LISBON SCHOOL OF ECONOMICS & MANAGEMENT
UNIVERSIDADE DE LISBOA

MASTER OF SCIENCE IN ECONOMICS

MASTER´S FINAL WORK

DISSERTATION

THE RELATIONSHIP BETWEEN INEQUALITY AND ECONOMIC GROWTH IN THE EURO AREA

ARMIN VALENTIN GRUSCHKA

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OCTOBER - 2017

Abstract

In past decades rising interest in economic literature has emerged concerning the question of how inequality is related to economic growth. No consensus has been reached yet. A reliable answer might help policy makers to design distributional policies that improve economic growth. This paper analyses the relationship between inequality and growth for euro area countries by regressing the Gini coefficient on accumulated GDP per capita growth and growth spells. Moreover, the fit of channels from the transmission mechanism to data is analysed in terms of correlation and causality. This paper makes use of OLS , FE and System GMM estimators, while using Granger causality tests to check for the causal direction of the variables of interest. An insignificant but slightly positive relationship between inequality and economic growth in the euro area was found. Countries with more inequality experienced on average fewer but longer growth spells. Further, only three out of 11 hypotheses regarding the transmission mechanism were confirmed by the data at hand.

Keywords: Inequality; Economic Growth; Euro Area; Transmission Mechanism.

JEL-Codes: D31; O15; O47.

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List of Abbreviations

Av.	Average
C	Constant
Cnty	Number of countries
COC	Complete coverage
Dur.	Duration
FE	Fixed Effects
GDP	Gross Domestic Product
GMM	Generalised Method of Moments
Inst.	Number of instruments
LoA	List of Abbreviations
No	Number
Obs.	Number of observations
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
PPPs	Purchasing Power Parities
R&D	Research and Development
Red.	Redistribution
Sl	Slope
Yrs	Years

1. INTRODUCTION

Economic growth is being considered one of the most important determinants of a country's performance in recent decades. Nowadays, in times of developed countries reaching high levels of welfare, other variables as happiness or health start to be considered important as well. Nevertheless, economic growth seems to remain the main concern of policy makers and in economic literature. Therefore, recent economic literature put a focus on investigating the main drivers of economic growth and answering the question of how to create an environment that optimises a country's growth prospects. Innovation, which is linked to investment in human capital, knowledge, infrastructure and equipment, is widely considered to be the main driver of economic growth. To be able to guarantee a working foundation on which investment and innovations are free to unfold their potential a high quality of institutions is essential (Fatás & Mihov, 2009).

During approximately the last 20 years an increasing interest in a social phenomenon, namely inequality, as a potential determinant of economic growth has emerged. Before, although there had been some literature analysing the issue at hand, economists had treated inequality generally as a secondary issue and it had just been perceived to be a necessary trade-off between efficiency and equality. In this field of research economic theory and empirical evidence have only been able to provide partial guidance. One possible explanation for this circumstance is that models suffer from uncertainty regarding the choice of and relationship between covariates and transmission mechanisms, which are difficult to account for accurately (Kourtellos & Tsangarides, 2015).

Obtaining a significantly positive or negative result for the relationship between inequality and economic growth might have important policy implications suggesting either high or low levels of inequality as desirable for a country. Such a result could also give guidance on questions like the size of the welfare state, how governments should channel expenditures to achieve high growth rates and on how much redistribution is beneficial.

This paper investigates the sign of the inequality-growth relationship for the 19 euro area countries. Taking the euro area as a sample might have several advantages over larger samples like the OECD countries. Although having less observations, arguably more reliable and comparable data from Eurostat can be used. Having the same currency and being part of the European Union makes countries more homogeneous in terms of formal institutions and economic conditions they face. Nevertheless, data evidences quite a variance of economic growth and income inequality within such an economic space (euro area), which is justifying this research. Further, with Europe being one of the most developed continents, considering only euro area countries narrows the sample to countries which are in a highly developed stadium compared to other regions in the world. Despite the drawback that it makes the results less generalisable since it cannot be assumed that they hold in a one to one relation for poorer countries facing different conditions, such a segmentation is of high interest since it has the potential to provide more reliable answers for euro area countries themselves. Moreover, if determinants of growth can be identified and aspects of the European framework prove to be growth enhancing, these qualities of the euro area might serve as a role model for other countries.

The question of how inequality is related to growth in the euro area is the main concern in this paper. It is dealt with by carrying out estimations for different time frames and sets of euro area countries taking previous literature into account. More specifically the conducted research tackles the investigation of elements of the transmission mechanism and a segmentation of the investigated period. 11 hypotheses are generated by the literature review regarding the transmission mechanism, which are explored in this paper. This paper aims to answer the following research questions:

1. What is the relationship between inequality and growth in the euro area?

    (a) What is the sign of the relationship and how significant is it?

    (b) To which extend does inequality affect growth or growth affect inequality?

2. What is the transmission mechanism at hand?

A post-positivist paradigm was used when conducting this research. The chosen research design is relationship-based and the route of extension driven by population, setting, method and measurement was followed for most part. Quantitative research methods were chosen in this research working with data sets while using a non-probability sampling technique. As a starting point, literature on the theory of the growth inequality nexus was taken based on which hypotheses were extracted and data collected to account for related variables. Models were build around the available variables and other data analysis techniques were made use of.

Resulting from the analysis a slightly positive or insignificant relationship between inequality and growth could be observed. Further, countries with a higher level of inequality showed to have on average longer but fewer growth spells. Considering the hypotheses extracted from the theory on the transmission mechanism only three out of 11 could be confirmed by data.

The structure of the paper is as follows: In section 2 there is a literature review, section 3 introduces the empirical analysis used in this paper, section 4 presents the results and section 5 synthesises the findings in a conclusion.

2. LITERATURE REVIEW

The set of economic literature concerning the relationship between inequality and growth encompasses a variety of theoretical and empirical justifications, which are in favour of a positive, negative, non-linear or even insignificant relationship between inequality and growth. Thereby, it is not clear to which extend inequality affects growth or *vice versa*. The following review presents the most relevant theoretical arguments for the transmission mechanism between inequality and growth focusing on the causal direction from inequality to growth. Several hypotheses are deducted from the transmission mechanism theory and tested for in section 4.

2.1. Transmission Mechanism: Theory

Economic literature suggests different models and assumptions used in the theoretical debate on the transmission mechanism, which indicate various possible results regarding the sign of the relationship and other characteristics like different impacts depending on the kind of country and its development stage. Thereby, it is possible that mechanisms coexist in a complex system of interactions and have opposing impacts and different significance in affecting growth and inequality. Moreover, the weights of these mechanisms might be significantly different across countries and over time, which both can explain the ambiguity of findings in literature regarding the impact of inequality on growth (Hellier & Lambrecht, 2012).

2.1.1. Arguments for a Negative Relationship

The possibly most prominent transmission channels found in literature can be attributed to the field of political economy. The political economy model by Alesina & Rodrik (1994, apud Charles-Coll, 2013) implies a negative relationship between inequality and growth.

Hypothesis 1. *More inequality leads to less growth.*

In this model, more unequal distributed income leads to a higher proportion of people voting for redistribution policies specifically through taxation.

Hypothesis 2. *More inequality leads to more redistribution.*

This would lead to a trade-off of more income for poor people and higher taxes on capital reducing the growth rate (Charles-Coll, 2013).

Another possible trade-off can be seen between an equitable and efficient distribution of resources. It can be argued that more equitably distributed resources and associated benefits have a growth enhancing impact while disturbing optimal production and allocation of resources associated with a detrimental impact. Okun (1975, apud Kourtellos & Tsangarides, 2015) argues that redistribution might diminish incentives to accumulate wealth due to the progressive structure of taxation. Further, transaction costs resulting from the perception of ineffective redistributive policies and allocation of resources and an efficiency loss during the redistribution process might occur (Kourtellos & Tsangarides, 2015).

Another mechanism, which also relates higher inequality to more redistributive taxation argues that redistribution creates adverse incentives for investment in human and physical capital and therefore decreases growth (Ehrhart, 2009).

Hypothesis 3. *More redistribution leads to less human and physical capital.*

Perotti (1993, apud Charles-Coll, 2013) presents a different political economy perspective through which inequality can affect growth negatively. In his theoretical model growth rates depend on the level of inequality, the associated distribution of voters preferences, resulting redistributive decisions and investment in human capital, which depends on the previously mentioned variables. Perotti argues that in this context less inequality leads to more people being able to obtain education and thereby an increase in human capital and growth (Charles-Coll, 2013).

Hypothesis 4. *More inequality leads to less education and less human capital.*

Hypothesis 5. *More education and human capital lead to more growth.*

Persson & Tabellini (1994, apud Charles-Coll, 2013) argue in line with Perotti (1993, apud Charles-Coll, 2013) that inequality has a negative impact on growth through human capital accumulation using a different line of argumentation. A high level of inequality would lead to a political equilibrium associated with high taxes on capital gains resulting in lower returns on investment in human capital and thereby discouraging people to invest in human capital meaning a lower growth rate (Charles-Coll, 2013).

Saint Paul & Verdier (1996, apud Ehrhart, 2009) point out that from a theoretical basis the relationship between inequality and redistribution is not necessarily positive as implicitly assumed in the above-mentioned theories. One reason for this is that an increase in inequality does not necessarily imply a decrease in the relative position of the median agent compared to the average meaning there would not be an increase in the tax rate. If one takes into account that agents can have different weights in politics or assumes endogenous political participation, the main idea of Saint Paul & Verdier (1996, apud Ehrhart, 2009) is strengthened. Moreover, to measure inequality by the ratio of median income over mean income to determine the level of tax imposition makes only sense given lump-sum transfers and flat tax rates (Ehrhart, 2009).

A further channel through which inequality can impact growth negatively is through political instability, which captures the likelihood of government changes. More inequality is associated with more political instability, which negatively impacts the quality of property rights. This decreases the investment rate and ultimately economic growth (Ehrhart, 2009).

Piketty (2014, apud Kourtellos & Tsangarides, 2015) shows that “extreme” inequality, which occurs when returns on capital are bigger than the economic growth rate, often causes political instability and weakens democratic values. Stiglitz shares the view that inequality harms democracies, while adding that economic inequality directly translates into political inequality (Kourtellos & Tsangarides, 2015).

Hypothesis 6. *More inequality leads to more political instability.*

Hypothesis 7. *More political instability leads to less growth.*

Stiglitz (2013, apud Kourtellos & Tsangarides, 2015) argues that political power is held by moneyed interests and therefore produces inequality due to a two-tiered society creating volatility, enhancing crises and diminishing growth consequently (Kourtellos & Tsangarides, 2015).

Next to explanations based on political economy models economic literature offers a variety of other possible channels through which inequality affects growth negatively.

Given an imperfect capital market more unequally distributed assets imply that a higher proportion of the population does not have access to credit to finance productive investments resulting in a lower growth rate (Ehrhart, 2009).

Another possibility through which inequality can impact economic growth negatively is through socio-political problems, which are more prominent in countries with unequal income distributions. These problems affect the investment rate negatively and therefore have a negative impact on economic performance (Charles-Coll, 2013).

One of the better-established arguments relating inequality negatively to growth concerns fertility differentials among different income brackets: more inequality leads to a higher fertility differential among poor and rich people and causes less investment in human capital. Therefore, it affects long term growth negatively (Charles-Coll, 2013). Parents who cannot afford to pay for their children’s education decide to increase their fertility rate preferring many children, which are badly educated over a few ones with good education (Ehrhart, 2009).

Hypothesis 8. *More inequality leads to a higher fertility rate.*

Hypothesis 9. *A higher fertility rate leads to less education and human capital.*

A model where inequality affects growth negatively through social capital is developed by Josten (2004, apud Charles-Coll, 2013). In this model, the communities' social capital decreases when inequality grows, which is assumed to have a negative impact on the growth rate (Charles-Coll, 2013).

