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The impact of fiscal policy on the economic growth of OECD members between 1985 and 2015

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Resumo

A OCDE é uma organização prestigiada que promove o comérico internacional e estimula a cooperação entre os seus membros de forma a estes alcançarem crescimento económico. Entre 1985 e 2015, em regra, os membros da OCDE apresentaram níveis positivos de crescimento económico. Durante este período ocorreram algumas crises económicos ou eventos importantes que originaram recessões ou um abrandamento do crescimento económico. Os países pertencentes à Zona Euro estão dependentes da sua política orçamental uma vez que apenas o Banco Central Europeu tem autoridade para administrar a política monetária. Com esta dissertação o nosso objetivo é avaliar o impacto da política orçamental na economia dos países da OCDE. Inicialmente, iremos fazer uma investigação e recolher informação útil; depois iremos estimar o impacto utilizando a metodologia de dados em painel; depois iremos comparar essas estimativas com o que seria expectável tendo em conta as informações recolhidas anteriormente. O principal objetivo desta dissertação é podermos concluir se a política orçamental é capaz de produzir um efeito positivo/negativo ou nenhum até nas economias da OCDE.

Palavras chave: Política orçamental; OCDE; crescimento económico

JEL codes: C23; E62; F43.

Abstract: The OECD is a prestigious organization that promotes international trade and stimulates the cooperation between its members so that they achieve economic growth. Between 1985 and 2015, in general, the OECD members presented positive levels of economic growth. During that period, some economic crisis or important events took place that led to recessions or lower economic growth. The countries belonging to the Eurozone must rely on their fiscal policy, given the fact that only the European Central Bank has the authority to change monetary policy. With this dissertation, we aim to evaluate the impact of fiscal policy on the economy of the OECD countries. First, we will do some research and gather useful information; then we will estimate the impact using econometric estimation, namely panel data; Lastly we will interpret the obtained estimates and compare them with the expected impact on economic growth. The main goal is to be able to conclude if fiscal policy is capable of having a positive/negative impact or none on the OECD economies.

Keywords: Fiscal policy; OECD; economic growth

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1. Introduction

On the last decades, there has been a huge discussion regarding the relationship between economic growth and fiscal policy. Many economists tried to study this relationship by developing theories and showing evidence that link both variables. To do so, they consider different countries, time periods and models. On this dissertation we wanted to measure and quantify the impact of fiscal policy on economic growth so we evaluated the effect of government spending, government spending on education, government spending on military and tax revenue on the economic growth for the OECD countries between 1985 and 2015.

For the Eurozone countries, this relationship is even more important to understand due to the monetary policy constraints as they have to follow the guidelines established by the European Central Bank (ECB). Due to the limitations on monetary policy it is crucial to understand if fiscal policy is enough to recover the situation of some countries when they are under recession or to enhance growth if the countries are already on a positive trajectory. *Ceteris paribus*, if the Eurozone countries cannot rely on their fiscal policy they are pretty much dependent of the monetary policy conducted by the European Central Bank (ECB) or of the global status of the economy.

Having these constraints in mind, each national government establishes a set of fiscal policies to conduct during its governmental period. However some policies take time to be implemented and to deliver the desired outcome but many governments do not rule over the necessary time to achieve those outcomes.

Important studies regarding economic growth started to be published on the second half of the 20th century, it started mainly with Solow in 1956 presenting a closed economy without government and evaluating the impact of savings and technologic progress on the economy, having a capital accumulation function on the model as well. In, 1988, Lucas adapted Solow's work and introduced human capital which is considered one of the most important variables for economic growth. Over the years, other variables were accepted and established as really important to determine the impact of any other variable on economic growth.

Although there are many studies, there is not a consistent conclusion regarding the relationship mentioned before. Most of the studies evidenced a negative impact of fiscal

policy on economic growth (Engen & Skinner, 1992; Paparas, Richter & Paparas, 2015; Folster & Henrekson, 2001; Muinelo-Gallo & Roca-Sagalés, 2011; Masca et al., 2015) but there are some that show a positive relationship or even insignificant as well (Benos, 2009; Paparas, Richter & Paparas, 2015; Muinelo-Gallo & Roca-Sagalés, 2011). These contradictory conclusions may rise from the variables studied, the different countries selected for the studies, the different databases chosen or even the methodology adopted.

