INCOME INEQUALITY AND ECONOMIC GROWTH: AN EMPIRICAL INVESTIGATION IN MEDITERRANEAN COUNTRIES

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1. Introduction

Sizeable economic differences still exist among Mediterranean countries, which complicate the economic integration of the two shores of the Mediterranean. Examining the personal income distributions of these Mediterranean countries reveals structural differences in their levels of income inequality. However, over the last decade, disparities in economic development have decreased while the dynamics of income inequality have diverged among countries in different geographic and political areas of the Mediterranean (Capasso and Astarita, 2011; Amendola and Ferragina, 2011; El-Lahity 2012; Daniele and Malanima, 2013). Given this scenario, this article analyses the relationship between inequality and economic growth in Mediterranean countries.

The relationship between income inequality and economic development has spawned a large theoretical and empirical body of literature (for a survey, see Barro 2000, Forbes 2000, Kanbur 2000, Banerjee and Duflo 2003, Knowles 2005, etc.). Notwithstanding, the following puzzles remain: (i) whether a correlation between inequality and economic growth exists and the direction of the association, (ii) the nature of this relation (short or long run), and (iii) whether causality runs from economic growth to inequality or vice versa.[1] In this paper, we focus on the first question - the nature and direction of the correlation between income inequality and economic growth - focusing on 18 Mediterranean countries over the period 1995−2012. Banerjee and Duflo (2003) argue that three main sources of bias contribute to the inconclusive results produced by this strand of research: (a) measurement error in the inequality data, especially because many studies do not consistently distinguish between income distributions before and after taxes and transfers; (b) selection of an estimator approach; (c) non-linearity in the relationship between the level of inequality and growth. Similarly, Ehrhart (2009)

[1] See Amendola and Dell'Anno (2013) for an analysis of these issues for EU countries.

provides two main reasons for these controversial results. First, the statistical relationship between income inequality and growth may reflect the effect of omitted variables. For instance, Birdsall et al. (1995) claim that the strong negative correlation observed is due to the omission of educational variables. The second issue in empirical analyses is that this literature does not measure inequality consistently because of comparable data are lacking (Ehrhart, 2009). Knowles (2005) argues that studies predating the Deininger and Squire (1996) dataset include data of dubious quality. Recently, Thewissen (2013) observed that the most important concerns in research on inequality are the availability and quality of data. Atkinson and Brandolini (2001) emphasise that the larger income inequality databases that include observations for developing countries suffer from measurement error, low comparability among countries, and heterogeneity in survey design.

Keeping in mind these caveats, this paper contributes to this empirical literature using a new income inequality database recently proposed by Solt (2009): the SWIID dataset. This dataset addresses some of previously identified limitations, e.g., by reducing both measurement error and bias due to heterogeneity in survey design and by distinguishing between the pre- and post-tax income distributions.

We observe the following main results in this analysis of Mediterranean countries: (1) there is tentative empirical evidence that Granger causality runs from income inequality to economic growth, and we can unambiguously reject the hypothesis that Granger causality runs in the other direction; (2) an inverted U-shaped curve exists between income inequality and the growth rate of GDP per capita. However, the latter result depends on the data source used for the index of income inequality.

This article is organised as follows. Following this introduction, some stylised facts characterising income development and inequality in the Mediterranean are presented in Section two. Section three summarises the main theories of the relationship between inequality and economic development. The fourth section provides the econometric approach and empirical results. Section 5 concludes.

2. Some stylised facts about economic development and inequality in the Mediterranean

An interesting body of literature addresses disparities in economic development among Mediterranean countries and their causes (Amendola and Ferragina, 2011). These studies emphasise that Mediterranean countries experience significant differences in both medium- and long-run levels of development. In Table 1, we report values for the Human Development Index (HDI), 2012 Gross National

Income (GNI) per capita and annual growth rate of Gross Domestic Product per capita. The last two columns report the inequality-adjusted HDI and GNI Loss, which are calculated by the UNDP to incorporate losses in HDI and GNI due to the distribution of these achievements among the population by discounting the average value of each dimension by its level of inequality (UNDP, 2013).

As these data indicate, in 2012, the per capita GNI of the EU countries and Israel ranges from $30,277 in France to $19,907 in Portugal, while in the Balkan and Middle East and North African (MENA) countries per capita GNI ranges from $26,224 in Israel to less than $5,000 in Morocco and Tunisia. Similar differences can be observed in the HDI values. For high-income countries, HDI ranges from 0.90 in Israel to 0.81 in Croatia, while in middle-income countries HDI ranges from 0.79 for Montenegro to 0.59 for Morocco. Smaller development disparities are observed among Mediterranean countries than those recorded at the global level (Daniele and Malanima, 2008; FEMISE, 2013).[2]

Utilising long-term data from 17 Mediterranean economies, Daniele and Malanima (2013) demonstrate that income inequality, as measured by the Gini index of GNI, slightly increases until 1970, decreases until the mid-80s and then increases again. They conclude, "on the whole, between 1950 and 2000, inequality has grown and Mediterranean countries have gone through a phase of economic divergence" (Daniele and Malanima, 2013, p. 18).

This long-run increase in development disparities in the Mediterranean is a consequence of the effectiveness of the European integration process, which favoured economic convergence among the EU countries of the Mediterranean, at least until the beginning of the new millennium. However, because of the partial failure of the Euro Mediterranean Partnership, the absence of a similar process of trade and economic integration, has contributed to the divergence of the MENA countries (Amendola, 2011).

Over the last decade, differences in income and development decreased, especially as GDP growth slowed in more developed countries. Moreover, since 2008 the EU Mediterranean economies where deeply involved affected by in the global financial crisis and, since because 2011, they were also affected by the negative effects of the so- called “sovereign debts crisis” (Daniele and Malanima, 2013; Amendola and Ferragina, 2014). However the improved economic performance observed in MENA countries appears to be led by non-innovative sectors, such as energy and rw materials exports, migrant remittances, tourism and constructions (Corm, 2011; Ansani and Daniele, 2014).

