	0.48	0.45	0.47	0.43	0.44	0.33	0.33	0.57	0.60	0.50	0.52	0.53	0.48	0.39	0.42	0.43	0.47	0.53	0.50	0.55	0.53	0.53
39-45	0.55	0.49	0.55	0.54	0.61	0.54	0.58	0.58	0.55	0.60	0.55	0.48	0.50	0.44	0.62	0.59	0.51	0.55	0.59	0.55	0.48	0.46	0.54	0.55	0.60	0.57	0.59	0.59	0.56
32-38	0.61	0.54	0.51	0.47	0.53	0.49	0.55	0.48	0.59	0.55	0.54	0.50	0.52	0.40	0.56	0.54	0.53	0.55	0.54	0.51	0.48	0.49	0.55	0.53	0.50	0.51	0.50	0.47	0.45
25-31	0.51	0.54	0.42	0.48	0.42	0.47	0.46	0.47	0.46	0.43	0.51	0.51	0.55	0.57	0.44	0.43	0.54	0.58	0.48	0.47	0.50	0.55	0.53	0.50	0.45	0.46	0.43	0.[illegible]	0.54

TABLE II. Share of individuals with an equivalent disposable income below the median (part 2)

	IS		IT		LT		LU		LV		MT	NL		NO		PL		PT		RO	SE		SI	SK		UK	
	2004	2010	2004	2010	2004	2010	2004	2010	2004	2010	2010	2004	2010	2004	2010	2004	2010	2004	2010	2010	2004	2010	2010	2004	2010	2004	2010
Income																											
Median	25177	18893	16703	18434	2358	4287	30249	34147	2512	4737	12745	19555	21643	28483	38044	2801	5630	8185	9607	2656	19213	23605	12746	3141	7141	22756	20384
Gender																											
Female	0.52	0.44	0.48	0.47	0.51	0.49	0.52	0.53	0.55	0.53	0.55	0.51	0.43	0.49	0.43	0.52	0.54	0.51	0.53	0.49	0.47	0.47	0.46	0.52	0.50	0.51	0.54
Male	0.44	0.42	0.51	0.48	0.49	0.48	0.52	0.51	0.51	0.51	0.51	0.47	0.39	0.47	0.43	0.54	0.53	0.52	0.52	0.53	0.48	0.45	0.44	0.47	0.46	0.47	0.48
Parents education																											
Low	0.54	0.46	0.53	0.53	0.57	0.55	0.64	0.68	0.64	0.64	0.59	0.54	0.48	0.53	0.46	0.61	0.63	0.55	0.55	0.59	0.49	0.44	0.52	0.58	0.60	0.56	0.58
Medium	0.48	0.43	0.32	0.34	0.48	0.48	0.38	0.38	0.48	0.49	0.43	0.47	0.41	0.47	0.45	0.48	0.49	0.15	0.30	0.29	0.41	0.51	0.34	0.47	0.45	0.37	0.51
High	0.42	0.38	0.27	0.24	0.35	0.29	0.32	0.28	0.35	0.33	0.27	0.36	0.32	0.45	0.38	0.25	0.29	0.15	0.17	0.15	0.48	0.45	0.27	0.35	0.27	0.41	0.35
Parents occupation																											
Low	0.50	0.48	0.57	0.57	0.60	0.57	0.63	0.60	0.65	0.64	0.64	0.56	0.56	0.54	0.48	0.62	0.62	0.57	0.59	0.61	0.40	0.57	0.58	0.59	0.59	0.62	0.69
Medium	0.51	0.45	0.54	0.53	0.52	0.50	0.63	0.64	0.57	0.58	0.59	0.57	0.46	0.50	0.46	0.58	0.59	0.59	0.58	0.56	0.50	0.46	0.50	0.52	0.53	0.57	0.57
High	0.46	0.41	0.36	0.34	0.37	0.39	0.36	0.36	0.41	0.41	0.37	0.43	0.36	0.44	0.40	0.36	0.36	0.26	0.30	0.25	0.48	0.44	0.32	0.41	0.37	0.38	0.41
Density																											
Low	0.56	0.46	0.56	0.54	0.61	0.58	0.54	0.50	0.65	0.58	N.A	N.A	N.A	0.53	0.49	0.61	0.62	0.57	0.56	0.63	0.52	0.46	N.A	0.58	0.56	0.48	0.49
Medium and high	0.44	0.42	0.47	0.46	0.37	0.38	0.51	0.53	0.41	0.46				0.45	0.40	0.46	0.46	0.50	0.51	0.39	0.39	0.45		0.44	0.42	0.50	0.52
Immigrant																											
Yes	0.63	0.55	0.71	0.75	0.48	0.45	0.62	0.65	0.53	0.55	0.55	0.52	0.51	0.55	0.61	0.49	0.55	0.50	0.46	0.57	0.63	0.68	0.61	0.48	0.58	0.50	0.57
No	0.47	0.42	0.48	0.45	0.50	0.49	0.42	0.38	0.53	0.52	0.53	0.49	0.41	0.47	0.41	0.53	0.53	0.52	0.53	0.51	0.46	0.43	0.43	0.50	0.48	0.50	0.51
Age cohorts																											
53-59	0.33	0.31	0.44	0.38	0.50	0.45	0.46	0.45	0.56	0.53	0.52	0.36	0.36	0.27	0.27	0.48	0.54	0.50	0.49	0.46	0.33	0.28	0.46	0.45	0.45	0.51	0.53
46-52	0.33	0.35	0.48	0.50	0.48	0.46	0.48	0.53	0.56	0.56	0.58	0.44	0.43	0.42	0.39	0.54	0.51	0.48	0.53	0.55	0.38	0.35	0.42	0.49	0.51	0.49	0.48
39-45	0.53	0.41	0.56	0.53	0.55	0.58	0.55	0.53	0.57	0.55	0.61	0.55	0.43	0.57	0.51	0.58	0.57	0.57	0.59	0.62	0.55	0.58	0.47	0.63	0.61	0.53	0.52
32-38	0.55	0.49	0.52	0.47	0.50	0.54	0.52	0.54	0.52	0.51	0.53	0.57	0.40	0.53	0.45	0.52	0.53	0.55	0.55	0.51	0.54	0.48	0.46	0.56	0.49	0.49	0.52
25-31	0.59	0.59	0.46	0.48	0.44	0.42	0.55	0.54	0.43	0.42	0.43	0.48	0.44	0.55	0.52	0.50	0.52	0.48	0.45	0.38	0.55	0.61	0.43	0.37	0.33	0.45	0.52

Likewise, it can be claimed that the variable *Density* is not strictly exogenous since individuals are free to choose a place for living. Nevertheless, we believe this is not entirely true, as -even if it is not an invariant factor- circumstances can be changeable in some cases.

With this regard we distinguish between two main types of circumstances: *Unalterable*, which are immutable and inherent to the individual, and *Alterable* characterised by the fact that they can change over the individual's life-cycle. In order to change alterable circumstances, individuals need to make an effort, but the level of effort required is not homogenous between individuals and it ultimately depends on unalterable circumstances such as region of birth or parental education.

Lastly in this section, it is important to point out that the fact that we do not find significant differences within the gender circumstance is not due to a lack of them (it is clear that there is a discrimination against women and we do not want to provide conflicting evidence) but to the choice of the advantage variable (equivalised disposable income). As we have described before this variable has the great advantage of being a highly accurate approximation to the truly available income each individual benefits from. However, a disadvantage of this measure is that it undervalues gender differences since each person in the household is assumed to have the same income given that this is the most approximate quantity of the true amount of income she can actually use[10].

[10] Following this reasoning, it could be thought that *Gender* should not be considered as circumstance but, since there are households with different compositions (e.g. a single mother, only women) its utilisation would allow us to capture inequalities due to this kind of facts.

3. EMPIRICAL ANALYSIS

This section provides empirical evidence of the level and evolution between 2004 and 2010 of inequality, inequality of opportunity and the contribution of the circumstances taken into consideration. It is known that the measurement of inequality of opportunity constitutes a great challenge, due to the unobservability of opportunities (they are a set of options not always exercised) which does not allow a direct estimation as it occurs with consumption or income.

Likewise, due to the normative nature of the concept of Equality of Opportunity there are many approaches to its measurement. While there is wide consensus on the core principles to be met in measuring inequality of opportunity, compensation and reward, empirical literature is not always consistent with them.

Empirical studies could be classified in two main ways. Firstly, regarding the interpretation given to the principle of compensation measures can be classified in *ex ante* (compensation between individuals is performed prior to the determination of their level of effort) and *ex post* (compensation should be conducted after knowing their effort, receiving the same outcome of advantage individuals who exerted the same degree of effort). Secondly, with regard to the methodology implemented, measures can be divided into three different types: the first relies in stochastic dominances analyses, while the second is based on the concept of fair allocation and the third rests on the construction of counterfactual distributions.

The estimations we undertake in this paper rely on the latter approach since it is the most widely used in the empirical literature. This method requires the isolation of inequality due to circumstances through direct measures based on the criterion of minimum mean, (Van de Gaer, 1993), or due to efforts through indirect measures based on the criterion of minimum average (Roemer, 1993), and then the comparison between the counterfactual and the initial distribution provides an estimation of the inequality of opportunity.

Our estimations are made from the *ex ante* perspective, since this approach is not inconsistent with the compensation and reward principles and therefore, congruent with the normative basis of equality of opportunity[11]. Furthermore, IO can be estimated through both parametric and nonparametric techniques, and we select the first approach since the nonparametric option leads to less accurate estimates when the set of circumstances is large.

The *ex ante* parametric procedure consists in dividing individuals into T different types, $t \in \{1,\ldots,T\}$, each of them comprising all individuals who share the same circumstances. Likewise, each circumstance k can take several values denoted as z_k, and therefore, the number of types is

[11] See Ramos & Van De Gaer (2015) for more information about compatibilities between these principles.

determined by the number of circumstances and the different values each of these circumstances can take. This can be expressed in a more analytical way as follows: $T = \prod_{k=1}^{K} z_k$.

The measurement of inequality is carried out through the mean logarithmic deviation, MLD, (also known as Theil's L) given by the expression: $GE(0) = \frac{1}{N}\sum_{i=1}^{N} \ln\left(\frac{\bar{y}}{y_i}\right)$, which belongs to the family of generalised entropy measures[12] and satisfies the property of being additively decomposable into subgroups by a path-independent decomposition (Foster & Shneyerov, 2000). The Gini index is also calculated since it is a more common and easy to interpret measure allowing more comparability with other studies.

In this context, IO estimates are obtained through the parametric procedure described by Ferreira & Gignoux (2011). This method relies on the ordinary least squares estimation of the following equation: $lny_i = C_i\beta + u_i$, which is the reduced form of the equation $lny_i = C_i\alpha + E_i\delta + v_i$, where α is the direct effect of circumstances on individual outcome, while δ would capture the effect of circumstances through their effect on the level of effort. Hence the β coefficient of the reduced form reflects the impact of both effects in the outcome variable, since efforts E_i depend on circumstances $E(C,e)$.

Once the regression is estimated, a counterfactual distribution can be constructed to measure inequality of opportunity as follows:

$$\hat{\mu}_i = \exp(C_i\hat{\alpha})$$

Hence, absolute and relative inequality of opportunity are obtained from the following expressions:

$$IO_A^P = I(\hat{\mu}_i) \qquad\qquad IO_R^P = \frac{I(\hat{\mu}_i)}{I(y)}$$

Having calculated IO estimates, the next step of this research is to account for the contribution that each circumstance has on IO. For this purpose, we use the decomposition procedure based on the Shapley value, which entails calculating the marginal effects of each circumstance under different sets of variables, and provides results of an inequality index, in this case the GE(0).

