MEASURING THE EFFECT OF FORMAL EDUCATION ON INCOME INEQUALITY: A LONGITUDINAL ANALYSIS ACROSS MEDITERRANEAN COUNTRIES

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Abstract

The paper aims at investigating the role of gender and personal education in explaining differences in generating individual earnings and their effects on income inequality. The analysis involves four countries of Southern Europe (Greece, Italy, Portugal, and Spain) in light of the macroeconomic and institutional settings and policy frameworks. Once that the main determinants of income have been sketched through random effects models, the ANOGI (Analysis of Gini) decomposition is performed in order to evaluate the contribution of each subgroup of population with different formal education to the overall income inequality and to assess the degree to which each subpopulation is stratified. In short, Greece and Portugal show the largest gender earnings gaps and the largest differences in returns on education, while earnings inequality is more severe for Italian and Portuguese women. In each country, except for Italy, lower educated workers show the lowest amount of overlapping and, therefore, high levels of income stratification, while higher educated individuals are usually less stratified. Italy instead shows similar degrees of overlapping for both the lowest and the highest education levels.

Keywords: Formal education, earnings inequality, ANOGI, South Europe.

1 INTRODUCTION AND BACKGROUND

For several decades, research has been giving evidence of a significant impact of formal education, work experience, and background characteristics on personal earnings [18;3] and, more generally, on income distribution [21;7] and inequality of a population [1;8]. A widespread literature [15;26] demonstrated that better educated and more experienced individuals with favourable family and environment backgrounds usually suffer less unemployment and poverty, reach higher job positions, and earn more than their less educated counterparts. However, what people know, and not just how many years of schooling they complete, may also be a key to understand how education investments improve individuals' productivity [14;5] and their capacity for research, development and innovation. In other words, both the quantity and quality of education significantly contribute to improve human capital and labour productivity [16], to implement new technologies [4] and to enhance the innovative capacity of the economy [25].

In this context, at least three of the five headline goals of the Europe 2020 strategy for smart, sustainable and inclusive growth relate directly to education and income distribution [11]. More precisely, the first target aims at increasing the employment rate of the population aged 20-64 to at least 75%, including through larger females' participation in the labour market and better integration of migrants. The fifth priority, meanwhile, would reduce the number of Europeans living below the national poverty lines by 25%, lifting over 20 million people out of poverty. The forth target concerns formal education more specifically and tackles the problem of early school leavers; the goal consists in reducing the dropout rate to 10% and increasing the share of the population aged 30-34 having completed tertiary education to at least 40%. This objective forms part of the currently severe socio-economic context of Europe where about 25% of students have still poor reading competences, and one in seven young people leaves education too early [20]. Secondary schools still represent the most frequent highest completed degrees in many European societies, and less than one person in three aged 25-34 has attained a university degree compared to 40% in the United States and over 50% in Japan [20]. In addition, many European workers are still mismatched in the labour market because their level of qualification diverges (over- or under-education) from the requirements to get the current job position [27], or competences acquired during the education process are useless in performing the job [9], or they are actually dissatisfied with their occupation [6].

Obviously, the European goals are translated into national trajectories [11] to reflect the diversity of each national context. Really, the second target also concerns in some ways education because it

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focuses on the need to invest in Research & Development (3% of the EU'S GDP should be invested in R&D), stressing the importance of improving the conditions for private R&D.

However, the five European targets are very ambitious and their attainability is not simple because of the harsh economic and financial scenarios in which the most of European countries are currently involved. Since 2008, the economic crisis – without precedent in this generation and still ongoing – has exposed important weaknesses of the economy of Euro area even though with different intensity across countries. However, Member States are interdependent, spillover effects usually involve national economies, and reforms in one country may affect the performance of some others [11].