[2] The recent crisis revealed that EU Mediterranean countries are also characterized by this weakness (Stiglitz, 2013; OECD, 2012).

Development is a multidimensional concept that considers not only per capita material living standards but also the distribution of income and non-material goods and services among individuals. Standard measures of development and growth, including HDI, ignore discrimination among household members who may not receive a proportional share of the outcomes considered. Hence, inequality in income and other dimensions of welfare should be addressed, especially in Mediterranean countries (El-Laithy, 2012).

Table 1 – *Mediterranean countries: human development and income indexes.*

	HDI*	GNI per capita*	Growth GDP per capita**		Ineq.-adjust. HDI Loss*	Ineq.-adjust. GNI Loss*
	2012	*2012*	*mean '95-'08*	*mean '09-'12*	*2012*	*2012*
Albania	0.749	7,822	6.8	2.8	0.139	0.183
Algeria	0.713	7,418	2.2	0.9		
Bosnia	0.735	13,300			0.115	0.192
Croatia	0.805	15,419	4.3	-1.9	0.151	0.278
Egypt	0.662	5,401	3.2	1.7	0.241	0.142
France	0.893	30,277	1.4	-0.4	0.090	0.133
Greece	0.86	20,511	2.9	-5.1	0.115	0.181
Israel	0.900	26,224	2.0	1.7	0.123	0.237
Italy	0.881	26,158	1.1	-1.3	0.119	0.181
Jordan	0.700	5,272			0.190	0.211
Lebanon	0.745	12,364			0.228	0.300
Macedonia	0.740	9,377	2.2	1.1		
Montenegro	0.791	10,471	3.4	-0.2	0.074	0.126
Morocco	0.591	4,384	2.7	3.3	0.297	0.23
Portugal	0.816	19,907			0.108	0.208
Serbia	0.769	9,533	4.5	-0.2	0.095	0.103
Slovenia	0.892	23,999			0.058	0.099
Spain	0.885	25,947	2.3	-1.8	0.101	0.197
Syria	0.648	4,674	1.3	1.7	0.204	0.183
Tunisia	0.683	8,103	3.8	0.8	0.252	0.218
Turkey	0.722	13,710	3.1	2.5	0.225	0.265
Average (21)	0.77	14,299	2.95	0.35	0.150	0.190
EU (5)	0.87	24,560	1.54	-1.72	0.110	0.180
Balkans (7)	0.78	12,846	3.03	0.23	0.090	0.140
Middle East (5)	0.74	12,449	1.28	1.18	0.190	0.240
North Africa(4)	0.66	6,327	2.98	1.68	0.200	0.150

*Sources: *UNDP (2013); **WDI. Note: Turkey is included among Middle Eastern countries. Croatia and Slovenia are included in the Balkans countries.*

Columns 3 and 4 of Table 1 report the percentage loss in HDI and GNI per capita values due to income inequality, which were recently calculated by the UNDP (2013). These two indicators help assess the economic performance of

Mediterranean countries with reference to the relationship between income disparities and economic development.

In 2012, the highest inequality adjusted GNI losses are observed for Lebanon, Croatia, Turkey, Israel and Morocco, with losses ranging from 30% for Lebanon to 23% for Morocco. This indicator suggests that excessively high inequality in the personal income distribution of a country can reduce per capita national income by approximately one-quarter. The smallest inequality adjusted GNI losses are observed for Slovenia, Serbia, Montenegro, France and Egypt, with smaller losses ranging from 10% for Slovenia to 14% for Egypt.

However, following Stiglitz (2012), examinations of the level and inequality of income should focus on the link between inequality and well-being. Inequality actually refers not only to income or consumption but also to the distribution of education, health services and security among individuals in a country. In Table 1, we also report the inequality adjusted HDI losses for 2012. The highest losses are again observed for Morocco (30%), Lebanon (23%) and Turkey (23%), but very high losses are also observed for Tunisia (25%) and Egypt (24%). The smallest HDI losses are observed for Slovenia, Montenegro, France, Serbia, Spain and Portugal, with losses ranging from 5.8% for Slovenia to 10.8% for Spain.

Several studies analyse the levels and medium- and long-run patterns of income inequality in the Mediterranean (Capasso and Astarita, 2011; El-Laithy, 2012; Sameti and Farahmand, 2013). These studies emphasise similarities and differences in both the levels and dynamics of income inequality among the different geographic and political areas of the Mediterranean. In Table 2, we report the income share held by highest 20% divided by the income share held by lowest 20% (the quintile income ratio), the ten-year income inequality indexes calculated by Capasso and Astarita (2011) and three measures of the Gini index. These data indicate that countries such as Tunisia, Morocco, Israel and Turkey are characterised by relatively high inequality. Other countries, such as Egypt and Algeria in the MENA region, France and Slovenia in the EU, and Serbia and Montenegro in the Balkans, exhibit relatively low inequality. However, the overall differences in income inequality are less prominent than expected given the observed disparities in development.

A peculiarity of the non-EU Mediterranean countries is that they are characterised by more equal personal income distributions than other middle-income countries, especially for monetary poverty incidence (FEMISE, 2013). Nevertheless, these countries show fragile income distribution structures. Significant shares of the populations of these countries live on the edge of the poverty threshold, and slight increases in food or fuel prices or unemployment can affect economic and political equilibrium (FEMISE, 2013).

