Master's thesis for the Double Degree of the Master in Economics

Fiscal Multipliers and Forecast Errors

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Abstract

The study of the fiscal multipliers is growing interest among economists and generating quite a debate on their determinants, size and forecast methodologies. During the financial crisis there has been some forecasting problems, because it was a unique scenario without any antecedent to support their estimations. In this thesis, we will focus on the Blanchard and Leigh's research '*Growth forecast errors and Fiscal multipliers'* published in 2013, in which they showed an underestimation of the fiscal multipliers in the 2010-2011 period. We are going to extend their baseline estimation from 2011-2012 until 2016-2017. The aim is to check if it was an isolate case and if the researchers have learnt to estimate accurately fiscal multipliers for the following periods, or if there is a deeper bias in the methodology of fiscal multipliers forecast which is to be found out. The result shows that fiscal multipliers have been accurately forecasted, that it just was an isolate 'mistake'. Additionally, we will reinforce our research developing panel data analysis for both data selection, and will carry out a robustness check for the economy's choice and possible influence for outliers for our case. The panel data analysis shows that the forecast has been more accurate after Blanchard and Leigh's exposition of underestimation of fiscal multipliers. In the other part of this robustness check, we will make a difference among three groups of economies: European countries, advanced economies and emerging markets estates. Overall, the baseline estimations have been accurate and robust for the outliers' influence. The results expose that the estimation of the fiscal multipliers is improving after the difficulties of forecasting accurately until 2017 for European countries. However, the fiscal multipliers framework is still being a black box for economic study.

JEL Classification Numbers: C21, C23, E32, E62, F43, H5, H20, H68

Key words: Fiscal multiplier, fiscal consolidation, forecast errors, outliers

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Introduction

For the last 30 years, the study of fiscal multipliers is increasing interest among economists. There is a wide discussion about size, determinants and calculation of the fiscal multipliers. Also, their coefficient changes depending on the economic phase, country (developed or developing), and can be strongly influenced by other economic variables. Furthermore, we obtain different results depending on which kind of fiscal multipliers we are estimating: revenue, spending, etc. There are two common tools to estimate the fiscal multipliers: DSGE models, and the SVAR structural model. There are many factor to be considered and so many problems when trying to spot them, which generates quite a debate among economists.

Nowadays, there is a special reason why this issue is growing interest, which is the last global crisis. During this period different fiscal policies were applied around the world and the fiscal multipliers became the key indicator to decide which measures would be the best for every economy. The financial crisis put the forecasters of fiscal multipliers in an unknown situation.

The International Monetary Fund defines the fiscal multipliers as “Fiscal multipliers measure the short-term impact of discretionary fiscal policy on output.” After this definition, we can clearly observe the importance of this coefficient to decide the best fiscal policies and forecast macroeconomic variables, a reasoning developed in the following sections.

We are interested in analysing the fiscal multipliers’ value, depending on the GDP growth and the fiscal consolidation plan. The purpose of this thesis is to study the estimation of the fiscal multipliers, checking forecast accuracy and if its support the literature.

The structure of this thesis is formed by the literature review, followed by baseline estimation for European Economies from 2011-2012 to 2016-2017. Next, we will carry out a panel data analysis on the Blanchard and Leigh’s baseline for European countries from 2009-2010 to 2010-2011, and also on the baseline for estimated from 2011-2012 to 2016-2017. Besides, we will develop a robustness check for economies choice and outlier influence. We will conclude exposing the conclusions reached after the study.

First, we will develop a meticulous review of the literature regarding the fiscal multipliers forecasted estimation, factors of influence and value. We will study determinants, value methodology, macroeconomic projections and the effect of the financial crisis on fiscal multipliers forecast.

For baseline estimation, we will focus on checking if the forecast of fiscal multipliers has been accurate in the last six years. For this reason, we will base our study in the paper of Blanchard O. and Leigh D. titled '*Growth Forecast Errors and Fiscal Multipliers',* published in 2013. This studies the baseline projection for the relationship between the planned fiscal consolidation and growth forecast error. This paper is focused on the problem of underestimated fiscal multipliers introduced in the box published in the October 2012 World Economic Outlook (WEO, 2012) at the beginning of the crisis. The purpose is to expand the estimation of this paper to check if the underestimation made in the forecast of the fiscal multipliers has been corrected or if nowadays there still exists some 'mistake' in the fiscal multipliers forecast value .

For this reason, we estimate the baseline value for the same model from 2011-2012 to 2016-2017. In this case, we are taking into account the European economies which will variate between 26 and 29 countries. The data base is from the World Economic Outlook. The real accumulative annual percentage GDP growth comes from the October 2017 *World Economic Outlook* and the forecast of GDP growth and forecast of fiscal consolidation are the variables obtained from the database from the year before in t, that is estimation in t of the reference point in t+1. In every estimation we will explain which variables are found in detail.

Next, we will develop a panel data analysis of the model for both data selection models in order to study them with more sophisticate techniques. We found that there is heteroskedasticity in both cases. Furthermore, we concluded that the best model will be for both of them the Random Effects model. It addresses the unobserved heteroskedasticity like random normal distribution, and assumes that there is no correlation between unobserved heteroskedasticity and regressors. The Random Effects model controls for serial correlation and is useful to study the cross-sectional variation. Summing up, Panel data analysis reinforces the previous conclusions about accurate forecasting of fiscal multipliers, and highlights the import role for fiscal multipliers forecast of the economies' features.

Then, we considered a quite interesting development study of the economy's selection and checked the influence of possible extreme values following the logic applied in the paper by Blanchard and Leigh (2013). The results show fiscal multipliers had been accurately estimated for European countries regardless the selection and for advanced economies with remarkable results in front of the outliers' influence. Overall, for emerging economies there has been a minor accurate estimation in the case of baseline 2015-2016, where there was an underestimation, because the emerging economies applied an expansive fiscal policy in order to stimulus their economies and their growth expectative were higher than real results.

Finally, we will show the conclusions reached after our study. We concluded that the fiscal multipliers forecast has been accurate except for the "error" of forecast showed by Blanchard's and Leigh's in 2010-2011. The forecaster perfectly faced the atypical situations generated during the crisis and there was an improvement on the capacity to estimate fiscal multipliers accurately in recession scenarios.

Literature review: Fiscal multipliers

The study of Fiscal multipliers is growing interest among economists, because there is not any wide accepted role for their estimation. There are many factors that have an influence in their value and the methodologies have some inefficiencies. As a result, accurate forecasting of fiscal multipliers is one of the challenges of the current macroeconomy. In this section, we are going to develop a meticulous review of the literature on this field. We will point out the main determinant of the fiscal multipliers size, methodologies for their forecast, macroeconomics projection, and the forecast regarding the financial crisis environment.

The fiscal multipliers is defined by the International Monetary Fund researchers as "the ratio of a change in output to an exogenous change in the fiscal deficit with respect to their respective baseline" (Chinn, 2012; Batini *et al.*, 2014). The value of the fiscal multipliers considers a key indicator to decide the fiscal policy because it shows the sensibility of GDP growth over stimulus or contractive fiscal consolidation plan. That stresses how important is accuracy in their estimation.

On the other hand, we can distinguish the multipliers calculation depending on time frame selected. There are the following kinds of calculation techniques: impact multipliers, with N horizon, peak multipliers and accumulative multipliers. The first one, impact multipliers, consider the effect of the change in the fiscal policy on the GDP at the same moment of the time. Secondly, the multipliers at some horizon N also follows the previous logic but it uses the N period instead of a t moment. Thirdly, the peak multipliers conveys the same causal relationship but focuses on the maximum value. Fourthly, the cumulative multipliers is forecasting how accumulative change in the fiscal consolidation plan affects the accumulative GDP growth at a determinate period. The last one is the best forecast technique, and it is used to obtain higher values than impact and peak methods (Spilimbergo, Symansky and Schindler, 2009).

The multipliers measure is a point of interest not only for researchers, but also for the institutions. The governments use their estimation to check the sensibility of their economy when facing a fiscal stimulus or contraction, depending on their value they decide the fiscal policy to be applied in their countries, among other factors to take in consideration.

Furthermore, European institutions develop their studies of the economic situation and highlight the objectives to be achieved by the European countries as a base for this measure. In addition, the researchers consider it a key indicator to base their macroeconomics models on and to develop their macroeconomic projections. Concluding, in every field where the study of the fiscal policy is necessary, the fiscal multipliers forecast cannot be missed.

Determinant of Fiscal multipliers

Specially, considering the different determinants which could influence in the size of the fiscal multipliers is necessary. The country conditions, economic phase, specific circumstances, and idiosyncratic factors are which determine the size of the fiscal multipliers. The most sensitive the economy is to the fiscal changes, the larger the multipliers will be, and otherwise (Chinn, 2012; Barrell, Holland and Hurst, 2013).

For this reason, we are going to explain the most important ones in this section. We will start talking about a general influence factor, the effect on their size depending on if they are larger and smaller, and finally we will address the possibility of obtaining a negative multiplier.

First, we have to consider that we live in a globalized world, where the governments apply fiscal policy their effect should leakage. For instance, the households should save part or simply import them if the national products are more expensive in comparison. The institutions could minimize this situation in the following cases. If the propensity to consuming is high and the propensity to importing is low, the effect of leakage minimizes and the fiscal multipliers are larger. Furthermore, if the agents are myope, they cannot ensure for possible future spending. For example, there is an increase in the government expenditure, if the agents are looking forward ones, they can prevent that it could be financed by future increase in the taxes (Spilimbergo, Symansky and Schindler, 2009; Batini *et al.*, 2014).

Necessarily, if we are studying the effect on the economy of fiscal changes, we must consider the monetary conditions. The countries with accommodative monetary structures as zero bounded nominal interest rate or fixed exchange rate are more sensitive to fiscal changes because the monetary actions are less reactive in order to contrast the fiscal stimulus or consolidations (Spilimbergo, Symansky and Schindler, 2009).

In addition, there are real variables which have an influence on the sensitivity of the economy over fiscal shocks. The economies with slack of economic activity and poor financial systems are more sensitive to fiscal shocks because the increase in benefit offered or the fall on taxes to pay on agents dependent on the system has a greater effect. Therefore, the countries which are more exposed to the fiscal action have larger fiscal multipliers (Spilimbergo, Symansky and Schindler, 2009).

On the other hand, the financial system development has a determinant role on the fiscal multipliers size. If it has a lack of access on financial resources, agents have less capability to smooth consumption, thus, the fiscal multipliers are higher. The agents are more exposed to the changes in the fiscal policy, because they do not have enough financial products to ensure their situation when facing these shocks. Also, it happens if the governments use their own products such as bonds to obtain fund to overcome their deficit. Then, the fiscal multipliers is higher than in the case where the institutions use high interest to finance the deficit. In conclusion, the more developed the financial system, the lower the fiscal multipliers (Spilimbergo, Symansky and Schindler, 2009).

Additionally, the level of debt, the size of automatic stabilizers and authority's management of the collection of their fiscal policies also have an influence in the size of fiscal multipliers. If there is high level of debt a contractive measure the effect is more

positive than negative because it may reinforce the confidence on risk premium interest and private demand. Regarding the size of automatic stabilizers, it is bigger when lower fiscal multipliers because faster is the offset. Finally, if the governments are not capable to correctly collect the result of the fiscal plans, the lower will be the fiscal multipliers size, indeed (Spilimbergo, Symansky and Schindler, 2009; Batini *et al.*, 2014).

In this context, we have to take account the fact that fiscal policies can be permanent or temporally. A rule of thumb is that permanent policies in taxes are used to give larger fiscal multipliers, while the temporary policies in prices use to give larger fiscal multipliers than permanents ones (Spilimbergo, Symansky and Schindler, 2009).

Also, the shape of the fiscal multipliers usually result in the shape of an inverted U, and the persistence of their effect is generally 5 year, achieving their peak in the second year. The persistence increased depending on the action applied in the fiscal plan, in the following order, from the lower to the higher persistence: indirect taxes, government consumptions, transfers, public investment, corporate taxes, income taxes, and government investment in infrastructures (Batini *et al.*, 2014).

Leading to consider the economic phase as determinant of the fiscal multipliers, following the literature, their size is usually larger in recession than in expansionary phases. Besides, the increase in the size during recession is greater than the fall in their vale on growth periods. Because of supply constraints, in recession they have a greater influence than in the growth phase (Batini *et al.*, 2014).

Furthermore, for the fiscal multipliers forecast used to bucket group of countries with similar characteristics as advanced economies (AEs), emerging countries (EMEs) and low income countries (LICs). Because of the estimation for example by SVAR models, we need to have high frequency observations. In advanced economies, the fiscal multipliers during growth phases used to be between 0 and 1 by SVAR and DGSE models. However, for EMEs and LICs there is not an agreement regarding the fact if they are higher or smaller than AEs. Generally, the limited literature existing suggest that the fiscal multipliers are higher for AEs than EMEs and LICs ones (Batini *et al.*, 2014).

Fiscal multipliers value

The fiscal multipliers value changes depending on economy, period or specific situations, but its values variate when we change the range considering low or high set. The fiscal multipliers during growth phases used to be between 0 and 1 by SVAR and DGSE models (Batini *et al.*, 2014). The revenue multipliers oscillate between 0.3 to 0.6, capital spending from 0.5 to 1.8, and spending ones from 0.3 until 1 (Spilimbergo, Symansky and Schindler, 2009).

Moreover, their value differs depending on the size of the economy. Larger countries are around 1.5 to 1, medium from 1 to 0.5, and smaller 0.5 or less. We can see that the smaller the economy the lower the fiscal multiplier, which means that less their economy is less sensitive to the fiscal changes. The spending multipliers used to be the highest, followed by investment spending, and the lowest the revenue and transfers ones (Spilimbergo, Symansky and Schindler, 2009).

The last financial crisis exposes some new situation that had never happened before, which introduced new factors to be considered in order to determinate the fiscal multipliers. In the recession phases the agents increase the propensity to save regarding consumption, which reduces the fiscal multipliers, because the agent increases their adversity of risk and likely hysterical effect.

As we mentioned above, the turbulent situation for the banking system made the requirement for their products increase in order to ensure the restriction of the financial resources to the agents, increasing the value of the fiscal multiplier. Additionally, the extreme accommodative monetary policy applied by European Central Bank induced a raise in the fiscal multipliers (Spilimbergo, Symansky and Schindler, 2009).

In particular, the case of negative fiscal multipliers is also interesting. They happened in an economy in which there is an application of expansionary fiscal contractions, for what the Spanish case during the crisis is a great example. In this kind of scenarios, this expectative plays a key role. In the case of Spain the European Union was key support to accomplish the objectives fixed by the troika.

Forecasting methodology

There is wide discussion among economists about which is the best methodology to forecast the Fiscal multiplier, and it is not solved yet. In this section, we are going to explain the main points of view of the different theories in the field. One of the reasons is that there is no reliable methodology neither a common well used for every economic phase.

There is a discussion among economists about the reliability of current methodologies to forecast multipliers. As the estimation tools are really different and furthermore, using the same methodology, the results have larger range of values. The biggest problematic on fiscal multipliers forecasting is isolate the causal effect between GDP growth and fiscal plans, because there are more factors which have an influence in both variables and between them there is two-ways relationship (Batini *et al.*, 2014).

In this field, there are methodologies to forecast fiscal multipliers: model-based simulations, cases study, Structural Autoregressive models (SVAR), and econometric analysis for consumer behaviour in response of fiscal policy (Spilimbergo, Symansky and Schindler, 2009; Chinn, 2012; Batini *et al.*, 2014; Warmedinger, Checherita-westphal and Hernándezde Cos, 2015).

First, we can calculate the multipliers value by model simulation considering a basic IS-LM structure with some constraints or current Dynamic Stochastic General Equilibria (DGSE). This methodology usually provides positive values, and just two factors can make their size smaller or result in a negative value: assumption of agents forward looking and no accommodative monetary actions (Spilimbergo, Symansky and Schindler, 2009).

Second, the case of study consists in selecting an economic situation with a strong fiscal plan which could be expansionary or contractive and experiment which assumptions, whether mathematical models and others tool. The aim is study which is the best in order to explain and control the scenario selected. This methodology is really restricted because it is not reliable in another situation, it is not flexible.

Third, Structural Vector Auto-regressive (SVAR) models is one of the most common models used. They study the response on the exogenous shock considering some assumptions on the reaction of the monetary adjustment for the monetary institutions. The problematic identifies the exogenous movements correctly, because it takes into account the elasticity of general government structural changes to sort the automatic stabilizer out and it may be affected by price movements, not just by discretionary ones (Batini *et al.*, 2014).

The main methodologies applied by researchers are empirical SVAR models and the model based DGSE approach. The SVAR has the benefit to use specific data of the country under study, but it has been criticized due to its measure of structural shocks. The DGSE are basic in microfoundation, as they consider the economic theory and the system behaviour. At the same time, the sensitivity on the fiscal multipliers on the assumption of the model is one of the reasons of the drawback on this estimation. The role of thumb bases in the fact that in a 'normal' scenario the history antecedents' empirical techniques are more accurate. However, in turbulent or unknown circumstances the model-base one are preferred (Chinn, 2012).