Therefore, it would be worth considering whether the narrowing of inequalities is actually feasible, especially in countries whose territorial disparities in education and income are continually growing and labour market characteristics are unequally distributed over different subpopulations. In this field, the paper intend to examine the role of gender and personal education in explaining differences in generating individual earnings and their effects on income inequality. The analysis involves, in a comparative perspective, four countries of Southern Europe (Greece, Italy, Portugal, and Spain), which have hardly felt the damaging effects of the global crisis with a significant widening of the pre-existing regional disparities. However, because of different macroeconomic conditions, institutional settings, and policy frameworks, each country has differently reacted to the recession. More precisely, Greece has suffered a pronounced throwback as direct consequence of the crisis more than any other country so that structural reforms are required to ensure the achievement of the European targets for 2020. In Italy, which has seen its real GDP back to levels of the start of 2000s, the low productive investments and the high long-term unemployment rates have negatively affected even the matching in the labour market. The cyclical deterioration impinged upon well-known structural weaknesses has given rise to the proliferation of atypical and flexible forms of work, and high shares of temporary contracts and irregular jobs. Socio-economic indicators have seen a drastic decline for Spain and Portugal with very poor performance of labour market and worsened macroeconomic imbalances.

2 METHODOLOGY

The study is carried out in a longitudinal perspective (2007-2010) using EU-SILC data (*European Union–Survey on Income and Living Conditions*), the main European reference source for comparable statistics on income distribution both at household and individual level. To meet both cross-sectional and longitudinal requirements, each participating country implemented an integrated design based on at least four-year rotational groups. The analysis is focused on all currently employees and self-employed, irrespective of activity sector, aged minimum 18 years in 2007 and maximum 65 in 2010. In this way, a strongly balanced panel is obtained with 3,460 individuals for Greece, 11,932 for Italy, 3,036 for Portugal, and 8,615 for Spain, observed over a period of four years (T=4).

Methodologically, the paper follows two steps. In the first one, to sketch the income dynamics over time, panel data regression models with random effects are performed [2;13], which also allow managing time-invariant regressors (e.g., gender):

$$\ln y_{it} = x_{it}\beta + \alpha + \nu_i + \varepsilon_{it} \qquad t = 1,2,...,T \qquad i = 1,2,...,n \tag{1}$$

lny_{it} and x_{it} are the logarithm of gross individual income and the 1x*k* vector of covariates, respectively. α_i is the time-constant, individual-specific effect that is composed of two parts: the first (α) is constant and independent from *i* and *t*, the second (v_i), the unit-specific residual, is random and differs between units; α_i is also named unobserved heterogeneity and its role is to capture time-invariant unobservable effects. ε_{it} is the disturbance term with zero mean, homoscedastic, not autocorrelated and uncorrelated with regressors and *v*. Moreover, random effects models are derived under the further assumption of strict exogeneity and uncorrelation between the individual effects α_i and the observed covariates:

$$E\left(\varepsilon_{it}\middle|\mathbf{X}_i,\alpha_i\right)=0 \quad \text{.....} \quad t=1,2,...,T \quad \text{and} \quad E\left(\alpha_i\middle|\mathbf{X}_i\right)=0 \tag{2}$$

Random effects models control for "individual heterogeneity", that is the variability across individuals (between) and the variability over time (within). Therefore, these models allow both to estimate the coefficients of the regressors that do not vary at all over time (null within variation) and to measure, with no efficiency loss, the effects of regressors that display a small within variation.

In this paper, income inequality is measured by Gini index (G) whose advantage lies in the opportunity to achieve a component of stratification that allows evaluating the degree to which incomes of different

subpopulations cluster. Indeed, G is not a suitable transformation of an additively decomposable index [22;19], and a third component can be viewed as a measure of income stratification [28], namely the degree of segmentation of population subgroups from each other. Therefore, in the second step, the decomposition of Gini index by education group allows investigating the relationship between total inequality and the inequality within and between subpopulations at different levels of formal education as well as the contribution of each educational subgroup to overall inequality. Specific groups form well-defined strata in terms of income if their members differ from the rest of population, e.g., incomes are confined to a specific range and the ranges do not overlap across subgroups. In short, subgroup inequality has to do with similarities and differences within the same group, while overlapping should be seen as the inverse of stratification.