As we can observe from Table 2, the EU countries exhibit lower inequality than other Mediterranean countries. From the mid-70s until the 2007 crisis, they also experienced slight decreases in the Gini index. This tendency is evident for France, Italy and, to a lesser extent, Spain and Greece, while Portugal represents a special case (OECD, 2011; Amendola and Dell'Anno, 2013). Several country studies reveal significant differences in the levels and long- and medium-term dynamics of income distribution as well as their causes. For example, the constant long-run decline in income inequality observed for France has been credited to particularly effective fiscal and transfer policies that favour the unemployed (Capasso and Astarita, 2011). Most recent studies suggest that Spain typically exhibits countercyclical behaviour in inequality indices (Pijoan-Mas and Sanchez-Marcos, 2010).

The Balkan countries also experienced slight decreases in inequality. However, missing data before 1990 does not allow reliable assessment of the long-run dynamics of the income distribution in these countries. Capasso and Astarita (2011) identify two common traits in the dynamics of inequality in Balkan economies. The first relates to the initial level of inequality, which is particularly low, as in all countries with centrally planned economies. The second common trait is the initial strong increase in the Gini index, which is a structural effect of transitioning to market economies characterised by greater competition and inequality. However, the dynamics of income inequality differ also among Balkan countries. For instance, Croatia and Slovenia were characterised by a stable level of inequality over the period 1990-2008 and strong growth following the period of central planning. For other Balkan countries instead, the Gini index presents a cyclically fluctuating trend (e.g., Macedonia) or an increasing dynamics (e.g., Montenegro, Serbia) (see Rutkowski, 1996; World Bank, 2006).

The patterns of inequality vary significantly across MENA countries. El-Laithy (2012) states, "only a slight change in the distribution of expenditure was detected for the majority of countries over the past two decades. In addition, with a few exception, inequality within countries is generally sluggish over time" (p. 12). Table 2 indicates that the highest levels of inequality are observed in Turkey, Tunisia and Morocco, while Egypt, Algeria and Syria are characterised by levels of inequality that are more moderate. Since the 80s, Middle Eastern countries have experienced continuous increases in income disparities and reached an intermediate level of inequality during the period 2000-2009. However, these results are strongly affected by inclusion of Turkey, which is characterised by very high levels of inequality. Therefore, by excluding this outlier, the average inequality in Middle Eastern countries decreased to the lowest rates in the Mediterranean. North African countries exhibit the highest levels of inequality. However, global income disparities have increased dramatically since the 90s (Karabsheh, 2001; World

Bank, 2002, 2006; Achy and Sekkat, 2004; Bourguignon, 2004; Khattab, 2005; El-Laythy, 2012; Femise, 2013).

Table 2 – *Mediterranean counties: human and development and income indexes*.

	Quintile Ratio	Income Inequality measure*				$Gini^{mkt}$ SWIID	$Gini^{net}$ SWIID	Gini WDI
	mean '00-'10	*mean '70-'79*	*mean '80-'89*	*Mean '90-'99*	*Mean '00-'08*	*Mean '95-'12*	*Mean '95-'12*	*Mean '95-'12*
Albania	5.3			29.3	29.6	34.8	30.2	31.2
Algeria			39.9	35.4		35.2	33.6	35.3
Bosnia	6.5			32.9	30.9			
Croatia	5.2		26.1	29.2	29.7	32.5	29.2	29.9
Egypt	4.4	35.8	35.5	37.7	36.1	34.9	35.3	31.5
France		37.4	34.9	29.3	27.6	46.1	28.3	32.7
Greece	6.2	41.7	36.3	34.7	33.3	40.3	33.6	34.3
Israel	7.9	36.6	39.6	38.9	38.1	44.8	35.6	39.2
Italy	6.5	38.6	33.4	33.8	33.9	45.8	33.5	36.0
Jordan	5.7	39.1	36.6	40.7	38.8			
Lebanon					36.0			
Macedonia			32.2	31.2	32.6	37.2	35.6	39.2
Montenegro	4.6			27.0	30.1	35.5	31.0	29.9
Morocco	7.3	56.8	41.0	39.2	40.9	41.1	38.4	40.3
Portugal		40.1	35.7	35.9	37.2	52.8	35.2	38.5
Serbia	4.2			27.0	35.5	35.2	30.6	30.7
Slovenia	4.8		21.9	26.0	26.1	34.0	23.1	29.9
Spain	6.0	34.8	30.3	32.0	32.1	42.1	32.9	34.7
Syria	5.7			33.7	37.4	37.4	34.8	35.8
Tunisia	8.1	44.6	40.7	40.6	40.6	39.6	37.6	40.0
Turkey	7.9	48.9	46.8	45.7	43.6	47.0	44.9	41.0
Average (21)	6.02	41.3	35.4	34.0	34.5	39.79	33.52	35.01
EU (5)	3.74	38.52	34.12	33.14	32.82	45.42	32.70	35.24
Balkans (7)	4.37		11.46	28.94	30.64	29.89	25.67	27.26
Middle East (5)	5.44	24.92	24.60	31.80	38.78	25.84	23.06	23.20
North Africa(4)	4.95	34.30	39.28	38.23	29.40	37.70	36.23	36.78

3. Income Inequality and Economic Growth

The relationship between economic disparities and economic growth has been explored in many empirical studies (e.g., Aghion et al., 1999; Temple, 1999; Kanbur, 2000; Barro, 2000; Banerjee and Duflo, 2003; Knowles, 2005; Ehrhart, 2009). Various theoretical explanations of how inequality affects growth have been suggested. A full discussion of these subjects is beyond the scope of this paper; however, following Ehrhart (2009), we classify this literature into two main types of explanations: (i) political economy and (ii) purely economic explanations.

Within political economy explanations, a first group of models argues that greater inequality motivates social demand for redistribution throughout political processes (e.g., Bertola, 1993; Alesina and Rodrik, 1994; Persson and Tabellini, 1994; Perotti, 1996). Typically, transfer payments and their associated taxation distort economic decisions; therefore, through this channel, inequality reduces growth. The second group of models (the socio-political unrest theory proposed by Barro, 2000) argues that high economic disparities cause political instability (Alesina and Perotti, 1994, 1996) and motivate the poor to engage in crime and disruptive activities (Bourguignon, 1999). Through socio-political unrest, inequality tends to reduce overall productivity and economic growth.