[12] The generalised entropy measures (Cowell, 1980; Shorrocks, 1984) are given by the expression $GE(\beta) = \frac{1}{\beta(\beta-1)}\left[\frac{1}{N}\sum_{i=1}^{N}\left(\frac{y_i}{\bar{y}}\right)^{\beta} - 1\right]$. They conform a family of measures that satisfy the principles of mean independence, population independence, symmetry, the Pigou-Dalton transfer principle and decomposability. The β parameter represents the weight given to the distances between incomes of different parts of the distribution. When β takes low values the measure is more sensitive to what occurs at the bottom of the distribution, whereas for high values of the parameter β the measures would be more sensitive to what occurs on the top. The measure proposed (MLD) entails β=0.

To observe the marginal effect of each circumstance we need to consider all possible sets that only differ in the inclusion or omission of the circumstance analysed. Subsequently, the weighted average of the marginal effects of all possible permutations is taken as the contribution of circumstances to inequality of opportunity. This procedure has the advantage of allowing the use of an inequality index to estimate IO and consequently it has a clear interpretation.

Tables III and IV show the coefficients from the regressions conducted by country for 2004 and 2010 respectively. In general terms, the estimated coefficients show the expected sign; in the case of the variable *Female* negative coefficients are estimated for most countries in both years, and significant changes between years are not observed.

In the case of the characteristic *Low density*, the sign is also negative as expected, with the exceptions of UK* in 2004 and Belgium in 2010. The coefficient has in general a high level of significance (at least at 5%) except for Belgium and Luxembourg in 2004 and Denmark, Greece, Luxembourg, Sweden and UK in 2010. The same happens with the variable *Immigrant* whose coefficient has a negative sign and a high level of significance, with the exception in 2004 of Hungary and Slovakia (where positive coefficients are obtained) and Iceland, Latvia, Norway, Poland, Portugal (with non-significant coefficients). With regards to 2010, Hungary, Poland and Romania show positive coefficients while Bulgaria, Czech Republic, Latvia and Malta provide non-significant results for Immigrant).

The variables Low and Medium education as well as Low and Medium skill tend to show significant negative coefficients, detecting a reduction of disposable income respect to most skilled occupations.

Finally, the coefficients of age cohort variables are in general negative and significant with some unimportant exceptions. This is consistent with the results of Table II where a lower share of disadvantaged individuals is observed for the elder cohort. In short, being a man, living in a high or medium density urban area, being born in the country of residence, having parents highly educated and in high-skilled occupations and being over 52 years are the desirable circumstances in order to perceive a high income.

TABLE III. Regression results for 2004 (part 1)

Variables\Countries	AT	BE	CY	CZ	DE	DK	EE	EL	ES	FI	FR	HU	IE
emale	-0.016	-0.033**	-0.027	-0.035**	-0.068***	-0.033*	-0.083***	0.039*	-0.040***	0.0092	-0.023*	-0.017	-0.098***
	(0.014)	(0.013)	(0.015)	(0.014)	(0.0092)	(0.014)	(0.018)	(0.018)	(0.0097)	(0.014)	(0.0091)	(0.011)	(0.019)
ow density	-0.10***	-0.045	-0.11***	-0.064***	-0.089***	-0.057***	-0.17***	-0.100***	-0.17***	-0.049***	-0.11***	-0.16***	-0.20***
	(0.015)	(0.032)	(0.017)	(0.014)	(0.012)	(0.016)	(0.019)	(0.018)	(0.012)	(0.014)	(0.013)	(0.012)	(0.020)
mmigrant	-0.23***	-0.15***	-0.23***	-0.15***	-0.12***	-0.11**	-0.16***	-0.39***	-0.28***	-0.16***	-0.19***	0.038	-0.069*
	(0.021)	(0.020)	(0.020)	(0.038)	(0.016)	(0.038)	(0.026)	(0.030)	(0.020)	(0.046)	(0.014)	(0.036)	(0.027)
ow Education	-0.035	-0.12***	-0.26***	-0.31***	-0.093***	-0.0075	-0.30***	-0.16***	-0.24***	-0.11***	-0.19***	-0.25***	-0.13***
	(0.032)	(0.020)	(0.032)	(0.032)	(0.016)	(0.024)	(0.029)	(0.031)	(0.019)	(0.023)	(0.017)	(0.021)	(0.027)
Iedium Education	-0.00047	-0.062**	-0.082**	-0.19***	-0.0085	-0.045*	-0.17***	0.054	-0.088***	-0.056*	-0.092***	-0.12***	0.077*
	(0.029)	(0.020)	(0.031)	(0.025)	(0.011)	(0.021)	(0.024)	(0.040)	(0.024)	(0.023)	(0.017)	(0.018)	(0.036)
ow Skill	-0.19***	-0.13***	-0.19***	-0.21***	-0.073***	-0.10***	-0.094**	-0.19***	-0.22***	-0.071**	-0.15***	-0.16***	-0.16***
	(0.026)	(0.020)	(0.027)	(0.024)	(0.016)	(0.024)	(0.030)	(0.030)	(0.016)	(0.023)	(0.013)	(0.019)	(0.024)
Iedium Skill	-0.089***	-0.088***	-0.13***	-0.13***	-0.043***	-0.040*	-0.13***	-0.16***	-0.14***	-0.095***	-0.11***	-0.14***	-0.13***
	(0.020)	(0.017)	(0.025)	(0.016)	(0.011)	(0.018)	(0.023)	(0.023)	(0.015)	(0.018)	(0.011)	(0.015)	(0.023)
ge 46-52	-0.03	0.0084	-0.038	-0.034	-0.03	-0.092***	-0.0033	-0.017	0.0061	-0.006	-0.077***	-0.062***	-0.018
	(0.024)	(0.021)	(0.025)	(0.022)	(0.015)	(0.024)	(0.030)	(0.032)	(0.018)	(0.021)	(0.015)	(0.018)	(0.030)
ge 39-45	-0.11***	-0.053**	-0.15***	-0.16***	-0.11***	-0.19***	-0.060*	-0.019	-0.096***	-0.091***	-0.17***	-0.13***	-0.11***
	(0.023)	(0.021)	(0.025)	(0.022)	(0.014)	(0.023)	(0.030)	(0.031)	(0.017)	(0.022)	(0.014)	(0.019)	(0.031)
ge 32-38	-0.15***	-0.044*	-0.18***	-0.17***	-0.12***	-0.19***	-0.039	-0.05	-0.03	-0.076**	-0.21***	-0.13***	0.043
	(0.023)	(0.021)	(0.025)	(0.022)	(0.015)	(0.023)	(0.031)	(0.030)	(0.017)	(0.023)	(0.015)	(0.019)	(0.031)
ge 25-31	-0.14***	-0.014	-0.12***	-0.095***	-0.17***	-0.31***	0.063	-0.090**	0.0022	-0.15***	-0.24***	-0.085***	0.075*
	(0.025)	(0.022)	(0.025)	(0.021)	(0.017)	(0.025)	(0.032)	(0.030)	(0.017)	(0.024)	(0.015)	(0.018)	(0.032)
onstant	10.1***	10.0***	10.1***	8.84***	10.0***	10.4***	8.52***	9.65***	9.85***	10.1***	10.2***	8.62***	10.4***
	(0.033)	(0.022)	(0.032)	(0.028)	(0.015)	(0.024)	(0.032)	(0.037)	(0.021)	(0.024)	(0.018)	(0.021)	(0.035)
	4874	3992	4200	4306	10969	2814	4365	3895	12721	4440	9200	6700	2738

tandard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE III. Regression results for 2004 (part 2)

riables\Countries	IS	IT	LT	LU	LV	NL	NO	PL	PT	SE	SI	SK	UK
nale	-0.038	0.027***	-0.029	-0.044**	-0.026	-0.045**	-0.069***	0.018	-0.021	0.0087	0.084***	-0.048***	0.043**
	(0.023)	(0.0082)	(0.020)	(0.014)	(0.022)	(0.014)	(0.015)	(0.011)	(0.018)	(0.025)	(0.016)	(0.011)	(0.015)
v density	-0.052*	-0.099***	-0.36***	-0.027	-0.33***	N.A	-0.078***	-0.19***	-0.091***	-0.12***	N.A	-0.12***	0.081*
	(0.025)	(0.011)	(0.021)	(0.018)	(0.023)		(0.017)	(0.011)	(0.022)	(0.028)		(0.012)	(0.040)
migrant	-0.088	-0.24***	-0.083*	-0.18***	-0.02	-0.15***	-0.042	-0.021	-0.067	-0.23***	-0.097***	0.069	0.098***
	(0.050)	(0.015)	(0.042)	(0.015)	(0.032)	(0.030)	(0.030)	(0.075)	(0.048)	(0.044)	(0.025)	(0.042)	(0.025)
v Education	-0.087**	-0.31***	-0.20***	-0.22***	-0.24***	-0.069***	-0.050*	-0.42***	-0.51***	-0.0094	-0.12***	-0.15***	0.11***
	(0.033)	(0.022)	(0.032)	(0.022)	(0.037)	(0.020)	(0.023)	(0.024)	(0.046)	(0.036)	(0.033)	(0.025)	(0.017)
dium Education	-0.027	-0.096***	-0.11**	-0.024	-0.094**	-0.0068	0.0029	-0.27***	-0.018	-0.013	0.00059	-0.089***	0.025
	(0.031)	(0.022)	(0.034)	(0.023)	(0.033)	(0.022)	(0.019)	(0.021)	(0.066)	(0.045)	(0.029)	(0.021)	(0.040)
v Skill	-0.062	-0.20***	-0.20***	-0.19***	-0.20***	-0.090***	-0.092***	-0.23***	-0.35***	0.03	-0.18***	-0.14***	-0.26***
	(0.042)	(0.012)	(0.032)	(0.021)	(0.033)	(0.022)	(0.028)	(0.019)	(0.031)	(0.041)	(0.025)	(0.017)	(0.021)
dium Skill	-0.033	-0.15***	-0.15***	-0.17***	-0.17***	-0.099***	-0.074***	-0.17***	-0.37***	-0.021	-0.16***	-0.092***	-0.20***
	(0.027)	(0.011)	(0.028)	(0.018)	(0.030)	(0.017)	(0.018)	(0.014)	(0.026)	(0.030)	(0.022)	(0.015)	(0.018)
e 46-52	-0.072	-0.087***	-0.0058	-0.076**	-0.03	-0.068**	-0.077**	-0.11***	-0.047	-0.042	-0.018	-0.056**	0.070**
	(0.041)	(0.014)	(0.034)	(0.023)	(0.037)	(0.023)	(0.027)	(0.017)	(0.032)	(0.042)	(0.026)	(0.018)	(0.024)
e 39-45	-0.15***	-0.16***	-0.12***	-0.11***	-0.035	-0.14***	-0.18***	-0.17***	-0.11***	-0.15***	-0.014	-0.20***	-0.023
	(0.039)	(0.014)	(0.032)	(0.023)	(0.037)	(0.022)	(0.026)	(0.018)	(0.031)	(0.041)	(0.026)	(0.018)	(0.024)
e 32-38	-0.22***	-0.17***	-0.11**	-0.17***	0.036	-0.14***	-0.20***	-0.13***	-0.17***	-0.19***	-0.034	-0.17***	0.041
	(0.038)	(0.013)	(0.034)	(0.023)	(0.038)	(0.022)	(0.025)	(0.018)	(0.030)	(0.041)	(0.025)	(0.020)	(0.024)
e 25-31	-0.28***	-0.15***	-0.024	-0.17***	0.063	-0.17***	-0.31***	-0.18***	-0.14***	-0.25***	-0.066*	-0.056**	0.050*
	(0.039)	(0.014)	(0.037)	(0.025)	(0.040)	(0.023)	(0.026)	(0.018)	(0.030)	(0.041)	(0.027)	(0.019)	(0.025)
nstant	10.4***	10.2***	8.23***	10.8***	8.20***	10.1***	10.5***	8.55***	9.95***	10.1***	9.26***	8.37***	10.2***
	(0.040)	(0.022)	(0.036)	(0.027)	(0.041)	(0.023)	(0.025)	(0.023)	(0.048)	(0.046)	(0.032)	(0.024)	(0.023)
	1380	17472	4666	4043	3598	4047	2962	15977	4245	943	3950	6521	6432

ndard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE IV. Regression results for 2010 (part 1)

