INCOME INEQUALITY AND FISCAL POLICY EFFECTIVENESS
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Biography

Helena Sampaio was born on 28th September 1994 in Guimarães. In the year of 2012, after a hole academic path in her home town, she moved in to Porto and started the Bachelor Program in Economics in School of Economics and Management of the University of Porto (FEP) where she completed that degree on July 2016.

In September 2016 she joined Master in Economics in the same institution. During this master she had the opportunity to take a semester in University Carlos III of Madrid, under the mobility program Eramus+.

At the same time, on the course of the year of 2017 she began her professional career in a financial internship on Epimethues.
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In addition, I have to thank my friends for the support they gave me over the past year. It was not always easy, but they made this path a lot lighter. I am thankful for their patience and incentive.

Last but certainly not least, to my family, mostly my parents and sister for always believing in me even when I don’t.
Abstract

Based on the premise that there is not a single fiscal multiplier and that economic environment impact on fiscal policy effectiveness, this dissertation aims to find out if income inequality may also be called a determinant for fiscal multipliers.

Throughout this work it is presented a vast literature review on the determinants of fiscal multipliers; on economic features affecting income inequality and, last but not least, on a more direct link between fiscal policy and inequality. The goal is to find out the mechanisms through which, directly or indirectly, income inequality affects the fiscal multiplier. Additionally, using a set of European Union countries, fiscal multipliers were computed and the relationship between them and income inequality was established.

This dissertation contributes to the existing literature in the following: i) a critical analysis of theoretical mechanisms that link the income inequality to the fiscal policy effectiveness; ii) an empirical analysis of the impact of this country specific feature on fiscal multipliers, accounting for fiscal policies both on spending and revenue side.

Using a vector autoregressive model for a set of European countries during the period 2002 to 2017 (quarterly data) we compute fiscal multipliers. Then using that results it was analysed the behaviour of fiscal multipliers depending on income inequality. The main results point to an effective impact of income inequality on fiscal policy effectiveness when also accounting for other multiplier determinants and different results depending on the side of the fiscal policy.

**JEL Code:** D31; E21; E62

**Keywords:** Income inequality; Fiscal policy; Fiscal multiplier.
Resumo

Com base na premissa de que não existe um único multiplicador orçamental e que diferentes fatores económicos afetam a eficácia da política orçamental, esta dissertação tem como objetivo perceber se a desigualdade de rendimentos também pode ser considerada um desses determinantes.

Ao longo deste trabalho apresenta-se uma vasta revisão de literatura sobre os determinantes dos multiplicadores orçamentais; sobre características das economias que afetam a desigualdade de rendimentos e, finalmente, sobre a relação mais direta, anteriormente estudada na literatura económica, entre a política fiscal e a desigualdade. Esta dissertação pretende identificar os mecanismos através dos quais, direta ou indiretamente, a desigualdade de rendimentos afeta o multiplicador orçamental. Adicionalmente, usando um conjunto de países da União Europeia, foram estimados os multiplicadores orçamentais e foi estabelecida a relação entre os mesmos e a desigualdade de rendimentos.

Os contributos desta dissertação para a literatura centram-se: i) numa análise crítica dos mecanismos teóricos que relacionam a desigualdade de rendimentos e a eficácia da política orçamenta; e ii) numa análise empírica do impacto desta característica, específica de cada país, nos multiplicadores orçamentais, quer do lado despesa quer do lado da receita.

Usando um modelo de vetores autorregressivos para um conjunto de países europeus durante o período 2002-2017 (dados trimestrais), foram calculados os multiplicadores fiscais. Usando esses resultados, analisou-se o comportamento dos multiplicadores orçamentais dependendo do nível de desigualdade de rendimentos. Os principais resultados apontam para um impacto da desigualdade de rendimentos sobre a eficácia da política orçamental, quando considerados outros determinantes dos multiplicadores na regressão, e resultados diferentes que dependem do facto de ser considerado um multiplicador da despesa ou da receita.

**Códigos JEL:** D31; E21; E62

**Palavras-chave:** Desigualdade de rendimentos; Política orçamental; Multiplicador orçamental.
Index

Biography ....................................................................................................................... i
Acknowledgments ........................................................................................................ ii
Abstract ........................................................................................................................... iii
Resumo .............................................................................................................................. iv
Tables Index ...................................................................................................................... vii
Figures Index .................................................................................................................... viii
1. Introduction .................................................................................................................. 1
2. Literature Review ........................................................................................................ 4
   2.1. Fiscal multipliers .................................................................................................... 4
       2.1.1. Definition of fiscal multiplier .......................................................................... 4
       2.1.2. The effectiveness of fiscal policy: the size of fiscal multipliers ...................... 5
   2.2. Economic Inequality ............................................................................................. 10
       2.2.1. Definition and measurement .......................................................................... 10
       2.2.2. Income inequality and the economy ............................................................. 11
   2.3. Mechanisms through which inequality affects fiscal policy effectiveness .......... 15
3. Methodology ................................................................................................................. 23
   3.1. Methodology – Overview and model selection ..................................................... 23
   3.2. Methodology – Data and variables ..................................................................... 26
4. Analysis of results – Income inequality and fiscal policy effectiveness in Europe .......... 28
   4.1. Fiscal multipliers in the EU .................................................................................. 28
   4.2. Inequality and the size of multipliers in the EU .................................................. 35
5. Conclusion .................................................................................................................... 39
Bibliographic References ................................................................................................. 41
Webgraphy ....................................................................................................................... 46
Annex ............................................................................................................................... 47
   A.1 Effects of income inequality on government spending multipliers, EU (baseline model, 2002-2017) ........................................................................................................ 47
   A.2 Effects of income inequality on government revenue multipliers, EU (baseline model, 2002-2017) ........................................................................................................ 47
   A.3 Cross-Section Estimation (Revenue Fiscal Multiplier (1Y); Trade openness; Debt level and IDH), 2002-2017 ................................................................. 48
A.4 Cross-Section Estimation (Revenue Fiscal Multiplier (2Y); Trade openness, Debt level and GDP per capita), 2002-2017

48
Tables Index

Table 1. Summary of fiscal multipliers’ (FM) determinants .................................................. 9
Table 2. Summary of relationship between income inequality and economic features .......... 14
Table 3. Summary of relationship between income inequality and fiscal policy .................. 19
Table 4. VAR estimation, FR 2004Q1 - 2017Q4 .................................................................. 28
Table 5. Fiscal multipliers of government expenditures, impact (1Q) and cumulative (1Y) or (2Y) ................................................................................................................................. 31
Table 6. Fiscal multipliers of government revenues, impact (2Q) and cumulative (1Y) or (2Y) ........................................................................................................................................ 32
Table 7. Effects of income inequality on government spending multipliers, EU (2004-2017) ................................................................................................................................. 36
Table 8. Effects of income inequality on government revenue multipliers, EU (2004-2017) ........................................................................................................................................ 37
Figures Index

Figure 1. Economic characteristics affecting income inequality and fiscal policy ...............22
Figure 2. Impulse response of GDP to spending (left-hand panel) and accumulated impulse response (right-hand panel), Poland .................................................................30
Figure 3. Impulse response of GDP to spending (left-hand panel) and accumulated impulse response (right-hand panel), Poland .................................................................30
Figure 4. Accumulated response of GDP to a shock in government expenditures, high (left-hand panel) vs low (left-hand panel) income inequality in the EU ........................................34
Figure 5. Accumulated response of GDP to a shock in government revenues, high (left-hand panel) vs low (left-hand panel) income inequality in the EU ........................................34
1. Introduction

The 2008 financial crisis, leading to the global economic crisis, left the economies, particularly developed economies, in deep and long-to-recover recessions. This unstable framework reminds us the importance of macro policies for stabilization. It is crucial to understand the effects and the effectiveness of the policies adopted, especially those associated with fiscal policies that are, for countries with a fixed exchange rate regime or in a monetary union, essential to ease the adjustments to asymmetric (effects of) shocks.

At the same time, accordingly to IMF (2014, p. 4), income inequality “has increased in both advanced and developing economies in the last ten decades”. Martínez-Vázquez et al. (2012), based on data from the World Income Inequality Database, conclude that, after having stabilized in the mid-1980s, inequality has increased dramatically, especially in the beginning of the 1990s, both in developing and developed countries. There are several views on what the causes for this increase are (for instance, Piketty and Saez (2014) assign it to the rise of the global competition for skills), and on what should be done to reduce this inequality. Fiscal policy plays a key role in trying to reduce income inequality through instruments such as taxes, social transfers and some other government expenditures related, for example, with education and health care (e.g., Bastagli et al., 2012; Martínez-Vázquez et al., 2012). However, the focus of this dissertation is not on the impact of fiscal policy on income inequality, but instead on the impact of income inequality in the effectiveness of the fiscal policy.

A substantial amount of research has been done covering for fiscal policy effectiveness and the impacts of fiscal policy on macroeconomic aggregates (for a survey on these impacts see, for example, Hebous, 2011). It is now well established in the literature that there is not a single fiscal multiplier but that, instead, fiscal policy effectiveness is state-dependent, namely reacting differently to several structural features of the economy or even to cycle phases (e.g., Corsetti et al., 2012, and Ilzetzki et al., 2013).

However, still, almost every author analyses this theme focusing on aggregate effects while overlooking heterogeneity in income among agents. Thus the results may be biased since different agents respond differently to fiscal shocks as recent results presented in the literature show (e.g., Anderson et al., 2016, and Kruger et al., 2016).

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1 The fiscal multiplier is broadly defined as “the change in real GDP or other output measure caused by one-unit increase in a fiscal variable” (Ilzetzki et al., 2013, p. 244).
Firstly motivated by the findings in Brinca et al. (2016) - that provide evidence for a positive relationship between wealth inequality and the size of the government spending multiplier - but also because there is no comprehensive set of literature explaining the mechanisms through which income inequality may shape the size, or even the sign, of fiscal multipliers, this dissertation aims to address the following questions: i) does income inequality affect fiscal policy effectiveness?; and, more specifically, ii) what are the mechanisms acting in the transmission of income inequality to fiscal multipliers?

In order to answer the previous questions, we perform a literature review which intends to identify economic mechanisms through which income inequality may directly, but also indirectly, affect fiscal policy effectiveness. By indirectly, we mean that having recognized the existence of such relation, we should also notice how inequality is affected by some economic factors (for instance, Krueger et al., 2010, relates inequality with business cycle phases), relating these factors with the fiscal multiplier. Moreover, another goal is to understand if these transmission channels differ, for example, among different fiscal policy instruments (e.g., taxes vs government spending). Since, in this regard, the literature is rather vague and, as far as we know, no detailed analysis exists on the theoretical models supporting this relation, an encompassing literature review is a first contribution of this work. The analysis bypassing income inequality will allow us to propose some additional explanations on why multipliers are state-dependent.