Of the "purely economic" explanations, a first approach hypothesises a (negative) relationship between inequality and growth due to the presence of imperfect capital markets (Galor and Zeira, 1993; Aghion et al., 1999). This proposition assumes that an unequal distribution of assets increases the number of individuals who do not have access to credit and, thus, cannot engage in productive investment. Through this channel, inequality reduces growth rates. According to the so-called endogenous fertility approach, income inequality noticeably reduces the future growth rate by positively affecting inequality in the overall fertility rate (e.g., Becker et al., 1990; Galor and Zang, 1997). Thus, worsening inequality jointly generates an increase in the fertility rate and a decrease in the rate of investment in human capital, which reduces the future growth rate of per capita GDP. A third approach claims that unequal distributions of income produce smaller domestic markets (Murphy et al., 1989). Domestic demand is thus too small to sustain fully developed local industries and to attract foreign direct investment. According to this approach, inequality reduces growth rates through lower exploitation of economies of scale and fewer incentives for foreign direct investment.

Many studies attempt empirical tests of theoretical hypotheses; however, these analyses often provide conflicting results. For instance, Alesina and Rodrik (1994), Persson and Tabellini (1994) Clarke (1995), Alesina and Perotti (1996), Deininger and Squire (1998) Kremer and Chen (2002), Josten (2003), Knowles (2005), Davis (2007), Pede et al. (2009), and De la Croix and Doepke (2009) observe that inequality reduces economic growth. Other studies observe a positive relationship between inequality and economic growth (e.g., Partridge, 1997; Li and Zou, 1998; Forbes, 2000; Castelló-Climent, 2004). Still other studies observe evidence of non-linear relationships similar to Kuznets (1955), e.g., an inverted U- shape (Barro, 2000; Banerjee and Duflo, 2003; Pagano, 2004; Voitchovsky, 2005; Bengoa and Sanchez-Robles, 2005; Barro, 2008; Castelló-Climent, 2010; Charles-Coll, 2010). Finally, some studies produce statistically insignificant or inconclusive results (e.g., Lee and Roemer, 1998; Panizza, 2002; Castelló and Doménech, 2002).

We contribute to this debate by exploring this issue for Mediterranean countries using different sources of inequality data. Accordingly, we provide an indirect test to control for measurement error in this empirical literature.

4. Empirical Analysis

In this section, we investigate the nature (i.e., long- or short-run dynamics) and direction of the relationship between income inequality and economic growth in a sample of Mediterranean countries. Two limitations usually affect empirical cross-country analyses of income inequality and growth: (i) measurement error and heterogeneous definitions of inequality; (ii) time horizons that are too short to analyse structural relationships and, more recently, a break in the data due to the economic crisis (2008−2009).

To control for measurement error, we use both the pre- and post-redistribution Gini index values estimated by Solt (2009) and collected in the Standardized World Income Inequality Database (SWIID) and the Gini index, decile and quartile share ratios collected by the World Bank in the World Development Indicators database[3]. The SWIID dataset maximises comparability of the Gini index by standardising observations from different data sources using the Luxembourg Income Study data.

This dataset also extends the sample period (from 1995 to 2012). The SWIID dataset provides the broadest available set of country-year observations by applying a custom missing-data multiple-imputation algorithm. Reducing missing values improves the analysis of the dynamic properties of inequality. Using of two data sources also verifies the robustness of the findings on the relationship between inequality and growth. Following Amendola and Dell'Anno (2013), this analysis first investigates whether (Granger) causality runs from economic growth to inequality and/or vice versa. We conduct Granger (1969) causality tests in the context of panel data to test whether previous changes in one variable help explain current changes in other variables. To control for spurious causality and potential omitted bias, we adopt a multivariate dynamic autoregressive model with fixed effects and a vector of control variables.[4] The variables employed in the Granger test should be stationary; therefore, we employ the growth rate of real GDP per

[3] The SWIID dataset is available at: http:///myweb.uiowa.edu/fsolt/swiid/swiid.html.

[4] These variables include potential causes of economic growth, i.e., log level of GDP per capita in 1992, propensity to invest in fixed capital (*K*), growth rate of the working age population as a percentage of the total population (H); openness to international trade (*Trade*), human capital measured by tertiary school enrolment (*Edu*), proportion of seats held by women in national parliaments (*WomP*). Two control variables are included in the regressions of income inequality: *Edu* and *WomP*.

capita (*GrGdp*) and the log level of income inequality (*Gini*) that consistent with panel unit root tests are I(0).

According to redundant fixed effects, the best model specification is a one-way fixed-effect model, i.e., a model that includes only cross-country and time dummies for regressions (1) and (2), respectively. The two regressions for Granger causality test are specified as follows:

$$Ineq_{it}^{SWIID} = d_i + \beta_0 + \sum_{l=1}^{m} \alpha_l GrGdp_{i,t-l}^{cap} + \sum_{l=1}^{m} \beta_l Gini_{i,t-l} + \gamma_1 Edu_{it} + \gamma_2 WomP_{it} + \varepsilon_{it} \quad (1)$$

$$GrGdp_{i,t}^{cap} = d_t + \beta_0 + \sum_{l=1}^{m} \alpha_l GrGdp_{i,t-l}^{cap} + \sum_{l=1}^{m} \beta_l Gini_{i,t-l} + \gamma_1 Edu_{it} + \gamma_2 WomP_{it} + \gamma_3 K + \gamma_4 H + \gamma_5 Trade + \varepsilon_{it} \quad (2)$$

where *GrGdp* is the first difference of the logarithm of GDP per capita and all other variables are in logarithmic form. The χ^2 (Wald) statistic for the joint hypothesis: H_0: $\beta_1 = \ldots\ldots = \beta_m = 0$ is the usual test used to identify Granger causality. We fix the length of lags (m) equal to three to conserve degrees of freedom. *Table 3* and 4 provide a selection of model estimates.