Particularly interesting is the case of some countries were the fiscal multipliers forecast is not available and there is a "bucket approach" technique to evaluate their fiscal multipliers likely size. They first arrange the country/ies with the economies with similar characteristics as openness trade, labour rigidities, size of automatic stabilizers, authority's management and public debt, among others. Secondly, they score these features and sum considering a relative weigh. Thirdly, depending on their outcome they are considered on low, medium or large size multipliers. Finally, they adjust their range of likely value depending on the conjunctural characteristics: business cycle and monetary policy, accommodative or not. This approach just provides an insight of the size of multipliers (Batini *et al.*, 2014).

Macroeconomic projections

Fiscal multipliers values usually have a difficult interpretation, and because of this reason some techniques are often applied to observe in detail which was exactly the causal-relation between growth and fiscal plans. There are some methodologies where the fiscal multipliers is calculated to assess the relation on GDP growth and fiscal multipliers: Fiscal shock and GDP forecast baselines, full-fledged model and demand-side approach. The Full-fledged model studies the effect of different policies, includes the fiscal plans on the output. However, this technique needs a lot of data resources of much economies which used not to be accessible (Chinn, 2012; Batini *et al.*, 2014).

In the case of Demand-side approach, it is capturing this effect from a demanding perspective. The GDP is considered as the sum of private consumption, private investment, net external balance (imports minus exports) and government. In this case, it is necessary to take into consideration how a change in the fiscal policy affects the different components of the GDP. The results are more detailed regarding how the fiscal shock has an effect on those factors. Nevertheless, the general effect should be incorrectly forecast and not consider the second-round effect.

Finally, the baseline output projections consist in the simulation of the causal relationship on GDP growth estimation impact for fiscal plans, considering lag of fiscal policy application. The relation is basic for the fiscal multipliers previously forecast with the objective to assess the effect of the fiscal shock on the economy. In contrast with the previous two different approaches, this technique has the following advantages: easiness of the implementation in some countries, transparency, control for different shocks, allows the circularity between GDP and fiscal plans, adjustment packages for structural factors (Batini *et al.*, 2014).

Financial crisis

The fiscal multipliers field rose interest especially since the financial crisis 2008 took place, because it showed a unique scenario where the tools for forecast fiscal multipliers never were that important. It denotes the necessity to upload and ensure the techniques for the estimation of fiscal multipliers. Especially, the majority of the countries applied fiscal plans in order to escape recession. It is remarkable that in the case of European countries where Stability and Growth pact was followed of chain reactions with strong fiscal consolidation plans, their sharp differed depending on the country (Cugnasca and Rother, 2015).

As we mentioned above, the fiscal multipliers' size differ among countries and within economy depending the economic phase (Chinn, 2012). However, in order to improve the accuracy of the estimation of the fiscal multipliers, we need to group countries as European economies with similar features. The combination between this new phenomenon of recession phase in a globalized world, plus the fact of the growing gap between the circumstances of European countries and the aggressive contractive fiscal policies made the economists reflect about the accurate estimation of fiscal multipliers. Blanchard and Leigh published the revolutionary paper of *'Growth forecast errors and fiscal multipliers',* which exposed the underestimation of the fiscal multipliers in 2010-2011.

Which are consequences of underestimating the fiscal multiplier? Probably the government should consider to keep the fiscal aim unattainable and undervaluate the necessary resources to overcome the debt. Then, the authorities will not be able to achieve their objectives, losing credibility, and they will raise their action in order to be successful regarding their objective, starting a vicious circle of low GDP growth, and restrictive measures (Batini *et al.*, 2014).

This was one of the most important papers about the fiscal multipliers forecast after the financial crisis. However, it was preceded and follow by a lot of different researches. Some papers expose the discussion between the austerity measures are good decision or to high cost measure (Hall, 2012). Others focus on model-based estimation introduction to reproduce the situation suffered during the crisis (zero bound interest rate, cyclical unemployment, …) in order to estimate and assess fiscal multipliers and fiscal consolidation plans consequences depending on the environment (Lawrence, Eichenbaum and Rebelo, 2009; Delong *et al.*, 2017).

On the other hand, some papers focus on some of the determinants of the fiscal multipliers size. As well the financial system rise some conditions in order to understand how this factors have an influence in their value, and on the effectiveness of the fiscal policies, by DSGE models (Kara and Sin, 2013; Kwaak and Wijnbergen, 2017). Some researchers are interested in contrast to the fiscal multipliers forecast engines and values depending on the economic phase (Auerbach and Gorodnichenko, 2013).

Nevertheless, the economists are interested in some particular cases present during this financial crisis such as the expansionary austerity fiscal policies (Guajardo, Leigh and Pescatori, 2014; Hernández de Cos and Moral-Benito, 2015). Surprisingly, there is also the case of paper focus on criticize the consideration made during the crisis by the International Monetary fund (Farnsworth and Irving, 2017). Interestingly, there are papers where researchers brought in a new factors' influence, such as the strong relationship with wealth inequalities and large size of fiscal multipliers (Brinca *et al.*, 2016).

Fiscal multipliers forecast is still a black box in the economics field which is slowly getting better understood. But there are still a lot of questions to be answered.

Estimation

There are a lot of economists who focus on the fiscal multiplier calculations, because they are key determinant for the fiscal policy. We are interested in analysing the fiscal multipliers value, depending on the growth of the GDP and the fiscal consolidation by the baseline output projection approach. Our aim is to study the accuracy of the fiscal multiplier's estimation.

For this reason, we base our study in the paper of Blanchard O. and Leigh D. called *'Growth Forecast Errors and Fiscal Multipliers',* published in 2013. It studies the relationship between planned fiscal consolidation and growth forecast error. This paper focuses on the problem of underestimated fiscal multipliers introduced in the box published in the October 2012 *World Economic Outlook* (WEO, 2012). We expand the estimation of this paper to check if the underestimation made in the estimation of the fiscal multipliers 2011 has been corrected or there still is a 'mistake' in the fiscal multipliers forecast value nowadays.

The dataset used comes from the database of Blanchard's and Leigh's, plus the variables of annual percentage of Gross Domestic Product in constant prices year-over-year, and the General Government Structural Balance as a percentage of the potential GDP from different datasets obtained by the International Monetary Fund. These two variables are obtained from the *World Economic Outlook* datasets from 2011 until 2017 databases. The real accumulative year-over-year GDP growth ($\Delta Y_{i,t:t+1}$) will always come from the October 2017 *World Economic Outlook*. The forecast of GDP growth ($f\{\Delta Y_{i,t:t+1} \mid \Omega t\}$) and forecast of fiscal consolidation ($f\{F_{t+1,i} - F_{t-1,i} \mid \Omega t\}$) will be from the *World Economic Outlook* database of the previous year if compared with the one considered as real depending on the time selection of the baseline. In every estimation we will explain which variables are from each source.

We replicated the baseline forecast obtained by Blanchard and Leigh for the same 26 countries for the baseline in 2010-2011. However, we also used the model to estimate the baseline values from 2011-2012 until 2016-2017 and we considered the European countries. But depending of the available information the number of economies change. It will be specified for every estimation. We considered the same model, for which under rational expectations and considering that predictors we used the right model to forecast.

The model that we used is expressed below in detail and the causal relation relates the real accumulative annual percentage GDP growth in t+1 minus the expected value with the available information in t on the fiscal consolidation plan as a percentage of the potential GDP expected in t, considering two years of lagged in the fiscal policy. Under the null hypothesis that the fiscal multipliers used for forecasting were accurate, the coefficient of the baseline(β) should be zero.

Our endogenous variable refers to the growth forecast errors, where the accumulative year-over-year growth of the real Gross Domestic Product in constant prices in the economy i error denoted by $\Delta Y_{i,t:t+1}$; and the error of forecast is the difference of it in two different years interval, conditioned for the information available in t, $\Delta Y_{i,t:t+1} - f\{\Delta Y_{i,t:t+1} \mid \Omega t\}$ (Blanchard and Leigh, 2013).

Regarding the fiscal consolidation forecast, it is represented by the variable of general government structure balance in percentage of potential GDP, forecasted in the available information in t. The variable measures discretionary change in the fiscal policy. When it is positive, it means that the fiscal consolidation plan is seen as a reduction in the underlying fiscal debt, contractive fiscal policy, while if it is negative it refers to discretionary fiscal stimulus, expansionary fiscal policy. Its forecast indicated by the following expression $\Delta F_{i,t:t+1|t}$ defined as $f\{ F_{t+1,,i} - F_{t-1,i} | \Omega t \}$ allows the delay effect of the fiscal policy in two years interval forecast with the available information in t (Blanchard and Leigh, 2013).

$$\text{Forecast Error of } \Delta Y_{i,\, t:t+1} = \alpha + \beta \text{ Forecast of } \Delta F_{i,\, t:t+1|t} + \varepsilon_{i,\, t:t+1}$$

We used the previous model to forecast the baseline from 2010-2011 until 2016-2017 following the previously explanation. Now, we are going to analyse each result obtained for every baseline.

First, we are going to evaluate the Blanchard and Leigh's baseline forecast result obtained for 2010-2011. They had used the growth forecast error as the difference between accumulative annual percentage of real GDP growth from the October 2012 *World Economic Outlook* minus the forecast with available information of accumulative GDP growth year-over-year from April 2010 *World Economic Outlook.* On the other hand, fiscal consolidation has been obtained from the April 2010 *World Economic Outlook*. The estimation considers 26[1] European countries. Remember that the authors selected the data from spring 2010 because the majority of the fiscal consolidation plans during the Great Crisis (2008) where implemented that year.

Then, we will refresh the baseline results obtained by Blanchard and Leigh. Table 1 shows that the estimated value of baseline for 2010-2011 is -1.095 at 1, 5 and 10 percent levels of significance, which means that for every additional percentage point of GDP of fiscal consolidation, the GDP growth was about 1 percent lower than forecasted. The constant term is 0.775 is significant at 10 percent, which has not a strong economic interpretation, and the R^2 is 0.496.

[1] The 26 economies are Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Germany, Denmark, Finland, France, Greece, Hungary, Ireland, Iceland, Italy, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom.

That shows the negative relationship between both variables, which proof the underestimation of the fiscal multipliers. The underestimation could be because the fall in GDP growth was worse than expected. In the next footnote, we can access a folder in Google Drive where the database used and the files used during the whole paper, estimated by STATA, can be accessed[2].

TABLE 1

Estimation of model for 26 European economies during 2010-2011

	Coefficient		*Std. Error*	*t-value*	*p-value*
Baseline	-1,095	***	0,255	-4,29	0,00
Constant term	0,775	*	0,382	2,03	0,054
Number of obs.	26				
R-squared	0,495				

Note: ***, ** and * denote statistical significance at the 1, 5 and 10 levels, respectively.

Furthermore, in Figure 1 we can observe the scatter plot of 26 countries and the regression line for the Blanchard and Leigh's estimation in 2010-2011 about the previous results. In the y axis, there is Growth Forecast "Error" and in the x axis the Fiscal consolidation forecast. Therefore, the dots represent the baseline value for each country. We can see a decreasing slope which is coherent with the negative value of the baseline, which is showing underestimation of the fiscal multipliers.

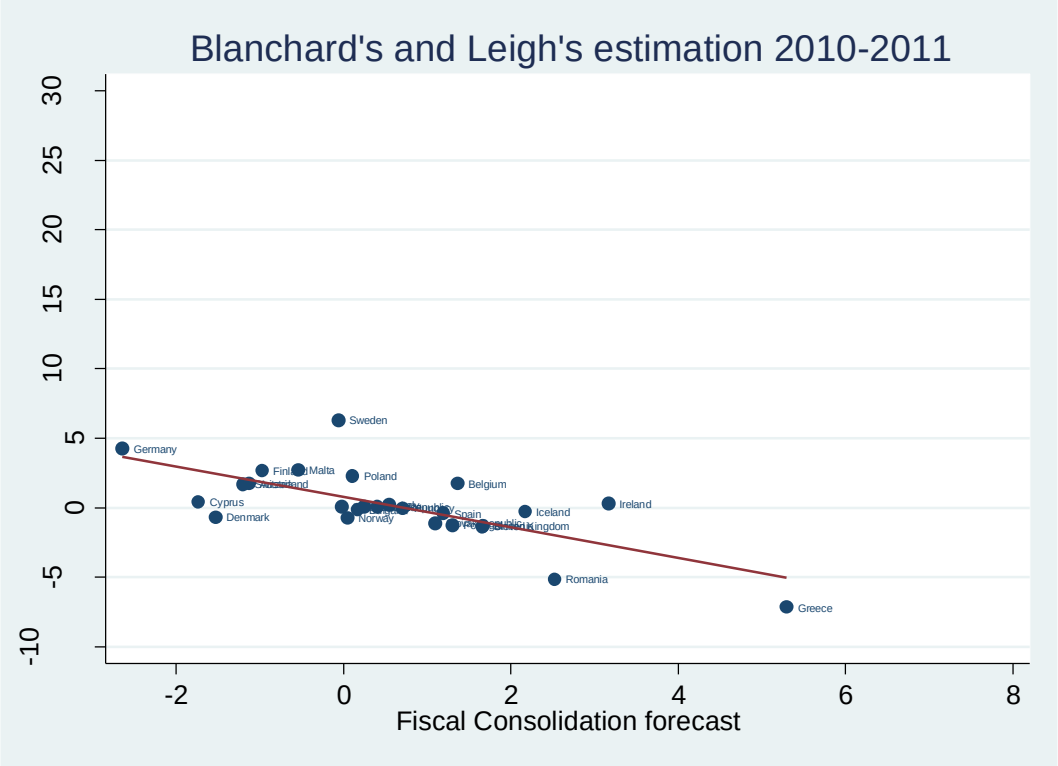
However, the baseline sign changes depending on the economy. The higher value is for Germany and Sweden, because their consolidation plans were the first that applied a pre-emptive consolidation plan with aims to the medium run, and the second one had comparatively less needs of a fiscal plan. Because of this, its application was the least aggressive, and it related the highest growth. Nevertheless, the lowest value of the growth forecast had the most deteriorated fiscal situation, hence, the most substantial consolidation plans (OECD, 2011a).

[2] Access to the Google Drive page where the folder with the database and files used to make the estimations and graphs by STATA can be accessed. Link: https://drive.google.com/drive/folders/13tDUA_DGf6WCSoUxukOmeGL-Q52rOwNH?usp=sharing

Therefore, we can observe that the more aggressive the consolidation plan, the lower the growth and the deeper the underestimation of the fiscal multiplier. In this period, the majority of the countries applied strong fiscal consolidation plans. Indeed, the differences among countries play an important role for the fiscal multipliers, thus in the following sections we will develop an analysis of the country choice in detail.

FIGURE 1

Scatter plot and regression line for Blanchard and Leigh's baseline in 2010-2011



After taking into account the underestimation of the fiscal multipliers stated by Blanchard and Leigh, we would like to check two possibilities. The underestimation was just an isolate case because the researchers were adapting to the turbulent scenario generate of the crisis and they corrected this "mistake". In contrast, the underestimation could not just be an isolate "error" in the fiscal multipliers forecast, and it could show a deeper problematic for working on the available tools for the fiscal multipliers forecast. Then, we have to consider if the inaccurate estimation of fiscal multipliers has been happening until nowadays. In other words, are we still making the same mistake on the fiscal multipliers forecast? Or, have we already learnt our lesson?

For this reason, we are going to forecast the baseline value from 2011-2012 to 2016-2017 considering the real accumulative year-over-year GDP growth in constant prices ($\Delta Y_{i,t:t+1}$), and the forecast of GDP growth ($f\{\Delta Y_{i,t:t+1} \mid \Omega t\}$) and forecast of fiscal consolidation ($f\{F_{t+1,i} - F_{t-1,i} \mid \Omega t\}$) given the available information the year before, for each baseline estimation. The accumulative annual percentage growth of the real GDP will come from the October 2017 *World Economic Outlook* for every estimation. Nevertheless, the forecast will come for the database of the previous year, which refers to the forecast in t of t+1.

First, we are going to forecast the baseline value in 2011-2012 for the estimation. We will use the same 26 European economies selected before by Blanchard and Leigh. As we stated above, in Growth forecast errors regarding the real GDP growth come from the October 2017 *World Economic Outlook.* However, the GDP growth and fiscal consolidation forecast in t is from the September 2011 *World Economic Outlook*.

In Table 2, we can see an estimated value of the baseline for 2011-2012 which is -0.136, which it is not statistically significant. We failed to reject the null hypothesis. Therefore, we can claim that the baseline is zero and the fiscal multipliers forecast has been accurate. The constant term is significant at 1, 5 and 10 percent and the R^2 is 0.0125. The Goodness of fit is understandable low because we failed to reject the null hypothesis which means that the baseline value is zero, and the fiscal multipliers forecast is accurate.