Under the Pyatt's approach [22], Gini coefficient of the entire population (Gu) is viewed as the sum of four components, each of them gives additional insights into the decomposition procedure:

$$G_u = \sum_{i=1}^{n} s_i G_i + G_{bp} + \sum_{i=1}^{n} s_i G_i (O_i - 1) + (G_b - G_{bp}) \tag{3}$$

The first (IG) and second (BGp) terms are the Intra-Group and Between-Group-Pyatt components, respectively; s_i denotes group *i*'s share of overall income. IG is equal to its upper limit (G_u), and thus BGp will be zero, if all groups are identical (complete overlapping); conversely, BGp reaches its maximum (G_u), and IG will be null, in the case of perfect stratification. The last two terms represent the *Overlapping effect* on *Intra-Group* (IGO) and the *Overlapping effect* on *Between-Group* (BGO), respectively; O_i denotes the overlapping index of the entire population by subpopulation *i*. More specifically, O_i describes the extent to which the different subpopulations are stratified and reaches its lower limit ($O_i=p_i$) if group *i* is a perfect stratum, where p_i is the group *i*'s proportion of the total population. The higher fraction of overlapping the higher O_i will be with a maximum value of ($2–p_i$) in presence of two perfect strata, i.e., group *i* is not a group at all, but it is composed of two groups located at extremes of the overall distribution; finally, $O_i=1$ if complete overlapping exists.

Briefly, O_i measures the total overlapping of subpopulation *i*, to be exactly the overlapping of *i* with all the other subgroups, including group *i* itself. Indeed, O_i may be obtained as the weighed sum of O_{ji} (overlapping index of group *j* by group *i*) by p_j and it is further decomposable to identify the overlapping of *i* with the other subgroups, excluding *i*:

$$O_i = \sum_j p_j O_{ji} = p_i O_{ii} + \sum_{j \neq i} p_j O_{ji} = p_i + \sum_{j \neq i} p_j O_{ji} \tag{4}$$

In other words, O_{ji} measures the extent to which the group *j* is included in the range of *i*. It is bounded between zero, if no member of distribution *j* lies within the range of distribution *i* (group *i* is a perfect stratum), and two if all observations belonging to distribution *j* that are located in the range of *i* are concentrated at the mean of distribution. $O_{ji}=1$ in the case of complete overlapping between the two distributions *j* and *i*. The Pyatt's approach also allows assessing the contribution of overlapping to the Intra-Group and Between-Group components. Indeed, if a subpopulation and the overall population are equally distributed ($O_i=1$), there will not be any overlapping effect on IG component (IGO=0); this impact is negative (IGO<0) if the subgroup forms a strata in the population (Oi<1) and meanwhile its contribution to between-group will be increased. The overlapping effect on BGp component (BGO) is always non-positive and it reaches zero (maximum value) in the event of complete stratification.

In this paper, in order to ease its interpretation, only O_i is adjusted to move from the lower limit ($O_i=1$) if group *i* is a perfect stratum to the upper limit of $(2–p_i)/p_i$ in the event of two perfect strata; thus, $O_i = 1/p_i$ in the case of perfect overlapping. Moreover, being overlapping a way for evaluating the degree of stratification of a subpopulation, following Yitzhaki and Lerman [29], stratification index (Qi), ranging between –1 and 1, may be derived as an inversely measure of the adjusted Oi:

$$Q_i = \frac{1 - p_i O_i}{1 - p_i} \tag{5}$$

$Q_i=1$ for perfect stratification ($O_i=1$), $Q_i=0$ for complete overlapping ($O_i=1/p_i$) and $Q_i=-1$ in the extreme event of two perfect strata ($O_i=2–p_i/p_i$).

In this context, the Gini approach is one of the suitable methods through which identifying the driving forces of income inequality, and, simultaneously, how different a group's members at a given

education level are from members of groups at other education levels. As a result, the weakest and most vulnerable sub-categories of individuals is easily identified.