The Wald tests suggest rejection of the hypothesis that Granger causality occurs from economic growth to income inequality. Unfortunately, the results of the Wald tests are inconclusive for Granger causality from inequality to growth. For regressions (VII) and (IX), the statistical tests suggest rejection of the null hypothesis that the Gini coefficients (pre-transfers and pre-taxes) are jointly equal to zero but only at the ten percent level of significance. Similarly, tests of Granger causality from the Gini index (after redistribution: $Gini^{net}$) to growth cannot reject null hypothesis at the 1% level of significance in regression (XII). However, models XII and IX include only 83 observations; therefore, this result may depend on the sample composition.

In conclusion, there is only partial empirical evidence that Granger causality runs in one direction from income inequality to economic growth; however, we can unambiguously reject the hypothesis that Granger causality runs in the other direction.

Given these results, we investigate the effect of inequality on GDP growth over the long run. This methodology follows the original proposal of Mankiw et al. (1992) to estimate the rate of income convergence among countries, which has been recently used in inequality and growth research (e.g., Arjona *et al.* 2002; Voitchovsky 2005; Rooth and Stenberg 2011; Thewissen 2013). In this model specification, the dependent variable is measured as the average annual growth rate of GDP per capita adjusted for the business cycle; therefore, this value tentatively converges on its steady state value. In particular, we fix the period for computing average growth rates to four years. We assume that such a period reflects a

reasonable trade-off between a sufficiently long time to control for business cycle fluctuations and preserving the sample size to assess the growth of GDP.

Table 3 – *Granger causality tests: regressions (1).*

Dependent Variables	$Gini^{mkt}$			$Gini^{net}$		
	I	*II*	*III*	*IV*	*V*	*VI*
$GrGdp^{cap}_{t-1}$	-0.09*	-0.03	-0.08	-0.07	-0.04	-0.08*
$GrGdp^{cap}_{t-2}$	-0.02	-0.04	-0.01	-0.05	-0.06	-0.06
$GrGdp^{cap}_{t-3}$	0.08	0.04	0.06	0.003	0.01	-0.03
$Gini^{mkt}_{t-1}$	1.10***	1.31***	1.06***	1.00***	1.32***	1.01***
$Gini^{mkt}_{t-2}$	0.09	-0.02	0.08	0.18	-0.04	0.19
$Gini^{mkt}_{t-3}$	-0.33***	-0.33***	-0.28**	-0.29***	-0.30***	-0.26***
$Gini^{net}_{t-1}$	--	--	--	--	--	--
$Gini^{net}_{t-2}$	--	--	--	--	--	--
$Gini^{net}_{t-3}$	--	--	--	--	--	--
Educ	--	--	0.01	--	--	0.01
WomP.	--	--	0.00	--	--	-0.00
K	--	--	--	--	--	--
H	--	--	--	--	--	--
Trade	--	--	--	--	--	--
Gdp^{cap}_{1992}	--	0.00	--	--	-0.00	--
Const.	0.52***	0.10***	0.44**	0.38***	0.09**	0.18*
Obs.	189	168	171	189	168	171
years/count.	(13/17)	(13/15)	(13/17)	(13/17)	(13/15)	(13/17)
Fixed Eff.	count.	--	count.	count.	--	count.
R^2-adjusted	0.986	0.984	0.984	0.992	0.990	0.992
χ^2 Wald p-value	0.12	0.48	0.41	0.18	0.36	0.16

*Notes: ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. Fixed effects are not reported. Standard errors are robust to heteroskedasticity (White method).*

The variables on the right-hand side include an income inequality index with a lag of two years.[5] The choice of lags reflects that the income distribution does not immediately affect economic growth but may take time (i.e., approximately five years). Other potential determinants of economic growth are taken at the beginning of each growth period. This lagged specification is also useful for preventing

[5] The dependent variable is measured as averages over four years (from t+1 and t+4), which implies that the lag between the potential cause (i.e., inequality) and the effect on the centred value of income growth is approximately five years (i.e., from t-2 to t+2). We also estimate the model with three lags without qualitatively affecting the results.

endogeneity problems (Thewissen, 2013). The benchmark regression is specified as follows:[6]

$$GrGdp^{cap}_{i,(t+1,t+n)} = d_i + d_t + \beta_0 + \beta_1 Ln\left(Ineq_{it-2}\right) + \beta_2\left[Ln\left(Ineq_{it-2}\right)\right]^2 + \\ + \beta_3 Ln\left(K_{it}\right) + \beta_4 Ln\left(H_{it}\right) + \beta_5 Ln\left(Edu_{it}\right) + \beta_6 Ln\left(WomP_{it}\right) + \varepsilon_{it} \quad (3)$$

where $i = 1,...,18$ countries; $t = 1,...,18$ years; n=4; and d_i and d_t are cross-sectional and time dummies, respectively. $Ineq_{it-2}$ indicates the proxies of income inequality extracted from the SWIID database (i.e. $Gini^{net}_{it}$, $Gini^{mkt}_{it}$) and WDI (i.e., $Gini^{WB}_{it}$, $Decile_{it}$, $Quintile_{it}$);