Furthermore, we formulate an empirical evaluation of the impact of income inequality on fiscal multipliers, considering different fiscal instruments and using panel data for European countries. To the best of our knowledge only Brinca et al. (2016) and Brinca et al. (2017) establish a direct relationship between income inequality and fiscal multipliers, and both studies left behind some fiscal instruments and overlooked some transmission mechanisms. The empirical analysis is based in a two parts approach, similarly to the methodology followed by Brinca et al. (2016), where we compute a VAR model followed by a least squares estimation.

From the estimation performed we get the following results: (1) it seems that income inequality actually affects the effectiveness of fiscal policy; (2) the impact depends on what is the instrument in analysis. According to these results there is a meaningful trade-off

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2 Although there is a vast literature on the effects of fiscal policy on income inequality, the opposite relation has not been much explored.
between fiscal policy effectiveness and income inequality, so this should be consider for policy decision purposes.

The present dissertation is structured as follows. In the next section it will be presented a summary of the literature review to clarify the main concepts and to introduce the theoretical framework in which this work arises. In section 3, we will briefly describe the methodology and data used on this dissertation. After that we present, in section 4, the results from the estimations performed and we analyse them based on economic literature. Finally, in section 5, we conclude summing up the results and pointing lacks to be explored in future works.
2. Literature Review

2.1. Fiscal multipliers

2.1.1. Definition of fiscal multiplier

Macroeconomic policy is a long-discussed subject, over the years many theories have been exploit. Since the discussion between the Keynesian and the neoclassic school until the fresher real business cycle models and new Keynesian models, one of the main goal of macroeconomists is to understand the economic response to policy shocks and to take advantage of the more effective policies.

Samuelson (1951, p. 395) defined fiscal policy as a “process of shaping public taxation and public expenditure so as (1) to help dampen down the swings of the business cycle and (2) to contribute toward the maintenance of a progressive, high employment economy free from excessive inflation or deflation”.

For the purpose of accomplishing the goals mentioned above, there are several fiscal instruments used, each of which with different impacts. Governments can apply policies both on expenditure side and on revenue side, being the main instruments current public spending, public investment, transfers and taxes. We should take into consideration how different instruments may have different impacts. For instance, Afonso and Sousa (2012) attribute small but positive effects on GDP, varied effects on private consumption and investment, a positive effect on housing prices, a quick fall in stock prices and, in general, a positive effect on price level and on interest rate to government positive shocks on the spending side. When it comes to the effects of a shock on the revenue side, they recognize positive impact on GDP and private investment, varied effect on consumption, varied impact on housing price, positive effect on stock prices, and mixed effects on interest rate.

Whatever the instruments, it is crucial to measure the effectiveness of the policy. Usually the effectiveness of fiscal policy is assessed in terms of changes in gross domestic product (GDP), through the computation of fiscal multipliers. The fiscal multiplier is broadly defined as “the change in real GDP or other output measure caused by one-unit increase in a fiscal variable” (Ilzetzky et al., 2013, p. 244). Thus fiscal multipliers can be as many as the number of fiscal instruments. Moreover, fiscal multipliers can be computed to different forecast horizons. Ilzetzky et al. (2013) define impact multiplier as the change in output, per unit change in the fiscal instrument, produced in the moment the shock in the fiscal variable occurs. Also called instantaneous multiplier (Coenen et al., 2012), it is adequate to measure the impacts of
temporary shocks. In turn, cumulative multiplier refers to the net present value of the cumulative change in output, per unit change in the fiscal instrument, due to a shock in a fiscal variable that occurred some periods before. Cumulative multipliers are not only useful to measure short run effects but also permanent fiscal stimulus shocks (Coenen et al., 2012).

2.1.2. The effectiveness of fiscal policy: the size of fiscal multipliers

The literature on the determinants of the effectiveness of fiscal policy, meaning the factors that influence the size of fiscal multipliers, is way too vast. Batini et al. (2014) starts by distinguish structural factors (country specific characteristics that influence the response to fiscal policy) as trade openness, labour market rigidity, the size of automatic stabilizers, exchange rate regimes and debt level; and conjunctural factors (temporary factors that deviate the level of multipliers) as cycle phases and the degree of monetary accommodation.

The impact of structural factors on the fiscal multiplier is widely approached among economists. Ilzetzki et al. (2013), using two criteria to define openness to trade, in the one hand legal restrictions (higher tariffs, less trade) and on the other hand economies dimension (larger dimension, less trade), identify smaller fiscal multipliers in opened economies in response to an increase in government consumption. They find negative multipliers for countries with high ratio trade-GDP both on short and long-run. The results obtained for the different countries are attributed to the reduction of net exports instead of an increase in domestic production in result of a rise in net demand. Likewise, Batini et al. (2014) and Barrell et al. (2012) defend a less pronounced demand’s leakage for imports in large countries or countries only partially open to trade.

Also, Batini et al. (2014) attribute larger multipliers to more rigid labour markets, since rigid wages tend to amplify the response of output to fiscal shocks. In agreement with this position, focusing on the New Deal cartelization policies (designed to increase labour bargaining power), Cole and Ohanian (2004) implement a multisector dynamic general equilibrium model and they conclude that those policies contributed to the persistent depression of the American economy on the 1930’s, even finding a match between the abandonment of these policies and the economic recovery of the 1940’s. Auerbach and Gorodnichenko (2012) also confirm more pronounced cyclical variation in fiscal multipliers.
and higher response of output in recession when labour markets are more rigid, consistently with the previous authors.

Still, regarding structural factors, larger automatic stabilizers are associated with reduced fiscal multipliers. Since automatic stabilizers are expected to smooth the business cycles, it is intuitive the inference made by Batini et al. (2014) and Dolls et al. (2012) that automatic response of transfers and taxes will offset the initial shock.

Furthermore higher fiscal multipliers are often associated with fixed exchange rates (e.g., Corsetti et al., 2012; Ilzetzki et al., 2013; Batini et al., 2014). For economies with predetermined exchange rates, Ilzetzki et al. (2013) find multipliers in response to a shock in government consumption larger than one in the long-run, while in case of flexible exchange rates they find negative multipliers at any forecast horizon. The evidence of higher public spending multipliers under fixed exchange rate regimes are in line with Mundell- Fleming model predictions, according to which the exchange rate movements offset the impact of discretionary fiscal policy. Even though that is coherent, some authors, for instance Corsetti et al. (2012), Born et al. (2013), or Ilzetzki et al. (2013), question the transmission mechanism stated in the Mundell-Fleming model. They relate some of the differences (to the model predictions) with a possible monetary accommodation of the fiscal policy.

Lastly, the association between high debt levels and effectiveness of fiscal policy, since this feature impact economic agents’ expectations. Sutherland (1997), focusing on the link between government debt and the expected distribution of taxes across generations finds that the impact of debt depends on its level. He points Keynesian effects (deficit as expansionary) for low credit levels since agents believe that stabilisation programs will not affect their generation. However, with high debt levels he finds contractionary behaviour due to the imminent threat of a debt stabilisation. Concurring to the non-Keynesian effects, Kirchner et al. (2010) conclude that high-debt levels affect long term multipliers negatively. Also, Huidrom et al. (2016) go further and find out that the effects of fiscal positions (related with government debt and deficits) are separate and distinct from business cycle. They accept the explanation given by the previous authors, calling it “Ricardian channel”, but they also present an “interest rate channel” through which the borrowing costs get higher due to a major perception of credit risks by the investors.

A structural characteristic not mentioned until now but also affecting the size of the fiscal multiplier is the level of development of a country. Ilzetzki et al. (2013) attribute larger multipliers to industrial countries, and they perceive not only differences on the effects but
also on execution, since high-income economies’ spending government shocks tend to be more persistent. According to Batini et al. (2014, p. 6) this may be related with “expenditure inefficiencies, the difficulty to unwind expenditures (with increases more likely to become permanent), or composition effects”. Easterly and Rebelo (1993) point the different policy instruments used by countries depending on their level of development. They state higher reliance on international trade taxes of poor countries, while income taxes are more important to developed countries.

On conjunctural factors side, a consensual opinion of business cycle phases’ impact on fiscal policy’s effectiveness is presented in several works over the past years (e.g., Auerbach and Gorodnichenko, 2012; Corsetti et al., 2012). They all recognised more effectiveness of fiscal policy during recessions than through expansions. Batini et al. (2014) claim that a fiscal stimulus is less effective in expansion due to a crowding out effect in private demand that may be explained by an inelastic resource’s curve, and a fiscal consolidation have more recessive impacts on downturn because credit-constrained agents cannot maintain their consumption. Michaillat (2011), on the effects of fiscal policy on unemployment over the business cycle, apply a model with job rationing in recession and find that the multiplier associated with the reduction of unemployment rate in response to an increase in public spending (through higher expenditures on public jobs or on wage subsidies) is positive and counter-cyclical. Concluding that either hiring in the public sector or applying a wage subsidy, specially in recession, reduces the unemployment, another point of view but also in agreement with the hypothesis of higher multipliers in recession. Still related with the business cycles, Canzoneri et al. (2016) show that during recessions government spending, particularly when financed by debt, is more effective if there are counter-cyclical financial frictions. The implicit mecanism rely on the believe that financial strapped agents react positively to government spending even when taking into consideration future taxes, and this wealth effect is larger when the financial constraint are more severe. The authors conjecture that if the focus of their research was the relaxation of borrowing constraints instead of spread movements the results would be the same.

In addition, there are also some authors who discussed the interaction between fiscal policy and monetary policy. Coenen et al. (2012) find that the effects of fiscal stimulus in different instruments are larger with higher levels of monetary accommodation (excluding from this the effects of labour taxes). They explain the drop of fiscal multipliers, when there is not monetary accommodation, by the higher interest rates in response to higher inflation.
(pattern effect for the different instruments analysed) and by higher taxes to service debt (referring this last effect as being more important in the long term). Also, several authors argue that at the Zero Lower Bound temporary increases on government spending will have a higher multiplier (e.g. Christiano et al., 2011). When the Zero Lower Bound is strictly binding, the nominal interest rate is stuck at zero, so the expected inflation caused by an increase on government spending will cause a decline on real interest rate and, consequently, a larger rise on output (Christiano et al., 2011).

Additionally to the economic features mentioned above, it is also important to remember that different instruments have different impacts on output, and hence different effectiveness. According to several authors, such as Forni et al. (2009), Coenen et al. (2012) and Batini et al. (2014), there is a hierarchy of fiscal instruments according to macroeconomic models. Batini et al. (2014) summarizes this hierarchy looking both on spending side and on the revenue side. On the spending side the highest short-term multipliers are usually related to public investment, followed by government wages and intermediate consumption and, at bottom of the list, the untargeted transfers. On the revenue side usually a shock on consumption taxes perform better, also being called growth-friendly, these instruments improve the GDP, and a shock associated with corporate income taxes and personal income taxes have a worst impact, so lower multipliers due to more negative impacts on GDP. However empirically the results point to a different ordering, Batini et al. (2014) associate labour income taxes with multipliers higher than the ones resultant of corporate income taxes application and even output losses for consumption taxes and they only confirm larger multipliers associated with public investment in emerging countries.