3 MAIN EMPIRICAL RESULTS

Panel data models with the logarithm of gross individual income as dependent variable are estimated through the maximum likelihood random effects method, which permits considering the personal longitudinal weights; the semi-log functional form is informed by Mincerian human capital models extended to other explanatory variables [18]. Random effects models, separately estimated for Greece, Italy, Portugal and Spain, are viewed as income-generating models tested on a set of personal characteristics (gender, marital status, consensual union, age, general health), human capital (educational attainment) and job background variables, namely employment status (self-employed *vs* employee), employment contract (full-time *vs* part-time) and occupation types (ISCO-88) scaled according to skill level. The choice of measuring the inequality on personal income derives from the interest in explaining the determinants of inequality in the individual capacity to earn income, regardless of how resources pool together and how individuals share them within own household [17]. Moreover, labour income is the main source of earning for most households and the gross income allows comparing countries regardless of the complexity of different tax rules.

χ^2-values with degrees of freedom equal to the number of restrictions confirm the statistical significance of regressions. The high values of "chibar2" of likelihood-ratio (LR) tests, which compare the ordinary linear regression model (without individual effects) and the model with random effects, denote that random effects models for each country significantly take into account the set of characteristics distinguishing each individual. In sum, the individual effects capture around 46% of the total variation of errors for Greece, 24% for Italy, 48% for Portugal and just 16% for Spain.

Table 1 – Random Effects Models: Greece and Italy

Variables	Greece		Italy	
	Coefficient	**(Std err)**	**Coefficient**	**(Std err)**
Individual characteristics:				
Gender (1 if *male*)	0.6308***	(0.0012)	0.4168***	(0.0004)
Marital status (1 if *married*)	0.0566***	(0.0027)	- 0.0174***	(0.0007)
Consensual union (1 if *share house*)	- 0.0048***	(0.0027)	0.1088***	(0.0007)
Age (*years*)	0.1772***	(0.0004)	0.0745***	(0.0002)
Age squared (*squared years*)	- 0.0018***	(0.0000)	- 0.0006***	(0.0000)
Human capital:				
Education (ref: *low*, ISCED97: 1;2)				
Medium (ISCED97: 3;4)	0.3617***	(0.0013)	0.1926***	(0.0005)
High (ISCED97: 5)	0.5298***	(0.0019)	0.4701***	(0.0008)
Job characteristics:				
Employment status (1 if *self-employed*)	0.6714***	(0.0029)	0.2424***	(0.0005)
Employment contract (1 if *full-time*)	- 0.0183***	(0.0027)	0.3537***	(0.0010)
Occupation (*elementary*, ISCO-88)				
Senior Officials	0.4851***	(0.0028)	0.4281***	(0.0010)
Managers	0.6511***	(0.0026)	0.5335***	(0.0010)
Professionals	0.3354***	(0.0028)	0.4997***	(0.0008)
Teaching professional,	0.2503***	(0.0023)	0.4098***	(0.0009)
Clerks	- 0.1449***	(0.0021)	0.0303***	(0.0008)
Service workers	0.1472***	(0.0022)	0.2468***	(0.0009)
Skilled agricultural	0.3446 ***	(0.0027)	0.3887***	(0.0033)
Sigma_u	0.7917***	(0.0004)	0.5429 ***	(0.0002)
Sigma_e	0.8496***	(0.0002)	0.9737 ***	(0.0001)
rho	0.4648***	(0.0003)	0.2372 ***	(0.0001)
*** significant at 1%	*n*=3,460; T=4 LR test of sigma_u=0: chibar2(01)=2.8e+06 *p-value*=0.000 LRchi2(16)=1.43e+06 *p-value*=0.000		*n*=11,932; T=4 LR test of sigma_u=0: chibar2(01)=3.9e+06 *p-value*=0.000 LRchi2(16)=4.25e+06 *p-value*=0.000	