Table 4 – *Granger causality tests: regressions (2).*

Dependent Variables	$GrGdp^{cap}_t$					
	VII	*VIII*	*IX*	*X*	*XI*	*XII*
$GrGdp^{cap}_{t-1}$	0.41***	0.35***	0.31**	0.43***	0.34***	0.28**
$GrGdp^{cap}_{t-2}$	0.07	0.08	-0.19	0.09	0.09	-0.22
$GrGdp^{cap}_{t-3}$	0.01	0.01	-0.03	0.04	0.02	0.03
$Gini^{mkt}_{t-1}$	-0.10	-0.07	0.17*	--	--	--
$Gini^{mkt}_{t-2}$	0.12	0.08	-0.10	--	--	--
$Gini^{mkt}_{t-3}$	-0.04	-0.02	-0.05	--	--	--
$Gini^{net}_{t-1}$	--	--	--	0.00	0.07	0.26*
$Gini^{net}_{t-2}$	--	--	--	0.05	-0.10	-0.16
$Gini^{net}_{t-3}$	--	--	--	-0.05	0.02	-0.08
Educ	--	--	0.04**	--	--	0.04**
WomP.	--	--	-0.01***	--	--	-0.01***
K	--	--	0.03**	--	--	0.03**
H	--	--	5.54***	--	--	5.12***
Trade	--	--	0.01	--	--	0.004
Gdp^{cap}_{1992}	--	-0.01**	-0.01*	--	-0.01***	-0.003
Const.	-0.07	0.10**	-0.03*	-0.003	0.09	-0.24**
Obs.	206	183	83	206	183	83
years/count.	(14/17)	(14/15)	(7/15)	(14/17)	(14/15)	(7/15)
Fixed Eff.	years	years	years	years	years	years
R^2-adjusted	0.480	0.478	0.686	0.467	0.478	0.700
χ^2 Wald p-value	0.07*	0.84	0.08*	0.97	0.82	0.00***

Notes: see table 3.

[6] We omit the control variable *Trade* because its missing values considerably reduce the sample size.

$GrGdp^{cap}_{i,(t+1,t+n)} = \left[\ln\left(Gdp^{cap}_{i,t+n}\right) - \ln\left(Gdp^{cap}_{i,t+1}\right)\right]/n$ indicates the average annual growth rate of GDP per capita at constant prices from t+1 and t+n.[7] Furthermore, as usual in this literature, we include a set of control variables to reduce omitted variable bias.

Table 5 – *Regression estimates (3) - Inequality indexes from SWIID.*

Dep. Var.: $GrGdp^{cap}_{t+1,t+n}$	*XIII*	*XIV*	*XV*	*XVI*	*XVII*	*XVIII*	*XIX*	*XX*
$Ln\left(Gini^{mkt}_{t-2}\right)$	1.12***	0.84***	0.54*	-0.002	--	--	--	--
$\left[Ln\left(Gini^{mkt}_{t-2}\right)\right]^2$	-0.15***	-0.11***	-0.07*	--	--	--	--	--
$Ln\left(Gini^{net}_{t-2}\right)$	--	--	--	--	2.96***	-0.31	-0.37*	-0.007
$\left[Ln\left(Gini^{net}_{t-2}\right)\right]^2$	--	--	--	--	-0.41***	0.04	0.05*	--
$Ln(K)$	-0.06***	-0.01**	-0.01	--	-0.06***	-0.01**	-0.01*	--
$Ln(H)$	1.29**	-0.61	--	--	0.56	-0.10	--	--
Ln(Educ)	-0.02***	-0.01	--	--	-0.03***	-0.01	--	--
Ln(WomP)	0.004**	0.0003*	0.002**	--	0.01***	0.0003*	0.003**	--
$Ln\left(Gdp^{cap}_{1992}\right)$	--	-0.01***	-0.01***	-0.01***	--	-0.01***	-0.01***	-0.01***
Const.	-1.81***	1.40**	-0.89	0.08***	-5.04**	0.70*	0.77**	0.11***
Observ. (time/cross)	167 (12/17)	154 (12/15)	165 (12/15)	170 (12/15)	167 (12/17)	154 (12/15)	165 (12/15)	170 (12/15)
Fixed Eff.	Countr. Years	Years	Years	Years	Countr. Years	Years	Years	Years
R^2-adj.	0.675	0.472	0.440	0.433	0.667	0.464	0.449	0.437

Notes: see table 3.

These include the propensity to invest in physical capital measured as the average annual of gross domestic fixed investment as a percentage of GDP (K); the growth of the working-age population as a percentage of the total population (H); the gross tertiary school enrolment rate (*Educ*); and a proxy for institutional quality, the proportion of seats held by women in national parliaments (*WomP*). The empirical analyses are conducted both with and without the initial level of real

[7] We also estimate the regressions using moving averages of the GDP growth rate as follows: $GrGdp^{cap}_{i,(t+1,t+n)} = \sum_{n=1}^{4} GrGdp^{cap}_{i,t+n}/4$. The results are qualitatively unaffected and are available upon request from the corresponding author.

GDP per capita (Gdp^{cap}_{i1992}). Due to convergence, the level of income in 1992 is thought to negatively affect subsequent growth. As is common in the growth literature, all variables are expressed in natural logarithm form (Islam, 1995). The appendix provides detailed variable definitions and data sources.

Table 6 – *Regression estimates (3) - Inequality indexes from WDI.*

Dep. Variable: $\overline{GrGdp^{cap}_{t+1,t+n}}$	*XXI*	*XXII*	*XXIII*	*XXIV*	*XXV*	*XXVI*
$Ln\left(Gini^{WB}_{t,t-2}\right)$	0.84	-0.00	--	--	--	--
$\left[Ln\left(Gini^{WB}_{t,t-2}\right)\right]^2$	-0.11	--	--	--	--	--
$Ln\left(\text{Quintile}_{t,t-2}\right)$	--	--	0.18	-0.00	--	--
$\left[Ln\left(\text{Quintile}_{t,t-2}\right)\right]^2$	--	--	-0.04	--	--	--
$Ln\left(\text{Decile}_{t,t-2}\right)$	--	--	--	--	0.05	-0.00
$\left[Ln\left(\text{Decile}_{t,t-2}\right)\right]^2$	--	--	--	--	-0.004	--
$Ln(K)$	-0.07**	--	-0.06**	--	-0.06**	--
$Ln(H)$	0.92	--	0.59	--	0.59	--
Ln(Educ)	-0.01	--	-0.01	--	-0.01	--
Ln(WomP)	0.00	--	0.00	--	0.00	--
$Ln\left(Gdp^{cap}_{1992}\right)$	--	-0.01***	--	-0.01***	--	-0.01***
Const.	-1.31*	0.09**	0.06	0.07**	0.16	0.08**
Observations	80	83	80	83	80	83
(time/cross)	(12/16)	(12/15)	(12/16)	(12/15)	(12/16)	(12/15)
Fixed Effects	Countr. Years	Years	Countr. Years	Years	Countr. Years	Years
R^2-adjusted	0.500	0.309	0.521	0.308	0.512	0.311

Notes: see table 3.