Variables\Countries	AT	BE	BG	CH	CY	CZ	DE	DK	EE	EL	ES	FI	FR	HR	HU	IE
emale	-0.016	-0.030*	0.011	-0.044***	-0.02	-0.032**	-0.022*	0.013	0.0075	0.0037	-0.018	-0.0091	-0.035***	0.042*	-0.0069	-0.059**
	(0.014)	(0.012)	(0.015)	(0.012)	(0.015)	(0.012)	(0.010)	(0.028)	(0.018)	(0.020)	(0.011)	(0.017)	(0.0094)	(0.016)	(0.0083)	(0.021)
ow density	-0.031*	0.014	-0.26***	-0.086***	-0.13***	-0.067***	-0.092***	-0.037	-0.093***	-0.037	-0.17***	-0.11***	-0.065***	-0.11***	-0.17***	-0.10***
	(0.016)	(0.031)	(0.016)	(0.019)	(0.018)	(0.012)	(0.014)	(0.033)	(0.019)	(0.022)	(0.013)	(0.018)	(0.013)	(0.017)	(0.0087)	(0.022)
nmigrant	-0.31***	-0.24***	-0.2	-0.066***	-0.30***	-0.059	-0.086***	-0.12*	-0.19***	-0.42***	-0.48***	-0.18***	-0.19***	-0.064*	0.013	-0.18***
	(0.018)	(0.017)	(0.11)	(0.014)	(0.019)	(0.031)	(0.016)	(0.058)	(0.028)	(0.031)	(0.015)	(0.042)	(0.016)	(0.026)	(0.041)	(0.025)
ow Education	-0.16***	-0.19***	-0.47***	-0.27***	-0.27***	-0.22***	-0.15***	-0.24***	-0.26***	-0.43***	-0.27***	-0.024	-0.18***	-0.34***	-0.29***	-0.091**
	(0.025)	(0.019)	(0.030)	(0.022)	(0.031)	(0.023)	(0.019)	(0.045)	(0.032)	(0.039)	(0.020)	(0.028)	(0.015)	(0.033)	(0.017)	(0.034)
Iedium Education	-0.086***	-0.084***	-0.15***	-0.12***	-0.13***	-0.12***	-0.045***	-0.16***	-0.17***	-0.20***	-0.12***	0.035	-0.089***	-0.20***	-0.15***	-0.045
	(0.022)	(0.017)	(0.025)	(0.019)	(0.028)	(0.020)	(0.013)	(0.039)	(0.023)	(0.039)	(0.024)	(0.025)	(0.018)	(0.030)	(0.015)	(0.030)
ow Skill	-0.11***	-0.11***	-0.22***	-0.11***	-0.15***	-0.19***	-0.12***	-0.067	-0.16***	-0.11**	-0.19***	-0.11***	-0.19***	-0.14***	-0.21***	-0.32***
	(0.026)	(0.019)	(0.026)	(0.023)	(0.027)	(0.021)	(0.017)	(0.074)	(0.029)	(0.035)	(0.016)	(0.030)	(0.013)	(0.025)	(0.014)	(0.031)
Iedium Skill	-0.076***	-0.057***	-0.11***	-0.11***	-0.10***	-0.11***	-0.098***	0.076*	-0.14***	-0.12***	-0.16***	-0.04	-0.093***	-0.11***	-0.12***	-0.18***
	(0.018)	(0.016)	(0.021)	(0.015)	(0.023)	(0.016)	(0.012)	(0.035)	(0.023)	(0.027)	(0.015)	(0.022)	(0.012)	(0.022)	(0.012)	(0.026)
ge 46-52	-0.02	-0.036	-0.086***	-0.067**	-0.100***	-0.033	-0.007	-0.089*	-0.059*	-0.15***	-0.11***	-0.02	-0.12***	-0.00077	-0.050***	-0.093**
	(0.022)	(0.019)	(0.023)	(0.021)	(0.026)	(0.018)	(0.015)	(0.044)	(0.029)	(0.036)	(0.019)	(0.028)	(0.015)	(0.026)	(0.013)	(0.034)
ge 39-45	-0.073**	-0.090***	-0.22***	-0.15***	-0.22***	-0.13***	-0.053***	-0.17***	0.026	-0.18***	-0.14***	0.012	-0.18***	-0.11***	-0.12***	-0.11**
	(0.022)	(0.020)	(0.024)	(0.020)	(0.026)	(0.018)	(0.015)	(0.044)	(0.030)	(0.034)	(0.018)	(0.029)	(0.015)	(0.026)	(0.013)	(0.035)
ge 32-38	-0.15***	-0.080***	-0.20***	-0.17***	-0.13***	-0.091***	-0.060***	-0.19***	0.097**	-0.22***	-0.11***	-0.045	-0.22***	-0.055*	-0.081***	0.034
	(0.024)	(0.020)	(0.023)	(0.021)	(0.027)	(0.017)	(0.017)	(0.044)	(0.031)	(0.034)	(0.018)	(0.030)	(0.015)	(0.027)	(0.013)	(0.033)
ge 25-31	-0.20***	-0.11***	-0.17***	-0.18***	-0.20***	-0.0023	-0.16***	-0.60***	0.12***	-0.26***	-0.17***	-0.15***	-0.25***	-0.012	-0.046***	-0.11**
	(0.024)	(0.021)	(0.025)	(0.022)	(0.026)	(0.019)	(0.017)	(0.046)	(0.031)	(0.035)	(0.019)	(0.028)	(0.016)	(0.027)	(0.014)	(0.036)
onstant	10.4***	10.3***	8.70***	10.9***	10.4***	9.32***	10.1***	10.5***	8.95***	10.0***	10.2***	10.2***	10.4***	9.10***	8.94***	10.4***
	(0.027)	(0.020)	(0.027)	(0.023)	(0.032)	(0.023)	(0.016)	(0.044)	(0.031)	(0.042)	(0.022)	(0.029)	(0.018)	(0.033)	(0.016)	(0.039)
	5519	4672	5920	5978	4274	6122	10434	2360	4824	3513	11929	2602	9729	4860	12130	2572

tandard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE IV. Regression results for 2010 (part 2)

	IS	IT	LT	LU	LV	MT	NL	NO	PL	PT	RO	SE	SI	SK	UK
Female	-0.0071	0.0093	-0.0077	-0.057***	-0.0025	-0.049**	-0.018	-0.021	0.0052	-0.0034	0.046**	-0.01	0.021	-0.021	-0.061***
	(0.030)	(0.010)	(0.021)	(0.011)	(0.019)	(0.017)	(0.012)	(0.017)	(0.010)	(0.016)	(0.015)	(0.034)	(0.014)	(0.012)	(0.015)
Low density	-0.041	-0.077***	-0.19***	-0.02	-0.13***	N.A	N.A	-0.034	-0.15***	-0.056**	-0.20***	-0.055	N.A	-0.14***	-0.007
	(0.032)	(0.015)	(0.021)	(0.014)	(0.020)			(0.019)	(0.011)	(0.020)	(0.015)	(0.035)		(0.013)	(0.023)
Immigrant	-0.11*	-0.31***	-0.035	-0.21***	-0.037	-0.042	-0.18***	-0.11***	0.063	-0.024	0.17	-0.18**	-0.15***	-0.13*	-0.11***
	(0.048)	(0.015)	(0.044)	(0.012)	(0.030)	(0.038)	(0.019)	(0.030)	(0.17)	(0.027)	(0.18)	(0.055)	(0.022)	(0.061)	(0.023)
Low Education	-0.03	-0.29***	-0.30***	-0.41***	-0.31***	-0.23***	-0.071***	-0.11***	-0.26***	-0.37***	-0.34***	-0.053	-0.21***	-0.24***	-0.19***
	(0.051)	(0.025)	(0.041)	(0.020)	(0.036)	(0.034)	(0.019)	(0.028)	(0.022)	(0.040)	(0.041)	(0.047)	(0.028)	(0.027)	(0.021)
Medium Education	-0.0093	-0.095***	-0.17***	-0.20***	-0.16***	-0.092**	-0.026	-0.072***	-0.17***	-0.22***	-0.15***	-0.035	-0.12***	-0.13***	-0.13***
	(0.043)	(0.024)	(0.033)	(0.019)	(0.028)	(0.035)	(0.016)	(0.022)	(0.019)	(0.050)	(0.036)	(0.047)	(0.025)	(0.022)	(0.023)
Low Skill	-0.049	-0.17***	-0.13***	-0.12***	-0.19***	-0.21***	-0.098***	-0.068	-0.24***	-0.30***	-0.23***	0.047	-0.13***	-0.16***	-0.25***
	(0.060)	(0.016)	(0.033)	(0.017)	(0.030)	(0.025)	(0.023)	(0.035)	(0.017)	(0.027)	(0.031)	(0.068)	(0.025)	(0.020)	(0.024)
Medium Skill	-0.0067	-0.12***	-0.064*	-0.11***	-0.15***	-0.17***	-0.072***	-0.077***	-0.19***	-0.28***	-0.16***	-0.0081	-0.03	-0.091***	-0.15***
	(0.034)	(0.014)	(0.028)	(0.015)	(0.025)	(0.021)	(0.015)	(0.021)	(0.014)	(0.022)	(0.027)	(0.040)	(0.022)	(0.016)	(0.018)
Age 46-52	-0.071	-0.17***	0.046	-0.081***	-0.015	-0.01	-0.047*	-0.10***	0.018	-0.099***	-0.14***	-0.076	-0.0095	-0.069***	0.051*
	(0.051)	(0.016)	(0.032)	(0.018)	(0.030)	(0.028)	(0.020)	(0.029)	(0.016)	(0.026)	(0.025)	(0.056)	(0.023)	(0.019)	(0.025)
Age 39-45	-0.13*	-0.20***	-0.20***	-0.043*	-0.044	-0.099***	-0.082***	-0.17***	-0.056***	-0.17***	-0.20***	-0.25***	0.007	-0.18***	0.018
	(0.051)	(0.016)	(0.034)	(0.018)	(0.031)	(0.029)	(0.019)	(0.027)	(0.017)	(0.026)	(0.024)	(0.056)	(0.024)	(0.020)	(0.025)
Age 32-38	-0.25***	-0.19***	-0.26***	-0.065***	0.012	-0.025	-0.10***	-0.22***	-0.015	-0.13***	-0.095***	-0.17**	-0.023	-0.11***	0.029
	(0.048)	(0.017)	(0.037)	(0.018)	(0.033)	(0.027)	(0.020)	(0.029)	(0.017)	(0.025)	(0.024)	(0.055)	(0.023)	(0.020)	(0.026)
Age 25-31	-0.31***	-0.22***	-0.088*	-0.11***	0.072*	0.087**	-0.15***	-0.35***	-0.023	-0.097***	-0.057*	-0.30***	-0.093***	0.0093	-0.041
	(0.048)	(0.018)	(0.039)	(0.019)	(0.033)	(0.028)	(0.021)	(0.029)	(0.017)	(0.026)	(0.026)	(0.054)	(0.025)	(0.021)	(0.026)
Constant	10.0***	10.3***	8.76***	11.0***	8.71***	9.76***	10.2***	10.8***	9.02***	9.86***	8.47***	10.3***	9.63***	9.19***	10.2***
	(0.052)	(0.025)	(0.039)	(0.022)	(0.034)	(0.037)	(0.020)	(0.028)	(0.021)	(0.041)	(0.036)	(0.056)	(0.027)	(0.025)	(0.026)
N	1502	13547	4580	6280	5886	3320	4770	2471	11650	4987	4251	600	4218	6335	5279