It can be argued that increasing inequality leads to more collective and private violence, which in turn reduces growth (Ehrhart, 2009).

Inequality can have a negative effect on growth due to its weakening impact on the social consensus needed in adjustment decisions when facing shocks (Ostry et al., 2014).

Assuming imperfections in the credit market one can argue that only rich people have access to the credit needed to invest in human capital leading to lower growth when facing more inequality (Simões et al., 2014).

A case could be made for that having higher levels of inequality leads to smaller domestic market sizes. Therefore, economies of scale are exploited to a lesser degree leading to less growth (Ehrhart, 2009).

2.1.2. Arguments for a Positive Relationship

Li & Zou (1998, apud Charles-Coll, 2013) present a contrasting view. If government spends its entire money on consumption, a more equal income distribution leads to people voting in favour of higher income taxes to increase government consumption, which decreases growth (Charles-Coll, 2013).

Patridge (1997, apud Charles-Coll, 2013) presents a mechanism which also relates inequality positively to economic growth. Assuming political power is disproportionately distributed in favour of people with high incomes, caused by a positive relationship between political influence or power and political contributions, the likelihood of having growth enhancing policies goes up with increased inequality and therefore a rise in growth rates is experienced (Charles-Coll, 2013).

A positive relationship can arise when arguing that a higher level of inequality leads to more incentives for entrepreneurship and innovation (Ostry et al., 2014).

In line with Kaldor (1957, apud Simões et al., 2014) rising inequality can increase savings and investment assuming rich people save a bigger proportion of their income, which then leads to more physical capital accumulation and ultimately to an increased growth rate (Simões et al., 2014).

Hypothesis 10. *More inequality leads to more investment.*

Hypothesis 11. *More investment leads to more growth.*

Assuming a scenario where the whole population has a very low level of income rising inequality by increasing the income for the richer people financed by a decrease for the poorer ones can also impact growth positively due to allowing at least some individuals to inquire the minimum needed to start businesses or to invest in education, which is a more relevant argument for poor countries (Ostry et al., 2014).

2.1.3. Arguments for a Non-Linear Relationship

Banerjee & Duflo (2003, apud Charles-Coll, 2013) created a model where inequality has a non-linear effect on growth. In this model growth is decreased if inequality changes in any direction since this would lead to distortive policy decisions. The justification for this fact is that inefficiencies are created in economic dynamics after distributional changes due to costs associated with negotiations and agreements on policy decisions (Charles-Coll, 2013).

Perotti (1993, apud Ehrhart, 2009) and Saint-Paul & Verdier (1993, apud Ehrhart, 2009) build models of political economy where the causality between inequality and growth works in both directions due to an endogenous interaction of those two variables until a steady state is reached implying more ambiguous conclusions regarding their relationship (Ehrhart, 2009).

While there exists a broad set of theories justifying a positive or negative relationship only some arguments have been made relating to some conditional relationships allowing for mechanisms to work in opposite directions depending on the conditions of an economy. Some of them will be presented in the following.

One theory argues that inequality can be beneficial for growth in the short run because of allowing for more savings and physical capital accumulation generated by richer people, while it can have negative effects in the long run since poor people cannot invest in human capital and in other activities which might be growth enhancing due to having imperfect credit markets (Charles-Coll, 2013).

Pagano (2004, apud Charles-Coll, 2013) claims that in rich countries it can be observed that inequality has a growth enhancing effect and in poor ones a growth detrimental one (Charles-Coll, 2013).

There are some theoretical considerations regarding the effect of redistribution on economic growth mentioned before. It can be argued that inequality should be stronger linked to redistribution in democracies than in authoritarian regimes since preferences of voters regarding the income distribution are taken more seriously in consideration (Ehrhart, 2009).

It is possible to argue that inequality increases growth given it is based on physical capital accumulation but decreases growth when it is driven by human capital or when one considers inequality related social disturbances. Furthermore, pro-equality policies can impact growth in different ways depending on how they influence factor accumulation. Galor & Moav (2004, apud Hellier & Lambrecht, 2012) argue that in early stages of development growth is driven by physical capital accumulation while in later stages it is driven by human capital accumulation. They conclude therefore that inequality is good for economies which are in their early stages while it is bad for economies which are in their late stages of development (Hellier & Lambrecht, 2012).

Further, Benhabib (2003, apud Ostry et al., 2014) constructs a theoretical model, which implies that increasing inequality from low levels leads to growth-enhancing incentives up to a point where rent seeking is encouraged and hence growth decreases (Ostry et al., 2014).

When answering the question, how large each mechanisms' impact is for economies, it is not sufficient to discuss them out of a theoretical perspective only. The next part elaborates to which extent data supports these theoretical considerations.

2.2. *Support of Data*

It is difficult to isolate the impacts of each of the transmission channels that are available in economic theory. Nevertheless, literature came to the consensus that human capital inequality has a significantly negative impact on growth and generally supports theoretical arguments related to investment in human capital. According to Castelló-Climent (2004, apud Charles-Coll, 2013) human capital inequality serves as a "high quality proxy" for wealth inequality. Further, she argues that income inequality is not a good measure because of deficiencies in quality and quantity of available data (Charles-Coll, 2013).

The endogenous fertility approach, which is closely entangled with human capital inequality arguments, and explanations related to political instability can be supported by data. According to Ehrhart (2009) inequality of assets has a significantly negative effect on growth suggesting that wealth redistribution has a growth enhancing effect. Although out of a theoretical perspective inequality of assets or wealth can find more support to have a significantly negative relationship with growth than inequality of income, it can be argued that empirical literature focuses on inequality of income rather than assets when evaluating the respective impact on growth since data on wealth distribution is much harder to find (Ehrhart, 2009).

Following the discussion on support of data the next part elaborates on issues related to data and estimations.

2.3. *Issues and Ambiguities with Data and Estimations*

When conducting empirical work to estimate the relationship between inequality and growth several problems or ambiguities can arise. For data to be considered of "high quality" Deininger & Squire (1996, apud Charles-Coll, 2013), who produced one of the most relevant dataset on income inequality, mention basic criteria, which should hold. Data should be taken from household surveys and the whole population should be covered e.g. not only data from urban areas should be used. Concerning how to measure income inequality, it is possible to measure it through expenditures or different kinds of income and to include not only wage income but also non-monetary and non-wage income. Particularly in developing countries the informal income accounts for a big part of total expenditure and income. Another issue is whether one should use gross or net income. If one decides to use gross income upward biases could be created on the estimations of income inequality due to not considering the impact of redistribution. The decision of which measure of inequality to choose can turn out to make a crucial difference for the result. Knowles (2005, apud Charles-Coll, 2013) discovered that when using income measures of inequality, the relationship is not significant, but when using expenditure data, the relationship turns to be significantly negative (Charles-Coll, 2013).

While interpreting results from estimations, various possible biases need to be considered. A significant correlation between inequality and growth might be explained by omitted variables. Birdsall Ross & Sabot (1995, apud Ehrhart, 2009) claim, for instance, that education can be such an omitted variable, which is correlated with both the distribution of income and growth, leading to an overestimation of the direct effect of inequality on growth. Moreover, a negative effect of inequality on growth might be sensitive to the inclusion of regional dummy variables. Inconclusive econometric results might arise due to different real underlying transmission channels than suggested by theory, which is being tested. Another explanation refers to data and instruments used, which might be insufficient to estimate how inequality affects growth using structural models (Ehrhart, 2009).

Kourtellos & Tsangarides (2015) point out that two of the main reasons why economic literature could not reach a consensus on the relationship between inequality, growth and redistribution are that most studies fail to account for model uncertainty in an adequate way. In turn, this leads to unclear interpretations regarding the variables used and ambiguity concerning the unit of analysis leading to diverse results and interpretations in different studies. Little theoretical guidance exists on how to specify the growth theories used. It is possible to argue that they are intrinsically open-ended to allow for many different specifications of determinants. Therefore, it makes sense to aim for a framework where all possible transmission channels might operate simultaneously. When it comes to the unit of analysis, most studies work with average growth rates for different time span lengths, which capture the overall growth but ignore to account for volatility of growth rates and duration of growth periods. Therefore, some more recent studies aim at improving on this issue by using the duration of growth spells as the unit of analysis.

Another issue when comparing different studies on this topic is the lack of comparability since data sources are often incomplete and have different values for the same observations. The recent trend on dealing with this issue is to try to improve the comparability of datasets rather than not considering incomplete or incomparable data.

The relationship between inequality and growth has been grasped in different ways. The next section summarises how the perception of this topic has developed.

2.4. Historical Development of the Debate

For most part of the 20th century when analysing the inequality-growth relationship economists were concerned with the causal effect growth has on inequality. The focus of economic literature did not switch to the opposite causal relation up to roughly 20 years ago. Since then, economists did not manage to agree on a generalised position regarding the sign of the relationship. It is possible to attribute two big waves of results regarding the sign of the relationship. In the early stages of research, the predominant position was suggesting a negative relationship, which can be labelled as the "Conventional Consensus View", named by Rehme (2007, apud Charles-Coll, 2013). Some deficiencies to the first wave of studies have been identified like the fact that only two mechanisms had been used to describe the channel through which inequality affects growth: the socio-political instability mechanism and the political economy channel. Moreover, datasets used for measuring income inequality were quite irregular mixing data from different sources and giving little emphasis on characteristics and composition. To measure inequality income shares and ratios have been used rather than the Gini coefficient. Ordinary Least Squares and Two Stage Least Squares have been the predominant econometric methodologies (Charles-Coll, 2013).

It was only after approximately a decade after the start of this first "wave" that a contrasting view was presented. Researchers started to put more emphasis on the quality of data and methodology used to examine this relationship. Because of this, the results obtained got more ambiguous in a sense that studies did not show overall a significant negative effect but varied a lot in their results. Researchers acted much more delicately with methodological issues further emphasizing the ambiguity of results (Charles-Coll, 2013).

In the 2000s some estimates suggested a positive relationship between inequality and growth. Nevertheless, those works were criticised for their methods and that they failed to account for the circumstance that this relationship can vary across countries and with time (Hellier & Lambrecht, 2012).

Forbes (2000, apud Kourtellos & Tsangarides, 2015), Panizza (2002, apud Kourtellos & Tsangarides, 2015) and Halter et al (2014, apud Kourtellos & Tsangarides, 2015) found some evidence that the relationship between inequality and growth likely depends on the considered time horizon and country's economic development. This suggests that there is not a unique decisive relationship, which holds in every scenario (Kourtellos & Tsangarides, 2015).

The next section discusses possible policy implications resulting from the investigation of the relationship between inequality and growth.

2.5. Policy Implications

Under the assumption that a negative relationship between inequality and growth exists, different policy recommendations have been suggested aimed at decreasing inequality. The most popular one is redistribution. Nevertheless, there are other potential policies fostering growth. Chusseau & Hellier (2007, 2008, apud Hellier & Lambrecht, 2012) suggest the implementation of a minimum wage leads to a reduction in the relative wage of skilled workers and thereby decreases R&D costs in relation to costs resulting from the production of goods. Moreover, combining R&D subsidies with substantial redistribution, which can be labelled the "Scandinavian model", can also be successful in increasing growth (Hellier & Lambrecht, 2012).