Coenen et al. (2012) highlight the channels through which different instruments affect the fiscal multipliers: while public investment and consumption shocks impact directly on the aggregate demand, taxes and transfers operate through personal disposable income, as well as incentives in cases of distortionary taxation.

Finally, in cases of fiscal consolidation, Alesina et al. (2015) find higher output losses when they are based on taxes and they state especially low costs, in terms of output losses, when consolidations are based on spending cuts in a permanent way.

Table 1, below, summarizes the economic characteristics that can affect fiscal policy effectiveness.
Table 1. Summary of fiscal multipliers' (FM) determinants

<table>
<thead>
<tr>
<th>Economic Features</th>
<th>Relationship</th>
<th>Authors</th>
</tr>
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<tbody>
<tr>
<td>Trade Openess</td>
<td>Smaller FM</td>
<td>Barrel et al. (2012)</td>
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<td></td>
<td>Opened economies</td>
<td>Ilzetzki et al. (2013)</td>
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<td></td>
<td></td>
<td>Batini et al. (2014)</td>
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<tr>
<td></td>
<td>More rigid labour markets</td>
<td>Batini et al. (2014)</td>
</tr>
<tr>
<td>Automatic Stabilizers</td>
<td>Smaller FM</td>
<td>Dolls et al. (2012)</td>
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<tr>
<td></td>
<td>Larger automatic stabilizers</td>
<td>Batini et al. (2014)</td>
</tr>
<tr>
<td>Exchange Rate Regimes</td>
<td>Larger FM</td>
<td>Corsetti et al. (2012)</td>
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<td></td>
<td>Predetermined exchange rates</td>
<td>Born et al. (2013)</td>
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<td></td>
<td></td>
<td>Ilzetzki et al. (2013)</td>
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<tr>
<td></td>
<td></td>
<td>Batini et al. (2014)</td>
</tr>
<tr>
<td>Debt Level</td>
<td>Smaller FM</td>
<td>Kichner et al. (2010)</td>
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<td></td>
<td>High debt-levels</td>
<td>Huidrom et al. (2016)</td>
</tr>
<tr>
<td>Level of Development</td>
<td>Larger FM</td>
<td>Ilzetzki et al. (2013)</td>
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<tr>
<td></td>
<td>Industrial countries</td>
<td>Batini et al. (2014)</td>
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<tr>
<td>Cycle Phases</td>
<td>Larger FM</td>
<td>Michaillat (2011)</td>
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<tr>
<td></td>
<td>Recession</td>
<td>Auerbach and</td>
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<td>Gorodnichenko (2012)</td>
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<td>Canzoneri et al. (2016)</td>
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<tr>
<td>Monetary Policy</td>
<td>Larger FM</td>
<td>Christiano et al. (2011)</td>
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<tr>
<td></td>
<td>Monetary accommodation</td>
<td>Coenen et al. (2012)</td>
</tr>
</tbody>
</table>
2.2. Economic Inequality

2.2.1. Definition and measurement

Although our focus is on income inequality, it is relevant to define economic inequality in a more general sense. Jenkins (1991, p. 4) defines economic inequality as “differences in access or control over economic resources”. This can apply to, e.g., consumption, wealth, skills or income. We will focus on income inequality as it closely relates to other forms of economic inequality, such as wealth or consumption inequality.

In this sense it is important clarify that income represents a flow, measuring the quantity of good and services produced and distributed each year and it can be accessed by the sum of labour income and capital income (Piketty and Saez, 2014). Therefore, income inequality is related with mechanisms that “include the supply of and demand for different skills, the state of the educational system, and the various rules and institutions that affect the operation of the labour market and the determination of wages” (Piketty, 2014, p. 742).

Atkinson (1970) explain the measure of inequality as a comparison of two frequency distributions for a given income, there are several ways to represent and measure income inequality. Accordingly to Jenkins (1991) the income distribution may be graphically represented by: “Histograms and Kernel Density Estimates”; “Pen’s Parade – the Quantile Function” or “Lorenz Curves”. The same author also presents several measures to summarize inequality: variance, percentile ratio measures, the Robin Hood index and the Gini index.

In order to define the best measure, Jenkins (1991) mention four properties that must bind. First, the index must have the scale invariance property, that is it should be the same regardless the scale of measure. The second property is the “replication invariance”, by which a replication of the population and their incomes must not change the aggregate inequality. Additionally, a third property is the symmetry axiom – the index depends only on the income values used to construct it, i.e. it is not important who earns the income- underlying the importance of equalization. Last but not least, the principle of transfers according to which if there is an income transfer from an individual to another with lower income so the new distribution should be preferred.

The Gini index is most-commonly used and takes values from 0 to 1, perfect equality to perfect inequality, respectively, and it is defined as “the ratio of the area enclosed by the Lorenz curve and the diagonal line of perfect equality to the total area below the diagonal” (Jenkins 1991, p. 15). In
accordance, the Lorenz Curve is the graph that represents the cumulative income shares against the cumulative population share (see, among others, Jenkins, 1991). Thus, the Gini index compares the cumulative shares of the population against the cumulative shares of income they receive, taking the value 1 when all income is held by a single person – perfect inequality.

2.2.2. Income inequality and the economy

There are in the literature some debate about the relationship between the economy and income inequality: on the one hand, what are the economic characteristics that affect income inequality and, on the other hand, how income inequality can impact on economic variables.

The core of this discussion is the relationship between income inequality and economic growth, where it is possible to find authors who defend a positive correlation and the opposite relationship as well. García-Peñalosa and Turnovsky (2006) say that these dual criteria are expected since the variables are endogenous and consequently their co-movements may depend on the changes (structural or political) caused by them.

Neves and Silva (2014) present an analysis of the theoretical and empirical studies about this relationship. They find four transmission mechanisms associated with different theories which point to opposite conclusion as said before: i) credit market imperfection channel; ii) fiscal policy channel; iii) socio-political instability channel; and iv) saving channel

The first identified channel is related with credit market imperfection and it is been explored since Galor and Zeira (1993). These authors developed an equilibrium model with overlapping generations and inter-generational altruism, where the individuals only differ in their inherited wealth, concluding that the more biased the distribution of wealth is to the poorer the worst the investment in human capital, the skilled work and the bequest leaved, meaning that inequality impacts negatively the growth.

The second channel is the fiscal policy one. Neves and Silva (2014) note two perspectives for this channel. The first view, also explained by Perotti (1996), presupposes two links leading to the result of higher growth with lower inequality: the political mechanism – the decrease on distortionary taxation implies increase in growth due to the median voter behaviour - and the economic mechanism - negative impact of taxation and redistribution on investment and consequently on growth. In a more recent perspective it is established an
association between the fiscal policy channel and the capital market imperfections channel: Neves and Silva (2014) point to a negative relationship between inequality and redistribution whose impact on growth depends on the balance between credit constraints and incentive distortions.

The third channel, also pointing to a negative long-term relationship between inequality and growth, is called by Neves and Silva (2014) *Socio-political Instability Channel*. According to the authors this channel acts through two links: (1) political instability caused by initial inequality in wealth or income and (2) the negative impact of the instability on investment and growth.

Last but not least, on the theoretical side of the literature, appears the saving channel which is based on the hypothesis of a higher marginal propensity to savings by the richer, indicating a positive impact of inequality on growth due to higher aggregate savings and, consequently, higher investment and growth in response to higher inequality.

From the empirical perspective, the results depend on methodologic issues. Neves and Silva (2014) conclude that in cross section studies, in less developed countries and using wealth distribution, the impact is negative and more pronounced. On the contrary, the results tend to be positive, although not significant, on panel data analysis with developed countries when income inequality is considered.

On the opposite way of this relationship Roine *et al.* (2009) find a positive impact of economic growth and financial development on top-income shares. The authors justify the positive impact of economic growth by the simple fact that top incomes are more related to actual performance, since their income is tied to the actual development, for instance, through bonus programs or stock options, causing higher inequality. Similarly, the authors relate financial development with increases on total capitalization and consequently advantages to top income shares, however the impact on the overall distribution of income is more limited.

On the other hand, trade openness seems to affect little top-income earners on average, and, if any, the impact is negative. Roine *et al.* (2009) study Anglo-Saxon countries and continental Europe countries having similar results on the impact of economic growth and financial development but in case of trade openness the effects are different which makes them think that the labour markets institutions may play a role on the differences observed.

Still related with the degree of opennessness, Jaumotte *et al.* (2013) study the impact of increasing globalization on income inequality. They find evidence of two counterweighing
effects of globalization. Firstly, and in the same line of thought as Roine et al. (2009), they find a reduction on income inequality due to the increase of trade. Concerning to this effect the authors divide their analyses between developed and developing countries. In developing countries, they find that the improvement on agriculture sector and the shift from primary sector to industry and services, in countries where there is a higher percentage of population working on primary sector, leads to the decrease in inequality in response to an increase on trade. In case of developed countries this effect is not so clear, they find that an increase of imports from developing countries reduces inequality but in case imports come from advanced economies the effect is opposite, the authors argue that in the first case people will move from low-ending manufacturing jobs to the services sector which does not happen in the latter situation. On the other hand, and inversely, Jaumotte et al. (2013) state that foreign direct investment (FDI) can increase income inequality since financial globalization allows agents to invest and borrow more easily in production or in human capital benefiting capital owners’ future income and impairing the agents who are unable to invest. All in all, they conclude that the second effect from FDI exacerbate the effect of the degree of openness.

Piketty and Saez (2014) also argue that globalization, by leading to skill-biased technical changes and to the increase of information technology, can lead to higher income inequality. They affirm that there is a “race between education and technology” (p.842) associated with a rise in the supply of skills and a rise in the demand of skills, respectively. Defending that the impact on income inequality depends on the faster process to occur.

Kumhof et al. (2015) explore the relationship between income inequality, leverage and crises. They introduce a theoretical model where a growing income share of high-income households leads to an increase of credit supply allowing higher consumption levels by poor and middle-income households. Thus, the loans keep growing and, consequently, the probability of crises.

Auclert (2017) looks at the transmission mechanism of monetary policy to consume and argues that redistribution is a channel through which this transmission occurs. He finds an “earnings heterogeneity channel” explained by the fact that monetary expansions induce gains in earnings both from labour and profits, despite it is expected that this distribution would be unequal. Moreover by the “fisher channel”, the nominal creditors will loose and the nominal debtors will gain since there will be unexpected inflation. A third channel is called “interest rate channel” acting through the fall of real interest rates, the author claim that assets holders will not be beneficiate by it, instead he invites us to think about the maturity of their assets
compared to their liabilities. The mechanism explained by Auclert (2017) show that monetary policy certainly affects income inequality since the mechanism considered will have a redistributive impact, decreasing inequality.