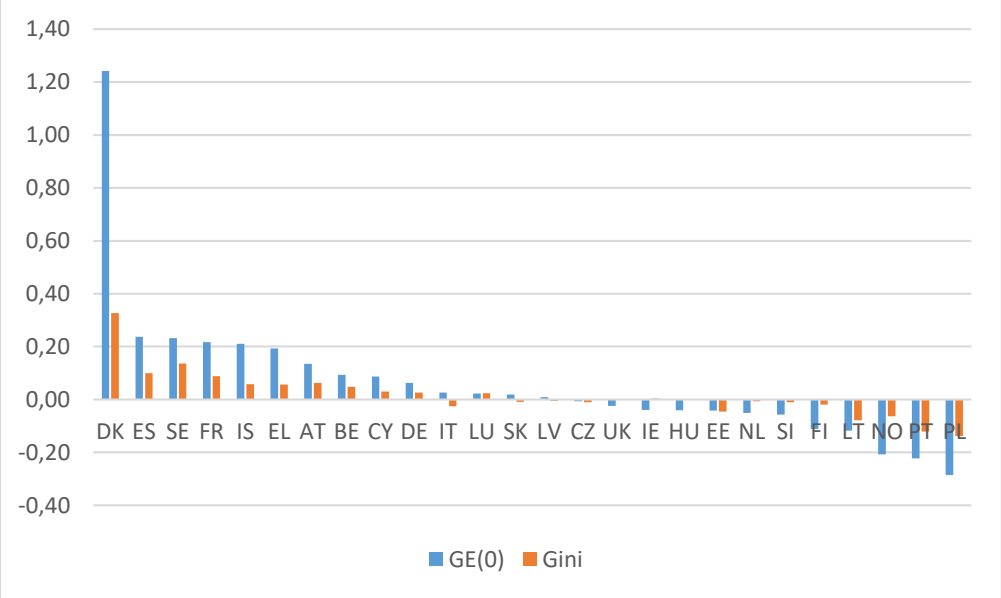
Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Tables V and VI show the results for the point estimates of inequality and circumstances' contribution respectively. Likewise, in order to provide a further illustration of major changes over time, Figures 5 and 6 are constructed.

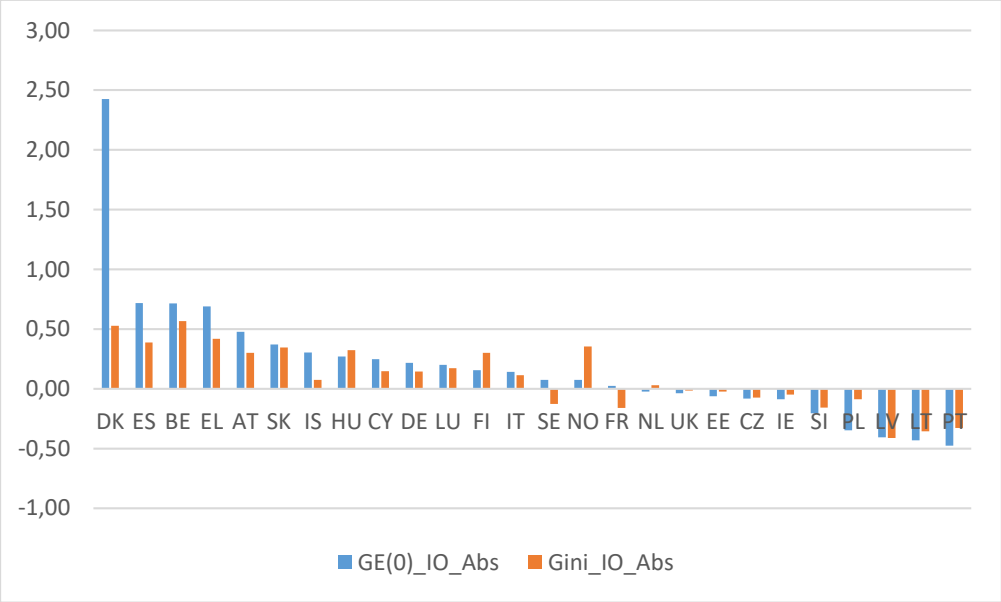
On the one hand, in Figure 5 draws our attention the rise in overall inequality both measured by GE(0) and Gini indices. According to the GE(0) index, inequality rises in 14 of the 26 countries, which are Austria, Belgium, Cyprus, Germany, Denmark, Greece, Spain, France, Iceland, Italy, Luxembourg, Latvia, Slovakia and Sweden while according to the Gini index grows in 13 countries mostly the same observed with the GE(0) except for Italy, Latvia and Slovakia which do not experienced an increase in the Gini index and Ireland and United Kindom where inequality does not rise measured by the entropy index. It is important to highlight the important growth in both indices experienced in Austria, Denmark, Greece, Spain, Iceland and Sweden, and the sharply decline of inequality in Norway, Poland and Portugal. It is important to notice that changes are more sharply for the GE(0), which indicates that inequality variations are mostly happening at the tails of the distribution.

Figure 5: Changes in income inequality measured by GE(0) and Gini indices between 2004 and 2010



Regarding IO, both indices in absolute values evolve in the same direction for all countries, inequality of opportunity rises in 16 out of 26 countries, with particularly worrying increases in Austria, Belgium, Denmark, Greece and Spain. It is also noticeable the great decline in IO (more than 20% decrease) observed in Lithuania, Latvia, Poland and Portugal. In Figure 6, as well as in Figure 5, is also noticeable the larger variations experimented by the GE(0) index, although, differences are not as remarkable than in Figure 5 and here we have some exceptions (Hungary, Finland, Sweden, Norway, France and Latvia) in which changes in the Gini index are more profound.

Figure 6: Changes in inequality of opportunity in absolute value measured by GE(0) and Gini indices between 2004 and 2010



As refers to the relative indices, some unimportant variations can be observed: IO increases in relative terms for 15 countries instead of 16, for the relative GE(0) inequality drops in Sweden and France, and rises in Netherlands where no change is experienced by the absolute index. Finally, differences observed with regard the relative Gini are that IO rises in Estonia and it declines in France and Sweden, similarly to relative GE(0).

Table VI shows the contribution of each circumstance analysed to inequality of opportunity and its change over the period studied. As it can be seen, *Gender* is the less important circumstance for inequality of opportunity in disposable income and its importance drops from 2004 to 2010 for most countries (19 out of 26). If we look at the variable *Density*, we can see a considerable increase in Cyprus, Czech Republic and Finland and a decrease in the rest of countries except for Poland where its contribution remains constant. The average weight of this circumstance is around 15% in 2004 and around 10% in 2010 and it is important to highlight the decrease of importance in Lithuania (from almost 50% to around 30%) and Latvia (from 40% to 15%).

In contrast to the generalised increase observed in these two circumstances, for *Immigrant* we observe a clear growth of its importance, rising in average from approximately 10% to 14%. It increases in 16 countries with especially remarkable increments in level and weights in Austria, Belgium, Spain, Ireland, Italy and Slovenia. *Parental education* also increases its importance over time, becoming the most important circumstance in average terms in 2010 with a contribution of 29.72% to IO (in 2004 its average contribution was also high, around 26%), which it is not uneven distributed between countries (the contribution is always superior to the 10% except for Sweden, Norway, Denmark and Finland). It is important to remark the increase experienced in Luxembourg and the decline in Finland.

With regard to the two remaining circumstances, *Parental occupation* declines its contribution, since it was the most important circumstance in 2004 (representing 26.57% of IO) and its weight dropped in 15 countries. Nonetheless, in average the decline was only of approximately 1 percentage point. In general, its contribution is always greater than 10% with few exceptions, likewise, it its noteworthy the variation observed in Belgium where the contribution of the circumstance changes from 37.15% to 21.17%

The last circumstance analysed, *Age*, shows a stable behaviour, with an average weight around 21% in both years. However, its importance varies widely between countries, showing little importance for United Kingdom, Slovenia, Portugal, Poland, Latvia, Luxembourg, Hungary, Spain and Belgium. On the contrary *Age* has a great contribution in Iceland and Denmark (higher than the 70%). Regarding over time variations, it can only be emphasised the increase in Lithuania from a 6,42% to a 26,21%.

In conclusion, income inequality and inequality of opportunity experienced a generalised rise in Europe, with worrying increases in Austria, Denmark, Greece and Spain and some remarkable exceptions such as Portugal and Poland. It is important to highlight that in two countries, Austria and Spain, the observed increase appears to be closely related to immigration since the contribution of the circumstance *Immigrant* rises in 2010 as well as the share of immigrants in total population.

The contribution of the remaining circumstances to IO is more or less constant over time, and the two most important circumstances for both years are those referred to family background, *Parental education and Parental occupation*, agreeing with the findings of Bourguignon, Ferreira, & Menéndez, (2007). In order to check the robustness of these changes over time a bootstrap methodology is undertaken in the next section.