TABLE 2

Estimation model for 26 European economies during 2011-2012

	Coefficient		*Std. Error*	*t-value*	*p-value*
Baseline	-0,136		0,346	-0,40	0,696
Constant term	-2,114	***	0,704	-3,00	0,006
Number of obs.	26				
R-squared	0,0125				

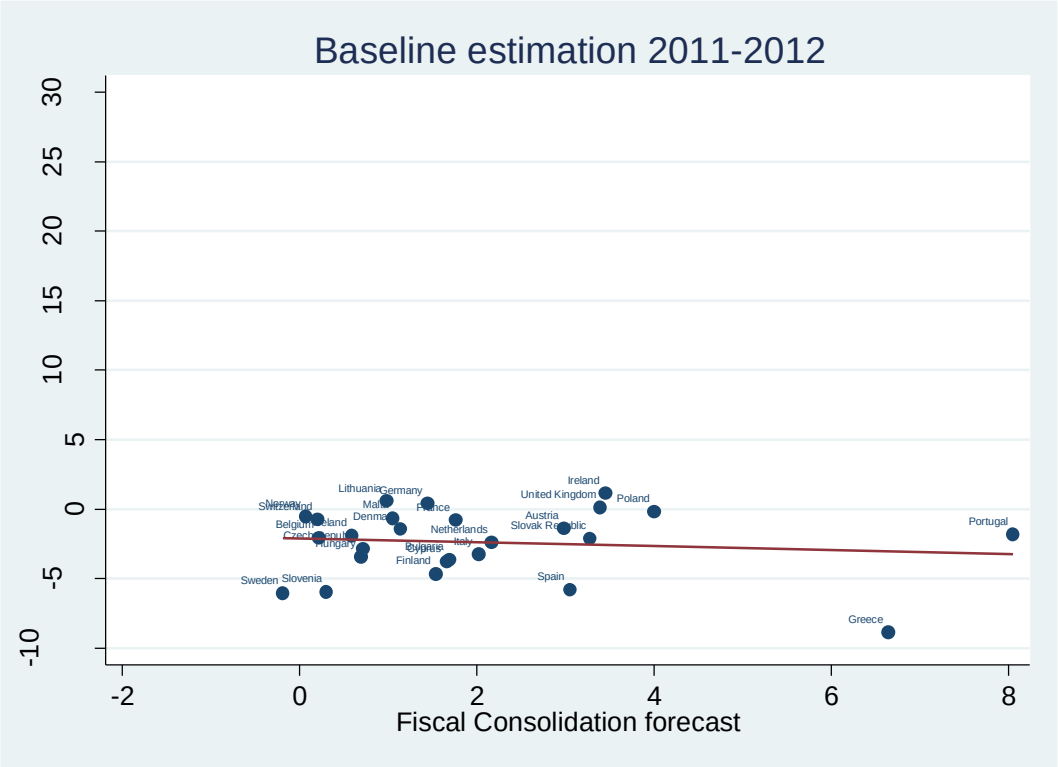
Note: ***, ** and * denote statistical significance at the 1, 5 and 10 levels, respectively.

Furthermore, in Figure 2 we can see the scatter plot of 26 countries and the regression line previous the estimation of baseline in 2011-2012. In the y axis, there is Growth Forecast “Error” and in the x axis the Fiscal consolidation forecast. Therefore, the dots represent the baseline value for each country. We observe a flat regression line which is coherent with the previous result of zero baseline showing accurate of the fiscal multiplier. In this case, there is significant differences among country and slightly dispersion among dots.

In contrast with Figure 1, Figure 2 shows lower dispersion, as the majority of the countries are concentrated less Greece and Portugal. In Portugal during this period the Economic Adjustment Programme was applied to cover fiscal need and the banking system in order to return in the growth path (European Comission, 2014). This is the reason why they had the highest fiscal plan. On the other hand, European Union imposed targets by the Economic Policy programme from Greece. Because of this reason, the Greek Parliament applied a strong contractive fiscal policy to stick to the budget (OECD, 2011b).

FIGURE 2

Scatter plot and regression line for baselines in 2011-2012



In Table 3, we forecasted the baseline for 28[3] European states in the 2012-2013 period, where the real accumulative year-over-year GDP growth ($\Delta Y_{i,t:t+1}$) variable comes from the October 2017 *World Economic Outlook*, and the forecast of the GDP growth ($f\{\Delta Y_{i,t:t+1} \mid \Omega t\}$) and fiscal consolidation ($f\{ F_{t+1,i} - F_{t-1,i} \mid \Omega t \}$) has been got from the October 2012 *World Economic Outlook*.

Then, the baseline value is 0.033, which it is not statistically significant. We failed to reject the null hypothesis; therefore, we can claim that the baseline is zero and the fiscal multipliers forecast has been accurate. The constant term is not economically significant and the R^2 is 0.001. The Goodness of fit is low for the same reason exposed for the previous baseline 2011-2012.

TABLE 3

Estimation of model for 28 European economies during 2012–2013

	Coefficient	*Std. Error*	*t-value*	*p-value*
Baseline	0,033	0,173	0,2	0,846
Constant term	-0,648	0,613	-1,06	0,3
Number of observations	28			
R-squared	0,001			

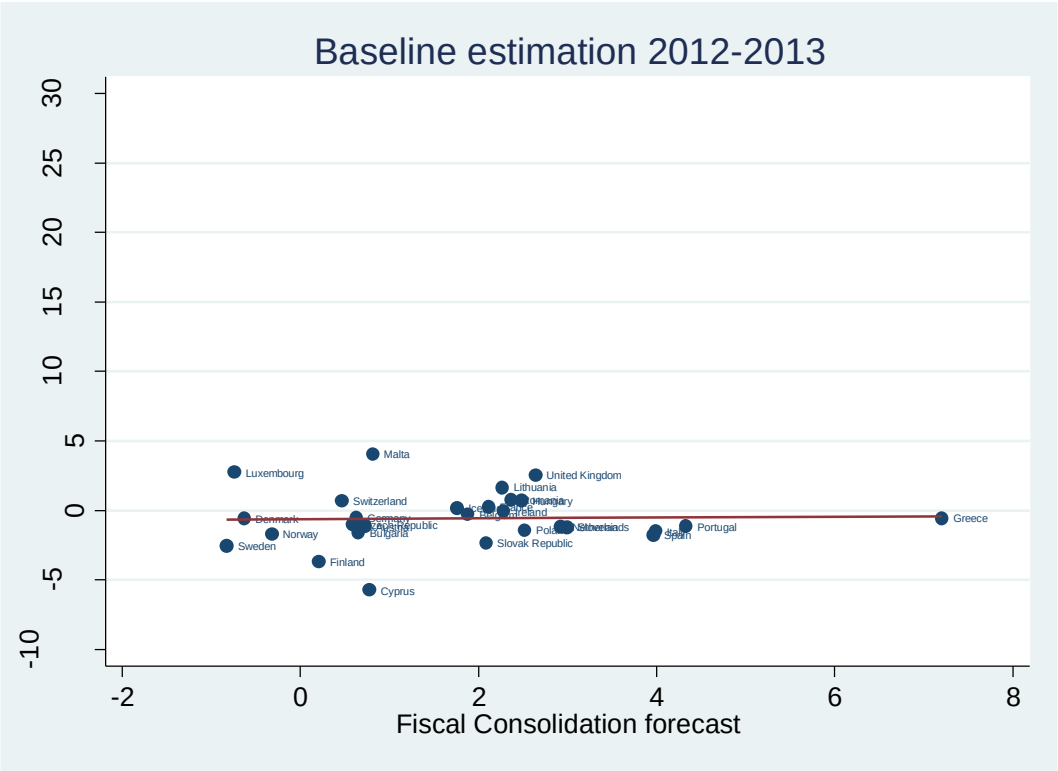
Note: ***, ** and * denote statistical significance at the 1, 5 and 10 levels, respectively.

In Figure 3, we can see the scatter plot of the previous 28 countries and the regression line of model following the estimation of baseline in 2012-2013. In the y axis, there is Growth Forecast "Error" and in the x axis, the Fiscal consolidation forecast. Therefore, the dots represent the baseline value for each country. We can see as well as in the previous figure a flat regression line in the zero point, which is coherent with the previous result of zero baseline showing the accuracy of the fiscal multipliers forecasting. In this case, there is not much dispersion but there is more than in Figure 2. Greece is still been the economy with most aggressive contractive policy, because the Economic policy plans was from 2011 until 2014.

[3] The 28 European economies used for the calculation of the baseline in 2012-2013 are the following: United Kingdom, Austria, Belgium, Denmark, France, Germany, Italy, Luxembourg, Netherlands, Norway, Sweden, Switzerland, Finland, Greece, Iceland, Ireland, Malta, Portugal, Spain, Cyprus, Bulgaria, Czech Republic, Slovak Republic, Hungary, Lithuania, Slovenia, Poland, and Romania.

FIGURE 3

Scatter plot and regression line for baselines in 2012-2013



Next we are going to forecast the baseline value for 29[4] European economies in 2013-2014. The data for the real GDP growth ($\Delta Y_{i,t:t+1}$) comes from the October 2017 *World Economic Outlook*, and the forecast of GDP growth ($f\{\Delta Y_{i,t:t+1} \mid \Omega t\}$) and fiscal consolidation ($f\{F_{t+1,i} - F_{t-1,i} \mid \Omega t\}$) is from the October 2013 *World Economic Outlook*.

In Table 4, the estimated value of the baseline for 2013-2014 can be observed, which is 0.487, which is not statistically significant. We failed to reject the null hypothesis; therefore, we can claim that the baseline is zero and the fiscal multipliers forecast has been accurate. The constant term is not statically significant at the 5 and 10 percentage levels and the R^2 is 0.033.

[4] The 29 European economies used for the calculation of the baseline in 2013-2014 are the following: United Kingdom, Austria, Belgium, Denmark, France, Germany, Italy, Luxembourg, Netherlands, Norway, Sweden, Switzerland, Finland, Greece, Iceland, Ireland, Malta, Portugal, Spain, Cyprus, Bulgaria, Czech Republic, Slovak Republic, Estonia, Hungary, Lithuania, Slovenia, Poland, and Romania.

TABLE 4

Estimation of model for 29 European economies during 2013-2014

	Coefficient		*Std. Error*	*t-value*	*p-value*
Baseline	0,487		0,471	1,03	0,311
Constant term	1,435	**	0,68	2,11	0,044
Number of obs.	29				
R-squared	0,033				

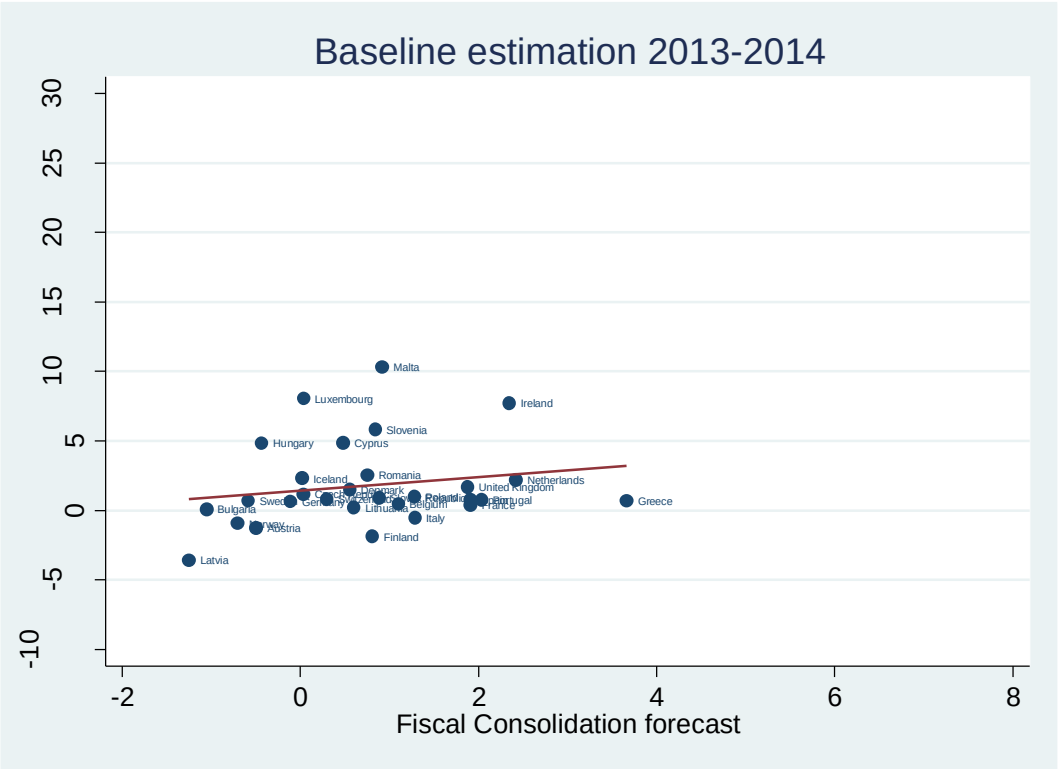
Note: ***, ** and * denote statistical significance at the 1, 5 and 10 levels, respectively.

In Figure 4, we can observe the scatter plot of 29 countries and the regression line previous estimation of baseline values in 2013-2014. In the y axis, there is Growth Forecast "Error" and in the x axis, the Fiscal consolidation forecast. Therefore, the dots represent the baseline value for each country. We can see a slightly increasing slope in comparison with Figures 2 and 3, but it still around zero.

The fiscal consolidation plans are less aggressive in this period. However, there is increase in dispersion among countries. In this period, it was the second fall of the financial crisis for European economies by the Risk premium crisis. Then, some economies suffered bad consequences, because in comparison where riskier and, therefore, they paid more to obtain funding. Otherwise, some other European countries took advantage depending on the valuation of their risk, bonus class.

FIGURE 4

Scatter plot and regression line for baselines during 2013-2014



Next, we are going to estimate the baseline coefficient in 2014 for 28[5] European countries. As before, the real accumulative annual percentage GDP growth ($\Delta Y_{i,t:t+1}$) is from the October 2017 *World Economic Outlook* and the forecast of the GDP growth ($f\{\Delta Y_{i,t:t+1} \mid \Omega t\}$) and fiscal consolidation ($f\{F_{t+1,i} - F_{t-1,i} \mid \Omega t\}$) is from the October 2014 *World Economic Outlook*.

In Table 5, the coefficient of the baseline for 2014-2015 is forecasted, which is 1.882, which it is not statistically significant. We failed to reject the null hypothesis; therefore, we can claim that the baseline is zero and the fiscal multipliers forecast has been accurate. The constant term is not statistically and the R^2 is 0.075.

[5] The 28 European economies used for the calculation of the baseline in 2014-2015 are the following: United Kingdom, Austria, Belgium, Denmark, France, Germany, Italy, Luxembourg, Netherlands, Norway, Sweden, Switzerland, Finland, Greece, Iceland, Ireland, Malta, Portugal, Spain, Bulgaria, Czech Republic, Slovak Republic, Estonia, Hungary, Lithuania, Slovenia, Poland, and Romania.

TABLE 5

Estimation of model for 28 European economies during 2014-2015

	Coefficient	*Std. Error*	*t-value*	*p-value*
Baseline	1,882	2,264	0,83	0,413
Constant term	1,767	0,867	2,04	0,052
Number of obs.	28			
R-squared	0,075			

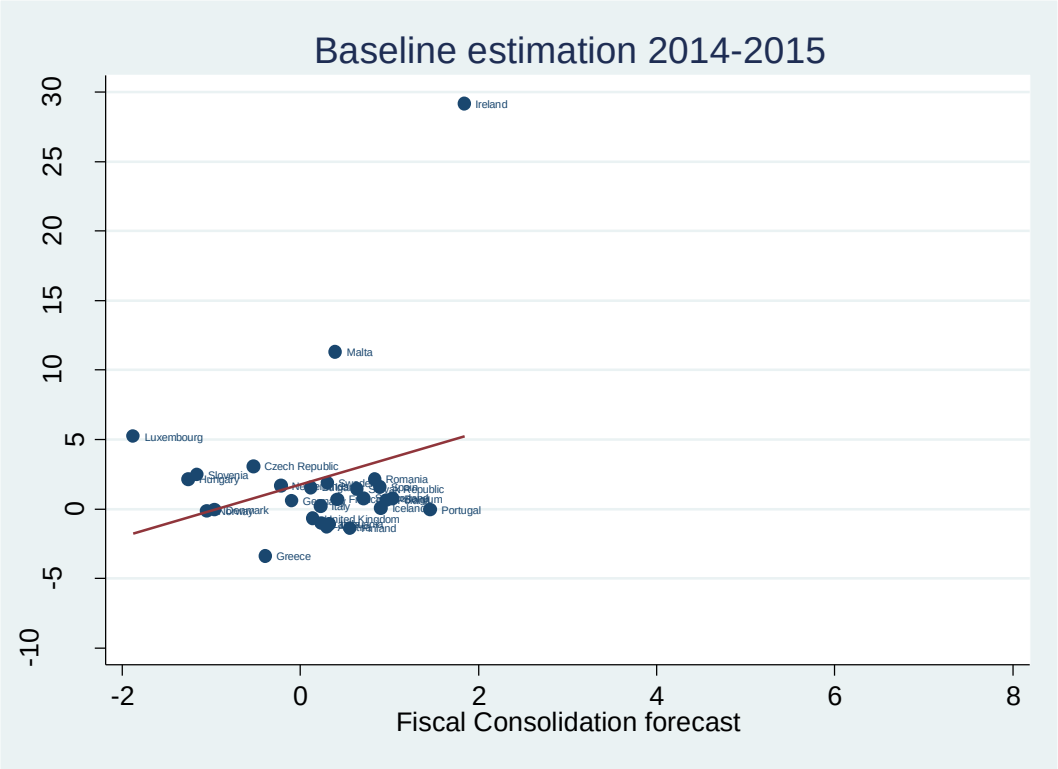
Note: ***, ** and * denote statistical significance at the 1, 5 and 10 levels, respectively.