The majority of the literature state that, in general, fiscal policy does not have a positive impact on economic growth. Although government spending on education is many times mentioned as having a positive impact, when it comes to the estimate interpretation few are able to confirm that positive effect. We noticed that few studies included a variable that studied the possible influence of the government decisions on the population and consequently on the economy. For us it was important to have such variable on this study so we included a variable to catch the effect of a transparent and trustworthy government. It evaluates, for example, the degree of independence between the government and the public and civil services as well as their quality. As setting and conducting fiscal policy is one of the functions of all governments it was important to have a variable perceiving the impact of the effectiveness of those decisions. We were able to estimate the point on which the impact of this variable switches from negative to positive.

There is a vast discussion regarding this topic. Nevertheless, there are few including all OECD countries so, on this dissertation we included all of them, except Colombia[1]. Most studies select a smaller sample. Selecting a bigger sample than usual and including a not so common variable are the main contributions of this dissertation.

Living on a country that is member of the Eurozone makes us question if, with all the monetary policy restrictions, when our government establishes a set of fiscal policy and a budget is capable of having a positive impact on economic growth.

The results obtained support the conclusions reached by previous studies regarding government spending and government spending on military. These studies estimated a negative impact of both on economic growth. Our estimates regarding government spending on education also confirmed the expected outcome of a positive impact.

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[1] Colombia was officially admitted as OECD member on April 2020. Due to the recent admission, we did not included Colombia on this dissertation.

The only contradictory result regarding fiscal policy was the impact of tax revenues, it was expected to have a negative impact on economic growth but we estimated a positive effect.

Initially we presented the evolution of economic growth theories, then the economic situation of the OECD members over the years is described and some potential solutions to recover from the European Sovereign Debt Crisis are introduced. To finalize section 2, the expected impact of fiscal policy on economic growth is summarized. On the beginning of section 3, the relevant variables for this dissertation are selected. Afterwards, table 3.1 is created with the expected impact of each variable and the descriptive analysis is performed as well. On section 4, the methodology used is described and the data analysis and the interpretation is performed. Finally, on section 5 the conclusions are presented as well as some suggestions for future further research.

2.   Literature review

Each country's government sets its budget for the following year, forecasting its revenues and expenditures. The most common fiscal policies consist of raising/lowering tax rates or increasing/decreasing public expenditures with personnel.

2.1. The general impact of fiscal policy on economic growth

During the 1950s, the explanation of economic growth was dominated by neoclassic theories. Solow (1956), assuming a closed economy without government, showed the impact of savings and technologic progress (exogenous) on the product growth over time, where the population and savings had an exogenous and constant growth.

This model was built based on two essential equations, a production function with constant returns to scale and a capital accumulation function, showing that there is a moment where the steady-state is reached regardless of the initial conditions. At this point, there is a balance, which is stable if no exogenous shock happens, between capital stock and labor force growth.

On the 1980s, several authors refuted the idea of being exogenous factors determining long-term growth. Here it is essential to refer Lucas (1988) who, adapting Solow's work, introduced human capital and learning-by-doing as possible explanations for the differences in output and growth. Learning-by-doing is as important as education on the valorization of human capital.

Besides Lucas, Romer (1986) rejected two central assumptions of the neoclassical model: technologic changes being exogenous and all countries having access to the same technology. He set 2 essential assumptions: increasing returns in the production of output and decreasing returns in the production of new knowledge. By assuming increasing returns in the production of output, Romer states that the production per capita does not necessarily converge, the growth may be persistently slower or not occur at all on less developed countries. The investment in knowledge turns out to be a natural externality; firms with new knowledge will not be able to patent nor keep it secret. This will have a positive external effect on other firms' production possibilities.

Kneller, Bleaney, and Gemmell (1999) claim that the share of government expenditure in output or the composition of expenditure and revenues do not affect the long-run growth rate. "In the neoclassical model, steady-state growth is given by exogenous factors, like population growth rate and technological progress while fiscal policy can only affect the rate of growth during the transition to the steady-state" (Easterly & Rebelo, 1993), so fiscal policy has an impact on the level of output. However, it is unlikely to affect the rate of growth.

However, the last decades of the twentieth century brought some interesting studies (for example, Lucas Jr 1990) proving that the structure and level of taxation and expenditure, under certain circumstances, may have an impact on the long-run. A higher deficit will be compensated in the future by a higher consumption or income taxes, which leads to a decline in the growth rate. The two most common predictions for growth models are: high-income taxes lower the rate of growth and high public spending on infrastructure investment raises growth. Barro (1990) claims that if the government's actions are treated as exogenous, "variations in the share of productive government expenditures in GDP affect the growth and savings rates. (…)Productive government spending would include the resources devoted to property rights enforcement, as well as activities that enter directly into production functions". Nevertheless, productive government spending depends on the size of the debt--to-GDP ratio; a higher debt-to-GDP ratio leads to a smaller impact on the growth.