Table 2 – Random Effects Models: Portugal and Spain

Variables	Portugal		Spain	
	Coefficient	**(Std err)**	**Coefficient**	**(Std err)**
Individual characteristics:				
Gender (1 if *male*)	0.4899***	(0.0014)	0.3502***	(0.0008)
Marital status (1 if *married*)	- 0.0037***	(0.0023)	0.0637***	(0.0010)
Consensual union (1 if *share house*)	- 0.1342***	(0.0025)	0.2532***	(0.0010)
Age (*years*)	0.1634***	(0.0005)	0.1100***	(0.0003)
Age squared (*squared years*)	- 0.0018***	(0.0000)	- 0.0012***	(0.0000)
Human capital:				
Education (ref: *low*, ISCED97: 1;2)				
Medium (ISCED97: 3;4)	0.2314***	(0.0016)	0.1283***	(0.0008)
High (ISCED97: 5)	0.7211***	(0.0024)	0.3099***	(0.0009)
Job characteristics:				
Employment status (1 if *self-employed*)	0.5998***	(0.0044)	2.3307***	(0.0057)
Employment contract (1 if *full-time*)	0.2886***	(0.0042)	- 0.1579***	(0.0057)
Occupation (*elementary*, ISCO-88)				
Senior Officials	0.5957***	(0.0026)	- 0.0784 ***	(0.0017)
Managers	0.8499***	(0.0030)	0.6209***	(0.0015)
Professionals	0.6279***	(0.0022)	0.4797***	(0.0015)
Teaching professional	0.5285	(0.0021)	0.3791***	(0.0014)
Clerks	0.0046***	(0.0018)	0.0686***	(0.0013)
Service workers	0.2273 ***	(0.0019)	0.1991***	(0.0013)
Skilled agricultural	0.3311***	(0.0022)	0.3560***	(0.0014)
Sigma_u	0.9257 ***	(0.0005)	0.7343 ***	(0.0004)
Sigma_e	0.9625***	(0.0002)	1.7007 ***	(0.0002)
rho	0.4805***	(0.0003)	0.1571 ***	(0.0001)
*** significant at 1%	*n*=3,036; T=4 LR test of sigma_u=0: chibar2(01)=1.11e+06 *p-value*=0.000 LRchi2(18)=2.7e+06 *p-value*=0.000		*n*=8615; T=4 LR test of sigma_u=0: chibar2(01)=1.6e+06 *p-value*=0.000 LRchi2(16)=7.17e+06 *p-value*=0.000	

The results show the crucial role of gender and formal education in determining personal earnings and confirm the significant gender gaps in employment and wages to the detriment of women, usually characterising countries of Southern Europe. In general, being a man increases significantly own personal incomes. In Greece, men earn, on average, about 63% more than women do, and this represents the highest gender earnings differential, followed by Portugal (49%), Italy (42%) and Spain (35%). Probably, in the most Mediterranean countries, the clear income disparities has also fuelled by the still unequal division of family responsibilities between partners, the scarcity of childcare places, problems concerning the reduction in time for mothers to spend with their children, and difficulties in changing husband/wife role in dual-income families [24]. However, even though Greece, Italy, Portugal and Spain substantially share similar cultural and economic structures, the impact of European gender equality and antidiscrimination principles depends on different forms of gender relations, the strength of organised feminisms, legislative and fiscal regimes [10]. For example, in Italy, which still ranks one of the last places in Europe for consistency of “aids packages for the children” [12], a general policy of equal opportunities is officially in force, but not actively pursued. In Greece and Portugal, legislation covers domain-specific aspects of gender equality, mainly in education, and specific programs for equal rights. Spain, instead, promotes the gender equality through even more specific anti-discrimination provisions. Indeed, in the Spanish education system, achieving effective equality for men and women is one goal of the Act of Education and gender perspective is adequately emphasised by the national legislation. In brief, gender gaps partially depend on the shortage of adequate supports to families (e.g., flexible forms of work organization, measures in support of parenthood, strategies to reconcile different roles), which could facilitate the females’ participation in the labour market. In Greece, which could boast forms of labour flexibility, the even more pronounced gender gap may be partially explained by the deep socio-political and economic recession that Europe is going through, which has been particularly severe for Greece. Moreover, it is worth to note that to be married or simply living “under the same roof” has a negative impact on personal incomes in in

Portugal, while Spain shows the opposed situation. An intermediate situation has sketched for Italy with a negative impact on individual earnings if married, and a positive impact if living "under the same roof" and in Spain with the opposed situation.