Moreover, in Figure 5, we can observe the scatter plot of 28 countries and the regression line previous baseline in 2014-2015. In the y axis there is Growth Forecast "Error" and in the x axis the Fiscal consolidation forecast. Therefore, the dots represent the baseline value for each country. We can see a considerable higher slope that the one observed in the previous figure, although the Blanchard and Leigh's one was higher than this one. In spite of raise on the slope, the forecast of the fiscal multipliers is still accurate.

There is clearly a possible influence of atypical value. We can observe a dot point in right in the top which refers to Ireland. The reason why there is pick should be because Ireland is a country where the Foreign Direct Investment had an important weigh on the country's GDP, especially for influences of high technological multinationals. For instance, Apple payment of taxes represents 6 percent of the GPD, when this is only required to pay just 1 percent of tax. These companies produced a percentage of growth in Ireland, but this was not real growth, which is clearly visible if we compare the GDP of the country with their GNP. The figure shows this fact as likely outlier, however, the results shown in Table 5 showed that it is not affecting the baseline statistical significance. Nevertheless, in the following sections we will study the possible influence of extreme values.

FIGURE 5

Scatter plot and regression line for baselines during 2014-2015



Next, we are going to estimate the baseline value for 27[6] European countries in 2015-2016. As before, the real accumulative annual percentage GDP growth ($\Delta Y_{i,t:t+1}$) is from the October 2017 *World Economic Outlook* and the forecast of the GDP growth ($f\{\Delta Y_{i,t:t+1} \mid \Omega t\}$) and fiscal consolidation ($f\{F_{t+1,i} - F_{t-1,i} \mid \Omega t\}$) is from the October 2015 *World Economic Outlook*.

[6] The 27 European economies used for the calculation of the baseline in 2015-2016 are the following: United Kingdom, Austria, Belgium, Denmark, France, Germany, Italy, Luxembourg, Netherlands, Norway, Sweden, Finland, Greece, Iceland, Ireland, Malta, Portugal, Spain, Bulgaria, Czech Republic, Slovak Republic, Latvia, Hungary, Lithuania, Slovenia, Poland, and Romania.

In Table 6, we can see estimated coefficient of the baseline for 2015–2016, which is 1.383 which it is not statistically significant. We failed to reject the null hypothesis; therefore, we can claim that the baseline is zero and the fiscal multipliers forecast has been accurate. The constant term is significant 10 percent level and the R^2 is 0.09.

TABLE 6

Estimation of model for 27 European economies during 2015-2016

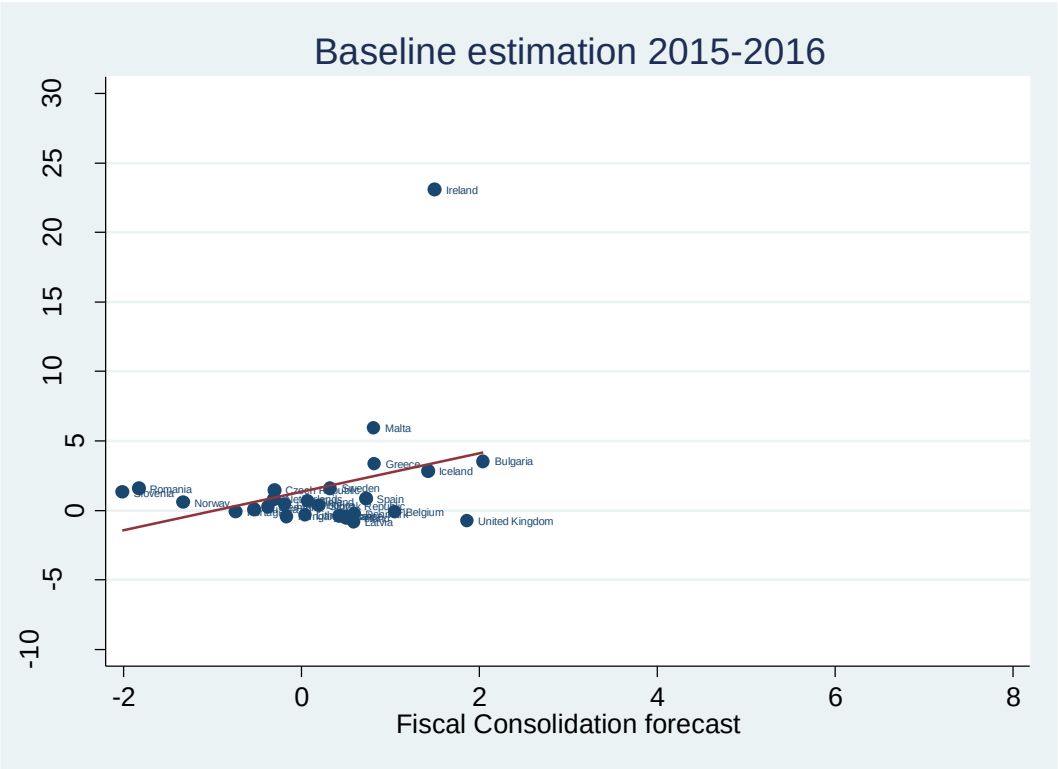
	Coefficient		*Std. Error*	*t-value*	*p-value*
Baseline	1,383		1,14	1,21	0,236
Constant term	1,362	*	0,663	2,05	0,051
Number of obs.	27				
R-squared	0,09				

Note: ***, ** and * denote statistical significance at the 1ˢ, 5 and 10 levels, respectively.

Additionally, in Figure 6, we can observe the scatter plot of 27 countries and the regression line previous baseline in 2015-2016. In the y axis, there is Growth Forecast "Error" and in the x axis, the Fiscal consolidation forecast. Therefore, the dots represent the baseline value for each country. We can see a similar slope regarding Figure 5, but it was just a bit lower and as before the fiscal multipliers has been accurate. Also, the baseline value of Ireland is the highest one probably for the same reasons previously stated. Moreover, the European Central Bank imposed a fine to Apple and it has to pay 15 billion dollars to Ireland for tax evasion in favour of Ireland.

FIGURE 6

Scatter plot and regression line for baselines in 2015-2016



Finally, we are going to forecast the baseline coefficient for 28[7] European states in 2016-2017. The real accumulative annual percentage GDP growth ($\Delta Y_{i,t:t+1}$) is from the October 2017 *World Economic Outlook* and the forecast of GDP growth ($f\{\Delta Y_{i,t:t+1} \mid \Omega t\}$) and fiscal consolidation ($f\{ F_{t+1,i} - F_{t-1,i} \mid \Omega t \}$) is from the October 2016 *World Economic Outlook*.

In Table 7, there is estimated value of the baseline for 2016–2017 which is -0.387 which it is not statistically significant. We failed to reject the null hypothesis; therefore, we can claim that the baseline is zero and the fiscal multipliers forecast has been accurate. The constant term is statistically significant at the 1, 5 and 10 percent levels and the R^2 is 0.002.

[7] The 28 European economies used for the calculation of the baseline in 2016-2017 are the following: United Kingdom, Austria, Belgium, Denmark, France, Germany, Italy, Luxembourg, Netherlands, Norway, Sweden, Finland, Greece, Iceland, Ireland, Malta, Portugal, Spain, Bulgaria, Czech Republic, Slovak Republic, Estonia, Latvia, Hungary, Lithuania, Slovenia, Poland, and Romania.

TABLE 7

Estimation of model for 28 European economies during 2016–2017

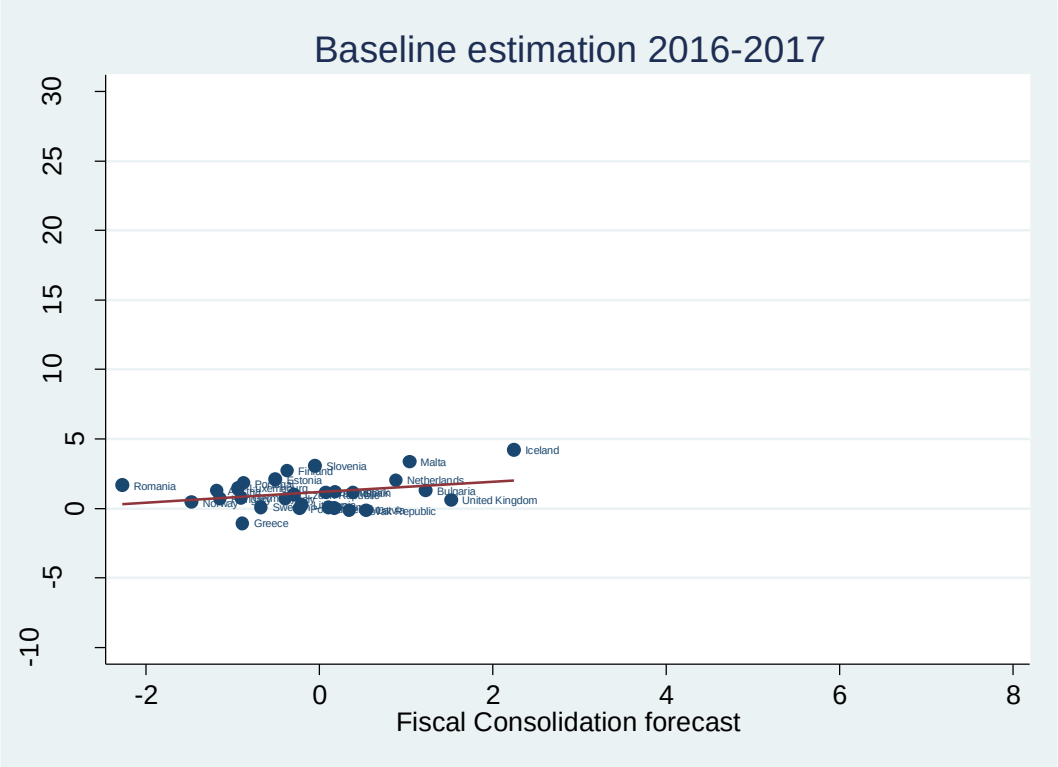
	Coefficient		*Std. Error*	*t-value*	*p-value*
Baseline	0,378		0,287	1,32	0,20
Constant term	1,177	***	0,23	5,11	0,00
Number of obs.	28				
R-squared	0,09				

Note: ***, ** and * denote statistical significance at the 1, 5 and 10 levels, respectively.

In addition, in Figure 7, we can observe the scatter plot of 28 countries and the regression line previous estimation of baseline in 2016-2017. In the y axis, there is Growth Forecast "Error" and in the x axis, the Fiscal consolidation forecast. Therefore, the dots represent the baseline value for each country. We observe a flat regression line with slope around zero. Also, the fiscal plans are softer and there are expansionary and contractive fiscal policies applied depending on the country. There is a clear difference on this scenario out of the financial crisis if compared to the first ones, which showed strong contractive policies.

FIGURE 7

Scatter plot and regression line for baseline in 2016-2017



In Table 8, we have summarised the baseline obtained and its respective p-value to check the significance of our forecast. We can observe that except for the baseline during 2010-2011, generally, there is an underestimation of the fiscal multipliers as Blanchard and Leigh stated in their paper (Blanchard and Leigh, 2013). In the rest of the estimation of the baseline their value is zero, and because we failed to reject the hypothesis null, the fiscal multipliers used for forecasting were accurate.

TABLE 8

Summaries of the baseline estimation

	Baseline		P-value
2010 - 2011	-1,095	***	0,000
2011 - 2012	-0,136		0,696
2012 - 2013	0,034		0,846
2013 - 2014	0,487		0,311
2014 - 2015	1,882		0,413
2015 - 2016	1,383		0,236
2016 - 2017	0,378		0,200

Note: ***, ** and * denotes statistical significance at the 1, 5 and 10 levels, respectively.

Then, we can conclude that the underestimation of the fiscal multipliers was an isolate case given the unique situation that we lived in during the financial crisis, but the forecaster has learnt about the mistakes and they are been accurate in the estimation of the fiscal multipliers during the last years.

Additionally, we can claim that generally during all the periods, crisis and recovering ones, the fiscal consolidation plan with contractive measures had a negative relationship with the GDP growth. In other words, the contractive policies used to depress the national economy.

The previous figures convey that the strongest contractive fiscal policies existed during the baseline from 2010-2011 to 2013-2014. There is more dispersion, because during the financial crisis the differences among European economies was aggravated. Furthermore, practically every European Union country during this phase implemented a contractive fiscal policy.

On the other hand, the baseline estimation for 2014-2015 and 2015-2016 displayed a lot of similarities with increase in their slope and the possible influence of conditional unusual variable, especially in the case of Ireland. The baseline in 2016-2017 figures make us go back to the previous flat tendency of the regression line, likely because there is no any possible extreme values shown in the graph.

Furthermore, the baseline coefficients from 2014-2015 until 2016-2017 displayed more diversity among fiscal plans strategy, as not just contractive policies were expansionary ones. Also, the intensity of the fiscal plans was lower.

Before we carry out the analysis of our estimation, we must take into account the theoretical framework around fiscal multipliers forecast. As we mentioned in the previous section, the size of the multipliers has to do with many factors: economic phase; if the interest rate is zero bind, which can give us larger multipliers; the slack of economic activity; poor functioning of the financing system; the country characteristics, among another factors.

The estimation of baseline gives us unbiased and consistent results, but we can apply some interesting tests to check the robustness of our estimations. We have to consider the importance of the economy's selection. Then, we will test in the following section if the results change depending the countries selection, taking account different factors: economic group depending on their development, how aggressive the fiscal consolidations plan applied is, among other. Moreover, we can expect influence of possible outlier which will be necessary to consider to know how accurate our estimations are and correct the possible influences. Also, some of the previous figures could likely be influenced.

Checking the Robustness

In this section, we are going to develop some analysis to check the robustness for the baselines by panel data study, and check of country selection and influence for outliers. Figures 5 and 6 showed possible influence of outliers. Furthermore, the literature about fiscal multipliers stated that fiscal multipliers coefficients vary among economies, idiosyncratic factor, and within countries and economic phase (Barrell, Holland and Hurst, 2013).

For the previous reason, using more sophisticate methodologies is necessary in order to reinforce the accuracy of the results achieved. We have to look for likely problematic such as heteroskedasticity, serial correlation, cross-sectional correlation, omitted variables, extreme value influence, among others. In the following part, we will develop different test to check the robustness.

First, we will develop panel data analysis meticulously. We must consider that depending on the baseline estimation. We will start by Blanchard and Leigh's baseline from 2009-2010 to 2011-2012, included the baseline which showed the underestimation of the fiscal multiplier. Next, we will study the baseline from 2011-2012 until 2016-2017, previously estimated.

Next, we will make the robustness test for the economy's choice and for possible influence of outliers made by Blanchard and Leigh in their paper titled '*Growth forecast errors and fiscal multipliers'* in 2013. Then, we will estimate the baselines robustness check from 2011-2012 to 2016-2017. Also, we will compare the results with the ones obtained by Blanchard and Leigh, and also with the ones shown in the section.

Panel data analysis:

After the estimation of our model and following the logic just explained, we are going to do a panel data study. We consider interesting to check robustness and contrast by Blanchard and Leigh's panel data study and baseline estimation for the following period in the previous part of this paper. We will start pointing out the reason why used panel data analysis is adding value in our research.

The Ordinary Least Squares (OLS) estimator has some limitations that can be covered by estimators with more sophisticate techniques. The OLS forecast offers Best Linear Unbiased Estimator (BLUE) results, showing unbiased and consistent estimations. Nevertheless, we will likely obtain an inefficient forecast of the model by problematics as heteroskedasticity, serial correlation, cross-sectional correlations, among others. In the case of panel data tool, we have some regression and test which gives robust outcomes for just mentioned inefficiency.

Why using panel data analysis? Because panel data analysis provides a more accurate inference because larger number of data points (N x T), increase the degrees of freedom and sample variability, which improves the efficiency of the econometric estimations. For the same reasons, the Goodness of fit used to be lower than the one obtained by OLS.

Moreover, this methodology allows to perform more sophisticated analyses. Panel data should control for omitted variables, when it is fixed over the time or behaving as a random variable, panel provides useful possibilities to eliminate the bias as: Fixed Effects and Random Effects

In the first part of the study, we are going to estimate the two panel data selection for baseline in different periods by Pooled OLS, Fixed Effects and Random Effects. The Pooled OLS behave such as OLS, but considering the panel data dimension N*T, N is number of observation and T is time dimension.

The Fixed Effects model controls time-invariant individual differences, unobserved heteroskedasticity. Additionally, this technique allows correlation between the unobserved heterogeneity and regressors. The method subtracts the average model from the original one, which eliminates time-invariant variables. It is a useful tool whenever you are interested in only analysing the impact of variables that vary over the time.

On the other hand, the Random Effect model considers unobserved heteroskedasticity behave such as random variable with a normal distribution. But, the Random effect model does not allow for correlation between unobserved heteroskedasticity and explanatory variable in every period. If we have a reason to believe that the differences across countries have some influence on our dependent variable, thus, we should use the Random effect model. The assumption of not correlation among regressors makes the Random effect model more efficient than Fixed Effect model.

The Random effects estimator focus on solving serial correlation. It is a good tool in order to study cross-sectional variations. On the other hand, Fixed effect is centred on solving cross-sectional variation, thus, it is useful for study variation among periods.

First, we are going to graph scatter plot and regression line for Blanchard and Leigh's baseline from 2009-2010 to 2011-2012 panel data, and the baseline from 2011-2012 until 2016-2017 model in Figure 8. In order to develop the panel data study, we will use loop selecting the periods and variables from different data bases.