Redistribution can be defined as "the difference between the market and net inequality series". Even though inequality might be bad for growth it cannot be deducted that redistribution automatically increases growth because it decreases inequality. From a theoretical perspective efforts to redistribute are often viewed to have a direct negative impact on growth, while the resulting decrease in inequality would have an indirect positive impact. In fact, policy literature focused primarily on the direct effect of redistribution assuming in general a negative impact on growth since more taxes and subsidies lower the incentive to work and invest (Okun, 1975, apud Ostry et al., 2014). Therefore, one should account for the possibility of having different outcomes relating to growth when increasing redistribution. To isolate the impact of redistribution on growth one should distinguish between market and net inequality. In their empirical estimations Ostry et al. (2014) concluded that when holding the level of redistribution fixed a significantly negative relationship between net inequality and growth exists. Moreover, redistribution shows to have only in extreme cases a negative direct effect on growth making the combined direct and indirect effects on average pro-growth. One can argue that political power is more evenly distributed than economic power in democracies giving most voters the opportunity to vote for redistribution. Stiglitz (2012, apud Ostry et al., 2014) emphasises that this does not need to be necessarily the case since rich people can have more political influence than poor people (Ostry et al., 2014).

After summarizing most relevant considerations in theory on the growth inequality nexus, the next part summarises methods and data used for the following analysis.

3. Data and Methods

This section is divided into four parts. First a discussion regarding the choice of data is provided. Second main variables are introduced. Third methods applied in this paper are introduced. Fourth a discussion of the chosen econometric specification is provided.

3.1. Data

The following analysis is based on using comparable and high-quality annual panel data. Only reliable websites were considered and mixing of data sources was avoided. Therefore, as much as possible data was retrieved from Eurostat and only supplemented by other websites, for some variables, which were not available in Eurostat, or covered for a too small period. Using this approach bias in the obtained results is reduced at the price of a weakened significance due to less observations. In most studies more emphasis is put on obtaining significant results by trying to collect as much data as possible by combining different sources of data. The comparability of data seems to be a secondary issue. Nevertheless, considerable work has been conducted towards making those sources comparable. However, one cannot totally get rid of biases, which occur from combining different data sources. Different ways to obtain and measure variables can have a considerable impact on the results.

An overview of the variables used for the analysis part of this paper is presented in Appendix A, their measurement, source and time span for complete coverage. The Gini coefficient serves as a proxy for inequality. Data for the Gini coefficient, which is one of the main variable of interest for the analysis of the relationship between inequality and growth, covers the period of 1995-2015, hence, the following analysis focusses on this period. As shown by the complete coverage section in Appendix A for most variables there are missing observations indicating an unbalanced panel data set. The total sample consists of the 19 euro area countries for which data coverage varies. The aim of the included variables in this data set is to best account for the main variables of concern: inequality, economic growth and redistribution and for the relevant variables considered in the theory on the transmission mechanism. Not all those variables could be obtained from Eurostat. Therefore, the Penn World Table 9.0, World Bank and the Robert J. Barro and Jong-Wha Lee dataset have been used to substitute for missing values. In line with Stetter (2015) dummy variables are included to segment the data set into different regimes to see whether there are regime specific differences.

The following part describes the main variables of interest.

3.2. Main Variables

The arguably most important variables used for the analysis are the Gini coefficient, GDP per capita and redistribution.

To account for inequality this paper makes use of the Gini coefficient or index, which is one of the most commonly used measures found in socio-economic literature on inequality. While many concepts of inequality exist, in economics, the two most common variables used for the measurement of inequality are income and wealth. The availability of data on wealth inequality is quite limited. Therefore, the more common approach of using income as the variable for the measurement of inequality is chosen. This paper uses the Gini coefficient of equivalised disposable income retrieved from Eurostat[1].

The same approach as in Ostry et al. (2014) is undertaken defining redistribution as the difference between the Gini of pre-transfer and post-transfer income making use of pre-transfer income data, which has only been available since recently. Again, for pre-transfer Gini coefficient the same source (Eurostat) is used, while using the identical definition of income as before. For data on pre-transfer Gini coefficient there exists the distinction in

[1]A more detailed description on the construction and composition of this variable can be found on the website of Eurostat: `http://ec.europa.eu/eurostat/cache/metadata/en/ilc_esms.htm`

the definition of transfers, where pensions are included or excluded. Although making use of both definitions in the analysis part this paper chooses to focus on the latter definition of transfers when constructing the redistribution variable, which seems to be the less volatile option for the results and make more intuitive sense when thinking of pensions as a direct consequence or link to working income.

This paper utilises expenditure-side real GDP at chained PPPs (in 2011US$) divided by population retrieved from Penn World Table 9.0. to account for economic growth. Growth rates are calculated from here on in standard fashion. The reason for using PPPs is that it better accounts for the standard of living than using real GDP, which has some impact on the results since there are some differences in countries for costs of living even though all of them are in the same monetary union. Another possible approach could also be to see whether a countries' economic power is growing disregarding the number of its citizens or their standard of living. Choosing the per capita values for GDP has the purpose of accounting for population movements.

Following the introduction of the main variables of interest methods used in this paper are summarised in the next section.

3.3. Methods

To estimate the impact inequality has on economic growth this paper makes use of two different ways economic growth can be viewed. First, the initial Gini coefficient or the average Gini coefficient of the chosen period is taken as the independent variable and plotted against the accumulated growth for the same period. Hereby, four different lengths of periods, three, five and 10 years and the maximum period from 1995 to 2014, are considered to account for short-, medium- and long-term effects. The most common approach undertaken in literature is to use the Gini coefficient of a given year and plot it against accumulated growth lagged by one year. The implicit assumption here is that the impact of inequality takes some time until it gets transformed into economic growth,

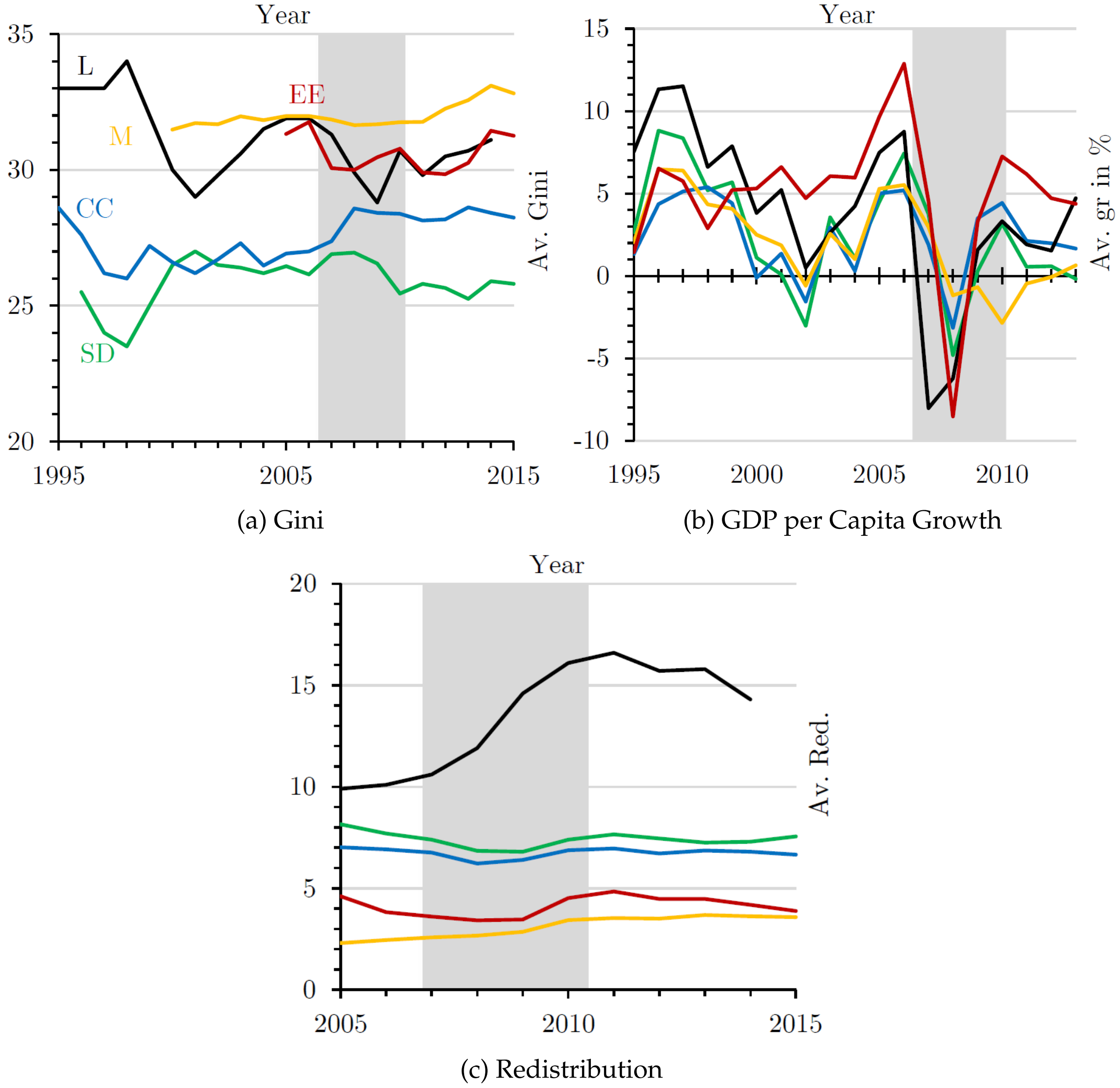


FIGURE 1: Evolution of Variables by Regime

Notes: Variables are explained in Appendix A and LoA. The gray shaded area attempts to highlight the time span of the financial crisis.

which makes intuitive sense for many variables in the transmission mechanism like education, from which benefits most likely take some time to be harvested. Nevertheless, it can be argued that it is impossible to assign a time value for this lag since many transmission channels work simultaneously while taking different amounts of time until they are transformed into growth. Consequently, each effect would have to be segmented and examined individually. As can be seen in Figure 1a and Figure 1b inequality seems to be much more of a structural variable, which does not vary much, compared to economic growth.

Thus, one can argue that it does not make a significant difference which Gini value to choose, a lagged one, the one from the start of the period or an average value for the whole period. Considering redistribution as presented in Figure 1c one can see that this variable behaves more volatile than the Gini coefficient itself but less volatile than GDP per capita growth.

Different specifications of lagged effects of redistribution might have a much bigger impact on the results than specifications for the Gini coefficient. In this paper, the approach of not specifying a lag for the effect of redistribution on growth is taken bearing in mind that the results must be treated with caution.

A second approach of looking at economic growth is to consider the duration and frequency of growth spells, which are defined as periods with a growth rate of at least 2%, following the approach of Kourtellos & Tsangarides (2015). The advantage of this procedure over the accumulated growth approach is that results give insight into sustainability of growth assuming that economies prefer sustained growth over large fluctuations in the growth rate.

To examine whether the theory of the transmission mechanism holds proxy variables, which are listed in Appendix A, are used to account for various transmission channels. Hereby, this paper uses a correlation matrix to see if those variables are correlated with inequality and economic growth with the same sign as predicted in theory.

Reverse causality is one of the biggest problems when analysing the inequality growth relationship. It is not clear to which extent inequality impacts growth and *vice versa*. This problem also occurs in the transmission mechanism theory where it is also not obvious to which extent inequality impacts the variables from all transmission channels and *vice* *versa*. Hence, when analysing those relationships simply considering correlation between variables is not sufficient. Additionally, one should assess the degree of causality to interpret econometric results correctly. Econometric tools, which try to answer the question of causality are quite limited. This paper makes use of the Granger and Dumitrescu Hurlin causality tests.

The standard Granger causality test investigates how much of a variable of interest Y can be explained by past values of another variable X. Hereby, one can add lagged values of X to see if the explanation is improved. Nevertheless, what is tested for is not "true causality". Granger causality measures information content and precedence. Two-way causation is not excluded as a possibility. X can Granger cause Y, while Y simultaneously Granger causes X (IHS, 2015).