We consider two specifications of the least-squares dummy variable (LSDV) estimator: an LSDV that includes country and time dummies (LSDV two-ways) and a LSDV one-way with period dummies and initial GDP per capita.

Keeping in mind Banerjee and Duflo's (2003) hypotheses, we consider whether the relationship between income inequality and growth is robust to measurement error in inequality indexes. We also test for non-linearity by including a quadratic term for the measures of income inequality in the models.

Tables 5 and 6 present the results of regression (3) using SWIID and WDI data, respectively.

The indexes of inequality extracted from the WDI database include only 68 observations of 324 (i.e., 80% of the values are missing). Using these statistics produces statistically unreliable estimates using the lagged specification of regression (3). For that reason we compute moving averages over three years for the WDI statistics. These values are calculated as $Ineq_{i,(t,t-n)} = \sum_{n=1}^{3} Ineq_{i,t-n-1} / 3$, which doubles the number of observations included in WDI index of inequality, and supports the hypothesis that there is no simultaneous effect of inequality on economic growth. Table 6 provides the main results of this econometric exercise.

Tables 5 and 6 provide several model specifications with a number of additional standard growth determinants. The findings of this analysis suggest that an inverted U-shaped curve exists between the lagged value of income inequality and the annual growth rate of GDP per capita adjusted for business cycles. We do not observe empirical validation of a statistically significant relationship between inequality and economic growth when data extracted from the WDI are used. This result is likely a consequence of sample bias. In fact, the number of observations, despite using three-year moving averages is approximately half of number of observations provided by the SWIID data. Consequently, the statistical relationship between growth and income inequality suffers from data limitations in this analysis as well.

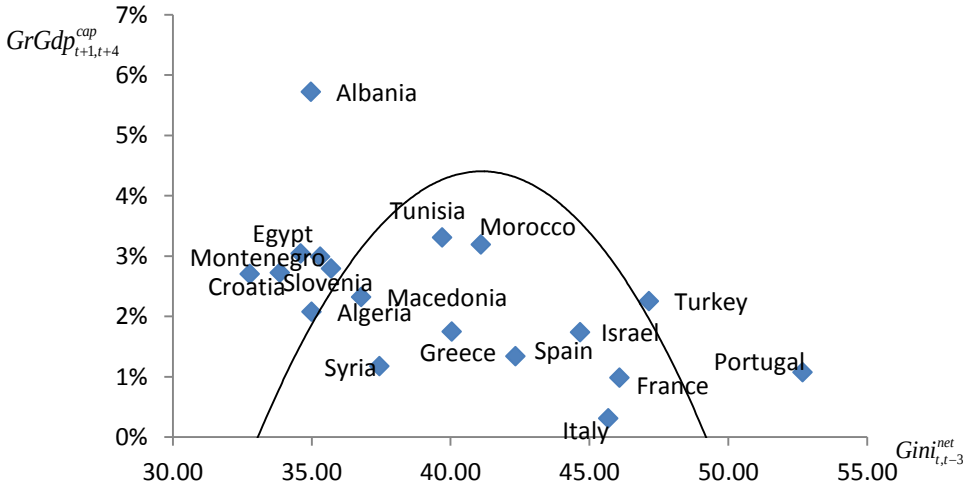
The final empirical exercise aims to capture a non-linear relationship between income inequality and economic growth utilising the steady state values of these variables. This analysis regresses the annual moving averages of the Gini index (pre-taxes and pre-transfer) over the previous four years $\left(Gini^{mkt}_{i,(t,t-4)}\right)$ on the moving averages of GDP growth over the subsequent four years $\left(GrGdp^{cap}_{i,(t+1,t+4)}\right)$. Using the LSDV two-ways estimator, the regression is specified as follows (t-statistics are in brackets):

$$GrGdp^{cap}_{i,(t+1,t+4)} = d_i + d_t - \underset{(-2.00)}{1.96} + \underset{(1.88)}{1.05} Ln\left(Ineq_{i(t,t-3)}\right) - \underset{(-1.76)}{0.14}\left[Ln\left(Ineq_{i(t,t-3)}\right)\right]^2 + \varepsilon_{it} \qquad (4)$$

where $i = 1,...,18$ countries; $t = 1,...,18$ years; 229 observations and $R^2_{adjusted} = 0.570$. Figure 2 displays this relationship as estimated by regression 4 graphically, which reveals a relationship *à la Kuznets* between pre-redistribution income inequality and growth of real GDP per capita.

From a positive perspective, these findings suggest that the real GDP per capita turning point of this concave relationship occurs approximately at a pre-taxes and transfers Gini value of 42.5.

Figure 1 - Growth of GDP per capita and pre-redistribution Gini index (SWIID)



In conclusion, our data provides evidence of a non-linear inverted U-shaped relationship between income inequality and growth.