The analysis shows significant results for formal education and draws attention to the significant role of employment status, contracts and professional typologies (table 1,2). In particular, being older and higher educated significantly improves personal incomes because older workers could have had time to accrue their experience in labour market and more experienced people are usually oriented to build better job-related careers [23]. In brief, formal education and work experience capture the impact of human capital on income differentials. Differences in the levels of formal education strongly affect personal earnings and earnings differentials with a noticeable detachment in returns on schooling in favour of individuals with tertiary education. However, for both the education levels (medium *vs* high), differences in returns on education are more marked for Greece (medium: 36%; high: 53%) and Portugal (medium: 23%; high: 72%) compared to Italy (medium: 19%; high: 47%) and Spain (medium: 13%; high: 31%). Large income differentials are also associated with the employment status and, above all, with the different typologies of occupation. For example, in Italy and Portugal, working full-time and being self-employed have a positive impact on individual incomes, while in Greece and Spain, a full-time contract has a negative effect on personal earnings. In short, along with gender, the endowments of human capital, in terms of formal education and skills acquired in informal ways, are crucial determinants of income and income differentials.

The results confirm the high complexity of inequality process as well as its moral and social meaning; however, any social policy aimed at reducing income inequality has to be oriented to incorporate in the productive markets the weakest segments of population (e.g., increase the participation of women and young people in the labour market). To identify these vulnerable subpopulations, the overall inequality is decomposed into contribution from the two population effects (*within*: individuals of a population group may strongly differ from each other; *between*: groups may have different mean income) and overlapping effect as an inversely measure of stratification, e.g., how different a group's members are from members of other groups. More precisely, the ANOGI (Analysis of Gini) decomposition is carried out separately by gender (female *vs* male) and education attainment (pre-primary, primary, lower and upper secondary, post-secondary non-tertiary, first- and second-stage of tertiary education). The ANOGI decomposition allows exploring the degree to which incomes of different gender and education groups cluster as well as the contribution of each one to the overall inequality (tables 3-4).

Table 3 – ANOGI decomposition: Greece and Italy

Variable	Components	Greece		Italy	
		Value	%	Value	%
Gender	IG	0.3376	93.02	0.2143	93.22
	IGO	- 0.0246	- 6.79	- 0.0163	- 7.12
	BGP	0.1184	32.65	0.0728	31.69
	BGO	- 0.0685	- 18.88	- 0.0409	- 17.79
	G (within)	0.3129	86.23	0.1979	86.10
	G (between)	0.0499	13.77	0.0320	13.90
Education	IG	0.2980	82.13	0.1912	83.18
	IGO	- 0.0556	- 15.33	- 0.0317	- 13.78
	BGP	0.2024	55.79	0.1187	51.62
	BGO	- 0.0819	- 22.59	- 0.0483	- 21.01
	G (within)	0.2424	66.80	0.1596	69.39
	G (between)	0.1204	33.20	0.0704	30.61

Table 4 – ANOGI decomposition: Portugal and Spain

Variable	Components	Portugal		Spain	
		Value	%	Value	%
Gender	IG	0.3365	95.87	0.3315	98.28
	IGO	- 0.0084	- 2.39	- 0.0013	- 0.38
	BGP	0.0705	20.08	0.0351	10.40
	BGO	- 0.0476	- 13.56	- 0.0280	- 8.31
	G (within)	0.3282	93.48	0.3302	97.90
	G (between)	0.0229	6.52	0.0071	2.10
Education	IG	0.2476	70.54	0.2929	86.87
	IGO	- 0.0677	- 19.29	- 0.0341	- 10.10
	BGP	0.2187	62.29	0.1514	44.89
	BGO	- 0.0475	- 13.54	- 0.0730	- 21.65
	G (within)	0.1799	51.25	0.2589	76.76
	G (between)	0.1711	48.75	0.0784	23.24

In Italy and Portugal, females are more unequal than males with a more severity for Portuguese women; while for Portugal the most of inequality is due to the higher income differentials within each single subgroup of men or women (93.48%), for Italy a discrete share of inequality is also between genders (13.90%). Conversely, Greece and Spain show the opposed situation: males are more unequal than females with a more severity for Spanish men; the overall inequality is still due to the highest income differences within each single subgroup of men and women for Spain (97.90%), while a discrete share of inequality is also between genders in Greece (13.77%).