Dumitrescu & Hurlin (2012) propose a simpler Granger non-causality test loosening up the null hypothesis of X Granger causing Y everywhere in the panel. The Dumitrescu Hurlin non-causality test allows taking two dimensions of heterogeneity into account: "the heterogeneity of the causal relationships and the heterogeneity of the regression model used". The heterogeneous non-causality hypothesis used assumes a causal relationship for a subgroup rather than for the whole sample of individuals. For this purpose, "the cross-section average of individual Wald statistics associated with the standard Granger causality tests based on single time series" is made use of.

In the lag specification of the Granger causality tests this paper chooses only one lag aimed at avoiding an over specification, which seems to be a sensible option because of working with annual data.

The following part elaborates on the econometric specification of the models used in this paper.

3.4. *Econometric Specification*

This paper works with four different model specifications starting with a base model, which has only one dependent variable, GDP per capita growth rate or accumulated three, five and 10 year growth rates respectively and one independent variable, Gini. In the subsequent three specifications control variables are added. Regional and regime specific effects are accounted for using dummy variables for OLS models using the conservative or continental regimes as the base group. In an attempt to choose "good" estimators this paper follows the approach of Kolev & Niehues (2016) offering three different estimators, OLS, FE and System GMM to produce a realistic range of results. The rationale behind using those three estimators is to provide a comparison between simple estimators like the OLS and FE estimators, which are likely to have the propensity to be biased in opposite directions given the presence of short T panels and lagged dependent variables, and consistent GMM estimators. The drawback of using the more traditional approach of OLS is that it fails at least some if not most of the underlying Gauss-Markov assumptions in the chosen framework indicating biased estimates. The feasible generalised least squares technique FE is chosen since most tests conducted indicate FE as a reasonable specification. FE is asymptotically more efficient than OLS given the presence of time constant attributes. Using the System GMM dynamic panel estimator introduced by Blundell and Bond in 1998 is a popular option in literature on the growth inequality nexus because of its favourable properties. Nevertheless, it can be argued that this estimator is biased due to the presence of weak instruments given that lagged differences of the independent variables, especially inequality, add little explanatory power to current inequality levels. Difference GMM would be another possible approach also often tried for in literature. Both Difference and System GMM estimators have been commonly used to circumvent dynamic panel bias and deal with issues of reverse causality and endogenous regressors. Further, since finding good instruments in the given framework is difficult it is convenient to use System or Difference GMM, which assume that only internal instruments are available coming in form of lags of the instrumented variables. Nevertheless, external instruments can be additionally used. As indicated by Roodman (2009), both estimators are suited well for panels with many individuals and short time periods, not strictly exogenous independent variables, fixed effects, autocorrelation and heteroscedasticity, which seems to be fitting to the framework this paper works in. The general approach taken in the Difference GMM estimator, established by Arellano and Bond in 1991, is to transform all regressors in the model by differencing and using lagged levels of the dependent variable as instruments for the lagged dependent variable aiming at eliminating country-specific effects. Given there are persistent processes present in the chosen framework Difference GMM might not be the best strategy to adopt since little information on future changes might be provided by using lagged levels. When facing the situation that past changes are better predictors of current levels than past levels of current changes, System GMM is likely to be the better estimator since the level equation can also include time-invariant variables. Assuming fixed effects are uncorrelated with the first differences of instrumental variables, System GMM allows for the possibility of including more instruments and thereby increasing efficiency. System GMM works with a system consisting of two equations, the transformed and original equation. In contrast to Difference GMM it follows a different strategy to eliminate fixed effects. Instead of transforming the regressors it transforms the instruments by differencing them. For these reasons, this paper chooses not to use difference GMM arguing that system GMM is the superior approach in the given context (Kolev & Niehues, 2016;Roodman, 2009).

After introducing the choices regarding data collection and methodology, the next part presents the results of the analysis.

4. ANALYSIS

As indicated earlier the analysis is divided into two parts, the first one using accumulated growth and the second one duration or number of growth spells as the dependent variable. Afterwards elements of the transmission mechanism are analysed using correlation matrices. Then the problem of reverse causality is being addressed. Last some models are presented.

4.1. Accumulated Growth

For accumulated growth, five different time span specifications are analysed: one, three, five and 10 years and the whole period. Further, the whole period is split into two periods: one accounting for the period before and one during/after the financial crisis.

4.1.1. Whole Period

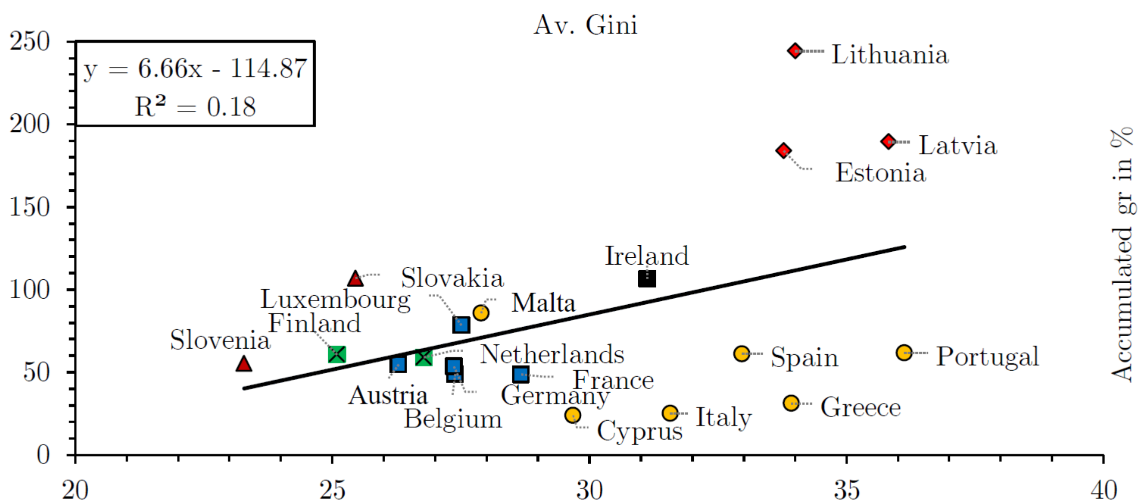


FIGURE 2: Relationship: Gini and Accumulated Growth (95-14)

Notes: Variables are explained in Appendix A and LoA. The black line represents the regression line. Regimes are distinguished by colour/symbol. The regression equation and R^2 are depicted in the upper left corner.

Figure 2 illustrates the relationship between the average Gini coefficient and the accumulated GDP per capita growth rate in the period from 1995 to 2014. For this period, a positive relationship is estimated. An increase of one Gini point is estimated to lead on average to an increase of roughly 6.7 percentage points in the accumulated growth rate, *ceteris paribus*. Considering the positioning of countries, it stands out that democratic, conservative and liberal regimes show similar Gini coefficients and growth rates relative to the other countries of their respective regime. Mediterranean regimes, apart from Malta, experienced collectively low growth rates while having high levels of inequality. Eastern European regimes stand out in this regression for two reasons. First the Baltic countries Lithuania, Latvia and Estonia experienced much higher accumulated growth relative to all other countries. One could even argue that those countries are outliers in this regression. Keeping this in mind the positive relationship result between inequality and growth should be treated with caution. Second, not all Eastern European regimes have experienced similar growth and have similar Gini coefficients, which is the case for the other regimes. In contrast to Latvia, Lithuania and Estonia, who have high Gini coefficients and growth rates, Slovenia and Slovakia show comparably low levels of growth and low Gini coefficients. Following the segmentation of regimes performed by Stetter (2015) it is not surprising that Eastern European regimes stand out since they developed from systems with large social benefits to systems, which are a mix of the features of the other mentioned regimes. One possible approach, used in this paper, is to further segment the Eastern European regimes into a Baltic group and a group consisting of Slovenia and Slovakia.

The relationships between the independent variables Gini before and after transfers and redistribution with the dependent variable accumulated growth of GDP per capita for the whole period are depicted in Table I. Since only for Gini after transfers data is available from as early as 1995 onwards, the other variables are represented as averages

TABLE I

Whole Period

	Av. Gini		Gini 95	
Var.	R^2	Sl	R^2	Sl
gini	0.18	6.66	0.00	-0.24
g-T	0.04	3.19		
g-Tp	0.17	7.24		
diff	0.00	-1.47		
diffp	0.06	-4.35		

Notes: Variables are explained in Appendix A and LoA .

of the available data in this period. The result for using the Gini values from the starting point as the independent variable is not comparable with the other results, which use averages, since less observations are available in 1995. For both variables Gini before and after transfers and both specifications in the definition of including pensions or not a positive relationship to accumulated growth is present, while redistribution seems to be negatively but less significantly correlated with accumulated growth.

4.1.2. *Long Run: 10 Year Periods*

TABLE II

Relationship to Accumulated Growth for 10 Year Periods

	Av. Gini		Gini t		Av. Gini-T		Gini t - T		Av. Diff.		Diff. t	
TS	R^2	Sl	R^2	Sl	R^2	Sl	R^2	Sl	R^2	Sl	R^2	Sl
95-05	0.31	3.22	0.14	2.09	0.43	4.51			0.01	-1.04		
96-06	0.37	4.32	0.09	1.28	0.38	5.18			0.05	-2.37		
97-07	0.32	4.50	0.08	0.96	0.25	4.83			0.06	-3.14		
98-08	0.23	3.53	0.06	0.56	0.09	2.72			0.12	-3.94		
99-09	0.20	2.60	0.20	1.09	0.04	1.30			0.16	-3.57		
00-10	0.16	2.39	0.26	2.70	0.04	1.27			0.12	-3.07		
01-11	0.10	2.12	0.15	2.40	0.04	1.41			0.04	-1.99		
02-12	0.08	1.93	0.14	2.44	0.02	1.22			0.03	-1.77		
03-13	0.06	1.61	0.15	2.32	0.02	1.05	0.23	-2.90	0.02	-1.34	0.48	3.46
04-14	0.06	1.62	0.21	2.49	0.03	1.21	0.21	2.70	0.01	-1.04	0.01	0.64

Notes: Variables are explained in Appendix A and LoA.

Table II shows the same relationships for all possible 10 year periods, or the long run.

To shorten the analysis, from this point onwards pensions are excluded in the definition of transfers. Again, the relationship between average Gini and accumulated growth is positive and the relationship between redistribution and accumulated growth negative for all possible periods. The positive relationship for both pre- and post-transfer Gini tends to get weaker the more one advances in time. Results for taking the starting value of Gini or redistribution as the independent variable should be treated with caution since different sample sizes of countries are considered.