Teles and Mussolini (2014) reached an interesting result with their estimation, they could conclude that if a country has a sustainable fiscal situation and its indebtedness is associated with an increase in productive expenditures, an increase in the debt size may lead to higher economic growth. This result shows that changes in the public debt can be Pareto optimal, leading to benefits for all generations, which is quite different from that suggested by endogenous models of debt, where expenditures are always unproductive.

According to Canale and Liotti (2015), restrictive discretionary fiscal policy has a negative impact on growth, so if the reduction of structural balance is the core of the guideline advocated by Brussels in order to face increases in health and pension expenditures, this should not be pursued in times of adverse demand shocks or ineffective monetary policy because the result would be lower growth and a further worsening of public accounts.

The inconstant time lags that characterize the budgetary process combined with the difficulty of measuring the output gap tends to be one more obstacle for the correct timing of policies implementation.

2.2. Economic growth evolution on the OECD (1985-2015)

2.2.1. Persian Gulf War: 1990 – 1991

The majority of the OECD countries showed positive levels of economic growth from the middle of the 1980s until the beginning of the last decade of the 20th century. Then, in the first years of the 1990s, the price of oil increased. This was the last of 4 shocks that happened in the second half of that century. The shock was the result of the Persian Gulf War, which was a military war on the Arab Region. Almost all OECD economies suffered from this oil shock. A global recession took place.

2.2.2. Introduction of Euro: 1999 – 2002

Since the introduction of the euro, most of the Eurozone countries have had competitiveness problems and the need for structural reform in public finances, banking structure, labor market restrictions and pension systems. Such reform takes time to be successful, and it is likely to lead to a disapproval of public opinion. These countries had a large current account, persistent budget deficits and high unemployment rates (youth unemployment rate also high, which is also a matter of concern), so the population had to endure this change because it was and it still is a central component for the economic recovery. There was the need for a consistent reduction of the deficit to ensure that spending cuts and tax increases phase in only gradually as countries recover.

In 2011, Milton Friedman expressed his opinion about the adoption of the euro by Ireland saying it was a political move in order to be part of a potential United States of Europe but did not take into account the economic consequences of such a move. He even criticized the EU for implementing equal policies in countries with different characteristics and needs, predicting that in the future, it could produce political tensions. His prediction was accurate because the Italian government approved raising the deficit of its GDP to 2% despite having agreed with EU a 0.8% limit, which raised some questions about the possibility of other countries being willing to do the same.

2.2.3. The European sovereign debt crisis: 2008 – 2010

The European sovereign debt crisis started to have its effects on 2008, but it was even more evident in the Eurozone since the end of 2009. Until 2006/2007 all European Union countries were prospering economically, then it is clear the shift with a vast majority of the European countries struggling. This led, as usual, to a global recession as well. In 2010 there was a general recovery, but the majority could not cover up the decline registered on the previous year. In terms of growth rate, Portugal was one of the European countries with the lowest loss of GDP. Countries like Norway and Sweden, known for being stable economies had a bigger setback, but the debt and confidence levels are different.

Some European countries were assisted by third parties like other European countries, the European Central Bank (ECB) or the IMF. This because they were either unable to repay or refinance their government debt or to bail out over-indebted banks under their national supervision. All these countries agreed to the terms of the Maastricht Treaty when they joined the European Union, which limits their budget deficit and debt levels but at some point, they were just unable to fulfil some of the conditions imposed by the Treaty, so they had to ask for external help. According to Pisani-Ferry, Sapir, and Wolff (2013), the IMF, due to the amounts involved, the politics and the countries belonging to the Euro area, had to accept participation as a minority lender which could put at risk its leadership as a provider of policy advice and setter of policy conditionality that could create difficulties for non-European IMF members.

Austerity measures were implemented to increase competitiveness, especially the so-called "internal devaluation" which was widely presented as the solution for the 'PIIGS' (Portugal, Italy, Ireland, Greece and Spain) to overcome the crisis. This consisted of wage cuts, producing greater negative effects due to poor adjustment of the labor and product markets in Greece and Portugal. Almost a decade after the implementation of these austerity measures results are observable, negative impact on the economic growth as well as on the social cohesion, which is comprehensive because the cut on wages brings no incentive on workers to be more productive, firms save on wages but lose on production. Cruces, Álvarez, Trillo, and Leonardi (2015) noted an obsession from the EU on wage-cutting and austerity, which suggests that capital gains are more important than decreasing social inequalities. It is important not to be a debtor, but it is equally important to have a population with a low rate of poverty (equal to 0 would be magnificent but utopic) and with the same opportunities.