Looking at the ANOGI decomposition and, in particular, the adjusted overlapping indexes (tables 5-6), notable differences among the education groups exist. In particular, individuals with primary education have the lowest amount of overlapping (3.8174 for Greece, 2.0167 for Portugal, 6.3412 for Spain) and thus high levels of stratification in their income distribution. By contrary, higher educated workers (e.g., post-secondary education) have the largest amount of overlapping (20.6477 for Greece, 15.8303 for Italy, 175.8077 for Portugal, and 164.6491 for Spain) and thus they are less stratified. As they say, the degree of income stratification shrinks as the education level increases. Only Italy shows similar values of overlapping for both the lowest and the highest education levels.

Table 5 – ANOGI decomposition and stratification index: Greece

Variable	Category	Population share p_i	Income share s_i	Overlap index O_i	Gini G_i	Adjusted overlap (O_i/p_i)	Stratification index Q_i
Gender	Male	0.5993	0.7178	0.9324	0.3384	1.5558	1.1011
	Female	0.4007	0.2822	0.9133	0.3354	2.2793	1.0580
Education	Pre-primary	0.0059	0.0040	0.6514	0.2016	110.4068	1.0021
	Primary	0.2174	0.1186	0.8299	0.3237	3.8174	1.0473
	Secondary	0.1273	0.0808	0.7861	0.2845	6.1752	1.0312
	Upper second	0.3331	0.3378	0.8739	0.3017	2.6235	1.0630
	Non-tertiary	0.0491	0.0503	1.0138	0.3609	20.6477	0.9993
	Tertiary	0.2672	0.4086	0.7297	0.2835	2.7309	1.0986

Table 6 – ANOGI decomposition and stratification index: Italy

Variable	Category	Population share p_i	Income share s_i	Overlap index Oi	Gini G_i	Adjusted overlap (O_i/p_i)	Stratification index Q_i
Gender	Male	0.6384	0.7112	0.9277	0.2138	1.4532	1.1276
	Female	0.3616	0.2888	0.9136	0.2156	2.5365	1.0489
Education	Pre-primary	0.0115	0.0085	0.8423	0.1949	73.2435	1.0018
	Primary	0.0533	0.0449	0.8192	0.1723	15.3696	1.0102
	Secondary	0.3256	0.2573	0.8039	0.1867	2.4690	1.0947
	Upper second	0.3789	0.3768	0.9453	0.2004	2.4949	1.0334
	Non-tertiary	0.0607	0.0590	0.9609	0.2079	15.8303	1.0025
	Tertiary	0.1699	0.2534	0.6523	0.1817	3.8393	1.0712

Table 7 – ANOGI decomposition and stratification index: Portugal

Variable	Category	Population share p_i	Income share s_i	Overlap index O_i	Gini G_i	Adjusted overlap (O_i/p_i)	Stratification index Q_i
Gender	Male	0.5256	0.5961	0.8758	0.3137	1.6663	1.1376
	Female	0.4744	0.4039	1.0992	0.3702	2.3170	0.9105
	Primary	0.4186	0.2990	0.8442	0.2593	2.0167	1.1122
	Secondary	0.2579	0.1907	0.8734	0.2692	3.3866	1.0440
	Upper second	0.1617	0.1669	0.8079	0.2445	4.9963	1.0371
	Non-tertiary	0.0052	0.0063	0.9142	0.2224	175.81	1.0004
	Tertiary	0.1566	0.3369	0.4619	0.2271	2.9496	1.0999