In the case of Blanchard and Leigh, we consider the same model used for baseline estimations, real accumulative annual percentage GDP growth ($\Delta Y_{i,t:t+1}$WEO17) , which comes from the October 2017 *World Economic Outlook* data base, and forecast of GDP growth (f{$\Delta Y_{i,t:t+1}$ | Ωt } SPRINGt) and fiscal consolidation (f { $F_{t+1,i} - F_{t-1,i}$ | Ωt } SPRINGt) from the Spring *World Economic Outlook* from the previous year of the baseline selected.

The panel data analysis for baseline from 2011-2012 to 2016-2017, we use data of real accumulative annual percentage GDP growth($\Delta Y_{i,t:t+1}$WEO17), which comes from the October 2017 *World Economic Outlook* data base, and forecast of GDP growth (f{$\Delta Y_{i,t:t+1}$ | Ωt } WEOt) and fiscal consolidation (f { $F_{t+1,i} - F_{t-1,i}$ | Ωt } WEOt), which comes from *World Economic Outlook* dataset of prediction made the year before in t of baseline select.

The aim is to obtain some insight of likely results. In Figure 8, we clearly observe that depending on the country there are different results in the case of Blanchard's and Leigh's dataset selection there is more dispersion, but in the other case, there are possible influence of atypical variables.

In our data selection, there are two dots on the top of the graph which refer to Ireland in 2015 and 2016, and to the right other two which refer to Greece in 2013 and 2014. Both cases they can produce problems due to the influence of extreme values. The Ireland part would be because of the case of the foreign direct investment for part of pharmaceutical and high-technology multinationals, whose case regarding defrauding taxes was exposed and that supposed an increase of the delayed payment of the taxes.

On the other hand, Greece during 2013 and 2014 suffered the most aggressive contractive policies, and was punished by the Risk prime crisis. However, the estimation of the model showed that null hypothesis were accomplished and that the fiscal multipliers are accurate and the baseline value zero. For this reason, we considered that these two cases could not influence results.

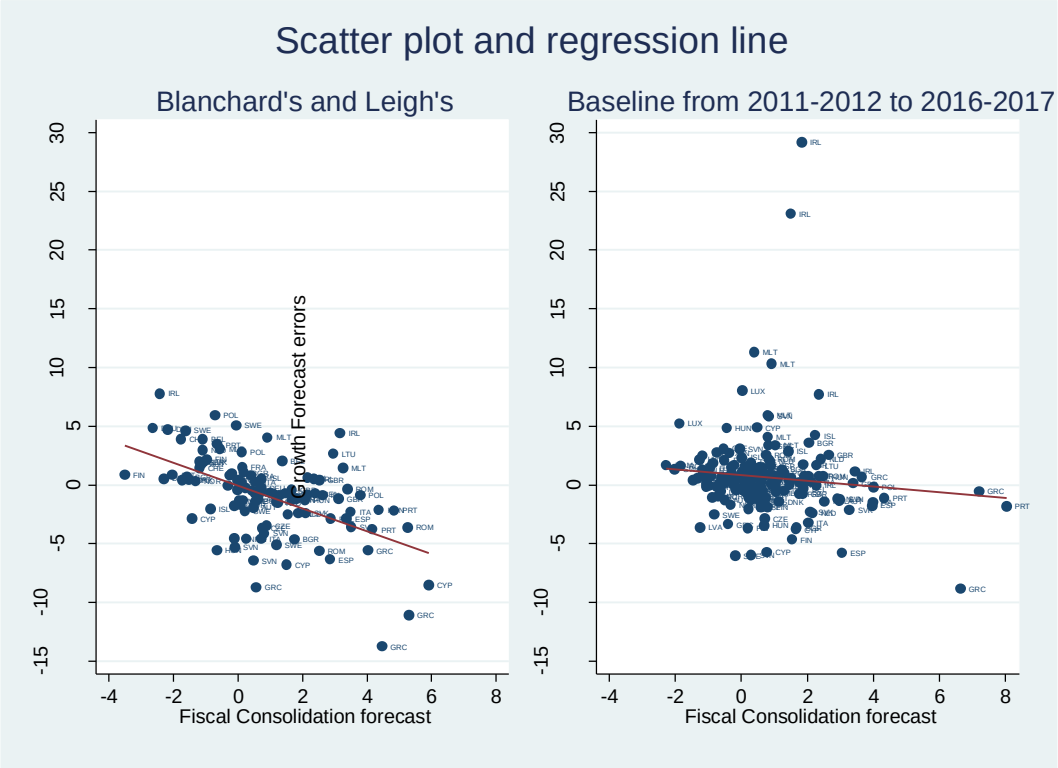
In addition, the regression line reinforces the previous baseline estimation regarding the fact that the Blanchard and Leigh's regression is decreasing, because baseline shows that there is underestimation. On the other hand, the study developed in this paper shows a practically flat regression around the zero value baseline, because it is conveying an accurate estimation of fiscal multipliers.

Consequently, we should expect a heteroskedasticity problematic for the case of Blanchard and Leigh's model seems could be a serial correlation and the Random effects model will the best model to control it. Furthermore, it is a useful technique for study variation during this period. Something coherent because during the beginning of the crisis there was a general sharp fall on GDP growth for the European economies and intensive increase in the application of aggressive consolidation plans, which increased differences among European economies. For example, there was wide differences during this period if comparing Germany and PIGS countries: Portugal, Ireland, Greece and Spain.

However, the baseline model estimated in this research selects a period with many time variations, because from 2011 until 2017 there was a financial crisis, the second fall by Risk premium crisis and the current recovery. Every of these economy scenarios sharped the differences among European countries. Therefore, we would expect the Random model will be the best model, because it corrects for serial correlation giving a good technique in order to study cross-sectional variations.

FIGURE 8:

Scatter plot and regression line for Blanchard's and Leigh's, and baseline from 2011-2012 to 2016-2017



Following the logic of the previous baseline estimation, we will expect the estimation by Poled OLS, Fixed effect and Random Effect models will give us underestimated fiscal multipliers for Blanchard and Leigh study, and accurate ones in the other case.

Panel data analysis by Blanchard and Leigh's estimations

First, we will develop in detail the panel data analysis to check the robustness of the Blanchard and Leigh's estimation. The aim is to control the possible problems of the omitted variable or heterogeneity in which panel data analysis is a good tool, like we explained in detail in the previous part. We will split meticulously up the panel data analysis for the Blanchard and Leigh's data selection for this model.

The panel data selection consists in previous model applied as a loop for every data selection, where we selected the range of year for every baseline from 2009-2010 to 2011-2012. The data base where variables come from will change depending on the baseline and following the model, creating the matrix of the baseline for the period. The case of the Blanchard and Leigh, we considered the same model used for baseline estimations: real accumulative annual percentage GDP growth ($\Delta Y_{i,t:t+1}$WEO17) comes from the October 2017 *World Economic Outlook* data base, and forecast of GDP growth ($f\{\Delta Y_{i,t:t+1} \mid \Omega t\}$ SPRINGt) and fiscal consolidation ($f\{F_{t+1,i} - F_{t-1,i} \mid \Omega t\}$ SPRINGt) from the Spring *World Economic Outlook* from the previous year of the baseline selected. But, the data of the different variables come from 2009 until 2012 so to introduce the forecast variables. We consider European economies which vary for 26 or 27 countries depending on the dataset where variable is obtained and its period (26+26+26+27=105).

In Table 9, we estimate the Blanchard and Leigh's model by the Pooled OLS. We reject the null hypothesis; thus, the fiscal multipliers is underestimated by 0.973 percentage points at the 1, 5 and 10 level of significance. Therefore, in every additional percentage point of potential GDP of fiscal consolidation, the GDP was around 0.973 percentage points lower than forecast. The constant term is not statistically significant and the Goodness of fit is 0.289 quite low, because of the increase of degrees of freedom offered by panel data (N*T), also increasing the variability by decreasing the Goodness of fit coefficient.

TABLE 9

Estimation of the regression by the POOLED OLS (POLS) model

	Coefficient		*Std. Error*	*t-value*	*p-value*
Baseline	-0,973	***	0,173	-5,600	0,000
Constant term	-0,075		0,293	-0,260	0,798
Number of observations	105				
R-squared	0,289				

Note: ***, ** and * denotes statistical significance at the 1, 5 and 10 levels, respectively.

Next, we are going to estimate the model by Fixed Effects and we have to decide which estimator will be the best: Within-group (WG), Least Squares Dummy variables (LSDV), or First Differences (FD). We know that the estimation by Within-Group and Least Squares Dummy Variable (LSDV) always results in an exactly equivalent slope coefficient and standard errors. But, the LSDV includes a dummy variable for each cross-sectional individual in the model which is not too efficient, because imply many regressors when N is big.

Regarding the First Differences procedure, the coefficient of the time-invariant regressors cannot be identified. This model usually resulted in different outcomes if compared to the two previous ones, except for when the panel data has time units (T=2). If we do not expect a serial correlation, Within-group and LSDV are more efficient than First differences, and otherwise. Then, we consider the best procedure is Fixed effects by within-group.

In Table 10, we estimated the Blanchard and Leigh's model by the Fixed effect by Within Group. We reject the null hypothesis; thus, the fiscal multipliers is underestimated by 0.957 percentage points at the 1, 5 and 10 level of significance. Therefore, in every additional percentage point of potential GDP of fiscal consolidation, the GDP was around 0.957 percentage points lower than forecasted. The constant term is not statistically significant and the Goodness of fit is 0.368.

Furthermore, the rho is known as intraclass correlation. Therefore, the 36,8 percent of the variance is due to differences across panel. The results are unexpected because we obtained an accurate estimation of the fiscal multiplier, while the baseline of Blanchard and Leigh showed an underestimation. The reason why we obtain this result can be to solve a problem of cross section.

TABLE 10

Estimation of the regression by Fixed effects model: within-group (WG) estimator

	Coefficient		*Std. Error*	*t-value*	*p-value*
Baseline	-0,957	***	0,143	-6,660	0,000
Constant term	-0,089		0,246	-0,360	0,719
Number of observations	105		R-squared	0,368	
Number of groups	28		rho	0,546	
Observation per group	4				

Note: ***, ** and * denote statistical significance at the 1, 5 and 10 levels, respectively.

Now, we are going to estimate the model by Random effect considering unobserved heterogeneity behaving such as a random normal distribution independent of the regressors. The aim is to check if there is an omitted significant variable and to solve possible serial correlations in order to study the cross-sectional variations.

In Table 11, we estimate the Blanchard and Leigh's model by the Pooled OLS. We reject the null hypothesis; thus, the fiscal multipliers is underestimated by 0.95 percentage points at the 1, 5 and 10 level of significance. Therefore, in every additional percentage point of potential GDP of fiscal consolidation, the GDP was around 0.95 percentage point lower than forecast. The constant term is not statistically significant and the Goodness of fit is 0.468. Therefore, the 36,8 percent of the variance is due to differences across panel.

TABLE 11

Estimation of the regression by Random effects model

	Coefficient		*Std. Error*	*t-value*	*p-value*
Baseline	-0,95	***	0,132	-7,16	0,000
Constant term	-0,004		0,468	-0,01	0,993
Number of observations	105		R-squared	0,368	
Number of groups	28		rho	0,484	
Observation per group	4		Prob>chi2	0	

Note: ***, ** and * denote statistical significance at the 1, 5 and 10 levels, respectively.

Now, we have to carry out some tests in order to decide which the best model to estimate the regression is. We will test by the following methodology: Breusch-Pagan LM test, F-test and Hausman test. We will start by the Breusch-Pagan LM test to decide between Random Effect and POLS model, under the null hypothesis of not systematic differences across individuals.

In Table 12, we reject the null hypothesis at the 1, 5 and 10 percent level of significance, which means that there are significant differences across individuals. Then, the Random Effects model is preferred if compared to POLS.

TABLE 12

Breusch-Pagan LM test (RE vs POLS)

	Var	sqrt (Var)
Y	12,04	3,47
E	4,768	2,183
U	4,479	2,116
Prob>chibar2	0,000	

Next, we are going to apply the F-test for fixed effects to decide between Fixed Effects and POLS models. In Table 13, the results obtained on F-test are shown thanks to which we can affirm that we reject the null hypothesis at the 1, 5 and 10 percent levels of significance. It means that it is a significant fixed effect, then, the Fixed Effect model is preferred instead of POLS.

TABLE 13

F-test for fixed effects (FE vs POLS)

	Coefficient		*Std. Error*	*t-value*	*p-value*
Baseline	-0,957	***	0,143	-6,660	0,000
Constant term	-0,089		0,246	-0,360	0,719
Number of observations	105		R-squared	0,368	
Number of groups	28		rho	0,546	
Observation per group	4		Prob>F	0,000	

Note: ***, ** and * denote statistical significance at the 1, 5 and 10 levels, respectively.

One test selects the Random effects model and another the Fixed effect model; therefore, we need to decide which is preferred between them. For this reason, we use the **Hausman test (1979**), which give us Prob>chi2 is 0,901. Then, we failed to reject the null hypothesis, which means that the difference (fe - re) is small given that the Fixed Effects and Random effects betas are consistent, because there is no expected correlation among unobserved heteroskedasticity and regressors $E[c_i, X_i] = 0$. In this case, the Random effect model is preferred rather than the Fixed effect model because it is more efficient.

After, carrying out this test we can conclude that the Random effect model is the best model for Blanchard and Leigh's case. Next, we will consider the unobserved heteroskedasticity draw as random factor with normal distribution, which does not allow of correlation for the explanatory variables. The expectative previously stated has been accomplished, as we control the serial correlation in order to study the variation across individuals.

After carrying out the previous study, we should refine our diagnostic test. Because of the selected model, Random effects, we assumed that homoskedasticity and u_{it} are uncorrelated over time and individuals $E[u_{it}\, u_{jt}] = E[u_{it}\, u_{js}] = 0$ for $t \neq s$ and $i \neq j$. The violation of these assumptions does not result in a biasness and inconsistency of the estimator. It does, however, invalidate the standard errors and the resulting test. Then, to check it, we applied the following diagnostic test:

- Wooldridge's test for serial correlation AR(1)
- Green's test for groupwise heteroskedasticity
- Driscoll-Kraay standard errors

First, we are going to test the serial correlation by **Wooldridge's test for serial correlation AR(1)**. The null hypothesis is not a serial correlation, as we obtained that Prob>F is 0.928. We failed to reject the null hypothesis, therefore, there is not a serial correlation in the model.

Secondly, we are going to estimate the **Green's test for groupwise heteroskedasticity**, for which Prob>chi2 is 0,000. We reject the null hypothesis at the 1, 5 and 10 percent levels of significance. This means that there are heteroskedasticity problems. As we mentioned before, it is something expected because the individuals are countries and they used to have idiosyncratic features.

Finally, we are going to estimate **Driscoll-Kraay standard errors**. In this test, Standard errors are robust to disturbances being heteroskedastic, autocorrelated with MA(1) and cross-sectional dependent. Prob>F is 0.005, then we can claim that the model is not covered for the previous issues. The baselines coefficient is -0.973 at 1,5 and 10 levels of significance, same result obtained in the previous models.

Panel data analysis baseline from 2011-2012 to 2016-2017

In the second part of the panel data analysis, we developed in detail the panel data analysis to check the robustness of baseline estimation made during this thesis. The objective is controlling the possible problems of serial correlation, heterogeneity, etc in which panel data analysis is a good tool, as we explained in detail in the previous part.

The panel data selection consists in a loop where we selected the range of year baseline from 2011-2012 to 2016-2017. It behaves as we explained previously. In the case of the estimations developed in this thesis, we considered the same model used for baseline estimations, real accumulative annual percentage GDP growth ($\Delta Y_{i,t:t+1}$WEO17) which comes from the October 2017 *World Economic Outlook* database, and forecasted the GDP growth (f{$\Delta Y_{i,t:t+1}$ | Ωt }WEOt) and fiscal consolidation (f { $F_{t+1,i} - F_{t-1,i}$ | Ωt }WEOt) from the *World Economic Outlook* from the year previous year the baseline selected. But the data of the different variables come from 2011 until 2017 in order to introduce the forecast variables. We considered European economies which vary approximately 28 countries depending on if the dataset were variable and their period (26+28+29+28+27+28=166).

In Table 14, we estimated the model by the Pooled OLS. We observed that we failed to reject the null hypothesis. It means that the fiscal multipliers used for forecasting were accurate. The constant term is statically significant at the 1, 5 and 10 percent levels and the R-squared is practically zero, exactly 0.009. The results make sense, because in the baseline estimation of our data selection the results show the same conclusion.

TABLE 14

Estimation of the regression by the POOLED OLS (POLS) model

	Coefficient		*Std. Error*	*t-value*	*p-value*
Baseline	-0,242		0,169	-1,43	0,155
Constant term	0,843	**	0,262	3,21	0,002
Number of observations	168				
R-squared	0,009				

Note: ***, ** and * denote statistical significance at the 1, 5 and 10 levels, respectively.

Table 15 shows the estimation of the regression estimated by the Fixed effect model using the within-group estimator approach. We reject the null hypothesis; thus, the fiscal multiplier is underestimated by 0.428 percentage points at the 5 and 10 levels of significance. Therefore, in every additional percentage point of potential GDP of fiscal consolidation, the GDP was around 0.428 percentage points lower than forecasted. The constant term is statistically significant at the 5 and 10 percent levels and the Goodness of fit is 0.033. The results are unexpected, because during previous estimation of the fiscal multipliers the outcome was accurately forecasted.