Pavolini, León, Guillén, and Ascoli (2016) describe the reforms implemented by Italy and Spain as consisting on rising taxation and freezes or reductions in salaries, efforts to lower public deficits, restrictive social policy reforms and even more severe budgetary cuts since the latter months of 2011, coinciding with the change of government in the intensification of pressure by the EU. The process was the same in Portugal.

Two of the most consensual reasons for this crisis are the burst of a bubble in 2007/2008 which was the result of speculative mortgage lending by US financial institutions and trading of resultant derivative securities and the integration of some precarious economies in the Eurozone.

2.3. Theoretical solutions for the OECD countries

A problem that is common to happen is the change of trajectory of the fiscal policy every time a new political party is elected. It is known that fiscal policy takes time to be effective, and 4/5 years or similar is not enough. As well as, in the first half of the mandate, the government is having the guts to set policies that will not be popular amongst the population but then it becomes softer because the politicians prefer another mandate instead of reaching the best for the country.

Some potential solutions pointed out by Betz and Carayannis (2016) to the Greek fiscal crisis might lie in immediate tax reform, anti-corruption measures, place debt repayment into the future and, if possible, avoid new fiscal indebtedness, even from the IMF. Solving the problem of the enormous debt (of previous Greek governments) could have been "kicked-down-the-road".

Given the difficult times that EU has been living, some countries, over the last decade, have been trying different and, in some way, innovative approaches like bigger fiscal decentralization, hoping to get improved efficiency by using local information, competition and accountability. Decentralization also has its problems, if local government is certain that it gets a bailout if needed, it may be willing to overspend, so it is important to set rules and create or improve mechanisms to control it.

2.4. Empirical studies

The existing empirical studies with econometric techniques are mostly from the 1980s onwards. Many studies are analyzing and evaluating the relationship between fiscal policy and economic growth, using different methodologies, for different countries and periods.

Table 2.1 – Empirical studies summary for different countries and periods

Study	Countries	Period	Methodology	General result
Engen and Skinner (1992)	107 countries	1970 - 1985	OLS and 2SIV	(1)
Fölster and Henrekson (2001)	23 members of OECD and the other 7 countries	1970 - 1995	WLS and 2SLS	(1)
Benos (2009)	14 EU countries	1990 - 2006	OLS and GMM	(2) and (3)
Muinelo-Gallo and Roca-Sagalés (2011)	22 high-income countries and 21 upper-middle-income countries	1972-2006	OLS, GLS and GMM	(1) and (2)
Paparas, Richter, and Paparas (2015)	15 EU countries	1995 - 2008	OLS, FE and GMM	(1), (2) and (3)
Maşca, Cuceu, and Văidean (2015)	27 EU countries	1995-2011	GLS	(3)

The vast majority of the studies utilized the real GDP growth rate of the GDP per capita (GDPpc) to measure the economic growth however the fiscal policy variables used varied a lot due to the wide range of choices available. Among these variables, some had a positive impact; others had a negative impact and some no impact at all.

Although there are several studies regarding the impact of fiscal policy on economic growth, there is no consensus, and the current results can be opposite from one study to another. We can divide the results from the studies in 3 categories: (1) fiscal policy has a negative impact, (2) fiscal policy has no significant impact or (3) fiscal policy has a positive impact on economic growth.

(1) Fiscal policy has a negative impact on economic growth

Engen & Skinner (1992) collected data from 107 different countries and estimated an OLS regression using as fiscal policy measures the change in government expenditures share and the change in the tax rate. They concluded that a balanced-budget increase in government spending and taxation of 10 percentage points resulted in a decrease in the long-term growth rates of 1.4 percentage points.

On the regression of Paparas, Richter & Paparas (2015) government spending on property rights protection, defense and public order safety had a strong and negative impact on economic growth.

Folster & Henrekson (2001) performed a set of robust regressions for the first 24 members of OECD (excluding Turkey), correcting for heteroscedasticity, on which they verified a negative relationship between government expenditures and growth in these rich countries. They also performed one regression for seven poorer countries (Chile, Hong Kong, Israel, Korea, Mauritius, Singapore and Taiwan) and, beyond the previous conclusion, they also found the same relationship between taxation and growth.

The study of Muinelo-Gallo & Roca-Sagalés (2011) wanted to evaluate the impact of fiscal policy both on the economic growth and on the income inequality by collecting data for 43 countries (22 high-income countries and 21 upper-middle-income countries) and using different estimation methodologies. They concluded that current expenditures and direct taxes might reduce income inequality at the expense of economic growth.