Table 8 – ANOGI decomposition and stratification index: Spain

Variable	Category	Population share p_i	Income share s_i	Overlap index O_i	Gini G_i	Adjusted overlap (O_i/p_i)	Stratification index Q_i
Gender	Male	0.7666	0.8017	1.0255	0.3413	1.3377	0.9162
	Female	0.2334	0.1983	0.8572	0.2916	3.6727	1.0435
Education	Primary	0.1181	0.0828	0.7489	0.3310	6.3412	1.0336
	Secondary	0.2499	0.1811	0.7820	0.3291	3.1293	1.0726
	Upper second	0.2678	0.2398	0.9027	0.3060	3.3708	1.0356
	Non-tertiary	0.0057	0.0049	0.9385	0.3183	164.65	1.0004
	Tertiary	0.3585	0.4913	0.9468	0.2666	2.6410	1.0297

Looking at the overlapping matrix (O_{ji}) for gender (table 9), whose rows indicate the reference group *i*, it is interesting to note the presence of relatively less women with incomes falling in the interval of men's income distribution for Greece (0.8312 *vs* 0.8554), Italy (0.8001 *vs* 0.8646) and Portugal (0.7383 *vs* 1.1888). Only Spain (1.1094 *vs* 0.8138) shows the opposite situation.

Table 9 – Overlapping matrix by gender: Greece, Italy, Portugal, and Spain

Greece	Female	Male	Italy	Female	Male
Female	1	0.8554	**Female**	1	0.8646
Male	0.8312	1	**Male**	0.8001	1
Portugal	**Female**	**Male**	**Spain**	**Female**	**Male**
Female	1	1.1888	**Female**	1	0.8138
Male	0.7383	1	**Male**	1.1094	1

Having regard to the overlapping matrix for education (tables 10-11), it is worth stressing a peculiarity of income distribution of Italy where the proportion of higher educated workers (0.4079) falling in the income intervals of lower educated is higher than the proportion of lower educated workers (0.3486) falling in the income ranges of higher educated. It means that there are fewer individuals with low education with incomes similar to the lowest incomes earned by the higher educated workers. Conversely, for Greece, Portugal and Spain, the proportions of higher educated workers falling in the income intervals of lower educated is lower than the proportions of lower educated falling in the income range of higher educated workers.

Table 10 – Overlapping matrix by education: Greece and Italy

	Pre-primary	Primary	Lower secondary	Upper secondary	Post-Non-tertiary	First- and second tertiary
Pre-primary	1	0.7939	0.9013	0.6741	0.7224	0.3672
	1	1.0389	1.0166	0.8529	0.8553	0.4079
Primary	1.1613	1	1.0953	0.8548	0.8289	0.5273
	0.8907	1	0.9805	0.8397	0.8369	0.3966
Lower secondary	1.1246	0.8724	1	0.8409	0.8116	0.5337
	0.9836	1.0030	1	0.8081	0.8081	0.3429
Upper secondary	1.0397	0.6675	0.8387	1	0.8570	0.9012
	0.8689	1.0437	0.9852	1	0.9878	0.7061
Post-secondary non- tertiary	1.1269	0.7825	0.9446	1.1387	1	1.0794
	0.9217	1.0724	1.0205	1.0111	1	0.6879
First- and second tertiary	0.6179	0.3753	0.4957	0.8362	0.7254	1
	0.3486	0.5018	0.4325	0.7104	0.6851	1

Table 11 – Overlapping matrix by education: Portugal and Spain

	Primary	Lower secondary	Upper secondary	Post-secondary non-tertiary	First- and second tertiary
Primary	1	1.0008	0.8293	0.5175	0.1964
	1	0.9829	0.8261	0.9236	0.4429
Lower secondary	1.0109	1	0.9363	0.6136	0.2408
	1.0186	1	0.8642	0.9018	0.4888
Upper secondary	0.8557	0.8364	1	0.9291	0.4313
	1.0699	1.0578	1	1.0002	0.6652
Post-secondary non- tertiary	0.9908	0.9906	1.0765	1	0.4134
	1.0762	1.0881	1.0338	1	0.7166
First- and second tertiary	0.3034	0.3157	0.5751	0.7510	1
	0.8513	0.8705	0.9884	0.9756	1

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