In a different point of view but also meaningful to this analysis, Auclert and Rognlie (2018) approach the impacts of income inequality on consumption and output. They find that transitory inequality shocks can decline consumption and output. However these effects are not significant. Looking at the long run they find stronger effects on output in case where inequality is the manifestation of higher individual income risk and volatility, and the interest rate response is constrained. In this last case, they point the long-run households asset demand as an important variable to explain the effect found, since the impact on consumption loses significance.

Table 2, below, summarize relationships that can be established between some economic variables and income inequality.

### Table 2. Summary of relationship between income inequality and economic features

<table>
<thead>
<tr>
<th>Economic Features</th>
<th>Relationship with Inequality</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Higher Inequality through positive impact on top income</td>
<td>García-Peñalosa and Turnovsky (2006) Roine et al. (2009)</td>
</tr>
<tr>
<td>Financial Development</td>
<td>Higher Inequality through positive impact on top-income shares</td>
<td>Roine et al. (2009)</td>
</tr>
<tr>
<td>Trade Openess</td>
<td>Lower inequality (little impact)</td>
<td>Roine et al. (2009) Jaumotte et al. (2013)</td>
</tr>
</tbody>
</table>
Table 2. (continuation) Summary of relationship between income inequality and economic features

<table>
<thead>
<tr>
<th>Economic Features</th>
<th>Relationship with Inequality</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Globalization</td>
<td>Two counterweighing effects: 1) lower inequality (trade); 2) higher inequality (FDI)</td>
<td>Jaumotte <em>et al.</em> (2013)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pikkety and Saez (2014)</td>
</tr>
<tr>
<td>Leverage</td>
<td>Higher inequality leads to higher leverage (crisis)</td>
<td>Kumhof <em>et al.</em> (2015)</td>
</tr>
<tr>
<td>Monetary Policy</td>
<td>Redistributive impact, consequently lower inequality</td>
<td>Auclert (2017)</td>
</tr>
</tbody>
</table>

2.3. Mechanisms through which inequality affects fiscal policy effectiveness

Recently, a new branch in the literature started inspecting the role of another structural factor affecting fiscal policy effectiveness: unequal distribution of wealth and income. In what follows we provide a, yet inexistent, comprehensive literature review on the state of the art covering this research topic. We propose to carefully detail the mechanisms linking broad economic inequality dimensions (e.g., consumption, wealth and income) to the fiscal policy effectiveness, measured by the size of fiscal multipliers.

In regard to the direct relationship between inequality and fiscal multipliers, Brinca *et al.* (2016) find a positive correlation between wealth inequality and fiscal multipliers due to the impact of the fraction of credit-constrained individuals and of the average wealth level. According to the authors, higher government consumption, financed through lump-sum taxes, will lead to an increase in labour supply, particularly strong among credit-constrained, poorer, workers. In addition, marginal propensity to consume is also larger among credit-constrained agents. Hence a wealthy economy, with a smaller proportion of credit-constrained agents, will have lower fiscal policy effectiveness. Moreover, under imperfect capital markets, average interest rates are lower for wealthier economies and that turns smaller the impacts of government spending on the individuals’ budget constraint, reducing the fiscal multiplier.
More recently, still relying on the mechanism of how credit-constrained agents respond to fiscal consolidation plans, Brinca et al. (2017) introduce a new mechanism in a model documenting a strong positive relationship between income inequality and the recessive impacts of fiscal consolidation plans, thus between income inequality and the size of fiscal multipliers. By reducing government debt, capital-to-labour increases and put upward pressures on wages. This produces an income effect that has a negative impact on labour supply and to which credit-constrained households react by less than non-constrained ones. When inequality is driven by higher idiosyncratic productivity risk, precautionary savings are higher and thus the fraction of credit-constrained agents is lower. This means that income effects from debt consolidation on decreasing labour supply are larger, and thus inducing a larger fall in output (larger multiplier). This mechanism though, assumes a negative correlation between inequality and the fraction of credit-constrained consumers, since the authors state that inequality is driving by idiosyncratic risk and consequently a lower fraction of constrained agents due to higher precautionary savings.

Working on a close subject, Dosi et al. (2013) conclude that more unequal economies face worst business cycle fluctuations, higher unemployment rates and greater probability of crises, and the more income distribution is biased towards profits (higher inequality) the greater the effects of fiscal policy (higher multiplier). They use mark-up rates to define the income distribution, and higher mark-up rates mean a distribution more biased to profits, reminding that these results where reach in a scenario of a positive level of fiscal redistributive policy. The authors point out the importance of redistributive policy to dampen the business cycle in presence of income distribution skewed toward profits.

Anderson et al. (2016) also bring into discussion the importance of heterogenous agents in the study of the effects of unexpected changes in fiscal policy. They conclude that the wealthiest and working-age individuals react more negatively to government spending policy shocks, decreasing their consumption due to be less credit-constrained. This is consistent with Real Business Cycle models that predict a decrease in consumption in response to the increase in government consumption due to expectations of higher taxes in the future. Krueger et al. (2016) also prove that wealth inequality can amplify the effects of aggregate shocks, nevertheless it is important, as mentioned above, the presence of a large fraction of “wealth-poor households”. They argue that in context of a recession, those agents react more by reducing consumption implying a lower collapse in investment and consequently a faster recovery.
Antunes and Ercolani (2016), in turn, study the role of households borrowing constraints. The authors say that fiscal policies that entail government debt expansion are expected to make the borrowing constraints tighter because of higher interest rates. It is predicted a cut in consumption because higher interest rates force constrained agents to deleverage and unconstrained agents to make precautionary savings. However, the authors find different reactions of constrained and unconstrained agents in response to such a fiscal policy shock, conjecturing that the aggregate effect of such a shock depends on wealth distribution. For instance, in response to an increase in government transfers consistently distributed, the authors claim that the constrained agents react by increasing consumption, while the unconstrained ones choose to smooth consumption and to buy assets or to decrease their indebtedness in order to pay higher future taxes. Thus if the population is more biased to constrained agents, than the response to the shock will be more effective in terms of aggregate consumption.

Other authors also describe the mechanism working through the marginal propensity to consume (MPC) which depends on the level of household’s wealth. For instance, Carroll et al. (2017) find evidence, considering heterogeneity in impatience among different households and a realist microeconomic income process which captures the dispersion in the distribution of wealth, of a higher MPC in response to a one-time income shock for “low-wealth” households. They conclude, as well, that the average marginal propensity to consume is larger when the fraction of households with less cash is also larger. In the same line of thought, Kaplan et al. (2014) conclude that “wealthy hand-to-mouth consumers” (households that hold little or no liquid wealth despite owing illiquid assets) exhibit a higher MPC out of transitory income shocks. They explain the behaviour of these households based on Kaplan and Violante (2014) in which they refer that “wealthy hand-to-mouth consumers” prefer bearing the welfare lost instead of smoothing the shock because the latter option imply either paying transaction costs over their illiquid assets or holding large balances of cash and consequently high return on illiquid assets or, even, getting credit at expensive interest rates. So the more biased population distribution is towards “low-wealth” and “wealthy hand-to-mouth” consumers, the larger the MPC (the marginal propensity to save is smaller) and, thus, the larger the expected aggregate impacts of fiscal policy.

Pointing in a different direction Palagi et al. (2017) build a model incorporating permanent inequality shocks and consequently a higher fraction of credit constrained agents plus lower aggregate consumption which leads to larger and more persistent falls on
aggregate output. From this model they test the effectiveness of some fiscal instruments—direct government spending or subsidies provided to low-income households—the general conclusion is that fiscal policy dampens the effects of those shocks presenting multipliers higher than one. Also, subsidies are more efficient than government spending, since the first instrument benefits low-income households which present higher marginal propensity to consume. However, they realise that inequality shock with larger magnitude leads to decrease of fiscal multipliers due to a larger redistributive effect in favour of richer agents (savers), leading to the augment of leakage in aggregate expenditure in the presence of credit rationing.

Looking at the American Recovery and Reinvestment Act (ARRA) 2009, Drautzburg and Uhlig (2015) include credit constrained agents in their model in order to quantify the fiscal multipliers in response to that fiscal stimulus. According to the results, this type of agents is important to be considered in terms of fiscal policies effectiveness. They argue that there are two reasons why the fraction of credit-constrained households is crucial: the first is the violation of Ricardian equivalence by this portion of population (amplifying the stimulus effect); and the second is the aggregate effects of transfers’ distribution to these credit-constrained households. They find that both a rise of constrained agents and a larger share of transfers to those consumers impact the size of fiscal multiplier by increasing it. Assuming that both represent lower inequality, then there is a negative correlation between inequality and the fiscal multiplier.

Samanta and Cerf (2009) using a set of transitional and developing countries and applying different types of econometric estimations (panel data approach and cross section approach) reach consistent results: less effectiveness of fiscal policy when economies are more unequal.

An important note is that despite the focus on wealth inequality by the majority of the authors, income and wealth inequality can be related, moreover income also includes wealth income and reflects, partially, wealth inequality. Notwithstanding the greater concentration on wealth inequality, both are positively correlated (Diaz-Gimenez et al., 1997). Hence, it is expectable that differences on income inequality will have different impacts on fiscal policy effectiveness due to heterogeneous behaviour from individuals.

Table 3, below, summarize relationships that can be established between some income inequality and fiscal policy and the implicit mechanisms.