TABLE V. Income inequality and inequality of opportunity estimates

							Inequality of opportunity											
	GE(0)			*GINI*			*GE(0) IO ABS*			*GE(0) IO REL*			*GINI IO ABS*			*GINI IO REL*		
Country	2005	2011	Change (%)	2005	2011	Change (%)	2005	2011	Change (%)	2005	2011	Change (%)	2005	2011	Change (%)	2005	2011	Change (%)
AT	0.11	0.13	13.50%	0.25	0.26	6.33%	0.0089	0.0132	47.73%	7.95%	10.35%	30.15%	0.07	0.09	17.33%	30.43%	33.57%	10.34%
BE	0.08	0.09	9.30%	0.22	0.23	4.73%	0.0057	0.0098	71.37%	6.83%	10.71%	56.79%	0.06	0.08	28.20%	27.70%	33.91%	22.41%
BG		0.19			0.32			0.0437			23.12%			0.17			52.08%	
CH		0.13			0.27			0.0109			8.54%			0.08			30.91%	
CY	0.13	0.14	8.70%	0.27	0.28	2.98%	0.0153	0.0191	24.70%	11.81%	13.55%	14.72%	0.10	0.11	11.52%	35.68%	38.64%	8.28%
CZ	0.11	0.11	-0.66%	0.25	0.25	-1.01%	0.0116	0.0107	-8.05%	10.86%	10.05%	-7.43%	0.09	0.08	-2.18%	34.54%	34.13%	-1.18%
DE	0.11	0.12	6.31%	0.25	0.26	2.61%	0.0043	0.0052	21.80%	3.73%	4.27%	14.57%	0.05	0.06	9.98%	20.39%	21.86%	7.18%
DK	0.06	0.14	124.14%	0.18	0.24	32.70%	0.0058	0.0198	242.44%	9.59%	14.65%	52.78%	0.06	0.10	68.47%	34.26%	43.49%	26.95%
EE	0.19	0.18	-4.13%	0.33	0.31	-4.52%	0.0238	0.0223	-6.21%	12.45%	12.18%	-2.17%	0.13	0.12	-3.57%	38.16%	38.54%	1.00%
EL	0.15	0.18	19.24%	0.29	0.30	5.70%	0.0162	0.0274	69.04%	10.89%	15.44%	41.76%	0.10	0.13	31.10%	34.09%	42.28%	24.03%
ES	0.15	0.18	23.66%	0.29	0.32	9.93%	0.0168	0.0289	71.79%	11.26%	15.64%	38.92%	0.10	0.13	27.15%	35.27%	40.79%	15.66%
FI	0.11	0.10	-11.08%	0.24	0.24	-1.93%	0.0039	0.0045	15.74%	3.46%	4.50%	30.16%	0.05	0.05	7.68%	20.43%	22.43%	9.81%
FR	0.11	0.13	21.75%	0.25	0.28	8.87%	0.0105	0.0108	2.38%	9.71%	8.16%	-15.91%	0.08	0.08	1.32%	32.13%	29.90%	-6.93%
HR		0.15			0.29			0.0166			10.81%		.	0.10			35.84%	
HU	0.13	0.12	-4.10%	0.27	0.27	-0.14%	0.0162	0.0206	26.97%	12.45%	16.48%	32.40%	0.10	0.12	12.43%	37.67%	42.41%	12.59%
IE	0.14	0.14	-3.87%	0.28	0.28	0.31%	0.0174	0.0159	-8.61%	12.07%	11.47%	-4.93%	0.11	0.10	-4.32%	37.69%	35.95%	-4.62%
IS	0.10	0.12	21.12%	0.23	0.24	5.74%	0.0059	0.0077	30.29%	6.02%	6.48%	7.57%	0.06	0.07	14.67%	27.48%	29.81%	8.45%
IT	0.15	0.15	2.58%	0.28	0.28	-2.50%	0.0159	0.0182	14.34%	10.75%	11.98%	11.47%	0.10	0.11	6.68%	34.89%	38.17%	9.41%
LT	0.24	0.21	-11.73%	0.36	0.33	-7.89%	0.0369	0.0210	-43.15%	15.62%	10.06%	-35.60%	0.16	0.12	-25.49%	43.44%	35.14%	-19.11%
LU	0.11	0.12	2.29%	0.26	0.26	2.36%	0.0197	0.0236	20.00%	17.15%	20.12%	17.31%	0.11	0.12	9.19%	44.04%	46.98%	6.67%
LV	0.23	0.23	0.85%	0.35	0.35	-0.52%	0.0360	0.0214	-40.65%	15.66%	9.21%	-41.15%	0.15	0.12	-22.61%	43.96%	34.20%	-22.21%
MT		0.12			0.26			0.0129			10.94%		.	0.09			34.67%	
NL	0.10	0.09	-5.09%	0.23	0.23	-0.69%	0.0041	0.0040	-2.31%	4.30%	4.42%	2.93%	0.05	0.05	-4.79%	21.90%	21.00%	-4.13%
NO	0.11	0.09	-20.68%	0.23	0.22	-6.27%	0.0068	0.0073	7.46%	6.28%	8.50%	35.47%	0.07	0.07	2.26%	28.83%	31.46%	9.10%
PL	0.23	0.16	-28.50%	0.36	0.31	-13.74%	0.0255	0.0166	-34.79%	11.11%	10.13%	-8.80%	0.13	0.10	-18.81%	35.82%	33.72%	-5.88%
PT	0.22	0.17	-22.20%	0.36	0.32	-12.16%	0.0377	0.0197	-47.67%	17.20%	11.57%	-32.74%	0.14	0.10	-27.20%	39.48%	32.72%	-17.12%
O		0.13			0.28			0.0275			20.50%			0.13			47.87%	
SE	0.07	0.08	23.23%	0.19	0.21	13.66%	0.0069	0.0074	7.62%	10.37%	9.06%	-12.66%	0.07	0.07	4.57%	35.04%	32.24%	-8.00%
SI	0.11	0.11	-5.69%	0.24	0.24	-1.02%	0.0095	0.0076	-20.46%	8.53%	7.19%	-15.66%	0.08	0.07	-12.39%	32.65%	28.90%	-11.49%
SK	0.11	0.12	1.90%	0.25	0.25	-0.86%	0.0097	0.0132	37.20%	8.42%	11.33%	34.64%	0.08	0.09	17.34%	31.21%	36.94%	18.36%
UK	0.18	0.17	-2.40%	0.31	0.31	0.01%	0.0119	0.0114	-3.71%	6.75%	6.66%	-1.34%	0.09	0.09	-1.93%	28.18%	27.64%	-1.93%

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TABLE VI. Contribution of circumstances to inequality of opportunity (Shapley value)

ntry	*GENDER*			*DENSITY*			*IMMIGRANT*			*PARENTAL EDUCATION*			*PARENTAL OCCUPATION*			*AGE COHORT*		
	2005	2011	Change (%)	2005	2011	Change (%)	2005	2011	Change (%)	2005	2011	Change (%)	2005	2011	Change (%)	2005	2011	Change (%
T	0.24%	0.27%	12.50%	13.11%	0.78%	-94.05%	31.30%	58.26%	86.13%	11.07%	12.99%	17.34%	27.01%	8.90%	-67.05%	17.27%	18.81%	8.92%
E	1.82%	0.88%	-51.65%	0.69%	0.13%	-81.16%	19.37%	38.36%	98.04%	35.18%	34.51%	-1.90%	37.15%	21.17%	-43.01%	5.79%	4.94%	-14.68%
G		0.18%			28.03%			0.12%			41.28%			25.12%			5.27%	
H		2.52%			4.36%			6.98%			73.74%			26.21%			16.19%	
Y	0.78%	0.85%	8.97%	11.33%	11.79%	4.06%	19.96%	34.85%	74.60%	31.33%	21.12%	-32.59%	24.49%	17.77%	-27.44%	10.10%	13.62%	34.85%
Z	1.20%	1.26%	5.00%	7.07%	7.61%	7.64%	3.11%	0.62%	-80.06%	38.19%	41.21%	7.91%	36.64%	37.16%	1.42%	13.80%	12.13%	-12.10%
E	13.33%	163.00%	1122.81%	12.65%	10.42%	-17.63%	15.83%	9.03%	-42.96%	13.73%	26.97%	96.43%	9.67%	30.22%	212.51%	34.79%	21.73%	-37.54%
K	1.91%	0.26%	-86.39%	6.04%	0.57%	-90.56%	3.80%	1.36%	-64.21%	5.11%	9.38%	83.56%	6.90%	4.14%	-40.00%	76.23%	84.29%	10.57%
E	3.73%	0.02%	-99.46%	17.24%	7.83%	-54.58%	5.67%	10.16%	79.19%	41.26%	37.96%	-8.00%	21.64%	25.23%	16.59%	10.46%	18.79%	79.64%
L	1.51%	0.02%	-98.68%	9.71%	2.43%	-74.97%	35.93%	31.08%	-13.50%	23.11%	38.23%	65.43%	28.12%	19.42%	-30.94%	1.62%	8.81%	443.83%
S	0.99%	0.11%	-88.89%	18.56%	9.58%	-48.38%	11.66%	47.88%	310.63%	31.87%	18.26%	-42.70%	31.40%	19.05%	-39.33%	5.52%	5.12%	-7.25%
I	0.26%	0.09%	-65.38%	11.00%	32.60%	196.36%	7.49%	12.98%	73.30%	27.62%	5.81%	-78.96%	32.18%	16.51%	-48.69%	21.44%	32.01%	49.30%
R	0.50%	1.29%	158.00%	7.97%	3.06%	-61.61%	15.61%	13.55%	-13.20%	23.22%	24.46%	5.34%	26.46%	32.18%	21.62%	26.24%	25.47%	-2.93%
R		1.68%			14.22%			1.81%			47.21%			28.46%			6.63%	
U	0.19%	0.02%	-89.47%	27.74%	25.05%	-9.70%	0.16%	0.06%	-62.50%	35.67%	37.84%	6.08%	29.98%	32.64%	8.87%	6.26%	4.39%	-29.87%
E	7.68%	2.94%	-61.72%	25.65%	9.19%	-64.17%	1.04%	12.45%	1097.12%	29.53%	14.05%	-52.42%	19.46%	47.83%	145.79%	16.65%	13.53%	-18.74%
S	2.73%	0.14%	-94.87%	5.45%	2.67%	-51.01%	3.82%	10.33%	170.42%	9.83%	1.03%	-89.52%	3.74%	1.00%	-73.26%	74.44%	84.83%	13.96%
T	0.78%	0.10%	-87.18%	5.46%	2.68%	-50.92%	12.52%	27.32%	118.21%	38.53%	30.20%	-21.62%	31.62%	25.43%	-19.58%	11.09%	14.27%	28.67%
T	0.17%	0.02%	-88.24%	49.62%	29.10%	-41.35%	0.31%	0.11%	-64.52%	21.77%	28.19%	29.49%	21.70%	16.36%	-24.61%	6.42%	26.21%	308.26%
U	1.02%	1.70%	66.67%	0.25%	0.11%	-56.00%	20.73%	22.43%	8.20%	38.28%	50.79%	32.68%	31.89%	22.83%	-28.41%	7.82%	2.14%	-72.63%
V	0.15%	0.01%	-93.33%	42.34%	15.15%	-64.22%	0.18%	0.48%	166.67%	28.84%	43.95%	52.39%	23.33%	31.69%	35.83%	5.15%	8.72%	69.32%
IT		2.26%			N.A			0.32%			39.36%			41.33%			16.73%	
L	6.43%	1.13%	-82.43%	N.A	N.A		12.60%	42.49%	237.22%	13.32%	12.28%	-7.81%	29.28%	22.76%	-22.27%	38.37%	21.33%	-44.41%
O	7.77%	0.66%	-91.51%	9.44%	1.55%	-83.58%	0.91%	8.82%	869.23%	3.50%	8.82%	152.00%	8.83%	10.67%	20.84%	69.56%	69.49%	-0.10%
L	0.30%	0.12%	-60.00%	22.84%	23.52%	2.98%	0.02%	0.11%	450.00%	40.23%	33.19%	-17.50%	31.15%	40.68%	30.59%	5.46%	2.38%	-56.41%
T	0.08%	0.03%	-62.50%	3.33%	2.57%	-22.82%	0.17%	0.16%	-5.88%	47.69%	41.01%	-14.01%	45.20%	49.73%	10.02%	3.53%	6.49%	83.85%
O		1.42%			24.22%			0.27%			34.65%			28.46%			10.97%	
E	0.30%	0.77%	156.67%	17.01%	2.97%	-82.54%	24.31%	19.22%	-20.94%	1.78%	3.37%	89.33%	2.00%	1.14%	-43.00%	54.60%	72.53%	32.84%
I	9.92%	0.82%	-91.73%	N.A	N.A		6.37%	18.02%	182.89%	36.53%	41.79%	14.40%	45.64%	33.74%	-26.07%	1.54%	5.64%	266.23%
K	2.90%	0.56%	-80.69%	23.50%	22.67%	-3.53%	0.70%	0.59%	-15.71%	19.65%	29.76%	51.45%	24.55%	25.68%	4.60%	28.69%	20.73%	-27.74%
K	220.00%	4.39%	-98.00%	1.01%	0.07%	-93.07%	2.36%	4.94%	109.32%	26.23%	37.81%	44.15%	60.81%	48.89%	-19.60%	7.39%	3.89%	-47.36%

4. ASSESING CHANGES OVER TIME

The ultimate goal of this paper is to assess changes over time for the countries of the EU through inferential methods. Statistical inference on measures of inequality is not easy to implement, since our estimates are nonparametric and they involve a complex process of estimation. We deal with this problem through the bootstrap methodology (Efron & Tibshirani, 1986) which allows us not to impose any distributional form of the data.

We aim to use the bootstrap to obtain confidence intervals for the estimates of inequality of opportunity and the contribution of circumstances, and also for the differences between the two years analysed. The bootstrap confidence intervals do not follow the classical statistical definition of confidence interval, but allow to compute the so-called *percentile intervals*, which are quite simple to perform and interpret. This method produces finite intervals and, instead of the normality assumption, it assumes that the distribution of the bootstrapped statistics approximates the true sampling distribution.