Therefore, the variance of the dependent variable is not explained by the variability of the independent variable. Furthermore, the rho is known as intraclass correlation. Therefore, the 34.8 percent of the variance is due to differences across the panel.

TABLE 15

Estimation of the regression by Fixed effects model: within estimator

	Coefficient		*Std. Error*	*t-value*	*p-value*
Baseline	-0,428	**	0,199	-2,15	0,033
Constant term	0,99	**	0,30	3,30	0,001
Number of observations	166		R-squared	0,033	
Number of groups	30		rho	0,348	
Observation per group	6				

Note: ***, ** and * denote statistical significance at the 1, 5 and 10 levels, respectively.

In Table 16, we can observe the results obtained and remark by Random Effects estimation of the mode. We reject the null hypothesis; thus, the fiscal multiplier is underestimated by 0.351 percentage points at the 10 level of significance, which is o economically significant. Therefore, every additional percentage point of potential GDP of fiscal consolidation, GDP was around 0.351 percentage point lower than forecast. The constant term is statistically significant at 5 and 10 percent level, and the Goodness of fit is 0.033.

The results are unexpected because during the previous estimation of the fiscal multipliers the outcome was accurately forecasted, but it is not quite economically significant. Furthermore, the rho 24.7 percent of the variance is due to differences across the panel.

TABLE 16

Estimation of the regression by Random effects model

	Coefficient		*Std. Error*	*z-value*	*p-value*
Baseline	-0,351	*	0,185	-1,89	0,058
Constant term	0,911	**	0,457	1,99	0,046
Number of observations	166		R-squared	0,033	
Number of groups	30		rho	0,247	
Observation per group	6		Prob>chi2	0,058	

Note: ***, ** and * denote statistical significance at the 1, 5 and 10 levels, respectively.

Now, we must decide which is the best model to estimate it, so we must compare the estimators testing them with the following methodology: Breusch-Pagan LM test, F-test and Hausman test. We started by the Breusch-Pagan LM test to decide between Random Effect and POLS model, under the null hypothesis of non-systematic differences in the coefficients.

In Table 17 we can claim that we reject the null hypothesis at the 1, 5 and 10 percent levels of significance, which means that there are significant differences across individuals. Then, RE is preferred POLS.

TABLE 17

Breusch-Pagan LM test (RE vs POLS)

	Var	sqrt (Var)
y	14,83	3,85
e	10,83	3,29
u	3,56	1,88
Prob>chibar2	0,000	

Now, we are going use the F-test for fixed effects to decide between Fixed Effects and POLS. Table 18 shows the results obtained, thanks to which we can claim that we reject the null hypothesis at the 1, 5 and 10 percent levels of significance. There is an individual fixed effect. Therefore, Fixed Effect is preferred to POLS.

TABLE 18

F-test for fixed effects (FE vs POLS)

	Coefficient		*Std. Error*	*t-value*	*p-value*
Baseline	-0,428	**	0,199	-2,15	0,033
Constant term	0,99	**	0,30	3,30	0,001
Number of observations	166		R-squared	0,033	
Number of groups	30		rho	0,348	
Observation per group	6		Prob>F	0,000	

Note: ***, ** and * denote statistical significance at the 1, 5 and 10 levels, respectively.

In both tests, we rejected the Pooled OLS estimator, then, we had to decide between the Random effects and Fixed effects models. Therefore, we used the **Hausman test (1979)** and we obtained that Prob>chi2 is 0,292. Then, we failed to reject the null hypothesis, as the estimation of the betas in both are equal, what means that this difference (fe - re) is small, as both are consistent because there are not correlation between unobserved heteroskedasticity and regressors, $E[c_i, X_i]=0$. In this case, Random Effects is preferred than Fixed Effects, because it is more efficient.

The results are expected because we considered variation on economic phase during the selected period rose the differences among countries. The best model is Random effects model such as for Blanchard and Leigh, who highlight the importance of the fiscal multipliers on country selection. The selected model is a good tool for study cross-sectional variation.

After having completed the previous study, we should refine our diagnostic test. Because of the selected model, Random effect model, we assumed that homoskedasticity and u_{it} are uncorrelated over time and individuals $E[u_{it}\, u_{jt}] = E[u_{it}\, u_{js}] = 0$ for $t \neq s$ and $i \neq j$. The violation of these assumptions does not result in biasness and inconsistency of the estimator. It does, however, invalidate the standard errors and resulting test. Then, to check it, we applied the following diagnostic test:

- Wooldridge's test for serial correlation AR(1)
- Green's test for groupwise heterokedasticity
- Driscoll-Kraay standard errors

First, we are going to test the serial correlation by **Wooldridge's test for serial correlation AR(1)**. The null hypothesis is not a serial correlation, as we obtained Prob>F is 0.000. We reject the null hypothesis at the 1, 5 and 10 percent levels of significance. Therefore, there is serial correlation in the model.

Secondly, we estimated the **Green's test for groupwise heteroskedasticity**, for which Prob>chi2 is 0.000. We reject the null hypothesis at the 1, 5 and 10 percent levels of significance. This means that there are problems of heteroskedasticity. As we mentioned before, it is something expected because the individuals are countries and they used to show idiosyncratic features.

Finally, we estimated the **Driscoll-Kraay standard errors**. In this test, the Standard Errors are robust to disturbances, as they are heteroskedastic, autocorrelated with MA(1) and cross-sectional dependent. Prob>F is 0.402, so we can claim that the model is covered by the previous problems. We failed to reject the null hypothesis, thus, the fiscal multipliers was accurate.

Sum up Panel data analysis

In Table 19 there is a summary of the results obtained for both Blanchard and Leigh's data selection and baseline selection carried out in this thesis. In this section, we are going to address the conclusions achieved after the panel data study.

TABLE 19

Summaries of the Panel Data analysis for Blanchard and Leigh's, and the baseline panel analysis from 2011-2012 to 2016-2017

	Blanchard and Leigh's	***Baseline from 2011-2012 to 2016-2017***
POOLED OLS model	We reject H_0***, underestimation of Fiscal Multiplier	We failed to reject H_0, accurate estimation of the Fiscal Multiplier
FE model by Within-Group estimator	We reject H_0***, accurate estimation of Fiscal Multiplier	Reject H_0***, accurate estimation of Fiscal Multiplier
Random Effects	We reject H_0***, underestimation of Fiscal Multiplier	Reject H_0*, accurate estimation of Fiscal Multiplier
Breusch-Pagan test	Reject H_0***, RE is preferred to POLS	Reject H_0***, RE is preferred to POLS
F-test for FE	Reject H_0***, FE is preferred to POLS	Reject H_0***, FE is preferred to POLS
Hausman test	We failed to reject H_0, RE is preferred to FE	We failed to reject H_0, RE is preferred to FE
Wooldridge's test	We failed to reject H_0, no serial correlation	Reject H_0***, serial correlation
Green's test	Reject H_0***, heteroskedasticity	Reject H_0***, heteroskedasticity
Driscoll-Kraay standard errors	Reject H_0***, standard errors with heteroskedasticity, autocorrelation MA(1), and cross-sectional dependence	We failed to reject H_0**, standard errors covered for heteroskedasticity, autocorrelation MA(1), and cross-sectional dependence

Note: ***, ** and * denote statistical significance at the 1, 5 and 10 levels, respectively.

First, we are going to assess the results obtained by Blanchard and Leigh's data selection for panel data models by Pooled OLS, Fixed Effects by Within-Group and Random Effects estimators. Every model follows the previous baseline estimation results. Thus, the fiscal multipliers had undergone underestimation.

In the panel data study for our data selection for the three models, Pooled OLS, Fixed effects by within-group, and Random Effects, the outcome differs. For POLS model, we failed to reject the null hypothesis; therefore, the forecast of the fiscal multipliers is accurate as expected. Surprisingly, both the Fixed effects and Random effects outcome conveyed underestimation on fiscal multipliers, but in the case of Random effects is not quite economically significant.

Now, we are going to consider the model selected for each case as a conclusion of the following test: Breusch Pagan test, F-test and Hausman test. In both cases, Random effects is chosen such as best model. Then, we assume the unobserved heteroskedasticity is treated as a random normal distribution. But, in this case the correlation between unobserved heteroskedasticity and regressors is not allowed. Therefore, the estimations are unbiased, consistent and more efficient than in the Fixed Effects model. The model used when there is a difference across individuals has some influence on the dependent variable as interest of study. Furthermore, it controls serial correlation.

Now, we are going to examine the results obtained in the diagnostic test. First, we exposed the results obtained by of Wooldridge's test for serial correlation AR(1) for Blanchard and Leigh panel data study was not serial correlation, it was for study of baseline from 2011-2012 to 2016-2017. Besides, Green's test for groupswise heteroskedasticity, in both case exposed heteroskedasticity inefficiencies.

On the other hand, Driscoll-Kraay standard errors give us different results depending on the data selection. As we mentioned above, Driscoll-Kraay standard errors have resulted in standard errors robust to disturbances being heteroskedastic, autocorrelated with MA(1) and cross-sectional dependent. In the case of Blanchard and Leigh's test does not cover the model due to its inefficiencies, but in our data selection for the baselines from2011-2012 to 2016-2017 does.

The conclusion that we reached after carrying out the panel data analysis are the following. The model for both data selections shows heteroskedasticity, which is a logical result because there are different features given the different environment and idiosyncratic characteristics. The expectations were successful. However, in the baseline selection carried out for the thesis the estimation has serial correlation inefficiencies, but not in Blanchard and Leigh's ones. However, Random effect was the best model selected in the previous section and it corrects for serial correlation.

Driscoll-Kraay concluded that thesis selection for the model gives more efficient results than Blanchard and Leigh's. It reinforces the idea of the previous part showing that the economists have learnt to carry out more accurate estimations of the fiscal multipliers. Additionally, the study highlights the heterogeneity among countries as an important factor to consider for fiscal multipliers forecasting. Because of two reasons, both cases select Random effects as the best model because it is the best analyse cross-sectional variations. Secondly, Green's test for groupwise heteroskedasticity confirms in any cases that there is heteroskedasticity.

We can conclude that the fiscal multipliers forecasting has been more accurate after Blanchard and Leigh's discovered the underestimation of fiscal multipliers. The forecaster has learnt its lesson and improved the estimation of multipliers.

Country selection and outlier influence

The bibliography review about fiscal multipliers shows that their value changes depending on the country selection. The European countries and advanced economies usually have the similar multipliers, however, the emerging economies used to differ. Furthermore, the estimation of the baseline in 2014-2015 and 2015-2016 showed some possible influence of atypical values. Moreover, the panel data analysis showed heteroskedasticity problems which remarks the importance to consider the country selection for accurate estimation of fiscal multipliers.

For this reason, we considered that developing a study about country data selection and checking the sensitivity for possible outlier's influence may be interesting. We observe in the Blanchard and Leigh's paper that they develop checking the robustness for the choice of the economies and the role of outliers, and we consider key to be applied in our case (Blanchard and Leigh, 2013). We consider that the study that they developed is really accurate regarding the verification for outliers and economies' sensitivity selection. Furthermore, it gives us the possibility to contrast the results that they had obtained with the ones that we will have.

The study of the economies selection where we estimated the regression considering different factor for the country selection as: excluding the two largest policy changes, excluding IMF programs, excluding emerging Europe countries, considering all the advanced economies, advanced economies in liquidity trap, and emerging economies. The objective is to check if the baseline results change depending on the economies selection.

On the other hand, we can use four different methods to identify observations outside the expected relation. First, the one that we used in the previous section in the Figure 8, by Eyeball, which is simply making scatter plot and observing if there is some atypical observation. Second, we can identify conditional unusual values by Standardized residual, which consists in checking if there is two or more standard deviations away to the expected value, and for the test we will apply the method by Robust regression for outliers. Third, Leverage statistic is analysing the difference from an independent data from the mean which the case of the Quantile regression that we will estimate, but in this case respecting the median is which gives more efficient results. Fourth, Influence statistics is measuring the influence of parameter's observation, and we will use the method by Cook's Distance.

We considered the last three methods to check the extreme values in this section, which are: Robust regressions for outliers, Quantile regression and Cook's Distance. The Robust regression for outlier consists in estimating standard regression with robust variance, which is providing robust standard errors where the results are more robust for atypical observations than OLS. Next, Quantile regression is minimizing the sum of absolute error to the median, instead of the OLS making it respect the mean, which gives less accurate estimations. Finally, the Cook's Distance is measuring the effect of deleting an observation on the fitted value considering that Cook's distance is bigger than 4/N, where N is the sample size. That corrects the influence of an observation on the parameter value.

For this analysis, we will expect that the baseline for every case has to be an accurate estimation of the fiscal multiplier, reinforcing the results obtained in the previous parts. Furthermore, we had observed in the previous figure possible influences for outliers, in special for the baseline in 2014-2015 and 2015-2016, as the case of Ireland could behave as an influent atypical observation. Nevertheless, the baseline value has showed that the fiscal multipliers are accurate, the previous methodologies mentioned for outliers checking are more sophisticated and could reinforce the accuracy of the forecast.

The check of robustness that we are going to perform has the following structure for each baseline forecast. The test will distinguish among three groups of countries depending or their economic characteristics. We are going to forecast the baseline value for every group and carry out the outlier robustness check by Robustness regression, Quantile regression and Cook's distance. In the case of European countries, we are going to prove the sensitivity for economies selection by excluding the 2 largest policy changes[8], excluding International Monetary Fund (IMF) programs[9], and excluding emerging European economies[10]. Regarding the advanced economies study we will just exclude the countries in liquidity trap[11], a part of the common test previously displayed.

First, we are going to refresh the results reported on the check of robustness made by Blanchard and Leigh for baseline in 2010-2011 for 26 European economies. They had used for real GDP growth dataset from the October 2012 *World Economic Outlook* and for forecast with available information for GDP growth and fiscal consolidation database the April 2010 *World Economic Outlook.*

In Table 20, we showed the results obtained for analysing the sensitivity for the possible influence of outliers and the country choice using our data selection. Overall, the results follow the previous baseline forecast for European and advanced economies, where the fiscal multipliers had been underestimated in 2010-2011. However, the baseline for advanced economies value was not significative, because they were influenced by the countries in liquidity trap showed underestimation of fiscal multipliers.

The value of underestimation is generally around one percentage point and the advanced countries baseline coefficients are slightly smaller than the ones from European estates. We could claim that for European economies and advanced countries an increase in one percentage point of GDP of fiscal consolidation reduces around one percentage point the real growth of the GDP if compared to the forecast.

[8] The two largest policy changes are Germany and Greece.

[9] The countries with IMF programs are Greece, Ireland, Iceland, Latvia, Portugal and Romania.

[10] The European economies considered as 'emerging' are Bulgaria, Hungary, Poland and Romania.

[11] In the liquidity trap countries selected for the estimation there are the advanced countries but excluding the following: Australia, Hong Kong SAR, Hungary, Iceland, Israel, Korea, New Zealand, Norway, Poland, Romania, Singapore, Sweden, and Taiwan Province of China.

Surprisingly, the results differ for the Emerging market economies, which show a consistent accurate estimation for every test. That is highlighted by the bibliography about the differences between fiscal multipliers economies depending on the economic group conditions. Because of the Advanced economies used to have higher multipliers than Emerging economies. Summing up, the European economies and advanced countries fiscal multipliers were consistently underestimated and the emerging economies were not affected by the fiscal multipliers 'mistake' of forecast. The conclusion exposed are robust for country selection and we can conclude that there is not an influence of atypical observations because the results do not change with any methodology.

TABLE 20

Check robustness for outlier's influence and countries choice baseline 2010-2011 by Blanchard and Leigh

	Baseline	Std. Error	Constant	Std. Error	Number of observations	R^2
Europe						
Baseline	-1.095***	(0.255)	0.775*	(0.383)	26	0.496
Excluding IMF programs	-0.812***	(0.281)	0.859**	(0.381)	21	0.235
Excluding Emerging Europe	-0.992***	(0.278)	0.832*	(0.416)	22	0.475
Excluding 2 largest policy changes	-0.776**	(0.345)	0.690	(0.405)	24	0.227
Outliers: Robust regression	-1.279***	(0.183)	0.606*	(0.317)	26	0.671
Outliers: Quantile regression	-1.088***	(0.240)	0.510	(0.410)	26	0.262
Outliers: Cook's Distance	-0.921***	(0.217)	0.738***	(0.247)	21	0.539
Advanced economies						
All available (AEs)	-0.538	(0.407)	0.696	(0.450)	36	0.097
Economies in liquidity trap	-0.986***	(0.270)	0.415	(0.282)	23	0.599
Outliers: Robust regression	-0.955***	(0.201)	0.540	(0.342)	36	0.400
Outliers: Quantile regression	-0.999***	(0.127)	0.486**	(0.216)	36	0.0991
Outliers: Cook's Distance	-0.746**	(0.279)	0.792**	(0.328)	33	0.211
Emerging economies						
All available (EMs)	0.007	(0.433)	1.791	(1.271)	14	0.000
Outliers: Robust regression	0.168	(0.228)	0.291	(0.466)	14	0.043
Outliers: Quantile regression	0.313	(0.355)	0.310	(0.791)	14	0.0312
Outliers: Cook's Distance	-0.143	(0.230)	1.364	(0.875)	12	0.004

Note: ***, ** and * denote statistical significance at the 1, 5 and 10 levels, respectively.