---

3 Based on Bernheim (1987) the Ricardian Equivalence assumes that individuals’ lifetime budgets do not depend on the timing of taxes implementation. Therefore, consumption decisions should not be affected by the increase of government consumption debt-financed.
Table 3. Summary of relationship between income inequality and fiscal policy

<table>
<thead>
<tr>
<th>Income and Fiscal Policy</th>
<th>Mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive correlation</td>
<td></td>
</tr>
<tr>
<td>• Increase labour supply, larger between credit constrained;</td>
<td>Brinca et al. (2016) (Shock in government consumption)</td>
</tr>
<tr>
<td>• Higher MPC of credit constrained;</td>
<td></td>
</tr>
<tr>
<td>• Lower interest rates (imperfect capital markets) in wealthier economies.</td>
<td></td>
</tr>
<tr>
<td>• K/L increase (\rightarrow) pressure on the wages (\rightarrow) decrease labour supply;</td>
<td>Brinca et al. (2017) (Fiscal consolidation)</td>
</tr>
<tr>
<td>• Precautionary savings (\rightarrow) less credit constrained (\rightarrow) higher response to first effect.</td>
<td></td>
</tr>
<tr>
<td>• More unequal: Worst business cycle fluctuations; Higher unemployment; Higher probability of crises.</td>
<td>Dosi et al. (2013)</td>
</tr>
<tr>
<td>• Less constrained (\rightarrow) expectation of future taxes (\rightarrow) decrease consumption</td>
<td>Anderson et al. (2016) (Spending policy)</td>
</tr>
<tr>
<td>• “wealth-poor” agents (\rightarrow) react more in terms of consumption</td>
<td>Krueger et al. (2016)</td>
</tr>
</tbody>
</table>
Table 3. (Continuation) Summary of relationship between income inequality and fiscal policy

<table>
<thead>
<tr>
<th>Income and Fiscal Policy</th>
<th>Mechanism</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive correlation</td>
<td>• Constrained agents increase consumption; • Unconstrained agents buy assets and decrease indebtedness</td>
<td>Antunes and Ercolani (2016) (transfers equally distributed)</td>
</tr>
<tr>
<td>Credit constrained agents (higher inequality) → higher MPC (higher response to income shock)</td>
<td></td>
<td>Kaplan et al. (2014) Kaplan and Violante (2014) Carroll et al. (2017)</td>
</tr>
<tr>
<td>Negative Relationship</td>
<td>• Inequality shocks with high magnitude → larger redistributive effect to richer – savers.</td>
<td>Palagi et al. (2017)</td>
</tr>
<tr>
<td></td>
<td>• Non-Ricardian behaviour of credit constrained; • Different responses to transfers.</td>
<td>Drautzburg and Uhlig (2015)</td>
</tr>
<tr>
<td></td>
<td>• Based only on econometric estimation</td>
<td>Samanta and Cerf (2009)</td>
</tr>
</tbody>
</table>

Additionally, McKay and Reis (2016) provide some indirect insights on the link between inequality and fiscal policy effectiveness, namely on the role of automatic stabilizers to stabilize the business cycle. They state that the impact of lowering taxes on personal income, or reducing the progressivity of them, does not have a significant impact on attenuating the volatility of the business cycle. However, higher transfers targeted to the unemployed and the poorer are quite effective at lowering the volatility of aggregate output. In opposite to the mechanisms presented throughout former revised papers, McKay and Reis (2016) results show that some fiscal instruments used to reduce inequality are more effective for macroeconomic stabilization purposes.
As well Kaplanoglou et al. (2015) argue that “fiscal fair adjustments”, meaning fiscal policy that support the weaker parts of society, may be more efficient. They find a statistically significant positive impact in a sustained deficit reduction when the social transfers are targeted with a goal of poverty alleviation. Thus, if the so called “fiscal fair adjustments” are more effective we may deduce that the lower the income inequality (resulting from such policies) the better the policy effectiveness.

In addition to the mechanisms described in this section, which show a more direct relationship between fiscal policy effects and inequality, we conjecture that if income inequality is explained by some of the structural features of the economy (such as the size of the government, financial development, trade openness, economic growth, globalization and leverage) or can impact on some of them, the widely-studied impacts of these features on the fiscal multiplier can also be, at least partially, explained by the impact on inequality.

Therefore it is central to keep in mind how different economic environments impact on income inequality, already exposed in the previous section. It becomes clear that the fiscal policy effectiveness may crucially depend on the conditions of the economy regarding inequality. Moreover, it seems accurate to assume that this relation may even help explaining how some structural features of the economy, already widely studied in the literature (e.g., development level, debt levels, trade openness), shape fiscal multipliers.

Bearing in mind the relationships showed before, we speculate that since both the size of fiscal multipliers and income inequality are influenced by business cycle phases, the latter may operate on the policy effectiveness through impacts on inequality. Furthermore, the probability of a crisis occurrence is larger when inequality is high, and this may help explain why during recessions, multipliers tend to be larger. Also, the economic growth and financial developments may have a positive impact on the multiplier because they foster inequality; in turn, one of the mechanisms that may explain lower fiscal multipliers in open economies is the impact of trade openness on, eventually, lowering income inequality. Still it can be noticed by the information provided earlier that monetary policy may have redistributive effects and may have impact on fiscal policy effectiveness. In the following we display a figure summing up these relationships:
Figure 1. Economic characteristics affecting income inequality and fiscal policy
3. Methodology

In order to test the impact of income inequality on the effectiveness of fiscal policy, we propose an empirical approach divided in two parts.

Using a sample of European Union (EU) countries, we first apply a vector autoregressive model (VAR) to estimate fiscal multipliers for spending and revenue in each country. Based on the data used to compute the multipliers we divide the sample between countries above and below average Gini index, as the goal is to study how most equal/unequal countries perform in terms of output responses to fiscal shocks. Second, on a cross-section basis, we regress Gini indexes on fiscal multipliers - for both public spending and revenue - using ordinary least squares (OLS) method. To complement this analysis, we estimate, also by OLS, the effect of income inequality in cases where other economic features, largely recognized as determinants of fiscal policy effectiveness, are included as independent variables.

The methodology followed in the first part of our empirical work is of standard use in the estimation of fiscal multipliers and in analysing determinants of fiscal policy effectiveness (see, e.g., Auerbach and Gorodnichenko, 2012 and Ilzetzki et al., 2013). As for the methodology used in the second, we will follow the work of Brinca et al. (2016), although we focus only on developed countries, namely EU members, and extend the empirical model to include, as controls, additional variables that are, according to literature, meaningful to explain the size of fiscal multipliers.

3.1. Methodology – Overview and model selection

The use of vector autoregressive models for the computation of fiscal multipliers has gained importance among economists over the years. In fact, inspired by the use of structural VAR models to assess the effects of monetary policy on output some authors decided to apply it to fiscal policy. Blanchard and Perotti (2002) consider that this kind of models are even more suitable to assess fiscal policy effectiveness, since there are clearly pure exogenous fiscal shocks and the decision and implementation lags allow that, at high frequencies, there is no discretionary response of fiscal policy to unexpected movements in activity. This enables a better identification of fiscal shocks and of the ordering of endogenous variables
than that we can achieve for policy feedback instruments that react at higher frequency, as is the case of central bank’s official rates.

The reduced VAR model can be described as:

\[ Y_t = \sum_{k=1}^{K} C_k Y_{t-k} + e_t \quad \cdots (1) \]

where \( Y_t \) represents the \( n \)-dimension vector of endogenous variables. \( C_k \) is a \( n \times n \) matrix of estimated coefficients. The index \( k \) represents the number of lags used in the model. As in any econometric estimation, the \( e_t \) is the reduced form of the estimation residuals and the \( t \) subscript refers to time. According to Perotti (2004), the reduced form of the residuals can be assumed as combination of automatic stabilizers, systematic discretionary response and random discretionary shocks to fiscal policies. The structural fiscal shock is meant to capture and reflects the last effect.

The structural VAR model has the following form:

\[ A_0 Y_t = \sum_{k=1}^{K} A_k Y_{t-k} + Bv_t \quad \cdots (2) \]

where \( A_0 \) is the matrix of the contemporaneous effects among variables in \( Y_t \). Furthermore, the relation between the reduced form (\( e_t \)) and the structural form (\( v_t \)) of the residuals is given by matrix \( B \), in the following way:

\[ v_t = B^{-1} A_0 e_t \quad \cdots (3) \]

The impact of fiscal policy can be measured by the behavior of variables included in \( Y_t \), through impulse response functions. Impulse responses summarize the dynamics of all endogenous variables included in the system responding to a one-unit increase in the value of a structural residual, with all the other residuals fixed.

After defining the structural form of the VAR, one of the main issues largely discussed by the authors who use this method is the identification of fiscal policy shocks. According to Hebous (2011) there are four approaches: the recursive formulation (Cholesky decomposition); the structural identification; the sign restriction approach and, finally, the narrative (dummy variable) approach. The first one relies on the fact that the first variable considered in the VAR model is the less endogenous, responding contemporaneously only to its own exogenous shock; the second variable responds, contemporaneously, to the shock in the first variable and also to its own shocks and so on. According to the second approach, the elasticities of spending and taxes to output are exogenously imposed to the VAR (see,
e.g., Blanchard and Perotti, 2002). The third approach imposes a sign to the impulse response of the fiscal variables (see, e.g., Mountford and Uhlig, 2009). And the last one uses dummy variables to capture pure discretionary shocks’ periods identified from the analysis, e.g., of reports on the meetings of fiscal committees - mostly used on studies applied to U.S. economy (see, e.g., Ramey and Shapiro, 1998).

We choose to rely on the Cholesky ordering already used in previous works as in Fatás and Mihov (2001) and Corsetti and Müller (2006), among others. In this case the ordering of the variables also indicates the tentative causal relationship between the variables. Therefore, it is important to understand the theory behind the order chosen. It is common to assume that government spending is predetermined and does not depend on current macroeconomic shocks or tax changes (e.g., Blanchard and Perotti, 2002 and Fatás and Mihov, 2001). Fatás and Mihov (2001) argue that tax changes are pre-announced and consequently captured by expectation variables. Additionally, Blanchard and Perotti (2002) note that government expenditure and government revenue must be both included when studying the effects of fiscal policy since they are, presumably, not independent. Thus, in our VAR model we assume the following, rather standard in literature, order:

\[ \text{Government expenditures} \rightarrow \text{Gross Domestic Product} \rightarrow \text{Government revenue} \]

This means that on equation (2), matrix \( A_0 \) and the matrix \( B \) can be replaced, correspondingly, by:

\[
\begin{bmatrix}
1 & 0 & 0 \\
\alpha_{21} & 1 & 0 \\
\alpha_{31} & \alpha_{32} & 1
\end{bmatrix}
\begin{bmatrix}
\varepsilon_{\text{expenditure}} \\
\varepsilon_{\text{output}} \\
\varepsilon_{\text{revenue}}
\end{bmatrix}
= 
\begin{bmatrix}
1 & 0 & 0 \\
0 & 1 & 0 \\
0 & 0 & 1
\end{bmatrix}
\begin{bmatrix}
\nu_{\text{expenditure}} \\
\nu_{\text{output}} \\
\nu_{\text{revenue}}
\end{bmatrix}
\]

Another important point to discuss when applying a VAR is the lag structure. To decide on the optimal number of lags to include, we can rely on some information criteria as Akaike or Schwartz criterion (Hebous, 2011). The best criteria to be used depend on the sample’s number of observations. For our small sample, with less than 100 observations per country, we base our choice on Akaike Criteria, determining the use of four lags. This is consistent with Ilzetzki et al. (2013) - who also use quarterly data and a lag structure of \( k = 4 \).