4.1.3. Medium Run: Five Year Periods

TABLE III

Relationship to Accumulated Growth for Five Year Periods

	Av. Gini		Gini t		Av. Gini-T		Gini t - T		Av. Diff.		Diff. t	
TS	R^2	Sl	R^2	Sl	R^2	Sl	R^2	Sl	R^2	Sl	R^2	Sl
95-00	0.05	0.55	0.03	0.58								
96-01	0.25	1.22	0.03	0.42								
97-02	0.31	1.36	0.09	0.51								
98-03	0.31	1.50	0.21	0.63	0.38	2.08			0.00	-0.12		
99-04	0.29	1.72	0.18	0.79	0.29	2.13			0.02	-0.58		
00-05	0.26	1.82	0.25	1.79	0.26	2.08			0.07	-1.39		
01-06	0.27	2.00	0.25	1.98	0.21	2.07			0.09	-1.73		
02-07	0.23	2.00	0.26	2.16	0.14	1.86			0.09	-1.93		
03-08	0.11	1.19	0.20	1.52	0.01	0.49	0.24	-1.09	0.13	-2.07	0.19	-0.78
04-09	0.06	0.56	0.39	0.95	0.01	-0.19	0.22	0.86	0.23	-1.58	0.14	-0.75
05-10	0.00	0.12	0.01	0.17	0.04	-0.47	0.00	-0.12	0.12	-1.02	0.04	-0.60
06-11	0.01	-0.19	0.00	-0.05	0.02	-0.38	0.00	-0.01	0.01	-0.27	0.00	0.10
07-12	0.02	-0.36	0.03	-0.43	0.03	-0.46	0.03	-0.50	0.00	-0.16	0.00	0.10
08-13	0.00	0.03	0.00	0.18	0.01	0.33	0.02	0.48	0.01	0.46	0.01	0.48
09-14	0.02	0.57	0.05	0.95	0.05	0.97	0.09	1.29	0.02	0.67	0.01	0.39
05-14*	0.00	0.05	0.00	0.17	0.00	0.01	0.01	0.32	0.00	-0.05	0.00	0.17

Notes: Variables are explained in Appendix A and LoA.
* All possible combinations

In Table III the same relationships are presented as in Table II for five year periods, or the medium run. Estimation results from regressing the starting value of Gini or redistribution on accumulated growth are more reliable from 2005 onwards since from this point on the data is complete. In contrast to the previous tables, the results are less significant in general and the relationships less strong, which makes sense, since in shorter periods countries have less time to accumulate growth leading to less volatile results. For the periods starting in 2006 and 2007 even a small insignificant negative relationship between Gini and accumulated growth is observable. For pre-transfer Gini, this period gets extended to periods starting from 2004 until 2007. Considering average redistribution, a switch in the sign from negative to positive is apparent for 2008 and 2009, while when taking the starting level of each period for redistribution this period gets extended to 2006 until 2009. Combining all possible observations from 2005 until 2014 all estimated relationships turn out to be rather insignificant.

4.1.4. *Short Run: Three Year Periods*

Table IV

Relationship to Accumulated Growth for Three Year Periods

	Av. Gini		Gini t		Av. Gini-T		Gini t - T		Av. Diff.		Diff. t	
TS	R^2	Sl	R^2	Sl	R^2	Sl	R^2	Sl	R^2	Sl	R^2	Sl
95-98	0.06	0.42	0.15	0.83								
96-99	0.00	0.10	0.00	0.07								
97-00	0.06	0.36	0.02	-0.17								
98-01	0.22	0.51	0.05	0.20								
99-02	0.31	0.99	0.25	0.66								
00-03	0.32	1.29	0.27	1.17	0.35	1.79			0.31	-1.37		
01-04	0.23	1.03	0.18	0.94	0.16	1.07			0.04	-0.52		
02-05	0.21	0.90	0.22	0.95	0.21	1.06			0.04	-0.65		
03-06	0.22	0.93	0.24	1.01	0.16	0.98	0.00	0.05	0.06	-0.81	0.01	-0.12
04-07	0.24	1.25	0.39	1.45	0.16	1.23	0.39	1.69	0.06	-1.01	0.01	-0.25
05-08	0.08	0.65	0.08	0.58	0.00	-0.08	0.01	0.22	0.20	-1.49	0.10	-1.02
06-09	0.02	-0.21	0.01	-0.09	0.31	-0.81	0.15	-0.55	0.23	-0.90	0.15	-0.74
07-10	0.13	-0.56	0.16	-0.60	0.27	-0.86	0.27	-0.88	0.04	-0.40	0.01	-0.17
08-11	0.03	-0.31	0.03	-0.29	0.00	0.06	0.00	0.06	0.07	0.55	0.08	0.68
09-12	0.00	0.21	0.02	0.42	0.04	0.58	0.06	0.73	0.02	0.59	0.01	0.42
10-13	0.02	0.44	0.07	0.85	0.04	0.60	0.10	0.89	0.01	0.35	0.01	0.34
11-14	0.02	0.36	0.05	0.52	0.04	0.45	0.08	0.61	0.00	0.17	0.01	0.26
05-14*	0.00	0.09	0.01	0.20	0.00	0.01	0.01	0.28	0.00	-0.12	0.00	0.10

Notes: Variables are explained in Appendix A and LoA.
* All possible combinations

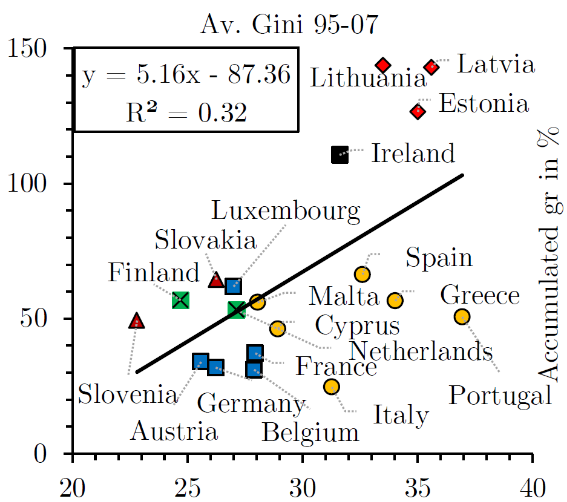
Table IV depicts the previously investigated relationships for 3 year periods, or the short run. Again, for most of the periods the relationship between Gini and accumulated growth turns out to be slightly positive. Only for Gini after transfers in the periods starting from 2006 to 2008 and for average Gini before transfers for the periods starting from 2005 to 2007 a negative relationship exists. For redistribution, a negative relationship is apparent for all periods with starting points until 2007. From 2008 onwards the relationship switches to positive. Results for all possible combinations of observations from 2005 until 2014 are again insignificant.

Because of the presence of a slight change in the sign for the Gini to accumulated growth relationship around the years of the outbreak of the financial crisis the next logical step in the analysis is arguably to split the whole sample period into two. One, where there is a positive relationship before the structural break and one, where there is a negative one to see how this impacts the analysis. The best attempt of doing so seems to be the period prior to the financial crisis from 1995 to 2007 (period A) and the crisis/post crisis period from 2007 to 2014 (period B).

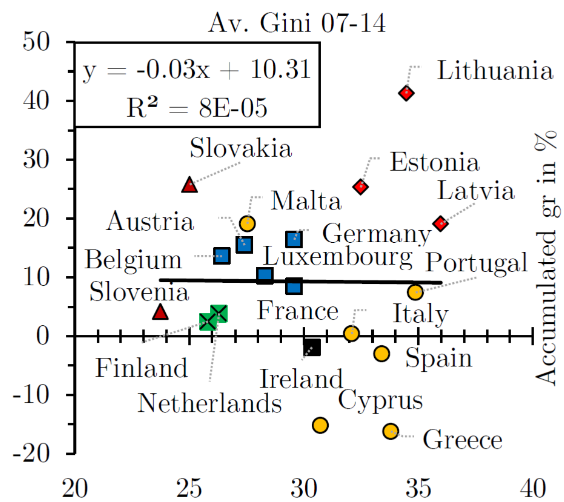
4.1.5. Two Periods

The relationship between average Gini and accumulated GDP per capita growth for the period 1995 to 2007 is represented in Figure 3a. A strong positive relationship is estimated mainly driven by the immense growth of the Baltic countries, which all have high levels of inequality. Further, Ireland also having a high level of inequality experienced a lot of growth in this period. Again, all countries within one regime tend to be positioned very similar to other countries in the same regime, showing similar growth rates and levels of inequality.

Figure 3b shows the relationship between the average Gini and accumulated GDP per capita growth for period B from 2007 to 2014. Compared to period A the situation changed drastically for the involved countries. Although probably insignificant, the re-



(a) A



(b) B

FIGURE 3: Relationship: Gini and Accumulated Growth for Two Periods

Notes: Variables are explained in Appendix A and LoA. The black lines represent the regression lines. Regimes are distinguished by colour/symbol. The regression equations and R^2 are depicted in the upper left corners.

lationship turned slightly negative. Mediterranean regimes, with the exception being Malta, performed badly showing negative growth rates for Spain, Cyprus and Greece. Ireland, which experienced a high growth rate for period A, also shows to have a negative growth rate for period B. The Baltic countries still have high growth rates. Otherwise the relative positioning of the involved countries is very similar as in the other regressions.

TABLE V

Relationship to Accumulated Growth for Two Periods

	Whole				A (95-07)				B (07-14)			
	Av.		t		Av.		t		Av.		t	
Var.	R²	Sl	R²	Sl	R²	Sl	R²	Sl	R²	Sl	R²	Sl
gini	0.18	6.66	0.00	-0.24	0.32	5.16	0.13	2.70	0.00	-0.03	0.00	-0.12
g-T	0.04	3.19							0.00	0.08	0.01	0.38
g-Tp	0.17	7.24							0.00	-0.13	0.00	-0.14
diff	0.00	-1.47							0.00	-0.16	0.00	0.02
diffp	0.06	-4.35							0.00	0.15	0.02	0.48

Notes: Variables are explained in Appendix A and LoA.

Table V aggregates all previously mentioned relationships for the entire sample period and the division of period A and B. For period A, only the relationship to post-transfer Gini can be considered because of limited data availability. As stated before, this relationship is positive, while in period B all relationships are rather insignificant.

The following part of this paper deals with growth spells. The methods applied follow closely Kourtellos & Tsangarides (2015). First some descriptive statistics of up-breaks, down-breaks and growth spells are provided, followed by regressions on durations and frequencies of growth spells.

4.2. Growth Spells

TABLE VI

Growth Breaks

Region	Cnty	Total	Av. size	95-99	00s	10-14
Up	19	59	2.86	11	30	18
SD	2	6	2.17	1	3	2
CC	5	23	2.17	4	14	5
L	1	3	2.00	0	1	2
M	6	15	2.73	3	9	3
EE	5	12	4.92	3	3	6
Down	19	59	2.18	4	43	11
SD	2	7	2.71	0	5	2
CC	5	23	1.64	1	15	6
L	1	3	2.00	0	2	1
M	6	16	3.06	1	14	1
EE	5	10	1.70	2	7	1

TABLE VII

Growth Spells

Region	Spells	Av. dur.	$\geq$ 10 yrs
Complete	48	2.94	0.04
SD	6	2.17	0.00
CC	21	2.24	0.00
L	2	2.50	0.00
M	12	2.92	0.00
EE	7	5.86	0.29
Incomplete	21	3.05	0.05
SD	1	5.00	0.00
CC	3	2.67	0.00
L	2	4.00	0.00
M	7	3.71	0.00
EE	8	2.13	0.13
Combined	69	2.97	0.04
SD	7	2.57	0.00
CC	24	2.29	0.00
L	4	3.25	0.00
M	19	3.21	0.00
EE	15	3.87	0.20

Notes: Variables are explained in Appendix A and LoA.

All identified up- and down-breaks for each regime are shown in Table VI. Up-breaks are defined as periods in which the growth rate increases from below 2% to above 2%, whereas down-breaks are periods where the growth rate drops below 2%. In total 59 up-breaks and 59 down-breaks have been identified. The average break size was similar for most regimes. Only for eastern European countries it was substantially larger. Most of the down-breaks occurred in the 2000s, while Mediterranean countries had the largest average down-break size and eastern European countries the lowest.

Table VII presents duration and frequency of growth spells. Hereby, one can distinguish between complete and incomplete growth spells. For complete growth spells the earlier mentioned definition applies. Incomplete growth spells refer to periods, in which the growth spell is cut off by the time frame used, meaning periods, which had growth rates of at least 2% but not simultaneously an up- and down-break. The only regimes, which have growth periods of at least 10 years, are the Eastern European regimes. There are 69 total spells in the sample, which have an average duration of close to three years for all regimes. On average Eastern European regimes experienced the longest and social democratic ones the shortest growth spells.