This procedure involves using as lower and upper bounds the α-th percentiles of the $\hat{F}$ distribution. Hence an equal-tailed confidence interval of 1-2α from the original sample estimator $\hat{\theta}$ is given by $(\hat{\theta}_{\alpha}^{B}, \hat{\theta}_{1-\alpha}^{B})$. According to this proposal, bootstrap intervals are implemented for overall income inequality, IO both in relative and absolute terms and the contribution of each circumstances computed through the Shapley value procedure.

Confidence intervals for the previously described indicators are computed, referred to both 2004 and 2010. Therefore, for each country we have two samples drawn from two unknown distribution functions of the population, respectively denoted by F_{04} and F_{10}. The bootstrap procedure implemented consist in B=1000 samples for each year with size n_{04} and n_{10} respectively, with empirical distributions $\hat{F}_{04}$ and $\hat{F}_{10}$. Within this framework, we are able to calculate confidence intervals at 95% for each estimator and year: (θ_{lb04}^{B} , θ_{ub04}^{B}) and (θ_{lb10}^{B} , θ_{ub10}^{B}). If the confidence intervals referred to the two years do not overlap it can be said that the increase or decrease observed in the empirical analysis is statistically significant.

Table VII collects the confidence intervals for IO and income inequality estimators, showing that in most countries intervals are found to overlap, and therefore, time changes are not significant. This is the case of 14 countries: Cyprus, Czech Republic, Germany, Estonia, Finland, France, Ireland, Iceland, Italy, Luxembourg, Netherlands, Norway, Slovenia and UK.

Conversely, significant changes observed in IO and overall inequality are heterogeneous, since some countries show a significant decrease in both IO and Income inequality, while other countries experience a decline in IO and there is a set of countries in which IO rises in most cases accompanied with an increase in overall inequality.

TABLE VII. Confidence intervals for IO and Overall Inequality

Country\Estimator	*GE(0)*		*Gini*		*Absolute IO_GE(0)*		*Absolute IO_Gini*		*Relative IO_GE(0)*		*Relative IO_Gini*	
	2005	**2011**	**2005**	**2011**	**2005**	**2011**	**2005**	**2011**	**2005**	**2011**	**2005**	**2011**
AT	(0.105 , 0.119)	(0.12 , 0.135)	(0.239 , 0.251)	(0.255 , 0.267)	(0.008 , 0.011)	(0.011 , 0.016)	(0.069 , 0.083)	(0.082 , 0.096)	(0.068 , 0.098)	(0.09 , 0.123)	(0.282 , 0.339)	(0.315 , 0.366)
BE	(0.079 , 0.089)	(0.087 , 0.096)	(0.213 , 0.225)	(0.224 , 0.235)	(0.005 , 0.007)	(0.008 , 0.012)	(0.055 , 0.069)	(0.072 , 0.086)	(0.057 , 0.087)	(0.092 , 0.13)	(0.252 , 0.312)	(0.315 , 0.373)
BG		(0.179 , 0.198)		(0.315 , 0.331)		(0.04 , 0.048)		(0.161 , 0.177)		(0.215 , 0.252)		(0.502 , 0.544)
CH		(0.119 , 0.136)		(0.263 , 0.277)		(0.009 , 0.013)		(0.077 , 0.091)		(0.075 , 0.101)		(0.289 , 0.336)
CY	(0.12 , 0.142)	(0.13 , 0.154)	(0.265 , 0.285)	(0.273 , 0.293)	(0.013 , 0.018)	(0.016 , 0.023)	(0.092 , 0.106)	(0.102 , 0.119)	(0.103 , 0.14)	(0.118 , 0.161)	(0.335 , 0.387)	(0.361 , 0.421)
CZ	(0.101 , 0.113)	(0.1 , 0.112)	(0.241 , 0.254)	(0.239 , 0.251)	(0.01 , 0.015)	(0.009 , 0.012)	(0.078 , 0.096)	(0.078 , 0.091)	(0.093 , 0.134)	(0.089 , 0.117)	(0.318 , 0.383)	(0.321 , 0.367)
DE	(0.109 , 0.121)	(0.116 , 0.129)	(0.249 , 0.259)	(0.256 , 0.266)	(0.004 , 0.006)	(0.004 , 0.007)	(0.047 , 0.059)	(0.051 , 0.066)	(0.031 , 0.049)	(0.035 , 0.056)	(0.185 , 0.233)	(0.197 , 0.25)
DK	(0.053 , 0.069)	(0.1 , 0.179)	(0.171 , 0.186)	(0.223 , 0.251)	(0.005 , 0.008)	(0.01 , 0.047)	(0.054 , 0.071)	(0.078 , 0.155)	(0.076 , 0.133)	(0.092 , 0.266)	(0.309 , 0.394)	(0.336 , 0.638)
EE	(0.179 , 0.203)	(0.173 , 0.194)	(0.317 , 0.337)	(0.304 , 0.322)	(0.02 , 0.029)	(0.019 , 0.028)	(0.114 , 0.138)	(0.111 , 0.134)	(0.108 , 0.148)	(0.106 , 0.148)	(0.354 , 0.415)	(0.359 , 0.426)
EL	(0.14 , 0.158)	(0.163 , 0.192)	(0.279 , 0.294)	(0.291 , 0.314)	(0.014 , 0.02)	(0.023 , 0.034)	(0.09 , 0.109)	(0.118 , 0.143)	(0.095 , 0.134)	(0.135 , 0.186)	(0.316 , 0.378)	(0.396 , 0.464)
ES	(0.145 , 0.154)	(0.177 , 0.193)	(0.285 , 0.294)	(0.312 , 0.325)	(0.015 , 0.019)	(0.026 , 0.032)	(0.096 , 0.109)	(0.124 , 0.138)	(0.101 , 0.127)	(0.144 , 0.175)	(0.334 , 0.374)	(0.392 , 0.431)
FI	(0.085 , 0.148)	(0.092 , 0.11)	(0.22 , 0.271)	(0.23 , 0.249)	(0.003 , 0.006)	(0.004 , 0.007)	(0.045 , 0.06)	(0.048 , 0.066)	(0.029 , 0.051)	(0.037 , 0.068)	(0.187 , 0.244)	(0.203 , 0.274)
FR	(0.104 , 0.112)	(0.124 , 0.14)	(0.25 , 0.26)	(0.27 , 0.285)	(0.009 , 0.012)	(0.01 , 0.012)	(0.077 , 0.088)	(0.078 , 0.089)	(0.086 , 0.111)	(0.072 , 0.093)	(0.302 , 0.344)	(0.281 , 0.318)
HR		(0.147 , 0.161)		(0.284 , 0.295)		(0.014 , 0.021)		(0.096 , 0.115)		(0.092 , 0.132)		(0.331 , 0.395)
HU	(0.121 , 0.14)	(0.121 , 0.128)	(0.265 , 0.284)	(0.27 , 0.278)	(0.014 , 0.018)	(0.019 , 0.023)	(0.097 , 0.11)	(0.111 , 0.121)	(0.112 , 0.141)	(0.154 , 0.178)	(0.357 , 0.4)	(0.409 , 0.441)
IE	(0.116 , 0.179)	(0.13 , 0.147)	(0.256 , 0.31)	(0.274 , 0.291)	(0.014 , 0.023)	(0.013 , 0.022)	(0.096 , 0.122)	(0.092 , 0.118)	(0.104 , 0.155)	(0.095 , 0.152)	(0.35 , 0.424)	(0.325 , 0.415)
IS	(0.08 , 0.12)	(0.099 , 0.143)	(0.207 , 0.244)	(0.225 , 0.251)	(0.005 , 0.009)	(0.006 , 0.014)	(0.055 , 0.078)	(0.062 , 0.095)	(0.044 , 0.103)	(0.053 , 0.115)	(0.24 , 0.354)	(0.265 , 0.399)
IT	(0.143 , 0.153)	(0.146 , 0.158)	(0.28 , 0.289)	(0.273 , 0.282)	(0.014 , 0.018)	(0.016 , 0.021)	(0.095 , 0.105)	(0.101 , 0.113)	(0.098 , 0.12)	(0.108 , 0.136)	(0.333 , 0.368)	(0.364 , 0.405)
LT	(0.224 , 0.248)	(0.194 , 0.225)	(0.349 , 0.366)	(0.322 , 0.339)	(0.032 , 0.044)	(0.017 , 0.028)	(0.145 , 0.169)	(0.105 , 0.134)	(0.137 , 0.182)	(0.083 , 0.135)	(0.407 , 0.468)	(0.319 , 0.405)
LU	(0.105 , 0.124)	(0.111 , 0.124)	(0.248 , 0.268)	(0.257 , 0.272)	(0.016 , 0.025)	(0.021 , 0.027)	(0.103 , 0.127)	(0.118 , 0.132)	(0.143 , 0.21)	(0.182 , 0.228)	(0.402 , 0.487)	(0.449 , 0.498)
LV	(0.215 , 0.246)	(0.222 , 0.241)	(0.338 , 0.361)	(0.341 , 0.353)	(0.032 , 0.043)	(0.018 , 0.026)	(0.144 , 0.167)	(0.11 , 0.13)	(0.141 , 0.18)	(0.081 , 0.11)	(0.417 , 0.472)	(0.319 , 0.372)
MT		(0.111 , 0.124)		(0.255 , 0.268)		(0.011 , 0.016)		(0.082 , 0.101)		(0.091 , 0.137)		(0.317 , 0.386)
NL	(0.086 , 0.106)	(0.085 , 0.096)	(0.222 , 0.243)	(0.225 , 0.237)	(0.003 , 0.006)	(0.003 , 0.006)	(0.045 , 0.062)	(0.041 , 0.06)	(0.033 , 0.065)	(0.032 , 0.067)	(0.192 , 0.267)	(0.181 , 0.255)
NO	(0.078 , 0.149)	(0.078 , 0.096)	(0.202 , 0.262)	(0.208 , 0.224)	(0.005 , 0.009)	(0.006 , 0.011)	(0.059 , 0.077)	(0.059 , 0.081)	(0.05 , 0.093)	(0.066 , 0.118)	(0.262 , 0.341)	(0.276 , 0.373)
PL	(0.222 , 0.237)	(0.158 , 0.171)	(0.351 , 0.362)	(0.302 , 0.314)	(0.023 , 0.028)	(0.015 , 0.019)	(0.122 , 0.134)	(0.098 , 0.11)	(0.102 , 0.122)	(0.091 , 0.115)	(0.343 , 0.376)	(0.319 , 0.358)
PT	(0.206 , 0.235)	(0.162 , 0.179)	(0.35 , 0.373)	(0.309 , 0.325)	(0.032 , 0.045)	(0.016 , 0.025)	(0.131 , 0.157)	(0.094 , 0.117)	(0.148 , 0.203)	(0.095 , 0.145)	(0.367 , 0.431)	(0.301 , 0.366)
RO		(0.126 , 0.142)		(0.27 , 0.285)		(0.024 , 0.032)		(0.124 , 0.143)		(0.184 , 0.233)		(0.453 , 0.51)
SE	(0.057 , 0.076)	(0.07 , 0.092)	(0.179 , 0.199)	(0.2 , 0.227)	(0.005 , 0.011)	(0.006 , 0.013)	(0.056 , 0.084)	(0.06 , 0.093)	(0.081 , 0.159)	(0.071 , 0.161)	(0.304 , 0.438)	(0.28 , 0.428)
SI	(0.102 , 0.122)	(0.097 , 0.113)	(0.236 , 0.25)	(0.233 , 0.247)	(0.008 , 0.013)	(0.006 , 0.01)	(0.071 , 0.092)	(0.06 , 0.082)	(0.072 , 0.113)	(0.056 , 0.099)	(0.298 , 0.377)	(0.254 , 0.337)
SK	(0.108 , 0.122)	(0.111 , 0.123)	(0.246 , 0.26)	(0.246 , 0.256)	(0.008 , 0.011)	(0.011 , 0.016)	(0.074 , 0.085)	(0.086 , 0.101)	(0.073 , 0.097)	(0.1 , 0.131)	(0.292 , 0.334)	(0.346 , 0.399)
UK	(0.167 , 0.184)	(0.157 , 0.188)	(0.307 , 0.32)	(0.302 , 0.327)	(0.01 , 0.014)	(0.009 , 0.014)	(0.082 , 0.097)	(0.079 , 0.097)	(0.059 , 0.081)	(0.056 , 0.083)	(0.263 , 0.308)	(0.253 , 0.307)

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More specifically, the countries for which only IO increases are Belgium, Hungary and Slovakia, providing results that are consistent with the empirical point estimates in which overall inequality does not show a remarkable rise/drop in any case. For Austria, Denmark, Greece and Spain income inequality also increases, in the empirical analysis the behaviour of the estimators for these countries has drawn already our attention due to the outstanding increase they experienced, therefore, the inferential analysis confirms the importance of these over time variations. Bootstrap analysis also shows that confidence intervals for the Gini index in Sweden do not overlap, leading to a significant increase of inequality measured by Gini index for this country.