Having fiscal multipliers estimated, we first attempt to split the sample between two groups: countries with higher than sample-average inequality and economies below sample-average. From this point we check for differences in the average responses to fiscal shocks across the two groups.
In the second part of our empirical analysis, we regress the values of fiscal multipliers previously computed for each country on an average inequality measure, as in Brinca et al. (2016), using only cross-sectional data for each country. The cross-section baseline model is described by:

$$FM_n = \alpha + \beta_1 Gini_n + \varepsilon_n \cdots \cdots (7)$$

In this model we regress the estimated fiscal multiplier (FM) for country n on the Gini coefficient in country n. Given that $\beta_1$ describes the change in $FM_n$ in response to a unit change in $Gini_n$, this estimation allows us to establish a relationship between the two variables.

Additionally, we use other variables, widely accepted as determinants of fiscal policy effectiveness, to estimate the effect of Gini index controlling for those factors.

For the both fiscal multipliers on the expenditure side and revenue side, $FM$, we estimate:

$$FM_n = \alpha + \beta_1 Gini_n + \beta_2 Trade Openess_n + \beta_3 Debt Level_n + \beta_4 Degree of development_n + \varepsilon_n \cdots \cdots (8)$$

In this regression, we add, to the original one in Brinca et al. (2016), the variables representing trade openness and debt level for country n (we maintain the effect for degree of development which also appears in Brinca et al. (2016) represented by output per capita). The estimation of the coefficient $\beta_2$, $\beta_3$ and $\beta_4$ represent the response of fiscal multiplier to these economic variables, respectively, and the estimate for $\beta_1$ has the same interpretation as before. The variables choice was based on the fact that these characteristics not only impact fiscal multipliers but also income inequality as discussed on previous section 2.3.

All estimations were performed using EViews9 software.

3.2. Methodology – Data and variables

We collect statistics for 27 EU’s countries - Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom. Despite the availability of data for Luxembourg (the 28th country from EU) we exclude this country from our analysis because most of the workforce is foreign and thus income dispersion as given by the Gini index may be rather distortive.
The fifteen years period from 2002 to 2017 was chosen to be used throughout the whole study. We intend to have the most homogenous period for the 27 countries and across all the variables. By using this homogenised period we also expect to capture more standardised shocks.

Variables used in the estimation of fiscal multipliers (government expenditures; government revenue; GDP) are taken in quarterly frequency from the Eurostat database and are available for the entire period of analysis for all the 27 countries. We choose such date frequency to enhance the performance of the VAR model in the presence of larger samples. Government consumption (VAREXP), gross domestic product (VARGDP) and government revenue (VARREV) used in the VAR should be both stationary and seasonally adjusted. In order to fulfil such requirements, we use variables in logarithms of the fourth difference, i.e., we use quarterly, seasonally-adjusted, growth rates. All the variables are at 2010 constant prices – converted through the application of GDP deflator - to remove the price’s effect. All nominal variables were first homogenised to euros.

Given that for the cross-section analysis we only need period-average values for the variables, we use annual statistics for the Gini coefficient, trade openness, debt level and development level, collected from the AMECO and the United Nations Development Programme (UNDP) databases. We choose equivalised Gini index (GINI_INDEX) to measure inequality, since it matches the properties that Jenkins (1991) points as essential for a good quantification of income dispersion. In what regards variables related to country-specific economic characteristics, we use trade openness (TRADE_OPENNESS) as conventionally computed - exports plus imports divided by two times gross domestic product. The debt-to-output ratio is the variable used for the debt level (DEBT_LEVEL). And, finally, to account for the country’s degree of development (DEGREE_DEVELOPMENT) we use the human development index (HDI) or, alternatively, the GDP per capita.
4. Analysis of results – Income inequality and fiscal policy effectiveness in Europe

The results obtained on the empirical estimation are now presented and analysed. Throughout this section we try to establish a link between our empirical results and those expected from the relevant literature explored throughout previous sections, always trying to highlight the likely theoretical mechanism behind such links. In section 4.1 we compute and analyse fiscal multipliers, providing detailed analysis for countries exhibiting a Gini index above and below average. In section 4.2, we quantitatively assess and analyse whether income inequality has impacts on the size of fiscal multipliers.

4.1. Fiscal multipliers in the EU

We apply a VAR model to each one of the 27 countries, using the previous mentioned Cholesky ordering and a structure of four lags. We now exhibit the results from the estimations performed on Eviews9.

Table 1 illustrates the VAR outcome for France. We first conclude, for a significance level of 5% that the estimation seems to be statistically significant overall, since the observed F-statistic is greater than the F-critical value. Adjusted R² also denote a fairly good adjustment, particularly in the case of the GDP equation.

Table 4. VAR estimation, FR 2004Q1 - 2017Q4

| Vector Autoregression Estimates |  |  |
|--------------------------------|---|---|---|
| Sample (adjusted): 2004Q1 2017Q4 |  |  |
| Included observations: 56 after adjustments |  |  |
| VAREXP | VARGDP | VARREV |
| VAREXP(-1) | 0.461833 | -0.086040 | -0.421636 |
| VAREXP(-2) | 0.102679 | 0.161974 | 0.723275 |
| VAREXP(-3) | -0.016380 | -0.076862 | -0.224451 |

 Obtained by the application of the following command on Eviews9: @qfdist(0.95,3,56).
Using similar VAR estimate for all countries, we then compute impulse response functions of GDP to fiscal shocks. Figure 2 and figure 3 illustrate the impulse responses and the accumulated impulse responses of GDP to spending for Poland and of GDP to revenue for Portugal, respectively, for a horizon of 8 quarters ahead. Even though the impulse responses do not show fiscal multipliers, they provide evidence of their statistical significance and sign. As we will see below, impulse responses provide the required input to compute
impact multipliers, while accumulated impulse responses are need for computing long-term multipliers.

Figure 2. Impulse response of GDP to spending (left-hand panel) and accumulated impulse response (right-hand panel), Poland$^5$

Impact impulse responses functions plotted in left side of figures above show period by period impact on GDP growth from one standard deviation shock in the growth rate of government expenditures (Figure 2) and from one standard deviation shock in taxes (Figure 3). The shock is defined as a one-shot shock in quarter 1. As both responses and confidence lines lie mostly off the zero line, we conclude for the overall significance of the responses. It derives from the assumptions underlying our option for Cholesky ordering, that the first period impact response of GDP to taxes is zero, while, and as expected according to the literature, an increase in government spending will increase GDP on impact and an increase on taxes will decrease GDP.

$^5$ Selected results for illustrative purposes.

$^6$ Selected results for illustrative purposes.
The right side of Figures 2 and 3, in turn, shows the cumulative effects (sum of the impact effects) on GDP growth, resulting from a one-shot shock of one standard deviation in quarter 1 in the growth of government spending and taxes.

Besides the qualitative perception on the sign of the multipliers, the impulse response functions are used to compute estimated fiscal multipliers. For the impact, or short-run, multiplier we base our analysis on the impact impulse responses (as in left side of the displayed figures) while for the long-run, cumulative, fiscal multipliers we use the accumulated responses (as in right side of the figures above). To compute fiscal multipliers we need two components: i) the elasticity of GDP to a fiscal instrument – the ratio between the reaction of GDP to a fiscal shock and the reaction of fiscal policy to itself from the computed directly from impulse responses; ii) the average weight of government spending (or revenue) GDP (Marvão Pereira e Roca-Sagalés, 2011). Fiscal multiplier is defined by how many euros GDP increases due to a shock of one euro in government spending (or revenue), \( i.e., \) i) over ii). This procedure is replicated to the 27 countries and for shocks in both government revenue and expenditures. Results for the computed multipliers are shown in Tables 4 and 5.

### Table 5. Fiscal multipliers of government expenditures, impact (1Q) and cumulative (1Y) or (2Y)\(^7\)

<table>
<thead>
<tr>
<th>Country</th>
<th>1Q</th>
<th>1Y</th>
<th>2Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>-0,0247</td>
<td>-0,1095</td>
<td>-0,2049</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>0,0068</td>
<td>0,0260</td>
<td>0,0136</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>-0,0024</td>
<td>-0,0627</td>
<td>-0,1067</td>
</tr>
<tr>
<td>Denmark</td>
<td>-0,0518</td>
<td>-0,1791</td>
<td>-0,2213</td>
</tr>
<tr>
<td>Germany</td>
<td>-0,0348</td>
<td>-0,1606</td>
<td>-0,2338</td>
</tr>
<tr>
<td>Estonia</td>
<td>-0,0583(^*)</td>
<td>-0,3963(^*)</td>
<td>-0,7466</td>
</tr>
<tr>
<td>Ireland</td>
<td>-0,0082</td>
<td>-0,0084</td>
<td>-0,0072</td>
</tr>
<tr>
<td>Greece</td>
<td>0,0353(^*)</td>
<td>0,1171</td>
<td>0,1595</td>
</tr>
<tr>
<td>Spain</td>
<td>-0,0141(^*)</td>
<td>-0,0513</td>
<td>-0,1794</td>
</tr>
<tr>
<td>France</td>
<td>0,0438</td>
<td>0,1097</td>
<td>0,2069</td>
</tr>
<tr>
<td>Croatia</td>
<td>-0,0502</td>
<td>-0,1576</td>
<td>-0,5340</td>
</tr>
</tbody>
</table>

\(^7\) The values marked with \(^*\) represent estimates that are statistically significant. The same is applied to the following two tables.
Table 5. (Continuation) Fiscal multipliers of government expenditures, impact (1Q) and cumulative (1Y) or (2Y)

<table>
<thead>
<tr>
<th>Country</th>
<th>1Q</th>
<th>1Y</th>
<th>2Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italy</td>
<td>0,0272</td>
<td>0,3638</td>
<td>0,3605</td>
</tr>
<tr>
<td>Cyprus</td>
<td>0,0091</td>
<td>0,0307</td>
<td>0,0605</td>
</tr>
<tr>
<td>Latvia</td>
<td>0,0175</td>
<td>-0,0020</td>
<td>0,0465</td>
</tr>
<tr>
<td>Lithuania</td>
<td>-0,0010</td>
<td>-0,0305</td>
<td>-0,0421</td>
</tr>
<tr>
<td>Hungary</td>
<td>0,0134</td>
<td>0,0960</td>
<td>0,2010</td>
</tr>
<tr>
<td>Malta</td>
<td>0,0259</td>
<td>-0,0034</td>
<td>-0,0563</td>
</tr>
<tr>
<td>Netherlands</td>
<td>0,0245*</td>
<td>0,0862</td>
<td>0,0171</td>
</tr>
<tr>
<td>Austria</td>
<td>-0,0287*</td>
<td>-0,1622</td>
<td>-0,1227</td>
</tr>
<tr>
<td>Poland</td>
<td>0,0706*</td>
<td>0,2214*</td>
<td>0,3891*</td>
</tr>
<tr>
<td>Portugal</td>
<td>-0,0046</td>
<td>-0,0132</td>
<td>-0,0342</td>
</tr>
<tr>
<td>Romania</td>
<td>0,0164</td>
<td>0,0164</td>
<td>0,0164</td>
</tr>
<tr>
<td>Slovenia</td>
<td>0,0114</td>
<td>0,0388</td>
<td>0,0514</td>
</tr>
<tr>
<td>Slovakia</td>
<td>0,0091</td>
<td>0,0837</td>
<td>0,1777</td>
</tr>
<tr>
<td>Finland</td>
<td>0,2316*</td>
<td>0,4677</td>
<td>0,0390</td>
</tr>
<tr>
<td>Sweden</td>
<td>0,1219*</td>
<td>0,3468</td>
<td>0,2124</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>-0,0143</td>
<td>-0,2347*</td>
<td>-0,4695*</td>
</tr>
</tbody>
</table>