Now, we are going to forecast the same robustness check for every baseline. We expected to obtain the same result that in the previous part for the baselines from 2011-

2012 to 2016-2017 by reinforcing the estimation with fiscal multipliers accurate forecast for every group of economies and covering for extreme values influences.

First, we will reproduce the check of robustness for the baseline for the previous 26[12] European economies in 2011-2012. Growth forecast errors are the real growth of the GDP ($\Delta Y_{i,t:t+1}$), which comes from the October 2017 *World Economic Outlook.* However, the forecast of growth of the GDP ($f\{\Delta Y_{i,t:t+1} \mid \Omega t\}$) and fiscal consolidation ($f\{F_{t+1,i} - F_{t-1,i} \mid \Omega t\}$) in t is from the September 2011 *World Economic Outlook*.

In Table 21, we can see the results obtained for analysing the sensitivity for the possible influence of outliers and the country choice for the baseline in 2011-2012. We obtained that fiscal multipliers forecast is accurate, as we had expected and following the previous estimations. Now, we will itemise the explain for each restriction imposed.

The estimation for the baseline 2011-2012 excluding countries, in which IMF programs were applied are Greece, Iceland, Ireland, Portugal and Romania. We failed to reject the null hypothesis and the baseline is zero, thus, the fiscal multipliers is accurate when we excluded economies with the IMF program. The results do not change, even controlling Portugal and Greece, the countries that in Figure 2 seemed to behave as extreme value.

Moreover, we estimate the model excluding the considered "Emerging" European countries consider by WEO database, which are Bulgaria, Hungary, Poland and Romania. Also, we regress the model excluding the largest policy changes, which are Germany and Greece. Clearly, both cases provided us with the same conclusion: the baseline coefficient is zero because the null hypothesis is accomplished, then the forecast of the fiscal multipliers is accurate.

Furthermore, we have developed a sensitivity check regarding the outlier influence following three methods: Robust regression of outliers, Quantile regression for outliers, and Cook's Distance. The three regressions show the same result, so we can claim that the estimation of the fiscal multipliers is accurate and not influenced by observations outside the expected relation.

[12] The 26 economies used for the baseline in 2010-2011 and 2011-2012 are Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Germany, Denmark, Finland, France, Greece, Hungary, Ireland, Iceland, Italy, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom.

The next step is checking the results in the case of advanced economies. The economies selected are the ones considered by the *World Economic Outlook*, which are the European countries previously chosen plus Australia, Hong Kong SAR, Israel, Korea, New Zealand, Singapore, and Taiwan Province of China. Besides, it is a model estimation just taking into account the countries in liquidity trap[13]. The results obtained are the same that the ones for European estates, and we failed to reject the null hypothesis, therefore the fiscal multipliers forecast is right. Regarding the extreme value influence analysis, we concluded that there is not any influence of outliers because when we regressed the model by the three different methodologies robust for atypical values the result did not change.

Finally, we have estimated the model considering the Emerging market economies[14] chosen by the *World Economic Outlook* database. The baseline estimation is not significative; therefore, we failed to reject null hypothesis. Then, the forecast of the fiscal multipliers is accurate also for emerging economies. The testing for possible influence of atypical observation for the three econometric tools does not differ in the previous result. We could conclude that the fiscal multipliers forecast had been accurate in 2011-2012 regardless of the country selection and it is not sensitive regarding extreme values.

[13] In the liquidity trap, countries selected for the estimation are the advanced countries but excluding the following: Australia, Hong Kong SAR, Hungary, Iceland, Israel, Korea, New Zealand, Norway, Poland, Romania, Singapore, Sweden, and Taiwan Province of China.

[14] The emerging market economies classified by the World Economic Outlook are Argentina, Brazil, Chile, China, India, Indonesia, Malaysia, Mexico, Russia, South Africa, Swaziland, Thailand, Turkey, and Ukraine.

TABLE 21

Check robustness for outlier's influence and countries choice baseline 2011-2012

	Baseline	Std. Error	Constant	Std. Error	Number of observations	R^2
Europe						
Baseline	0.378	(0.287)	1.178***	(0.231)	28	0.095
Excluding IMF programs	0.235	(0.243)	1.117***	(0.229)	22	0.035
Excluding emerging Europe	0.612*	(0.315)	1.307***	(0.255)	22	0.194
Excluding 2 largest policy changes	0.311	(0.288)	1.250***	(0.230)	26	0.071
Outliers: Robust regression	0.304	(0.247)	1.132***	(0.237)	28	0.055
Outliers: Quantile regression	0.260	(0.443)	1.014**	(0.422)	28	0.0264
Outliers: Cook's Distance	0.227	(0.254)	1.021***	(0.218)	26	0.028
Advanced Economies						
All available (AEs)	0.287	(0.274)	1.098***	(0.193)	38	0.049
Economies in liquidity trap	0.117	(0.293)	1.102***	(0.219)	25	0.006
Outliers: Robust regression	0.165	(0.218)	1.045***	(0.189)	38	0.016
Outliers: Quantile regression	0.180	(0.289)	1.045***	(0.245)	38	0.00303
Outliers: Cook's Distance	-0.054	(e.179)	0.886***	(0.164)	35	0.002
Emerging economies						
All available (EMs)	0.079	(0.113)	-0.038	(0.247)	17	0.021
Outliers: Robust regression	-0.190	(0.261)	0.068	(0.281)	16	0.036
Outliers: Quantile regression	0.040	(0.218)	-0.067	(0.381)	17	0.00253
Outliers: Cook's Distance	-0.214	(0.143)	0.094	(0.252)	16	0.056

Note: ***, ** and * denote statistical significance at the 1, 5 and 10 levels, respectively.

Next, we forecasted the check of robustness for the baseline for 28[15] European estates in 2012-2013, where the real accumulative year-over-year GDP growth ($\Delta Y_{i,t:t+1}$) variable comes from October 2017 *World Economic Outlook*, and the forecast of the GDP growth ($f\{\Delta Y_{i,t:t+1} \mid \Omega t\}$) and fiscal consolidation forecast ($f\{F_{t+1,i} - F_{t-1,i} \mid \Omega t\}$) has been obtained from the October 2012 *World Economic Outlook*.

[15] The 28 European economies used for the calculation of the baseline in 2012-2013 are the following: United Kingdom, Austria, Belgium, Denmark, France, Germany, Italy, Luxembourg, Netherlands, Norway, Sweden, Switzerland, Finland, Greece, Iceland, Ireland, Malta, Portugal, Spain, Cyprus, Bulgaria, Czech Republic, Slovak Republic, Hungary, Lithuania, Slovenia, Poland, and Romania.

In Table 22, we show the results obtained for the sensitivity analysis for the possible influence of outliers and the country choice for the baseline forecast in 2012-2013. We estimated our model excluding the countries with IMF programs, emerging European economies, and the two largest policy plans. The result coincides, as expected we failed to reject the null hypothesis that the baseline value is zero, thereby, the researcher had forecast accurate fiscal multipliers. The outcomes support our expectative.

Moreover, we applied a check on the sensitivity of the extreme values following three methods: Robust regression of outliers, Quantile regression for outliers, and Cook's Distance. The three robust regressions show the same result for 26 European economies. Thus, we can claim that the estimation of the fiscal multipliers was accurate and not influenced by the outlier.

Next, we checked the baseline value for advanced countries, considering the same selection that in the previous estimations: European estates plus advanced economies decided by the *World Economic Outlook* dataset. We estimated the baseline of these countries and also considered just the countries in liquidity trap. The results are equal, we failed to reject the null hypothesis, therefore the fiscal multipliers forecast is right. Regarding the extreme value influence analyses, there is not an influence of atypical observation. Both groups, European estates and advanced economies, have provided the same results, which are consistent with the expectative.

Finally, we estimated the model considering the Emerging market economies[16] for the WEO dataset. The baseline estimation is not significative; therefore, we failed to reject null hypothesis. Then, the fiscal multipliers is accurately forecasted for Emerging economies. The testing for possible influence of atypical observation for Robust regression and Quantile regression gives a robust result for extreme value, as the baseline is not influenced.

Nevertheless, the Cook's distance method show unexpected results obtaining a baseline estimation of -0.616 at the 1, 5 and 10 percent of significance. We rejected the null hypothesis, as there is underestimation of the fiscal multiplier. The meaning of the baseline value is for every additional percentage point of fiscal consolidation as the percentage of the potential GDP, the real GDP growth is 0.616 percent lower than forecasted.

[16] The Emerging market economies consider it by World Economic Outlook are Argentina, Brazil, Chile, China, India, Indonesia, Malaysia, Mexico, Russia, South Africa, Swaziland, Thailand, Turkey, and Ukraine.

However, in our model we considered the level of significance, which means a percentage of rejection of the null hypothesis when it is true. We believe that this result would be inside this allowed 5 percent. Considering the baseline estimation has been accurate for all the case less in Cook's Distance regression for emerging market economies, it could be an error of type I. The model forecast is considering by default a 5 percent of significance, which is a 5 percent of possibility for a type 1 error. The type I error rejects the null hypothesis when is true. We consider that this result is inside this five percent.

TABLE 22

Robustness check for outlier's influence and countries choice baseline 2012-2013

	Baseline	Std. Error	Constant	Std. Error	Number of observations	R^2
Europe						
Baseline	0.034	(0.173)	-0.648	(0.613)	28	0.001
Excluding IMF programs	0.048	(0.277)	-0.747	(0.706)	23	0.001
Excluding emerging Europe	-0.007	(0.172)	-0.706	(0.672)	23	0.000
Excluding 2 largest policy changes	0.051	(0.257)	-0.675	(0.715)	26	0.001
Outliers: Robust regression	0.035	(0.196)	-0.715	(0.491)	28	0.001
Outliers: Quantile regression	0.076	(0.234)	-1.094	(0.681)	28	0.00180
Outliers: Cook's Distance	0.075	(0.147)	-0.662	(0.508)	26	0.007
Advanced Economies						
All available (AEs)	-0.132	(0.181)	-0.217	(0.518)	38	0.015
Economies in liquidity trap	-0.094	(0.173)	-0.327	(0.649)	25	0.007
Outliers: Robust regression	-0.038	(0.139)	-0.465	(0.319)	38	0.002
Outliers: Quantile regression	-0.020	(0.195)	-0.514	(0.450)	38	0.000639
Outliers: Cook's Distance	-0.033	(0.139)	-0.343	(0.415)	36	0.001
Emerging economies						
All available (EMs)	0.444	(0.532)	-0.412	(0.761)	16	0.040
Outliers: Robust regression	0.389	(0.242)	-0.259	(0.300)	16	0.156
Outliers: Quantile regression	0.521	(0.307)	-0.214	(0.374)	16	0.0631
Outliers: Cook's Distance	0.616**	(0.253)	-0.527	(0.457)	14	0.156

Note: ***, ** and * denote statistical significance at the 1, 5 and 10 levels, respectively.

Besides, we are going to perform a robustness check for the baseline value for 29[17] European economies in 2013-2014. The data for the real accumulative year-over-year GDP growth ($\Delta Y_{i,t:t+1}$) comes from the October 2017 *World Economic Outlook*, and the forecast of GDP growth ($f\{\Delta Y_{i,t:t+1} \mid \Omega t\}$) and fiscal consolidation ($f\{F_{t+1,i} - F_{t-1,i} \mid \Omega t\}$) from the October 2013 *World Economic Outlook*.

In Table 23, we show the results obtained for the sensitivity analysis for the possible influence of outliers and the country choice for the baseline in 2013-2014. The estimation for the baseline excluding countries to which the IMF programs were applied are Greece, Iceland, Ireland, Portugal and Romania. We failed to reject the null hypothesis, and the baseline is zero, thus, the fiscal multipliers is accurate when we exclude economies with IMF program.

In addition, we estimated the model excluding the considered emerging European countries considered by the WEO database, which are Bulgaria, Hungary, Poland and Romania. Also, we regressed the model excluding the largest policy changes, which are Germany and Greece. Clearly, both cases provided us with the same conclusion, the baseline coefficient is zero because the null hypothesis is accomplished, then the forecast estimated accurate fiscal multipliers.

Furthermore, we developed a sensitivity check of the outlier influence following three methods: Robust regression of outliers, Quantile regression for outliers, and Cook's Distance. The three regressions show the same result: we can claim that the estimation of the fiscal multipliers is accurate and not influenced by observations outside the expected relation.

[17] The 29 European economies used for the calculation of the baseline in 2013-2014 are the following: United Kingdom, Austria, Belgium, Denmark, France, Germany, Italy, Luxembourg, Netherlands, Norway, Sweden, Switzerland, Finland, Greece, Iceland, Ireland, Malta, Portugal, Spain, Cyprus, Bulgaria, Czech Republic, Slovak Republic, Estonia, Hungary, Lithuania, Slovenia, Poland, and Romania.

Then, we are checking the results in the case of advanced economies. Economies selected are the ones considered by the *World Economic Outlook*, which are European countries previously chosen plus Australia, Hong Kong SAR, Israel, Korea, New Zealand, Singapore, and Taiwan Province of China. Besides, it is a model estimation just taking into account the countries in liquidity trap[18]. The results obtained are the same that the ones for European estates, we failed to reject the null hypothesis, therefore the fiscal multipliers forecast is right. Regarding the extreme value influence analysis, we concluded that there is not any influence of outliers, because when we regressed the model by different methodologies robust for atypical values the result did not change.

Finally, we estimated the model considering the Emerging market economies[19] chosen by the *World Economic Outlook* database. The baseline estimation is not significative; therefore, we failed to reject null hypothesis. Then, the forecast of the fiscal multipliers is accurate for Emerging economies. Also, we recreated the test for outlier's influence, the results of Robust regression for standard errors and the Cook's distance are following the previous ones, and the fiscal multipliers estimation was accurate.

Surprisingly, the Quantile regression gave unexpected results where baseline estimation is 1.858 at the 5 and 10 percent of significance. We rejected the null hypothesis, as there is overestimation of the fiscal multiplier. The meaning of the baseline value is for every additional percentage point of fiscal consolidation as the percentage of the potential GDP, and the real growth of the GDP is 1.858 percent higher than forecasted.

Considering that the baseline estimation has been accurate for all the cases except for the Quantile regression for emerging market economies, there could be a type I error. The model forecast is considering by default 5 percent of significance, which is a 5 percent possibility to incur in a type I error. The type I error rejects the null hypothesis when is true. We considered that this result would be inside this allowed 5 percent.

[18] In the liquidity trap, countries selected for the estimation are the advanced countries but excluding the following: Australia, Hong Kong SAR, Hungary, Iceland, Israel, Korea, New Zealand, Norway, Poland, Romania, Singapore, Sweden, and Taiwan Province of China.

[19] The emerging market economies classify by World Economic Outlook are Argentina, Brazil, Chile, China, India, Indonesia, Malaysia, Mexico, Russia, South Africa, Swaziland, Thailand, Turkey, and Ukraine.

TABLE 23

Robustness check for outlier's influence and countries choice baseline 2013-2014

	Baseline	Std. Error	Constant	Std. Error	Number of observations	R^2
Europe						
Baseline	0.487	(0.471)	1.436**	(0.681)	29	0.033
Excluding IMF programs	0.142	(0.466)	1.726**	(0.734)	23	0.002
Excluding emerging Europe	0.251	(0.504)	1.810**	(0.835)	23	0.008
Excluding 2 largest policy changes	0.743	(0.545)	1.388*	(0.705)	27	0.058
Outliers: Robust regression	0.304	(0.291)	0.466	(0.393)	29	0.039
Outliers: Quantile regression	0.141	(0.306)	0.783*	(0.399)	29	0.00652
Outliers: Cook's Distance	-0.067	(0.393)	1.521**	(0.634)	25	0.001
Advanced economies						
All available (AEs)	0.133	(0.304)	1.237**	(0.530)	39	0.004
Economies in liquidity trap	0.259	(0.486)	1.349	(0.893)	26	0.010
Outliers: Robust regression	0.005	(0.208)	0.546*	(0.307)	39	0.000
Outliers: Quantile regression	-0.003	(0.189)	0.699**	(0.297)	39	0.000131
Outliers: Cook's Distance	-0.141	(0.164)	0.973**	(0.364)	35	0.011
Emerging economies						
All available (EMs)	0.838	(0.939)	-0.955	(0.990)	17	0.026
Outliers: Robust regression	0.910	(1.281)	-1.061	(0.941)	17	0.033
Outliers: Quantile regression	1.858**	(0.697)	-0.852	(0.669)	17	0.0624
Outliers: Cook's Distance	-0.141	(1.251)	-0.929	(0.958)	16	0.000

Note: ***, ** and * denote statistical significance at the 1, 5 and 10 levels, respectively.

Continuing, we are going to estimate the robustness check for baseline coefficient in 2014-2015 for 28[20] European countries. As before, the real accumulative annual percentage GDP growth ($\Delta Y_{i,t:t+1}$) is from the October 2017 *World Economic Outlook* and the forecast of GDP growth ($f\{\Delta Y_{i,t:t+1} \mid \Omega t\}$) and fiscal consolidation ($f\{F_{t+1,i} - F_{t-1,i} \mid \Omega t\}$) from the October 2014 *World Economic Outlook*.