TABLE VIII

Average Before, During and After Growth Spells

	(a) Growth			(b) Gini			(c) Redistribution		
Region	Before	During	After	Before	During	After	Before	During	After
Complete	-0.44	4.55	-0.61	28.32	28.44	28.46	6.02	5.70	5.76
SD	-0.46	4.85	-0.56	26.41	25.37	25.97	7.78	7.58	7.65
CC	-0.30	3.93	-0.15	27.63	27.54	27.62	6.51	6.58	6.62
L	-1.87	4.54	-1.25	29.90	31.09	30.08	12.37	12.66	14.26
M	-0.09	4.66	-0.91	31.70	31.30	31.29	2.50	2.59	2.90
EE	-1.05	5.95	-1.31	22.97	28.02	27.66	3.60	4.11	3.66
Incomplete	-1.47	5.02	-1.35	30.66	30.92	31.33	5.43	5.79	3.20
SD	0.00	6.35	0.06		27.00	27.38			
CC	1.23	4.15	-3.58	28.30	28.80	26.00	6.93	7.03	
L	1.72	6.20	0.49	30.15	31.35	29.80	16.15	15.80	
M	-0.15	4.27	0.08	32.31	33.35	33.24	3.95	4.67	
EE	-3.99	5.54	-3.58	30.71	30.41	34.50	3.58	4.26	3.20

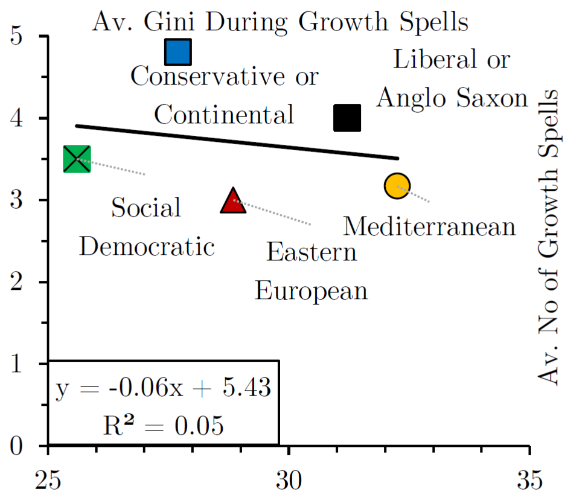
Notes: Variables are explained in Appendix A.

Table VIIIa displays the average growth rates before, during and after growth spells. For complete growth spells the growth rates before and after growth spells are on average slightly negative for all regimes. For incomplete growth spells the results are much more volatile since there is not much data on this variable. Eastern European regimes' growth rates turn out to be far more volatile than for other regimes, having high growth rates on average during growths spells, while having highly negative ones before and after growth spells.

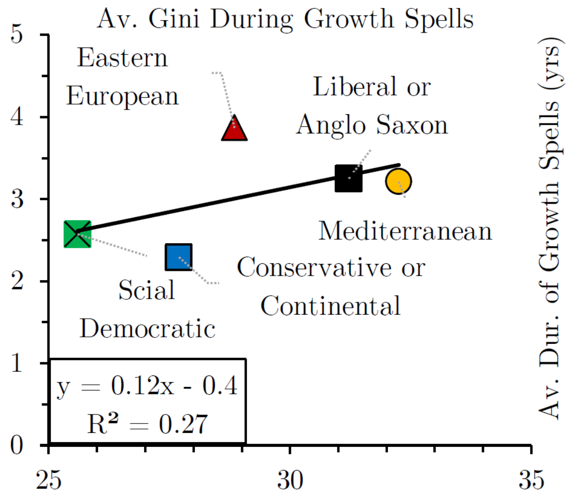
Average inequality before, during and after growth spells is depicted in Table VIIIb. The results must be treated with caution since data is limited for the Gini coefficient. Nevertheless, one can see that inequality before, during and after incomplete or complete growth spells does not vary much from scenario to scenario for the regimes involved.

Table VIIIc shows average redistribution before, during and after growth spells. Due to the small number of observations results for incomplete growth spells must be treated with caution. In the case of complete growth spells there are no big differences for average levels of redistribution before, during and after growth spells.

The next part summarises conducted regressions for growth spells.



(a) Number



(b) Duration

FIGURE 4: Relationship: Gini and Growth Spells for Regimes

Notes: Variables are explained in LoA. The black lines represent the regression lines. Regimes are distinguished by colour/symbol. The regression equations and R^2 are depicted in the lower left corners.

The relationship between average Gini during growth spells and average number of growth spells for regimes is illustrated in Figure 4a . The relationship is slightly negative meaning that countries from regimes with low levels of inequality experienced on average slightly more growth spells in this period than countries from regimes with higher levels of inequality.

Figure 4b depicts the relationship between average Gini during growth spells and average duration of growth spells. A positive relationship is observable meaning that in the given period regimes with higher levels of inequality experienced longer growth spells on average but with a lower frequency.

TABLE IX

Relationships of Growth Spells

		(a) Regimes						(b) Countries					
		Complete		Incomplete		Total		Complete		Incomplete		Total	
		R^2	Sl	R^2	Sl	R^2	Sl	R^2	Sl	R^2	Sl	R^2	Sl
Gini	No	0.23	-0.21	0.41	0.17	0.05	-0.06	0.39	-0.20	0.06	-0.03	0.35	-0.19
	Dur.	0.00	0.01	0.06	-0.11	0.27	0.12	0.28	0.39	0.20	0.20	0.37	0.34
Red.	No	0.02	0.04	0.32	0.06	0.21	0.08	0.21	0.20	0.08	0.04	0.22	0.20
	Dur.	0.20	-0.18	0.41	0.10	0.02	-0.02	0.15	-0.39	0.02	-0.08	0.13	-0.27

Notes: Variables are explained in LoA.

Table IXa summarises regression results for the variables Gini and redistribution for regimes. One striking result is that redistribution takes on the opposite sign compared to Gini for the relationships of total spells. Regimes, which redistribute more had on average slightly more growth spells with a shorter duration.

The same relationships considering countries instead of regimes can be seen in Table IXb. Choosing countries seems to be more accurate since the considered regimes vary in the amount of countries, which is not accounted for in the previous regressions. Disregarding the incomplete growth spell specification, the results are very similar to the regressions for regimes. This time the relationships seem to be more significant and stronger. The next part elaborates on how well the transmission mechanism theory fits the chosen sample.

4.3. Transmission Mechanism

Transmission mechanism theory suggests different causal relationships. The fit of the theory to the sample used in this paper is tested for using correlations matrices. What is being checked for is whether variables are correlated with the proposed sign, which however still does not account for the problem of causality. In particular, one cannot be sure whether the causality has the predicted direction. A further problem of not knowing how to accurately account for time lags remains. What is tested for are 11 hypotheses extracted from the literature review.

TABLE X

Correlation Matrix for all Variables - Whole Period

	ac10	ac3	ac5	diff	fert	gdp	gini	g-T	GE	GR	gr
gini	✗0.14	✗0.54	✗0.57	✗-0.70	✗-0.41	-0.77					
g-T	✗0.41	✗0.63	✗0.36	✓0.10	✓0.33	-0.36	0.64				
GE	-0.29	-0.75	-0.34	0.02	-0.24	0.15	-0.50	-0.67			
GR	0.01	-0.57	-0.33	0.39	0.05	0.29	-0.74	-0.61	0.87		
gr	0.64	0.72	0.73	-0.04	0.03	-0.46	✗ 0.51	✗ 0.66	-0.54	-0.41	
hc	✓0.49	✓0.21	✓0.10	✗0.43	✗0.25	0.21	✓-0.51	✓-0.25	0.07	0.38	✓0.08
invt	✓0.47	✓0.86	✓0.67	-0.29	-0.21	-0.48	✓ 0.52	✓ 0.41	-0.73	-0.67	✓0.66
le	-0.82	-0.77	-0.73	-0.04	-0.05	0.54	-0.42	-0.62	0.47	0.30	-0.68
ps	✓0.17	✓0.01	✗-0.13	0.67	0.53	0.43	✓-0.32	✗ 0.27	-0.07	0.13	✓0.07
pg	-0.35	-0.10	-0.50	0.28	0.41	0.67	-0.24	-0.03	-0.42	-0.34	-0.16
sch	✓0.36	✓0.47	✓0.08	0.43	✗0.54	0.18	✓-0.15	✗ 0.26	-0.56	-0.28	✓0.26

Notes: Variables are explained in Appendix A. ✓Green corresponds to the right and ✗red to the wrong sign of correlation.

Table X shows the correlation of all the variables used to each other for the whole period. For the predicted relationships concerning inequality Hypothesis 4, 6 and 10 hold for this sample, namely that inequality is negatively related to the level of education and positively to political instability and investment. Hypothesis 1, 2 and 8 cannot be confirmed for the sample. Inequality is positively related to growth and negatively to redistribution and fertility rates. Hypothesis 3 and 9 are not holding. Redistribution is positively correlated with human capital and a higher fertility rate is positively correlated with human capital and education. Hypothesis 7 fit is ambiguous. For some measures, political instability is negatively correlated to growth. Hypothesis 5 and 11 are holding. Investment, human capital and education are positively correlated with growth.

The correlation matrix for period A can be found in Appendix B. The results are very similar to the ones from the whole period. Hypothesis 10 and 11 cannot be tested for since data on the investment variable is not available for this period. Hypothesis 7, which predicts political instability to be negatively correlated to growth can this time be confirmed with the data.

The correlation matrix for period B is given in Appendix B. Again, the results are similar to the ones of the whole period. This time Hypothesis 1, stating that inequality is leading to less growth, can be partly verified with the data. The only striking difference is that investment is negatively related to growth, which is contrary to Hypothesis 11. This result should be treated with caution though, since data on investment is very limited. Again, Hypothesis 7 can be fully confirmed.

The following part addresses the issue of causality between the main variables of concern: Gini and growth rate and the variables investigated in the transmission mechanism theory.

4.4. Causality

Table XI summarises the p-values for the Granger and if possible also Dumitrescu Hurlin causality tests for the variables of interest in the transmission mechanism with the null hypothesis being that X does not Granger cause Y. Considering the 11 hypotheses extracted from the literature review on the transmission mechanism there is no hypothesis which can be fully approved by Granger and Dumitrescu Hurlin tests meaning that non-

TABLE XI

Causality Matrix

	gr	ac3	ac5	ac10	gini	diff	hc	sch	ps	fert	invt
gr					0.16		0.10	0.53	0.00^3		0.00^3
					0.38		0.10	0.00^3	0.08		
ac3					0.90		0.00^3	0.35	0.00^3		0.00^3
ac5					0.34		0.00^3	0.57	0.04^2		0.00^3
ac10					0.05^1		0.00^3	0.17	0.33		0.01^2
gini	0.06^1	0.19	0.61	0.86		0.42	0.56	0.53	0.06^1	0.50	0.90
	0.48					0.08^1	0.00^3		0.16	0.04^2	
diff					0.41		0.11	0.60			
					0.02^2		0.00^3				
hc	0.88	0.42	0.06^1	0.13	0.55	0.11		0.00^3		0.03^2	
	0.27				0.00^3	0.00^3				0.00^3	
sch	0.83	0.41	0.10	0.39	0.73	0.84	0.29			0.01^2	
	0.00^3									0.00^3	
ps	0.69	0.26	0.22	0.47	0.05^1						
	0.65				0.00^3						
fert					0.19		0.00^3	0.13			
					0.00^3		0.00^3	0.00^3			
invt	0.37	0.99	0.15	0.97	0.60						

Notes: Variables are explained in Appendix A. Read matrix: left/column (variable X) not Granger causing right/row (variable Y). Dumitrescu Hurlin test p-values are in the second row of each variable if applicable. P<0.10 indicated by "^{3}"; p<0.05 indicated by "^{2}"; p<0.01 indicated by "^{1}". Tests are conducted with Eviews.

causality could not be rejected at a p-value of 10% in all possible relevant specifications. For Hypothesis 7, 10 and 11, stating causal effects of: political instability on growth, inequality on investment and investment on growth, no Granger causality is estimated. However all other hypotheses partly show evidence of Granger causality.