Table 6. Fiscal multipliers of government revenues, impact (2Q) and cumulative (1Y) or (2Y)

<table>
<thead>
<tr>
<th>Country</th>
<th>2Q</th>
<th>1Y</th>
<th>2Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>-0,222</td>
<td>-0,135</td>
<td>-0,411</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>0,001</td>
<td>-0,008</td>
<td>-0,057</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>-0,002</td>
<td>-0,042</td>
<td>-0,098</td>
</tr>
<tr>
<td>Denmark</td>
<td>0,061</td>
<td>0,311*</td>
<td>0,548*</td>
</tr>
<tr>
<td>Germany</td>
<td>0,125</td>
<td>0,529</td>
<td>0,901</td>
</tr>
<tr>
<td>Estonia</td>
<td>0,042*</td>
<td>0,199</td>
<td>0,277</td>
</tr>
<tr>
<td>Ireland</td>
<td>0,025</td>
<td>0,100</td>
<td>0,400</td>
</tr>
<tr>
<td>Greece</td>
<td>0,008</td>
<td>0,007</td>
<td>0,099</td>
</tr>
<tr>
<td>Spain</td>
<td>0,021*</td>
<td>0,137*</td>
<td>0,321*</td>
</tr>
</tbody>
</table>
Table 6. (Continuation) Fiscal multipliers of government revenues, impact (2Q) and cumulative (1Y) or (2Y)

<table>
<thead>
<tr>
<th>Country</th>
<th>2Q</th>
<th>1Y</th>
<th>2Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>0.005</td>
<td>-0.110</td>
<td>-0.225</td>
</tr>
<tr>
<td>Croatia</td>
<td>0.074*</td>
<td>0.220*</td>
<td>0.199*</td>
</tr>
<tr>
<td>Italy</td>
<td>-0.004</td>
<td>0.037</td>
<td>-0.072</td>
</tr>
<tr>
<td>Cyprus</td>
<td>0.002</td>
<td>0.018</td>
<td>0.035</td>
</tr>
<tr>
<td>Latvia</td>
<td>0.061*</td>
<td>0.310*</td>
<td>0.869*</td>
</tr>
<tr>
<td>Lithuania</td>
<td>0.014</td>
<td>0.031</td>
<td>0.054</td>
</tr>
<tr>
<td>Hungary</td>
<td>-0.033</td>
<td>-0.066</td>
<td>-0.004</td>
</tr>
<tr>
<td>Malta</td>
<td>0.002</td>
<td>0.001</td>
<td>0.015</td>
</tr>
<tr>
<td>Netherlands</td>
<td>-0.024</td>
<td>-0.116</td>
<td>-0.204</td>
</tr>
<tr>
<td>Austria</td>
<td>-0.145*</td>
<td>-0.453*</td>
<td>-0.816*</td>
</tr>
<tr>
<td>Poland</td>
<td>0.037*</td>
<td>0.122*</td>
<td>0.225*</td>
</tr>
<tr>
<td>Portugal</td>
<td>-0.024*</td>
<td>-0.103*</td>
<td>-0.324*</td>
</tr>
<tr>
<td>Romania</td>
<td>0.028</td>
<td>0.109</td>
<td>0.015</td>
</tr>
<tr>
<td>Slovenia</td>
<td>-0.052</td>
<td>-0.346*</td>
<td>-0.742*</td>
</tr>
<tr>
<td>Slovakia</td>
<td>0.0001</td>
<td>-0.117</td>
<td>-0.187</td>
</tr>
<tr>
<td>Finland</td>
<td>0.089</td>
<td>0.172</td>
<td>-0.698</td>
</tr>
<tr>
<td>Sweden</td>
<td>0.210*</td>
<td>0.718*</td>
<td>1.122*</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>0.013</td>
<td>0.062</td>
<td>0.196</td>
</tr>
</tbody>
</table>

Some of the results for the fiscal multipliers both for the response to a shock in expenditures and revenues present an opposite sign to what was expected and are statistically significant. Among the relevant literature reviewed above, some evidence was found indicating non-Keynesian effects from fiscal policy shocks, depending on the size and persistence of the shock (see, e.g., Giavazzi and Pagano, 1995). Despite having these unexpected results, we will use the computed FM in the second stage of our empirical approach.

But before, and taking the same time series data, we split the sample into countries exhibiting an average Gini coefficient above and below sample-average. Then, using a panel for the two groups of countries, we perform VAR estimation for each group separately. Figure 4 and 5 depict the accumulated response functions, respectively to a shock in
government spending and revenue. Left-hand panels refer to countries with higher than average Gini coefficient while right-hand panels refer to EU countries that exhibit low inequality.

**Figure 4. Accumulated response of GDP to a shock in government expenditures, high (left-hand panel) vs low (left-hand panel) income inequality in the EU**

From the inspection of the above impulse responses, it seems that EU countries with lower inequality exhibit higher government expenditure multipliers when compared to countries with higher inequality (for which impulse response functions are not statistically significant). This indicates higher response to demand-side fiscal policy in countries with lower inequality.

As for the results in regarding shocks to government revenues (taxes), a tax increase is more likely to result in an increase in GDP where inequality is higher, while it produces no effects on output when inequality is low. In this case, the results point to more efficiency of
this kind of fiscal policy in more unequal countries (higher Gini coefficient), although with evidence for non-Keynesian effects.

The results regarding government expenditures multipliers are distinct from that reported on Brinca et al. (2016) since in their works was shown evidence of higher multipliers in response to a shock in government consumption associated with countries with higher inequality. Unlike the consistence with Brinca et al. (2017) who find evidence of a positive correlation when accounting for a fiscal consolidation between fiscal multipliers and income inequality, accordingly to what we find out.

These results point to two different directions regarding the impact of income inequality on fiscal policy effectiveness depending on the “side” of the shock. We will now proceed with a complementary analysis to verify the robustness of this result.

4.2. Inequality and the size of multipliers in the EU

The second part of our empirical analysis makes use of a cross-section model, considering period-average values of the discussed variables across the 27 countries. We here show the Eviews9 outputs with selected results for OLS estimations of the impacts of inequality level on the size of fiscal multipliers.

In regards to government spending, the baseline model includes the Gini coefficient as the single regressor (see appendix A.1) of the 1-year fiscal multiplier. Apparently, Gini coefficient is not statistically significant to explain government spending multiplier as the corresponding coefficient shows a \( p \text{-value} \) of 0.3345.

In turn, Table 7 shows results for the complete model, where we also control for the degree of openness, the debt level and the degree of development (measured by IDH). The coefficient of Gini index is significant at a confidence level of 90%, however the other three control variables has, apparently, no impact on the size of the government spending in the EU.

The not significant result found for the coefficient of trade openness may be related with large differences in the sample. Usually authors divide the sample between countries opened to trade or closed finding evidence of a relationship between each group and fiscal multipliers. As Ilzetzki et al. (2013) who claim high multipliers for close countries and

---

8 We use the values for fiscal multipliers as shown in the above tables.
negative multipliers for opened. Thus, a very heterogenous sample may it is not possible to establish a pattern.

On the other hand the differences on the multipliers found together with the homogenous sample used in terms of the degree of development may be turning the results of coefficients regarding the degree of development. The values’ gap between the most developed and the less developed country in terms of IDH is only 0.143 - the maximum 0.909 (Denmark) and the minimum 0.766 (Bulgaria) – which means that all the countries have really high levels of human development. According to Ilzetzki et al. (2013) fiscal multipliers should all be high for these economies which does not happen.

Regarding the coefficient of debt level, the fact of being not significant may be explained by the conclusions in Sutherland (1997), since we have countries with very low levels of debt - less than 30% of GDP in Estonia, Bulgaria, Romania, Latvia, Lithuania - which may be skewing the results.


OLS estimates for \( F_{M_n} = \alpha + \beta_1 Gini_n + \beta_2 Trade\_Openess_n + \beta_3 Debt\_level_n + \beta_4 Degree\_development\_IDH_n + \epsilon_n \) \((p-value \text{ in parenthesis})\)

<table>
<thead>
<tr>
<th>( \alpha )</th>
<th>( \beta_1 )</th>
<th>( \beta_2 )</th>
<th>( \beta_3 )</th>
<th>( \beta_4 )</th>
<th>( R^2 )</th>
<th>F-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.866801</td>
<td>-2.212986</td>
<td>-0.227291</td>
<td>0.001574</td>
<td>-1.361245</td>
<td>0.190369</td>
<td>1.293214</td>
</tr>
<tr>
<td>(0.1421)</td>
<td>(0.0860)</td>
<td>(0.1806)</td>
<td>(0.2439)</td>
<td>(0.2387)</td>
<td>(0.303172)</td>
<td></td>
</tr>
</tbody>
</table>

Confirming results in Table 7, above, the higher income inequality is, the smaller will be the effects of a government spending shock on output. This result is statistically significant at 10%. Relying on a sample of developed countries, evidence for a negative relationship between the Gini coefficient and government spending multiplier is, however, dissimilar from the positive relationship found by Brinca et al. (2016). We tentatively find some possible explanations to this result, some related with more direct factors and other of more indirect nature. (1) First, a word of caution in interpreting these results: some fiscal multipliers assume values that are not expected, since we have estimated negative fiscal multipliers of shocks in government spending; moreover, the overall significance of the model falls out of the 90% confidence band \((p-value \text{ of } F-\text{statistic is } 0.303)\). (2) Still, results from Samanta and Cerf (2009) indicate a similar relationship as the one obtained here. The sample used in their study cover for transitional and developing countries, including some countries from our sample, namely,
Romania, Slovenia, Bulgaria, Latvia, Poland, and Lithuania. Besides the difference in the period of analysis, the inclusion of these countries may be biasing the results. (3) A third explanation may be attached with the composition of the expenditures. According with McKay and Reis (2016) transfers targeted to unemployed and poorer agents decrease inequality, also this kind of policy is more efficient. If the composition of government expenses is biased to targeted transfers then we expect lower inequality to be associated with higher effectiveness of the fiscal policy (inverse-causality though). (4) Additionally, Kumhof et al. (2015) associate higher inequality with higher leverage and, for instance, Kirchen et al. (2010) links high debt levels with worst fiscal multipliers, and thus we may conjecture a negative relationship between these two variables. If income inequality is one of the reasons to high debt levels, then its impact on fiscal multiplier will be negative; this argument may also help to explain why debt is not statistically significant as well, given that Gini may be capturing part of its effect on the multiplier. (5) Moreover, the monetary policy impact both on inequality (Aucclert, 2017) and on fiscal multipliers (Christiano et al., 2011). Since monetary accommodation – followed by some policy makers over the past fewer years – lead to higher fiscal multipliers and it also has a redistributive impact, lowering income inequality, then it is expected a negative relationship between the two variables driven by monetary policy (inverted causality).