[20] The 28 European economies used for the calculation of the baseline in 2014-2015 are the following: United Kingdom, Austria, Belgium, Denmark, France, Germany, Italy, Luxembourg, Netherlands, Norway, Sweden, Switzerland, Finland, Greece, Iceland, Ireland, Malta, Portugal, Spain, Bulgaria, Czech Republic, Slovak Republic, Estonia, Hungary, Lithuania, Slovenia, Poland, and Romania.

In Table 24, we show the results obtained for the sensitivity analysis for the possible influence of outliers and the country choice for the baseline in 2014-2015. We obtained that the fiscal multipliers forecast is accurate, as we had expected, and following the previous estimations. Now, we itemise the explanation for each restriction imposed.

The estimation for the baseline 2014-2015 excluding countries in which IMF programs were applied are Greece, Iceland, Ireland, Portugal and Romania. We failed to reject the null hypothesis and the baseline is zero, thus, the fiscal multipliers is accurate when we excluded economies with the IMF program. The results did not change, even controlling for Ireland the countries that in Figure 5 seemed to behave as an atypical observation.

Furthermore, we estimated the model excluding the considered emerging European economies considered by the *World Economic Outlook* database, which are Bulgaria, Hungary, Poland and Romania. Also, we regressed the model excluding the largest policy changes, which are Germany and Greece. Clearly, both cases provided us with the same conclusion, the baseline coefficient is zero because the null hypothesis is accomplished, then the forecast of the fiscal multipliers is accurate.

Additionally, we forecasted a sensitivity check for the outlier influence following three methods: Robust regression of outliers, Quantile regression for outliers, and Cook's Distance. For every test, we obtained the same result and we rejected the null hypothesis; thus, they concluded that the fiscal multipliers estimation has been accurate. Then, we concluded that there is not any influence of extreme values because the results did not change when we control the outliers.

Next, we make the robustness check for advanced economies considering the same economies for every case. Besides, is the model estimation is just taking into account the countries in liquidity trap. The results obtained are the same that the ones for European estates, we failed to reject the null hypothesis, therefore the fiscal multipliers forecast is right. Regarding the extreme value influence analysis, we concluded that there is not any influence of outliers because when we regressed the model by three methodologies the results were not altered.

Finally, we estimated the model considering the emerging market economies. The baseline estimation is not significative; therefore, we failed to reject null hypothesis. Then, the forecast of the fiscal multipliers is accurate also for emerging economies. The testing for a possible influence of atypical observations by the three econometric tools does not differ on the previous result. We can conclude that the fiscal multipliers forecast had been accurate in 2014-2015 regardless on the country selection and it is not sensitive for extreme values.

TABLE 24

Robustness check for outlier's influence and countries choice baseline 2014-2015

	Baseline	Std. Error	Constant	Std. Error	Number of observations	R^2
Europe						
Baseline	1.882	(2.265)	1.768*	(0.868)	28	0.075
Excluding IMF programs	-0.647	(0.567)	1.428**	(0.577)	22	0.037
Excluding emerging Europe	2.352	(2.649)	2.080*	(1.122)	22	0.102
Excluding 2 largest policy changes	1.735	(2.260)	2.004**	(0.884)	26	0.065
Outliers: Robust regression	-0.695	(0.417)	0.877**	(0.335)	27	0.100
Outliers: Quantile regression	-0.702	(0.434)	1.272***	(0.380)	28	0.0116
Outliers: Cook's Distance	-0.057	(0.416)	0.936*	(0.510)	26	0.000
Advanced economies						
All available (AEs)	0.984	(1.482)	1.068*	(0.600)	38	0.030
Economies in liquidity trap	1.519	(2.230)	1.523	(0.898)	25	0.048
Outliers: Robust regression	-0.482	(0.313)	0.416	(0.284)	37	0.064
Outliers: Quantile regression	-0.394	(0.515)	0.557	(0.507)	38	0.00110
Outliers: Cook's Distance	-0.175	(0.284)	0.516	(0.412)	36	0.004
Emerging economies						
All available (EMs)	-1.436	(1.020)	-0.612	(0.669)	17	0.166
Outliers: Robust regression	-0.498	(0.775)	-0.730	(0.665)	16	0.029
Outliers: Quantile regression	-0.763	(0.968)	-1.025	(0.939)	17	0.0379
Outliers: Cook's Distance	-0.284	(0.756)	-0.377	(0.650)	16	0.009

Note: ***, ** and * denote statistical significance at the 1, 5 and 10 levels, respectively.

Then, we are going to carry out a robustness check for the baseline value for 27[21] European countries in 2015-2016. As before, the real accumulative annual percentage GDP growth ($\Delta Y_{i,t:t+1}$) is from the October 2017 *World Economic Outlook* and the forecast of the GDP growth ($f\{\Delta Y_{i,t:t+1} \mid \Omega t\}$) and fiscal consolidation ($f\{F_{t+1,i} - F_{t-1,i} \mid \Omega t\}$) from the October 2015 *World Economic Outlook*.

In Table 25, we show the results obtained for the sensitivity analysis for the possible influence of outliers and the country choice baseline in 2015-2016. We have obtained that the fiscal multipliers forecast is accurate, as expected, and following the previous estimations.

[21] The 27 European economies used for the calculation of the baseline in 2015-2016 are the following: United Kingdom, Austria, Belgium, Denmark, France, Germany, Italy, Luxembourg, Netherlands, Norway, Sweden, Finland, Greece, Iceland, Ireland, Malta, Portugal, Spain, Bulgaria, Czech Republic, Slovak Republic, Latvia, Hungary, Lithuania, Slovenia, Poland, and Romania.

On the other hand, we estimated our model excluding the countries in which the IMF programs were applied, which are Greece, Iceland, Ireland, Portugal and Romania. The results show that the baseline is not economically significant, then the forecast of the fiscal multipliers is accurate. Even though we excluded Ireland, which in the previous scatter plots seemed to show extreme values, our result was still unaffected. It is conveying an accurate estimation of the fiscal multipliers.

Additionally, we estimated the model excluding the considered emerging European countries consider by the WEO database selection as before. Also, we forecasted excluding the largest policy changes, which are Germany and Greece. Both cases gave us the same conclusion, that the baseline is zero, because the null hypothesis is accomplished, then the forecast of the fiscal multipliers is accurate.

Furthermore, we have developed a sensitivity check of the outlier influence following three methods: Robust regression of outliers, Quantile regression for outliers, and Cook's Distance. The Quantile regression and Cook's distance concluded that fiscal multipliers are accurate and not influenced by observations outside the expected relation.

Considering that the baseline estimation has been accurate for all the case except for the Robust regression for European economies, it could be an type I error. The model forecast is considering by default 5 percent of significance, which is a 5 percent possibility of type I error. The type I error is rejected by the null hypothesis when is true. We considered that this result would be inside this allowed 5 percent. Furthermore, Figure 6, which drawn the scatter plot and regression line for the baseline in 2015-2016, did not expose any possible atypical value.

Next, we are going to carry out a robustness check for advanced economies following the WEO perspective. Also, estimated the model just taking account the countries in liquidity trap. The results obtained are the same as previously, we failed to reject the null hypothesis, therefore the fiscal multipliers forecast is right. Regarding the extreme value influence analyse, we obtained the same result, where there is not any influence of atypical observation.

Finally, we have estimated the model considering the emerging market economies for the WEO dataset. Surprisingly, the baseline is negative and significative at the 1, 5 and 10 percent for emerging market economies, and also applying the three previous regression robust for outliers. Overall, it means that for every additional percentage point of fiscal consolidation regarding to potential GDP, GDP growth was about approximately 0.5 percent lower than forecasted. The economist widely accept that in growth phase advanced economies used to have lower fiscal multipliers than emerging countries.

Interestingly, the baseline coefficient for emerging economies in 2015-2016 displayed unexpected underestimation on the fiscal multipliers around the 0.5 percent. The results could be those because of different factors. The period is in the recovery phase for emerging countries as China, which are quite trade opened economies, fact which increases fiscal multipliers.

On the other hand, emerging countries as Malaysia, Indonesia, Argentina or South Africa likely had not much development in their financial systems. As we mentioned in the literature review section, the lower the financial system development the larger the fiscal multiplier. Furthermore, emerging markets economies used to have high rates of unemployment and high percentage of population depending on public compensation facts, which also increase the size of fiscal multipliers.

The results show the opposite case outcome than in Blanchard and Leigh's underestimation, where the fiscal consolidation cost for GDP growth was higher than expected. The baseline for emerging market economies in 2015-2016 is underestimated, because the expansionary expected effect for the discretionary fiscal stimulus on GDP growth was lower than expected. The reason why that should be for the previous determinant has been just explained.

TABLE 25

Robustness check for outlier's influence and countries choice baseline 2015-2016

	Baseline	Std. Error	Constant	Std. Error	Number of observations	R^2
Europe						
Baseline	1.384	(1.141)	1.363*	(0.664)	27	0.091
Excluding IMF programs	0.236	(0.432)	0.657**	(0.297)	21	0.020
Excluding emerging Europe	1.824	(1.629)	1.590*	(0.789)	21	0.114
Excluding 2 largest policy changes	1.350	(1.176)	1.359*	(0.726)	25	0.085
Outliers: Robust regression	-0.513***	(0.145)	0.209	(0.141)	26	0.342
Outliers: Quantile regression	-0.149	(0.359)	0.364	(0.356)	27	0.00486
Outliers: Cook's Distance	0.283	(0.345)	0.783**	(0.284)	26	0.030
Advanced economies						
All available (AEs)	1.017	(0.825)	0.868*	(0.485)	37	0.063
Economies in liquidity trap	1.244	(1.155)	1.027*	(0.592)	24	0.063
Outliers: Robust regression	-0.119	(0.206)	0.212	(0.206)	36	0.010
Outliers: Quantile regression	0.094	(0.310)	0.316	(0.336)	37	0.000198
Outliers: Cook's Distance	0.242	(0.267)	0.461*	(0.244)	36	0.023
Emerging economies						
All available (EMs)	-0.517**	(0.195)	0.031	(0.333)	17	0.220
Outliers: Robust regression	-0.466***	(0.145)	-0.000	(0.186)	17	0.408
Outliers: Quantile regression	-0.348***	(0.079)	0.107	(0.144)	17	0.250
Outliers: Cook's Distance	-0.501***	(0.110)	-0.040	(0.168)	15	0.547

Note: ***, ** and * denote statistical significance at the 1, 5 and 10 levels, respectively.

Finally, we are going to develop of the robustness check for baseline coefficient for 28[22] European estates in 2016-2017. The real accumulative annual percentage GDP growth ($\Delta Y_{i,t:t+1}$) is from the October 2017 *World Economic Outlook* and the forecast of GDP growth ($f\{\Delta Y_{i,t:t+1} \mid \Omega t\}$) and fiscal consolidation ($f\{F_{t+1,i} - F_{t-1,i} \mid \Omega t\}$) from the October 2016 *World Economic Outlook*.

[22] The 28 European economies used for the calculation of the baseline in 2016-2017 are the following: United Kingdom, Austria, Belgium, Denmark, France, Germany, Italy, Luxembourg, Netherlands, Norway, Sweden, Finland, Greece, Iceland, Ireland, Malta, Portugal, Spain, Bulgaria, Czech Republic, Slovak Republic, Estonia, Latvia, Hungary, Lithuania, Slovenia, Poland, and Romania.

In Table 26, we address the results obtained for the sensitivity analysis of the possible influence of outliers and the country choice for the baseline 2016-2017. We estimated the model excluding the countries with IMF programs, emerging European economies, and the two largest policy plans. The result is as expected, and we failed to reject the null hypothesis as the baseline value is zero, thereby, the researcher had forecasted accurate fiscal multipliers. The outcomes support our expectative.

Moreover, we applied a sensitivity check on the extreme values following three methods: Robust regression of outliers, Quantile regression for outliers, and Cook's Distance. The three robust regression show the same result for 28 European economies. Thus, we can claim that the estimation of the fiscal multipliers is accurate and not influenced by outlier.

Next, we checked the baseline coefficient for advanced countries, considering the same selection that in the previous estimations, European estates plus advanced economies, decided by the *World Economic Outlook* dataset. We estimated the baseline of this countries and also considered just the countries in liquidity trap. The results are equal, we failed to reject the null hypothesis, therefore the fiscal multipliers forecast is right. Regarding the extreme value influence analyses, there is not any influence of atypical observation. Both groups European estates and advanced economies have provided the same results, which are consistent with the expectative.

Finally, we have estimated the model considering the emerging market economies for the *World Economic Outlook* dataset. The result displays that we failed to reject null hypothesis. Then, the fiscal multipliers is accurately forecasted for emerging economies. The testing for a possible influence of atypical observation for Robust regression, Quantile regression and Cook's distance gives robust result for extreme value, as the baseline is not influenced.

TABLE 26

Robustness check for outlier's influence and countries choice baseline 2016-2017

	Baseline	Std. Error	Constant	Std. Error	Number of observations	R^2
Europe						
Baseline	0.378	(0.287)	1.178***	(0.231)	28	0.095
Excluding IMF programs	0.235	(0.243)	1.117***	(0.229)	22	0.035
Excluding emerging Europe	0.612*	(0.315)	1.307***	(0.255)	22	0.194
Excluding 2 largest policy changes	0.311	(0.288)	1.250***	(0.230)	26	0.071
Outliers: Robust regression	0.304	(0.247)	1.132***	(0.237)	28	0.055
Outliers: Quantile regression	0.260	(0.443)	1.014**	(0.422)	28	0.0264
Outliers: Cook's Distance	0.227	(0.254)	1.021***	(0.218)	26	0.028
Advanced economies						
All available (AEs)	0.287	(0.274)	1.098***	(0.193)	38	0.049
Economies in liquidity trap	0.117	(0.293)	1.102***	(0.219)	25	0.006
Outliers: Robust regression	0.165	(0.218)	1.045***	(0.189)	38	0.016
Outliers: Quantile regression	0.180	(0.289)	1.045***	(0.245)	38	0.00303
Outliers: Cook's Distance	-0.054	(0.179)	0.886***	(0.164)	35	0.002
Emerging economies						
All available (EMs)	0.079	(0.113)	-0.038	(0.247)	17	0.021
Outliers: Robust regression	-0.190	(0.261)	0.068	(0.281)	16	0.036
Outliers: Quantile regression	0.040	(0.218)	-0.067	(0.381)	17	0.00253
Outliers: Cook's Distance	-0.214	(0.143)	0.094	(0.252)	16	0.056

Note: ***, ** and * denote statistical significance at the 1, 5 and 10 levels, respectively.

In conclusion, we can claim that for the European countries and the advanced economies their fiscal multipliers have been accurately forecasted for every baseline from 2011-2012 to 2016-2017 for the robustness check for country selection and outliers' influence. Only there is underestimation for the baseline in 2010-2011 calculated by Blanchard and Leigh in 2013. That means that the forecaster has been estimating well the fiscal multipliers and the underestimation was just an isolate 'mistake' in front of a situation which never had had before.

In the case of the emerging market economies, the results are the same that in European estates and advanced economies for the baseline from 2010-2011 to 2014-2015, and 2016-2016. However, the baseline in 2015-2016 showed underestimation, which could be for the fact the emerging economies for the previous determinant. But, as overvaluation of the expansionary fiscal policy effect on their GDP growth.

Summing up, for the European countries and the advanced economies the results are always the same regardless of the period, and country selection. The results are robust and so similar, providing the same conclusions. In the Blanchard and Leigh's data selection there is a negative baseline, which slightly differs depending on the restriction applied, but always concluding with underestimation of the fiscal multipliers. In contrast, when we consider our that selection the results show that the fiscal multipliers estimation is accurate. Then, we can claim that generally forecasters had estimated accurate fiscal multipliers for every economies group adapting fast to the turbulent situation of the crisis.

Conclusions

We can conclude that forecasters of fiscal multipliers are adapting their methodologies for the unknown turbulent economic situation. After the underestimation discovered by Blanchard and Leigh for the fiscal multipliers in 2010-2011, there was a change. The fiscal multipliers have been accurate European countries until 2017, their result have reinforced by the three empirical procedures made: baseline estimation, panel data analysis, and country selection and extreme values influence check.

The research reinforces the bibliography regarding the difference of the fiscal multipliers depending on the economic phase and country. We could use the knowledge acquire to estimate the fiscal multipliers in each European country to consider their idiosyncratic differences. We guess the importance of controlling other variables that affect causal relationships between the GDP growth and fiscal consolidation, such as banking system situation, household's debt, and others macroeconomics variables.

European economies and Advanced countries had had practically the same baseline results for every period. On the other hand, emerging economies give different results in the baseline 2010-2011 and 2015-2016 because the factors which could influence the accuracy of the fiscal multipliers differ substantially for idiosyncratic features. Also, it is interesting that the baselines which differ are those results from European countries and ADEs for baseline in 2010-2011, when the most aggressive consolidation plans in the financial crisis were applied. On the other hand, the baseline 2015-2016 was in the recovery phase.

That highlights the importance of the country selection and its high influence in order to determine the fiscal multipliers size depending on the economic phase and the countries' characteristics. We can conclude this thesis supports the literature on the fiscal multipliers field.

We guess it could be interesting for other control research for other variables that affect causal relationship between the GDP growth and fiscal consolidation, such as banking system situation, household's debt, and others macroeconomics variables.

Many are the factors that affect this learning process. Applying the experimental method would be interesting to isolate some of the relevant determinants of the learning process, to understand how it would impact the macroeconomic scenario. Experimental economics can be a very powerful tool in order to understand the evolution of expectations in an economic environment.

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