Applying both conditions of the right sign of correlation and right direction of causality as in Figure 5 narrows the hypotheses on transmission channels, which could be approved by the sample used, down to Hypothesis 4, 5 and 6, stating that more inequality leads to less education, less human capital and more political instability, and more education and human capital lead to more growth. Supporting evidence for the other hypotheses could only be found partly or not at all.

Next some models are presented aimed at accounting for the impact of inequality on

Hypothesis	Correlation	Causation
1. More inequality leads to less growth.	×	~
2. More inequality leads to more redistribution.	×	~
3. More redistribution leads to less human and physical capital.	×	~
4. More inequality leads to less education and less human capital.	✓	~
5. More education and human capital lead to more growth.	✓	~
6. More inequality leads to more political instability.	✓	~
7. More political instability leads to less growth.	~	×
8. More inequality leads to a higher fertility rate.	×	~
9. A higher fertility rate leads to less education and human capital.	×	~
10. More inequality leads to more investment.	✓	×
11. More investment leads to more growth.	✓	×

FIGURE 5: Fit to Data

growth/accumulated growth.

4.5. Models

Regression results for models with the GDP per capita growth rate being the dependent variable are shown in Table XII. In general, the results should be treated with caution since for OLS and FE estimations not all Gauss-Markov assumptions are satisfied, while for the System GMM estimates some indication for weak instruments and second order autocorrelation exists. Moreover, given the dynamic nature and the relatively short time frame considered one could argue that the obtained results serve more of a descriptive function of what happened during this time in the given sample than giving strong indications on generalisable causal relationships applicable in a broader context. The impact of inequality on growth is found to be significantly positive for the baseline model in both OLS specifications and the System GMM specification. The relationship turns insignificant in all other cases when adding control variables. The argument of Kolev & Niehues (2016) that the System GMM estimator should lie in between OLS and FE could only be partly confirmed in these regressions, which could be due to some degree of model

Table XII

Models with Growth Rate as Dependent Variable

	(1) Baseline model				(2) + Control var.			(3)			(4)		
Var.	OLS	OLS	FE	GMM	OLS	FE	GMM	OLS	FE	GMM	OLS	FE	GMM
C	-1.38	-4.06	-1.51	-7.30	44.18	103.17	52.88	40.75	212.67	58.79	72.66	190.60	48.80
gini	0.15^{2}	0.25^{2}	0.15	0.34^{2}	0.08	0.12	0.08	0.11	0.07	0.11	0.17	-0.09	0.16
	(0.01)	(0.01)	(0.37)	(0.03)	(0.42)	(0.44)	(0.66)	(0.50)	(0.81)	(0.62)	(0.35)	(0.77)	(0.11)
lgdp					-4.12^{3}	-10.04^{3}	-5.05^{2}	-3.95^{2}	-20.64^{3}	-5.86^{1}	-5.82^{2}	-26.70^{3}	-3.44
					(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.08)	(0.02)	(0.00)	(0.20)
diff								0.15	0.52	0.31	0.40	0.70^{1}	0.34^{2}
								(0.53)	(0.10)	(0.15)	(0.15)	(0.06)	(0.03)
fert											-4.16	-4.15	-2.86
											(0.12)	(0.45)	(0.20)
GE											-0.18^{2}	-0.15	-0.07
											(0.03)	(0.20)	(0.28)
hc											-1.20	-13.13	1.55
											(0.56)	(0.32)	(0.11)
invt											-0.07	0.08	0.02
											(0.54)	(0.64)	(0.86)
le											0.04	1.70^{1}	-0.21
											(0.91)	(0.08)	(0.44)
ps											1.57	6.90^{3}	1.85^{1}
											(0.18)	(0.00)	(0.09)
B		1.70			-0.35			-0.16			-2.73		
EE		1.51			-0.81			-0.60			-1.81		
L		0.37			0.96			-1.78			-3.30		
M		-2.02			-2.57			-2.96			-4.05		
SD		0.24			-0.13			-1.12			-0.70		
Obs.	323	323	323	323	323	323	323	187	187	187	180	180	180
Inst.				54			107			92			180
R^2	0.02	0.11	0.00		0.17	0.16		0.15	0.18		0.26	0.28	

Notes: Variables are explained in Appendix A and LoA. In the System GMM specifications the instrument count is substantially reduced to the first two lags of each independent variable to reduce instrument proliferation and robust standard errors for heteroscedasticity and autocorrelation are used. For the FE models, the within R squared is used as a measure of goodness of fit. P-value in second row of each variable in (). P<0.10 → "1"; p<0.05 → "2"; p<0.01 → "3". Regressions are conducted with Stata.

misspecification. The initial income per capita level shows to be significantly negatively correlated with growth supporting the convergence hypothesis. In most specifications, especially when adding control variables, the regional or regime dummy variables show a negative coefficient indicating that the baseline group, conservative regimes, has been growing quicker in the chosen time frame, *ceteris paribus*. Redistribution has either a significant or insignificant positive coefficient indicating a positive *ceteris paribus* effect on growth. Political stability shows to be positively correlated with growth, while the other chosen control variables fertility, government expenditure, human capital, investment and life expectancy turn out to be rather insignificant.

Appendix C presents the same models for accumulated three year growth rates being the dependent variable. The results are very similar to the ones of Table XII. One rather surprising difference is that investment has a significantly negative coefficient for all estimators indicating a negative relation to growth.

Appendix D depicts estimation results for models accounting for the medium run having five year accumulated growth as the dependent variable, which is arguably the most used specification in literature on the inequality-growth nexus. Inequality still shows to have a positive or insignificant coefficient with the only exception being for model specification four the OLS estimate, which turns out to be significantly negative. Results for redistribution are relatively mixed this time. Again, investment shows to have a significantly negative coefficient for all estimators.

Estimation results for 10 year accumulated growth being the dependent variable, aimed at accounting for the long run, can be seen in Appendix E. Because of the relatively short time span used the observation count is dropped now up to a point where especially in model specifications three and four results can be expected to be biased a lot more than in the other specifications. As a likely consequence, most coefficients are now estimated to be insignificant.

Obtaining a positive or insignificant relationship is not a surprising result when arguing along Kolev & Niehues (2016), who found a non-linear relationship between inequality and growth, a negative one for developing and a positive or insignificant one for developed countries. Since the chosen sample of Eurozone countries can be considered rather developed, the obtained positive or insignificant relationship does not exclude the possibility of obtaining a different result when considering a different set of countries.

Following the presentation of the conducted analysis the next part offers a conclusion.

5. CONCLUSION

This paper deals with the relationship between inequality and growth and the respective transmission mechanism in the euro area. In most scenarios, the relationship has been estimated to be insignificant and rather positive than negative using FE, OLS and System GMM estimators for one, three, five and 10 year accumulated growth periods as the dependent variable. In terms of the direction of causality between these two variables almost no evidence could be found for either variable to Granger cause the other. Countries with more inequality showed to have on average less but longer growth spells than countries with less inequality. 11 hypotheses have been extracted from the literature regarding the transmission mechanism. To evaluate whether these hypotheses can be confirmed by data correlation matrices and Granger causality tests have been used. When considering the right sign of correlation, five of these hypotheses could be validated. When additionally checking for Granger causality only three hypotheses survived the process of elimination, indicating that more inequality leads to less education, less human capital and more political instability, and more education and human capital lead to more growth.

Internal validity in the growth-inequality nexus or in general when producing models, which aim at accounting for economic growth, is a common concern since no clear guideline or accepted theory exists stating which variables one should control for and how to exactly specify models used. The chosen research design checks for robustness of the obtained results to different sets of control variables and estimators, which does not ensure internal validity but decreases the risk of making bad inferences about causal relationships. It can be claimed with a reasonably high degree of confidence that construct validity is guaranteed since variables were chosen by construction in a way that they work as a close proxy for the variables of interest. Variables which could not be properly operationalised were left out of consideration for the conducted study. When considering external validity, it is important to mention that the chosen sample of the euro area is unlikely representative for the whole world, indicating that obtained results are not generalisable and only applicable for the euro area itself. Moreover, considering the dynamic nature of the chosen framework the relatively short time frame seems also not to be representative for much longer time spans adding some doubt on generalisability of results. Statistical conclusion validity is another concern since due to the nature of the data used it is difficult to use appropriate measurement procedures. To account for various problems one encounters in a simple OLS framework, FE and System GMM estimators are used in this paper as possibly superior estimators and for comparison sake of obtained results.

The predominantly insignificant positive coefficient for the inequality growth relationship obtained in this study is in line with Kolev & Niehues (2016), namely that a non-linearity in this relationship exists related to poor countries having a negative relationship and rich ones a positive or insignificant one, since euro area countries are rather on the richer spectrum of countries. Expectations have not been met when studying the transmissions mechanisms' fit to the considered sample since only three out of 11 hypotheses could be validated. In general insignificance of results can be expected given the chosen framework. The arguably only exception for a strong indication for validation of a hypothesis is the convergence hypothesis, which holds in almost all considered scenarios.

The most mentionable limitations of this research are related to the sample selection, data accumulation and possible inaccuracies in econometric specifications. Moreover, the channels from the transmission mechanism could be analysed in more depth.

The contribution by this paper in literature on the inequality growth nexus is the sample selection of euro area countries, which logically leads to the suggestion to investigate and compare other smaller sets of countries. Otherwise rather general suggestions for future research would be to put more effort in data collection and econometric tools to improve the reliability of results. Moreover, given the dynamic nature of the topic theory should be constantly updated and a discussion provided on how to exactly build a framework for investigation, to obtain reliable results. Based on the obtained results of this paper offering policy recommendations would be rather ill-advised given the insignificance of results and possible biases in their estimation.

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Appendices

A. Variables

Var.	Explanation	Unit	Source	COC
gini	Gini coefficient of equivalised disposable income ⇒ [ilc_di12]	(0–100)	Eurostat	05-15
g-Tp	Gini coefficient of equivalised disposable income before social transfers (pensions included in social transfers) ⇒ [ilc_di12b]	(0–100)	Eurostat	05-15
g-T	Gini-T ⇒ Gini coefficient of equivalised disposable income before social transfers (pensions excluded) ⇒ [ilc_di12c]	(0–100)	Eurostat	05-15
diff	gini minus g-T	(0–100)	Eurostat	05-15
diffp	gini minus g-Tp	(0–100)	Eurostat	05-15
gdp	Expenditure-side real GDP per capita at chained PPPs in 2011US$	US$	PWT 9.0	95-14
lgdp	Natural logarithm of gdp			
gr	gdp growth rate	%	PWT 9.0	95-13
ac3	Accumulated 3 year gr between year x and x+3	%	PWT 9.0	95-11
ac5	Accumulated 5 year gr between year x and x+5	%	PWT 9.0	95-09
ac10	Accumulated 10 year gr between year x and x+10	%	PWT 9.0	95-04
GE	Total general government expenditure in % of GDP	%	Eurostat	95-15
GR	Total general government revenue in % of GDP	%	Eurostat	95-15
hc	Human capital index, based on years of schooling and returns to education		PWT 9.0	95-14
ps	Political Stability and Absence of Violence/Terrorism	(-2.5–2.5)	World Bank	96-15
sch	Average years of total schooling, age 75+, total	Years	Barro & Lee	95-10
pg	Population growth of total population, national concept	%	Eurostat	99-15
fert	Total fertility rate		Eurostat	00-15
le	Life expectancy of people Less than 1 year old	Years	Eurostat	02-15
invt	Total investment in % of GDP	%	Eurostat	10-15
SD	Social Democratic regimes	Dummy		
CC	Conservative or Continental regimes	Dummy		
L	Liberal or Anglo Saxon regimes	Dummy		
M	Mediterranean regimes	Dummy		
EE	Eastern European countries - Baltic countries	Dummy		
B	Baltic countries	Dummy		

Notes: Variables are explained in LoA.