Countries which present a significant downward evolution of inequality estimators are Poland, Portugal, Lithuania and Latvia, showing this tendency both for IO and overall income inequality, also confirming the empirical evidence in which we observed noteworthy declines of the estimators for these countries.

Table VIII collects bootstrap confidence intervals for the contribution of circumstances to IO, showing that in most countries, 14 of 26, there are not significant changes (Denmark, Cyprus, Czech Republic, Estonia, Greece, Finland, France, Hungary, Iceland, Norway, Poland, Portugal, Slovenia and Slovakia). Regarding changes in the contributions, on the one hand there are some countries in which we observe changes in the contribution of circumstances not accompanied by changes in IO or overall inequality: UK (increase importance of *Immigrant)*, Netherlands (decrease importance of *Gender*), Luxembourg (increase importance of *Parental Education*), Italy (rise on the contribution of *Immigrant*), Ireland (rise in *Immigrant* and *Parental Occupation*) and Denmark (increase in *Parental Occupation*).

On the other hand, we find a set of countries in which significant changes are observed for both inequality estimators and contributions of circumstances. These countries are: Austria and Spain, where the importance of *Immigrant* significantly increases; Belgium, where the contribution of *Immigrant* and *Parental Occupation* increases; Lithuania, where the contribution of *Density* declines and it is observed a rise in the importance of *Age*; Latvia, where the importance of *Density* drops and the contribution of *Parental Education* increases and lastly Sweden which shows a decline in the contribution of *Density*.

Summarising, the bootstrap procedure allows us to corroborate and to present a more robust evidence of the changes in inequality indicators and in the contribution of circumstances to IO. In general, there are only nine countries in which we do not observe any significant change over the two periods analysed: Cyprus, Czech Republic, Greece, Finland, France, Iceland, Latvia, Norway and Slovenia.

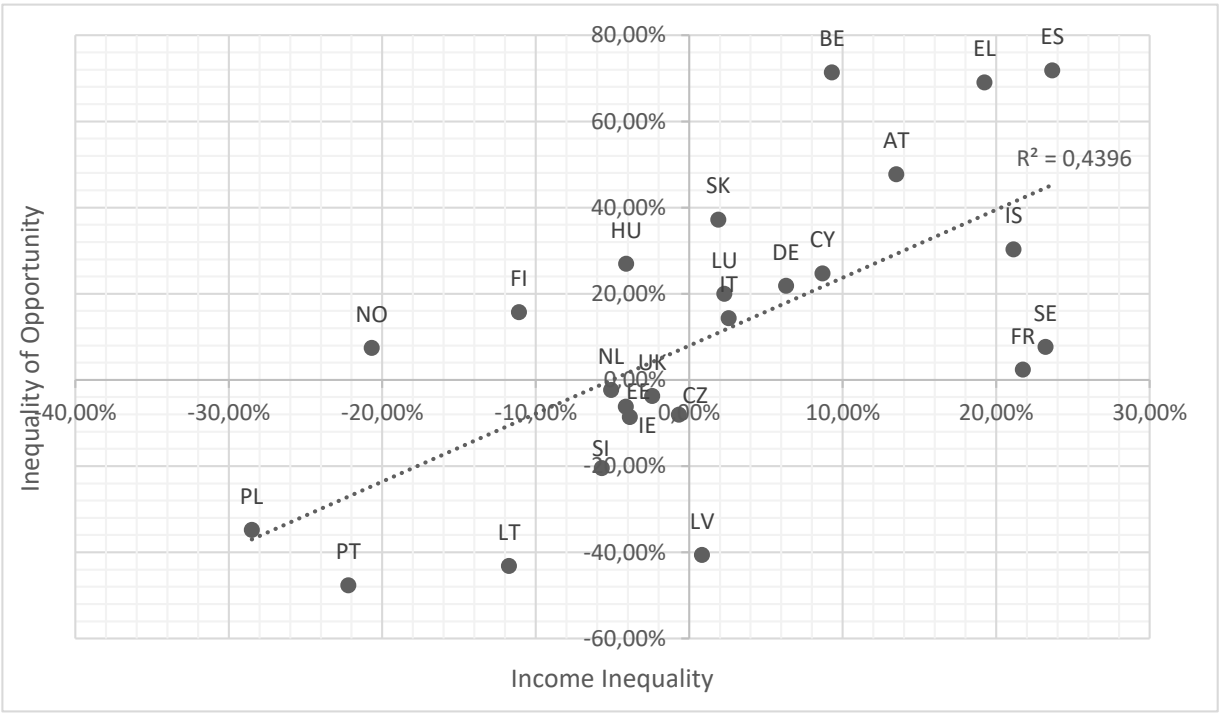
Inequality of opportunity increases in seven countries, Austria, Belgium, Denmark, Greece, Spain, Hungary and Slovakia, in which we can observe four different patterns of behaviour:

Firstly, for Austria and Spain, the increase in IO is accompanied with a rise of overall income inequality and in the importance of the circumstance *Immigrant*. Secondly, Denmark and Greece experienced a significant growth in overall inequality, but the contributions of circumstances do not show any significant change. In the third place we find Belgium, where overall inequality does not show any significant change but the importance of the circumstances *Immigrant* and *Parental Education* increases. Lastly, in Hungary and Slovakia we observe only a significant increase in IO, remaining overall inequality and the contribution of each circumstance constant.

On the contrary IO decreases in four countries: Poland, Portugal, Lithuania and Latvia, where we see two different patterns: only in the two first cases this decline is accompanied with a reduction in overall income inequality, whereas the two latter countries experienced a decrease in the contribution of density to IO and an increase in the contribution of *Age* (Lithuania) and *Parental Education* (Latvia).

Furthermore, it is important to highlight the role played by the circumstance *Immigrant*, since we observe a significant increase of its contribution for six countries: Austria, Belgium, Spain, Ireland, Italy and UK, being the circumstance that experienced more significant changes.

Figure 7[13]*:* Income inequality and IO measured by GE(0) index



Finally, Figure 7 illustrates the relationship between income inequality and IO, most countries are in the upper right quadrant, showing an increase in both indicators. The fitted regression line shows a positive slope, with an explained variation of 0.44 points, which seems to evidence a

[13] Denmark has been excluded since its values of inequality are quite extreme (it would be in the upper right quadrant) compared with the remaining countries and therefore distorts the global vision.

positive relationship between inequality and IO. Likewise, it can be clearly observed that countries for which the inferential analysis provides robust evidence of the changes observed are the ones which presents more extreme values.