We performed similar estimations, using multipliers of government revenues. The baseline specification is poorly defined and yields no significance for the Gini coefficient (appendix A.2). When looking at the more complete model we still do not find significant results in a horizon of 1 year (appendix A.3). Notwithstanding, Gini becomes statistically significant at 5% (estimated \( p\)-value of 0.0350) when accounting for a two years (eight quarters) horizon in the more complete model, including the trade openness, the degree of development and the debt level as controls (see Table 8).

**Table 8. Effects of income inequality on government revenue multipliers, EU (2004-2017)**

OLS estimates for \( FM(rev)_n = \alpha + \beta_1 Gini_n + \beta_2 Trade\_Openness_n + \beta_3 Debt\_level_n + \beta_4 Degree\_development_n + \epsilon(rev)_n \) (\( p\)-value in parenthesis)

<table>
<thead>
<tr>
<th>( \alpha )</th>
<th>( \beta_1 )</th>
<th>( \beta_2 )</th>
<th>( \beta_3 )</th>
<th>( \beta_4 )</th>
<th>( R^2 )</th>
<th>F-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>-5.908307</td>
<td>6.589471</td>
<td>0.058783</td>
<td>-0.005775</td>
<td>5.067645</td>
<td>0.266119</td>
<td>1.994398</td>
</tr>
<tr>
<td>(0.0553)</td>
<td>(0.0350)</td>
<td>(0.8820)</td>
<td>(0.0786)</td>
<td>(0.0716)</td>
<td></td>
<td>(0.130611)</td>
</tr>
</tbody>
</table>
From this estimation we conclude for the statistical significance of three variables’ coefficients at a confidence level of 90%, being the coefficient associated with the trade openness the only one not significant. The main results are the following: positive impact of Gini index on fiscal (revenue) multiplier; negative relationship of debt level and positive impact of the degree of development on the fiscal (tax) multiplier.

Relating these results with the literature, Batini et al. (2014) summarizes the results from several authors from that analysis we can relate higher fiscal multipliers with industrialized countries both in case of spending multipliers and revenue multipliers, this last case is consistently with our results - positive coefficient associated with the degree of development, based on HDI. On the opposite side, Sutherland (1997) relate lower fiscal multiplier with higher debt level pointing in the same directions as ours results. Regarding the result indicating not significance for the trade openness coefficient this may be related with a high marginal propensity to import associated with variation on taxes, it is expected little impact on trade openness since the transmission mechanism of a shock in taxes acts mainly through disposable income (Coenen et al., 2012) and, consequently, impacts closer to individual consumption and investment.

Last but not least, from the analysis of the coefficient associated with Gini index ($\beta_1=6.589471$) we find, once again, similar results to what was reported by Brinca et al. (2017). These results point for a higher multiplier associated with higher values of inequality, i.e., a unit increase on Gini coefficient leads to an improvement of, approximately, 6.59 euros on the effects on output per one euro increase in taxes. Economically the overall conclusion is that income inequality intensifies the response of output to a shock, due to its positive impact on fiscal multiplier. Thus, assuming that fiscal multipliers associated with revenues are negative, meaning that an increase in taxes leads to a decrease in product, a higher level of income inequality will lead to less recessive impacts; this conclusion meets the one found by Brinca et al. (2017) of a positive impact of income inequality in response to fiscal consolidation.

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9 Using either GDP per capita or HDI in the estimation, indicating the degree of development the result point for the similar relationship (see appendix A.4).
5. Conclusion

Over the last years worldwide economies faced a fragile situation, driven by the 2008 financial crisis. Policy makers notice the increcent importance of applying policies with the most efficient result. Focusing on European Union, we can notice a superior importance in fiscal policy, since monetary policy is centralized, “local” policy makers have to rely on fiscal policy to achieve better results for each country.

Also the economic and political debate have always had a main concern regarding fiscal policy relate to the dual choice between economic efficiency and equity. The evidence of an unexpected increase in income inequality mainly in developed countries highlights the concerns of policy-makers. Usually the approach to this theme focus on the results of a fiscal policy in terms of inequality, however before that it is important to understand the impact of income inequality as a characteristic that may affect the effectiveness of the fiscal policy. Hence, to find out if the income inequality level may be a determinant of the effectiveness of fiscal policy it is crucial to measure the impact of some inequality indicator on the fiscal multiplier, both qualitatively and quantitatively.

The analysis performed along this study is divided in two parts: a VAR model and an OLS model. The first part consists in a time series analysis to compute fiscal multipliers and after that based on the results to analyse the qualitative relationship between two groups of countries (below and above average of index coefficient) and the fiscal multipliers. In the second part we quantify this relationship, applying a least squares model to a cross sectional sample in which we regress Gini coefficients on fiscal multipliers. Our analysis is based on a sample of UE countries (excluding Luxembourg) and on the period between 2002 and 2017.

Through the computation of the VAR model we reach impact (short run) and cumulative (long run) fiscal multipliers both for government expenditures and revenues. From these results we analyse the mentioned relationship, we get opposite outcomes for multipliers based on expenses and revenues. The results point to a negative impact in case of expenditure multiplier and the opposite one for revenues case.

For the purpose of quantify the impact found we perform a least square model. To go further in the analysis, we also use other economic determinants of fiscal policy in order to understand if the impact remains similar in case where that factors are include. The accomplished results corroborate that obtained on the analysis based on time series data. The negative impact of Gini index in fiscal multipliers associated with expenses is also the result.
of OLS model, and even bind if we consider trade openness, debt level and the degree of development in the estimation. Also the positive relationship associated before with Gini coefficient and revenue’s fiscal multiplier appear in this cross section analysis, and the inclusion of trade openness, degree of development and debt level does not change this result.

Although the consistence between the two models applied, we can recognize some limitations of our analysis: first our fiscal multipliers results have unexpected signs, especially expenditures’ multipliers; also, the facts that our sample size is limited and has a lack of heterogeneity among countries; a third limitation is the use of aggregate of fiscal instruments that may have biased the results; finally the lack of accounting for inverted causality. For future works these are points that may be improved. For the first limitation, it can be simply settled by using multipliers already computed in former works. Regarding the sample issues, in a future work it is important to have countries with larger differences principally on income inequality indicator and the other point seems simply to improve and understand since size of the sample always matter for more consistent estimation. Also, the use of disaggregate instruments could give a better comprehension of the mechanisms implicit in these results. Lastly, the estimation may be reformulated in order to account for inverted causality, for instance by adding an instrumental variable.

The most important conclusion on this study is to understand the extreme importance of consider the heterogeneity of agents when looking for the fiscal policy with the greater effectiveness. Namely, in what concerns to income inequality since our results point to an impact of this feature. So policy makers should consider the distribution of income not only as a goal to be reach with different policies but a determinant of its effectiveness.
Bibliographic References


Webgraphy


Annex

A.1 Effects of income inequality on government spending multipliers, EU (baseline model, 2002-2017)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.300991</td>
<td>0.291793</td>
<td>1.031521</td>
<td>0.3122</td>
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<tr>
<td>GINI_INDEX</td>
<td>-0.952008</td>
<td>0.967402</td>
<td>-0.984087</td>
<td>0.3345</td>
</tr>
</tbody>
</table>

R-squared: 0.037292
Mean dependent var: 0.016031
Adjusted R-squared: -0.001216
S.D. dependent var: 0.186785
S.E. of regression: 0.186898
Akaike info criterion: 0.445317
Schwarz criterion: 0.349329
Log likelihood: 8.011780
Hannan-Quinn criter.: 0.416775
Durbin-Watson stat: 1.825167
Prob(F-statistic): 0.334501

A.2 Effects of income inequality on government revenue multipliers, EU (baseline model, 2002-2017)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
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</thead>
<tbody>
<tr>
<td>C</td>
<td>-0.212265</td>
<td>0.375072</td>
<td>-0.565931</td>
<td>0.5765</td>
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<tr>
<td>GINI_INDEX</td>
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</table>

R-squared: 0.020773
Mean dependent var: 0.058798
Adjusted R-squared: -0.018396
S.D. dependent var: 0.238060
S.E. of regression: 0.240240
Akaike info criterion: 0.056829
Schwarz criterion: 0.152817
Log likelihood: 1.232807
Hannan-Quinn criter.: 0.085371
Durbin-Watson stat: 1.629087
Prob(F-statistic): 0.473227
A.3 Cross-Section Estimation (Revenue Fiscal Multiplier (1Y); Trade openness; Debt level and IDH), 2002-2017

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
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<td>DEBT_LEVEL</td>
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<td>DEGREE_OF_DEVELOPMENT_ID</td>
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<td>1.376948</td>
<td>1.698925</td>
<td>0.1034</td>
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</table>

R-squared                             | 0.251841    | Mean dependent var | 0.058798 |
Adjusted R-squared                    | 0.115812    | S.D. dependent var | 0.238060 |
S.E. of regression                    | 0.223851    | Akaike info criterion | 0.009903 |
Sum squared resid                     | 1.102403    | Schwarz criterion | 0.249873 |
Log likelihood                        | 4.866306    | Hannan-Quinn criter. | 0.081259 |
F-statistic                           | 1.851381    | Durbin-Watson stat | 2.077051 |
Prob(F-statistic)                     | 0.154989    |                    |          |

A.4 Cross-Section Estimation (Revenue Fiscal Multiplier (2Y); Trade openness, Debt level and GDP per capita), 2002-2017

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
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</tr>
</tbody>
</table>

R-squared                             | 0.237255    | Mean dependent var | 0.060743 |
Adjusted R-squared                    | 0.098574    | S.D. dependent var | 0.467264 |
S.E. of regression                    | 0.443637    | Akaike info criterion | 1.377954 |
Sum squared resid                     | 4.329895    | Schwarz criterion | 1.617924 |
Log likelihood                        | -13.60238   | Hannan-Quinn criter. | 1.449310 |
F-statistic                           | 1.710794    | Durbin-Watson stat | 2.444951 |
Prob(F-statistic)                     | 0.183510    |                    |          |