B. Correlation Matrix - Two Periods

A (95-07)

	ac10	ac3	ac5	diff	fert	gini	gdp	g-T	GE	GR	gr
gini	✗0.08	✗0.48	✗0.43	✗-0.67	✗-0.42						
gdp	0.01	-0.14	-0.13	0.29	0.32	-0.59					
g-T	✗0.31	✗0.53	✗0.26	✓0.09	✓0.26	0.68	-0.50				
GE	-0.29	-0.75	-0.31	0.02	-0.24	-0.46	0.01	-0.59			
GR	0.02	-0.57	-0.26	0.39	0.05	-0.71	0.15	-0.56	0.86		
gr	0.59	0.66	0.78	-0.02	0.02	✗ 0.44	-0.15	✗0.57	-0.49	-0.35	
hc	✓0.49	✓0.21	✓0.08	✗0.43	✗0.25	✓-0.49	0.10	-0.23	0.07	0.38	✓0.07
le	-0.81	-0.77	-0.69	-0.05	-0.05	-0.39	0.20	-0.57	0.46	0.29	-0.66
ps	✓0.22	✓0.05	0.00	0.61	0.51	✓-0.41	0.56	✗0.05	-0.08	0.13	✓0.09
pg	-0.26	-0.06	-0.34	0.27	0.42	-0.33	0.59	-0.17	-0.40	-0.30	-0.13
sch	✓0.36	✓0.47	✓0.06	0.43	✗0.55	✓-0.15	0.11	0.22	-0.56	-0.28	✓0.23

Notes: Variables are explained in Appendix A. ✓Green corresponds to the right and ✗red to the wrong sign of correlation.

B (07-15)

	ac3	diff	fert	gini	gdp	g-T	GE	GR	gr
gini	✗0 .03	✗-0.41	✗-0.23						
gdp	-0.22	0.53	0.39	-0.37					
g-T	✗0.13	✓0.36	✓0.30	0.70	0.03				
GE	0.07	0.39	0.38	-0.17	0.34	0.13			
GR	0.03	0.23	0.33	-0.42	0.45	-0.25	0.61		
gr	0.63	0.08	-0.10	✓-0.09	✓-0.03	-0.03	0.06	0.11	
hc	✓0 .36	✗0.24	✗0.11	✓-0.53	0.07	✓-0.36	-0.05	0.15	✓0.17
le	-0.38	0.27	0.18	-0.34	0.65	-0.14	0.54	0.52	-0.12
ps	✓0.26	✓0.53	0.19	✓-0.55	0.29	✓-0.15	0.05	0.30	✓0.23
pg	-0.52	0.22	0.24	-0.38	0.57	-0.22	0.01	0.13	-0.23
sch	✓0.20	0.33	✗0.29	✓-0.47	0.04	✓-0.22	-0.21	-0.19	✓0.06
invt	✗-0.43	-0.22	0.01	✓ 0.07	-0.26	✗-0.10	-0.56	-0.23	✗-0.33

Notes: Variables are explained in Appendix A. ✓Green corresponds to the right and ✗red to the wrong sign of correlation.

C. Models with Three Year Accumulated Growth Rate as Dependent Variable

	(1) Baseline model				(2) + Control var.			(3)			(4)		
Var.	OLS	OLS	FE	GMM	OLS	FE	GMM	OLS	FE	GMM	OLS	FE	GMM
C	-6.73	-14.31	-13.47	-31.60	150.92	377.47	182.55	137.80	799.96	165.10	384.15	741.37	210.55
gini	0.53^{3}	0.84^{3}	0.76^{1}	1.37^{2}	0.23	0.64^{2}	0.13	0.10	0.02	0.35	-0.08	0.21	0.29
	(0.00)	(0.00)	(0.06)	(0.01)	(0.27)	(0.04)	(0.77)	(0.79)	(0.97)	(0.53)	(0.83)	(0.66)	(0.37)
lgdp					-14.10^{3}	-37.52^{3}	-17.19^{3}	-12.55^{3}	-76.81^{3}	-16.68^{2}	-26.36^{3}	-79.89^{3}	-15.30^{1}
					(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.04)	(0.00)	(0.00)	(0.07)
diff								0.19	1.03^{1}	0.96	-0.05	-0.44	0.81
								(0.72)	(0.09)	(0.11)	(0.94)	(0.49)	(0.11)
fert											-13.29^{2}	8.01	-0.91
											(0.02)	(0.44)	(0.88)
GE											-0.50^{2}	-0.18	-0.24
											(0.01)	(0.41)	(0.25)
hc											-8.55^{1}	-104.31^{3}	5.21
											(0.05)	(0.00)	(0.19)
invt											-1.26^{3}	-1.18^{3}	-0.83^{2}
											(0.00)	(0.00)	(0.01)
le											0.08	5.38^{3}	-0.56
											(0.93)	(0.00)	(0.49)
ps											0.28	12.42^{3}	2.54
											(0.91)	(0.00)	(0.37)
B		5.04			-2.43			-2.54			-15.02		
EE		3.56			-4.38			-5.20			-10.88		
L		0.13			2.33			-4.01			2.49		
M		-6.76			-8.30			-9.40			-20.15		
SD		0.17			-0.96			-3.94			-0.19		
Obs.	285	285	285	285	285	285	285	149	149	149	142	142	142
Inst.				48			95			74			142
R^2	0.05	0.20	0.01		0.33	0.42		0.26	0.44		0.50	0.66	

Notes: Variables are explained in Appendix A and LoA. In the System GMM specifications the instrument count is substantially reduced to the first two lags of each independent variable to reduce instrument proliferation and robust standard errors for heteroscedasticity and autocorrelation are used. For the FE models, the within R squared is used as a measure of goodness of fit. P-value in second row of each variable in (). P<0.10 → "^{1}"; p<0.05 → "^{2}"; p<0.01 → "^{3}". Regressions are conducted with Stata.

D. *Models with Five Year Accumulated Growth Rate as Dependent Variable*

	(1) Baseline model				(2) + Control var.			(3)			(4)		
Var.	OLS	OLS	FE	GMM	OLS	FE	GMM	OLS	FE	GMM	OLS	FE	GMM
C	-10.70	-19.34	-10.12	-31.59	243.70	603.02	278.73	181.03	723.35	228.81	622.97	599.65	343.76
gini	0.80^{3}	1.22^{3}	0.83	1.56^{3}	0.26	0.65^{1}	0.31	-0.21	-0.52	0.38	-1.07^{2}	-0.15	0.22
	(0.00)	(0.00)	(0.13)	(0.00)	(0.34)	(0.07)	(0.64)	(0.63)	(0.38)	(0.59)	(0.01)	(0.78)	(0.54)
lgdp					-22.49^{3}	-58.95^{3}	-26.53^{3}	-15.18^{3}	-66.88^{3}	-22.64^{1}	-52.45^{3}	-40.89^{2}	-24.78^{2}
					(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.07)	(0.00)	(0.01)	(0.02)
diff								-0.17	-0.60	0.95	-0.53	-1.31	1.35^{2}
								(0.80)	(0.51)	(0.33)	(0.39)	(0.10)	(0.03)
fert											-20.66^{3}	7.38	-0.37
											(0.00)	(0.57)	(0.96)
GE											-0.13	0.98^{3}	-0.05
											(0.55)	(0.00)	(0.87)
hc											-6.32	161.19^{3}	8.71^{2}
											(0.17)	(0.00)	(0.03)
invt											-1.23^{3}	-0.79^{2}	-1.14^{3}
											(0.00)	(0.03)	(0.00)
le											0.81	3.72^{2}	-1.10
											(0.44)	(0.03)	(0.22)
ps											-3.72	11.24^{2}	-0.95
											(0.14)	(0.01)	(0.74)
B		9.87			-2.61			-0.21			-11.69		
EE		4.76			-7.98			-8.87			-21.33		
L		-0.14			3.52			-6.51			17.46		
M		-10.07			-12.32			-14.39			-25.43		
SD		-0.63			-2.27			-7.18			2.75		
Obs.	247	247	247	247	247	247	247	111	111	111	104	104	104
Inst.				42			83			56			104
R^2	0.07	0.27	0.01		0.45	0.60		0.44	0.41		0.73	0.66	

Notes: Variables are explained in Appendix A and LoA. In the System GMM specifications the instrument count is substantially reduced to the first two lags of each independent variable to reduce instrument proliferation and robust standard errors for heteroscedasticity and autocorrelation are used. For the FE models, the within R squared is used as a measure of goodness of fit. P-value in second row of each variable in (). P<0.10 $\rightarrow$ "^{1}"; p<0.05 $\rightarrow$ "^{2}"; p<0.01 $\rightarrow$ "^{3}". Regressions are conducted with Stata.

E. *Models with 10 Year Accumulated Growth Rate as Dependent Variable*

	(1) Baseline model				(2) + Control var.			(3)			(4)	
Var.	OLS	OLS	FE	GMM	OLS	FE	GMM	OLS	FE	GMM	OLS	GMM
C	-25.99	-45.00	-42.85	-68.10	271.16	933.14	294.48	29.53	291.01	1478.14	765.74	765.74
gini	1.89^{3}	2.69^{3}	2.46^{3}	3.31^{3}	1.32^{2}	0.84	1.66	1.30	1.11	-7.63	-0.66	-0.66
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.13)	(0.21)	(0.55)	(0.22)	(0.28)	(0.91)	(0.51)
lgdp					-26.63^{3}	-90.45^{3}	-30.55^{2}	-6.02	-29.81	-114.26^{2}	-8.68	-8.68
					(0.00)	(0.00)	(0.04)	(0.75)	(0.35)	(0.01)	(0.86)	(0.74)
diff								2.74	1.50	-5.57	2.59	2.59
								(0.24)	(0.30)	(0.55)	(0.73)	(0.33)
fert											-10.01	-10.01
											(0.85)	(0.66)
GE											0.08	0.08
											(0.97)	(0.93)
hc											-0.21	-0.21
											(1.00)	(0.99)
invt											0.24	0.24
											(0.95)	(0.91)
le											-8.06	-8.06^{2}
											(0.46)	(0.02)
ps											-10.75	-10.75
											(0.56)	(0.11)
B		29.70			11.83							
EE		5.63			-11.33							
L		0.16			4.40							
M		-19.55			-21.11							
SD		0.55			-2.33							
Obs.	152	152	152	152	152	152	152	16	16	16	14	14
Inst.				27			53			11		14
R^2	0.10	0.51	0.06		0.59	0.62		0.14	0.89		0.77	

Notes: Variables are explained in Appendix A and LoA. In the System GMM specifications the instrument count is substantially reduced to the first two lags of each independent variable to reduce instrument proliferation and robust standard errors for heteroscedasticity and autocorrelation are used. For the FE models, the within R squared is used as a measure of goodness of fit. P-value in second row of each variable in (). $P<0.10 \rightarrow$ "^{1}"; $p<0.05 \rightarrow$ "^{2}"; $p<0.01 \rightarrow$ "^{3}". Regressions are conducted with Stata.