TABLE VIII. Confidence intervals for the contribution of circumstances

Country\Estimator	*Gender*		*Density*		*Immi*		*Educ*		*Occu*		*Age*	
	2005	**2011**	**2005**	**2011**	**2005**	**2011**	**2005**	**2011**	**2005**	**2011**	**2005**	**2011**
AT	(0 , 0.022)	(0 , 0.019)	(0.078 , 0.192)	(0.005 , 0.021)	(0.48 , 0.65)	(0.208 , 0.411)	(0.073 , 0.16)	(0.085 , 0.188)	(0.194 , 0.34)	(0.05 , 0.14)	(0.115 , 0.252)	(0.129 , 0.268)
BE	(0.002 , 0.057)	(0.001 , 0.029)	(0 , 0.035)	(0 , 0.013)	(0.093 , 0.288)	(0.292 , 0.457)	(0.257 , 0.429)	(0.271 , 0.407)	(0.275 , 0.454)	(0.158 , 0.269)	(0.03 , 0.134)	(0.031 , 0.095)
BG		(0 , 0.007)		(0.237 , 0.318)		(0 , 0.005)		(0.376 , 0.448)		(0.218 , 0.281)		(0.041 , 0.074)
CH		(0.005 , 0.055)		(0.021 , 0.075)		(0.032 , 0.115)		(0.354 , 0.507)		(0.201 , 0.324)		(0.115 , 0.225)
CY	(0.001 , 0.026)	(0.002 , 0.028)	(0.071 , 0.158)	(0.071 , 0.17)	(0.136 , 0.268)	(0.262 , 0.418)	(0.25 , 0.374)	(0.15 , 0.271)	(0.205 , 0.316)	(0.127 , 0.241)	(0.067 , 0.154)	(0.091 , 0.195)
CZ	(0.001 , 0.038)	(0.002 , 0.033)	(0.032 , 0.119)	(0.044 , 0.117)	(0.001 , 0.096)	(0 , 0.027)	(0.303 , 0.447)	(0.35 , 0.46)	(0.284 , 0.436)	(0.308 , 0.428)	(0.091 , 0.206)	(0.082 , 0.177)
DE	(0.066 , 0.206)	(0.001 , 0.052)	(0.065 , 0.191)	(0.054 , 0.162)	(0.057 , 0.278)	(0.021 , 0.196)	(0.073 , 0.211)	(0.171 , 0.363)	(0.047 , 0.168)	(0.216 , 0.386)	(0.248 , 0.45)	(0.137 , 0.315)
DK	(0.001 , 0.079)	(0 , 0.06)	(0.018 , 0.123)	(0.001 , 0.077)	(0.004 , 0.098)	(0.001 , 0.069)	(0.02 , 0.139)	(0.032 , 0.229)	(0.028 , 0.135)	(0.012 , 0.155)	(0.626 , 0.834)	(0.625 , 0.88)
EE	(0.011 , 0.08)	(0 , 0.014)	(0.108 , 0.236)	(0.04 , 0.129)	(0.027 , 0.096)	(0.06 , 0.152)	(0.339 , 0.482)	(0.301 , 0.446)	(0.161 , 0.277)	(0.183 , 0.324)	(0.065 , 0.168)	(0.122 , 0.266)
EL	(0.001 , 0.045)	(0 , 0.014)	(0.046 , 0.151)	(0.007 , 0.053)	(0.243 , 0.471)	(0.218 , 0.388)	(0.152 , 0.316)	(0.289 , 0.465)	(0.192 , 0.362)	(0.136 , 0.258)	(0.009 , 0.061)	(0.039 , 0.167)
ES	(0.002 , 0.023)	(0 , 0.007)	(0.148 , 0.222)	(0.072 , 0.12)	(0.08 , 0.159)	(0.399 , 0.54)	(0.271 , 0.368)	(0.142 , 0.229)	(0.264 , 0.363)	(0.149 , 0.234)	(0.037 , 0.082)	(0.036 , 0.077)
FI	(0 , 0.043)	(0.001 , 0.042)	(0.025 , 0.212)	(0.153 , 0.473)	(0.019 , 0.147)	(0.022 , 0.281)	(0.162 , 0.373)	(0.024 , 0.157)	(0.189 , 0.442)	(0.069 , 0.295)	(0.114 , 0.367)	(0.181 , 0.478)
FR	(0 , 0.017)	(0.003 , 0.031)	(0.053 , 0.109)	(0.015 , 0.051)	(0.109 , 0.207)	(0.088 , 0.189)	(0.185 , 0.287)	(0.191 , 0.298)	(0.217 , 0.307)	(0.264 , 0.378)	(0.213 , 0.31)	(0.205 , 0.307)
HR		(0.002 , 0.042)		(0.093 , 0.192)		(0.003 , 0.044)		(0.399 , 0.532)		(0.223 , 0.345)		(0.043 , 0.111)
HU	(0 , 0.01)	(0 , 0.003)	(0.222 , 0.33)	(0.218 , 0.285)	(0.222 , 0.33)	(0.218 , 0.285)	(0.307 , 0.406)	(0.344 , 0.409)	(0.255 , 0.342)	(0.295 , 0.354)	(0.043 , 0.094)	(0.033 , 0.06)
IE	(0.028 , 0.14)	(0.004 , 0.086)	(0.167 , 0.328)	(0.036 , 0.155)	(0.002 , 0.04)	(0.06 , 0.206)	(0.203 , 0.386)	(0.082 , 0.229)	(0.119 , 0.267)	(0.358 , 0.573)	(0.114 , 0.242)	(0.073 , 0.229)
IS	(0.001 , 0.106)	(0 , 0.067)	(0.003 , 0.15)	(0.001 , 0.141)	(0.002 , 0.125)	(0.01 , 0.239)	(0.019 , 0.247)	(0.009 , 0.141)	(0.011 , 0.131)	(0.006 , 0.113)	(0.512 , 0.852)	(0.581 , 0.878)
IT	(0.002 , 0.019)	(0 , 0.007)	(0.036 , 0.076)	(0.014 , 0.045)	(0.089 , 0.167)	(0.22 , 0.327)	(0.337 , 0.434)	(0.251 , 0.351)	(0.268 , 0.36)	(0.211 , 0.296)	(0.084 , 0.146)	(0.111 , 0.183)
LT	(0 , 0.013)	(0 , 0.022)	(0.415 , 0.559)	(0.16 , 0.396)	(0.001 , 0.014)	(0 , 0.044)	(0.17 , 0.267)	(0.18 , 0.369)	(0.17 , 0.262)	(0.097 , 0.25)	(0.042 , 0.105)	(0.164 , 0.387)
LU	(0.001 , 0.036)	(0.005 , 0.037)	(0.001 , 0.014)	(0.001 , 0.006)	(0.135 , 0.276)	(0.167 , 0.287)	(0.303 , 0.447)	(0.447 , 0.555)	(0.243 , 0.387)	(0.178 , 0.273)	(0.045 , 0.137)	(0.012 , 0.048)
LV	(0 , 0.011)	(0 , 0.009)	(0.355 , 0.483)	(0.101 , 0.207)	(0.002 , 0.01)	(0.001 , 0.02)	(0.236 , 0.34)	(0.365 , 0.498)	(0.181 , 0.282)	(0.25 , 0.379)	(0.031 , 0.091)	(0.057 , 0.138)
MT		(0.003 , 0.057)		N.A		(0 , 0.033)		(0.299 , 0.467)		(0.329 , 0.479)		(0.109 , 0.25)
NL	(0.009 , 0.153)	(0 , 0.071)	N.A	N.A	(0.019 , 0.256)	(0.219 , 0.561)	(0.056 , 0.267)	(0.057 , 0.24)	(0.163 , 0.408)	(0.119 , 0.345)	(0.232 , 0.567)	(0.119 , 0.348)
NO	(0.024 , 0.153)	(0 , 0.046)	(0.039 , 0.158)	(0.001 , 0.062)	(0.001 , 0.057)	(0.023 , 0.173)	(0.016 , 0.083)	(0.04 , 0.161)	(0.04 , 0.157)	(0.05 , 0.188)	(0.553 , 0.785)	(0.541 , 0.789)
PL	(0 , 0.009)	(0 , 0.008)	(0.194 , 0.264)	(0.194 , 0.279)	(0 , 0.004)	(0 , 0.01)	(0.361 , 0.441)	(0.28 , 0.378)	(0.275 , 0.348)	(0.355 , 0.457)	(0.041 , 0.075)	(0.017 , 0.043)
PT	(0 , 0.007)	(0 , 0.009)	(0.018 , 0.055)	(0.01 , 0.048)	(0.001 , 0.011)	(0.001 , 0.015)	(0.398 , 0.547)	(0.32 , 0.499)	(0.378 , 0.517)	(0.405 , 0.574)	(0.02 , 0.068)	(0.036 , 0.114)
RO		(0.004 , 0.034)		(0.189 , 0.292)		(0 , 0.024)		(0.288 , 0.394)		(0.233 , 0.334)		(0.079 , 0.15)
SE	(0.001 , 0.053)	(0.001 , 0.093)	(0.047 , 0.303)	(0.002 , 0.13)	(0.087 , 0.382)	(0.042 , 0.348)	(0.013 , 0.101)	(0.02 , 0.154)	(0.006 , 0.096)	(0.006 , 0.112)	(0.369 , 0.671)	(0.457 , 0.827)
SI	(0.037 , 0.174)	(0 , 0.051)	N.A	N.A	(0.015 , 0.132)	(0.087 , 0.271)	(0.273 , 0.455)	(0.302 , 0.505)	(0.343 , 0.53)	(0.232 , 0.414)	(0.016 , 0.076)	(0.031 , 0.154)
SK	(0.01 , 0.058)	(0 , 0.021)	(0.178 , 0.284)	(0.167 , 0.281)	(0 , 0.028)	(0.001 , 0.02)	(0.147 , 0.251)	(0.239 , 0.353)	(0.194 , 0.297)	(0.206 , 0.31)	(0.237 , 0.35)	(0.161 , 0.262)
UK	(0.004 , 0.052)	(0.012 , 0.092)	(0 , 0.035)	(0 , 0.012)	(0.004 , 0.065)	(0.014 , 0.102)	(0.198 , 0.328)	(0.286 , 0.458)	(0.523 , 0.664)	(0.392 , 0.563)	(0.045 , 0.126)	(0.019 , 0.096)

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5. CONCLUDING REMARKS

The vast majority of empirical studies analysing inequality of opportunity focus on a specific period, averaging data of several years in order to eliminate transitory variations of income and estimate permanent income. In this paper we make an attempt to assess changes over time through bootstrapping, and therefore the proposed analysis includes the comparison between two different years, 2004 and 2010, referred to significantly different economic scenarios, and thus providing interesting information about the evolution of inequality of opportunity over time, both in absolute and relative terms.

Likewise, our empirical analysis shows the contribution of each particular circumstance on inequality of opportunity in different moments of time, allowing us to test if changes from 2004 to 2010 are statistically significant. It is important to stress that these effects would have been ignored if, as it is usual in the existing empirical analysis, we had considered the average of information related to both years.

Furthermore, regarding the implementation of public policies to soften or eliminate the effects of the circumstances on income inequality, the consideration of the effects referred to the current period seems to be more sensible than the assumption of an average with past years. Similarly, the special focus on immigrants' situation may be important when designing public policies which want to take into account disadvantageous collectives.

This study helps to understand where and why inequality of opportunity is higher, which institutional factors are more related with its increase or decrease and how it can be alleviated through public policies. Although the empirical analysis of Section 3 provides a clear evidence of an increase on income inequality and inequality of opportunity, when interpreting the evidence it is important to bear in mind that most changes are not significant (taking into account the inferential analysis of Section 4), therefore, it can be said that increases in inequality are not as alarming as they might seem at first sight.

Nevertheless, there are some particular cases which deserve our attention. More specifically, countries so different from each other, such as Austria, Denmark, Greece and Spain, in which we observe significant increases in inequality of opportunity and Poland, Portugal, Lithuania and Latvia in which the contrary occurs and inequality of opportunity declines.

Regarding the contribution of circumstances, the most remarkable fact is the increase of the contribution of being an Immigrant in most countries, being this increase significant in six of them. This fact is especially remarkable in three countries, Austria, Belgium and Spain, where this increase comes together with an increment on inequality of opportunity.

In general terms, the available information shows that living in a high or medium density urban area, being born in the country of residence, having parents highly educated and in high-skilled occupations and being a man over 52 are the suitable circumstances in order to perceive a high income.

References

Alesina, A., & La Ferrara, E. (2005). Preferences for redistribution in the land of opportunities. *Journal of Public Economics*, *89*(5), 897–931.

Almås, I., Cappelen, A. W., Lind, J. T., Sørensen, E., & Tungodden, B. (2011). Measuring unfair (in)equality. *Journal of Public Economics*, *95*(7–8), 488–499.

Björklund, A., Jäntti, M., & Roemer, J. E. (2012). Equality of opportunity and the distribution of long-run income in Sweden. *Social Choice and Welfare*, *39*(2–3), 675–696.

Bossert, W. (1995). Redistribution mechanisms based on individual characteristics. *Mathematical Social Sciences*, *29*(1), 1–17.

Bourguignon, F., Ferreira, F. H. G., & Menéndez, M. (2007). INEQUALITY OF OPPORTUNITY IN BRAZIL. *Review of Income and Wealth*, *53*(4), 585–618.

Cowell, F. A. (1980). On the Structure of Additive Inequality Measures. *Review of Economic Studies*, *47*(3), 521–531.

Efron, B., & Tibshirani, R. (1986). Bootstrap Methods for Standard Errors,Confidence Intervals, and Other Measures of Statistical Accuracy. *Statistical Science*, *1*(1), 54–77.

Eurostat (2005, 2011). European Union Statistics on Income and Living Conditions database (EU-SILC)

Ferreira, F. H. G. ;, & Peragine, V. (n.d.). *Equality of Opportunity: Theory and Evidence* (IZA Discussion Papers No. No. 8994).

Ferreira, F. H. G., & Gignoux, J. (2011). The measurement of inequality of opportunity: Theory and an application to Latin America. *Review of Income and Wealth*, *57*(4), 622–657.

Fleurbaey, M. (1994). On fair compensation. *Theory and Decision*, *36*, 277–307.

Foster, J. E., & Shneyerov, A. A. (2000). Path independent inequality measures. *Journal of Economic Theory*, *91*(2), 199–222.

Gaertnertt, W., & Schwettmannt, L. (2007). Equity, Responsibility and the Cultural Dimension. *Economica*, *74*(74), 627–649.

Ramos, X., & Van De Gaer, D. (2015). Approaches to Inequality of Opportunity : *Journal of*

Economic Surveys.

Roemer, J. E. (1993). A Pragmatic Theory of Responsibility for the Egalitarian Planner. *Philosophy & Public Affairs*, *22*(2), 146–166.

Roemer, J. E. (1998). *Theories of distributive justice*. Harvard University Press.

Schokkaert, E., & Devooght, K. (2003). Responsibility-sensitive fair compensation in different cultures. *Social Choice and Welfare*, *21*, 207–242.

Shorrocks, A. F. (1984). Inequality Decomposition by Population Subgroups. *Econometrica*, *52*(6), 1369–1385.

Suárez-Álvarez, A., & López-Menéndez, A. J. (2016). *Inequality of opportunity and income inequality in Spain : An analysis over time* (WP 2016 No. 423).

Swire, P. P. (1995). Equality of Opportunity and Investment in Creditworthiness. *University of Pennsylvania Law Review*, *143*(5), 1533–1559.

Van de Gaer, D. (1993). *Equality of opportunity and investment in human capital*. *Dissertation Thesis, Katholieke Universiteit Leuven*.