5. Conclusions

This article pursues two objectives: one focused on methodological concerns and one on public policy concerns. From a methodological perspective, the article compares the empirical findings produced by different sources of data on income inequality. In particular, we focus on 18 Mediterranean countries over the period 1995−2012. This approach reflects the authors' view that measurement error in the indexes of income inequality represents an important disadvantage within the empirical analysis of the relationship between inequality and economic growth. We observe varying findings obtained through different inequality statistics, and we agree with Banerjee and Duflo (2003) that measurement error is among the most serious limitations in this empirical field of study. The following potential shortcomings of this paper suggest cautious interpretation of the results: (i) inequality is a multidimensional phenomenon; therefore, scholarly attention to income inequality alone may produce a biased view of the relationship between inequality and growth (see Amendola, Dell'Anno, 2008, 2013 on this issue); (ii)

inequality and economic growth are known to be persistent phenomena; therefore, both of these processes are expected to exhibit slow dynamics. Although the sample period, which has a maximum length of 15 years, is long in this body of literature, it may still be insufficient to capture the long-run interactions between inequality and economic growth.

From a public policy perspective, two main results emerge for the 18 Mediterranean countries considered in this study. First, we observe that income inequality (as measured by SWIID) may Granger cause economic growth while we can unambiguously reject the hypothesis that Granger causality runs from growth to inequality. Second, we demonstrate that there is a statistically significant non-linear relationship (i.e., an inverted U-shaped curve) between inequality and economic growth. We observe that as the Gini index increases in Mediterranean countries, the GDP growth rate of the steady state first decreased, peaked, and then increased. However, this result only holds for SWIID data. There is no empirical evidence of a statistical correlation between WDI indexes of inequality and growth. Keeping in mind this caveat, applying the SWIID data, we observe that Mediterranean countries characterised by medium income inequality (i.e., a pre-redistribution Gini index of approximately 40-45) have the highest growth rates. In other words, countries with lower GDP per capita growth rates are characterised by inequality that is either too high or too low.

Appendix: Database

Variable	Description	Source [Code]	Mean	Max	Min	Obs
$Gini^{net}$	Estimate of Gini index of inequality in equivalized (square root scale) household disposable (post-tax, post-transfer) income, using Luxembourg Income Study data as the standard	Solt (2009) - SWIID 4.0 [gini_net]	33.52	48.34	22.06	256
$Gini^{mkt}$	Estimate of Gini index of inequality in equivalized (square root scale) household market (pre-tax, pre-transfer) income, using Luxembourg Income Study data as the standard	Solt (2009) - SWIID 4.0 [gini_market]	40.41	54.79	27.28	256
Redist	Estimated percentage reduction in market income inequality due to taxes and transfers: $100\left(Gini^{mkt} - Gini^{net}\right)/Gini^{mkt}$.	Solt (2009) - SWIID 4.0 [redist]	16.06	40.04	-12.77	256
$Gini^{WB}$	Gini index measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution.	World Development Indicators (WDI) [SI.POV.GINI]	34.77	44.20	26.82	68
Decile	Decile share ratio is calculated as Income share held by highest 10%/Income share held by lowest 10%	WDI [SI.DST.10TH.10/SI.DST.FRST.10]	9.89	16.72	5.45	68
Quintile	Quintile share ratio is calculated as Income share held by highest 20%/ Income share held by lowest 20%	WDI [SI.DST.05TH.20/SI.DST.FRST.20]	6.14	10.02	3.91	68
Gdp^{cap}_{1992}	GDP per capita is gross domestic product fin the 1992 in constant 2005 US$ divided by midyear population.	WDI [NY.GDP.PCAP.KD]	9389	28292	895.7	288
Gdp^{cap}	GDP per capita is gross domestic product in constant 2005 US$ divided by midyear population.	WDI [NY.GDP.PCAP.KD]	11247	34982	956.9	317
$GrGdp^{cap}$	Annual percentage growth rate of GDP per capita based on constant local currency. Aggregates are based on constant 2005 US $. GDP per capita is gross domestic product divided by midyear population	WDI [NY.GDP.PCAP.KD.ZG]	2.34	14.19	-10.88	318
K	Gross fixed capital formation (% of GDP)	WDI [NE.GDI.FTOT.ZS]	21.82	38.25	9.95	311
H	Population ages 15-64 (% of total)	WDI [SP.POP.1564.TO.ZS]	65.44	71.07	53.03	324
WomP	Women in parliaments are the percentage of parliamentary seats in a single or lower chamber held by women.	WDI [SG.GEN.PARL.ZS]	14.41	36.60	0.60	265
Educ.	School enrolment, tertiary (% gross). It is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the tertiary level of education.	WDI [SE.TER.ENRR]	40.44	94.97	9.09	264
Trade	Trade openness Index. (Exports of goods and services in current US$ + Imports of goods and services in current US$) / GDP in current US$.	WDI [(BX.GSR.GNFS.CD+ BM.GSR.GNFS.CD)/ NY.GDP.MKTP.CD]	0.77	1.46	0.45	135

Note: The countries included in the empirical analysis are: Albania; Algeria; Croatia; Egypt, Arab Rep.; France; Greece; Israel; Italy; Macedonia, FYR; Montenegro; Morocco; Portugal; Serbia; Slovenia; Spain; Syrian Arab Republic; Tunisia; Turkey.

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SUMMARY

Income inequality and economic growth: an empirical investigation in Mediterranean countries

This article analyses the relationship between inequality and economic growth in Mediterranean countries over the period 1995−2012. We pursue a twofold objective. From a methodological point of view, the article compares empirical findings based on different sources of data on income inequality. This analysis supports the view that the measurement errors on the index of income inequality represents an essential drawback in this literature. From a public policy perspective, for Mediterranean counties: (i) we find that income inequality may Granger causes economic growth while we can unambiguously reject the hypothesis that Granger causality runs to the other way; (ii) we find an inverted U-shaped curve exists between income inequality and growth rates of GDP per capita. That is inequality is detrimental for growth only if it is relatively high while, when the size of income disparities is low redistributive policy may influence positively the economic growth.

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