(2) Fiscal policy has no significant impact on economic growth

Benos (2009) and Paparas, Richter & Paparas (2015) estimated for a sample of 14 and 15 European countries respectively that government outlays on human capital such as education, health, housing-community amenities, environment protection and recreation/culture/religion had no significant impact on per capita growth.

Muinelo-Gallo & Roca-Sagalés (2011) beyond the results already mentioned on (1) they also concluded that the indirect taxes effects are not significant.

(3) Fiscal policy has a positive impact on economic growth

Benos (2009) and Paparas, Richter & Paparas (2015) also found that government spending on infrastructure had a positive effect on per capita growth. This type of expenses results in positive externalities to private producers by raising their productivity, which enhances economic growth. Regarding property rights (defense, public order - safety) only for the first author, there is a positive impact on economic growth. Property rights give protection to the citizens on retaining the rights of their products and services, which encourages people to obtain and accumulate human/physical capital.

On a recent study, Masca et al. (2015), for a sample of 27 European Union countries (the 27 members before Croatia being admitted and the BREXIT) gathered data for the period between 1995 and 2011, established that a reduction on the government spending and relaxation on the fiscal pressure on labor as well as taxing consumption harder had a positive impact on growth.

3. Data and variables' definition

In order to analyze and evaluate the relationship between fiscal policy and economic growth, we collected data for the 36 EU countries (excluding Colombia due to its recent admission as OECD member) on the World Bank, Penn World Table and OECD databases since 1985 until 2015.

3.1. Economic growth and fiscal policy variables

Taking in consideration previous studies, the most common *proxies* for economic growth are the GDP per capita (GDPpc) or GDP growth rate and to represent the fiscal policy; it is usual to use government spending on education, tax revenue, government spending on military and government expenditure and government spending on infrastructures.

On this case, the dependent variable will be the GDP per capita which may be interpreted as the economic production value that can be attributed to each citizen. If this value in one country increases, we may conclude that the economy as a whole for that country is growing as well.

Regarding fiscal policy variables, the chosen variables were government spending on education (GSEdu), government spending on "primary" expenses (GS), government spending on military (GSMil) and tax revenues (TAX). The proxies used were the respective total divided by the GDP, which means that the variables are GDP related ratios. On table 3.1, there is a brief description of each of these variables.

Government spending on infrastructures was not used on this study, but a variable related to capital was selected as a control variable as can be verified afterwards on section 3.2. So, the importance of capital accumulation and investment will be reflected in that variable.

3.2. Control Variables

As referred before, fiscal policy alone may not be enough to enhance economic growth. Its impact on the economy will be strongly dependent on each country's specificities

so, in order to get complete analysis, the inclusion of control variables is essential. These control variables must be variables that are commonly mentioned and used as determinants of economic growth on previous studies.

The first neoclassical theories introduced Technologic advancements, innovations and capital accumulation as they are considered important factors to enhance economic growth. So, a proxy that is typically used and that we will use as well as the Gross Fixed Capital Formation (GFCF) which is represented by the Capital stock at constant 2011 national prices (in million 2011 USD).

A few years later human capital is also introduced as one variable important for countries' growth so, all studies that want to evaluate economic growth must have at least one variable of this kind on their estimations. It is expected from human capital to have a positive impact on economic growth as verified on some studies (Engen & Skinner, 1992; Folster & Henrekson, 2001; Muinelo-Gallo & Roca-Sagalés, 2011) but, surprisingly, on other cases the results are negative (Benos, 2009; Paparas, Richter & Paparas, 2015; Maşca, Cuceu & Văidean, 2015). On our investigation, we will not use any control variable because there might some conflict with one of the Fiscal Policy explanatory variables that we want to study (Government Spending on Education).

David Ricardo (1817) presented the comparative advantage theory, stating that a country should specialize its production and minimize the consumption of a good for which they have a comparative advantage. A country has a comparative advantage when it can produce a good at a lower relative marginal cost before the trade. If two countries capable of producing two commodities, each country should specialize itself on the production of the most efficient good, exporting it and importing the commodity on which each country is less efficient. So, international trade would be beneficial for the countries, and this effect is present on most, if not all, studies regarding economic growth. The Degree of Openness is one of the most used variables to represent this effect.

Government effectiveness plays an important role because a government that gives precise and reliable information to its firms and people develops a trustworthy relationship with them which leads to better decisions by these agents on their financial and economic choices and investments. With this said, an estimate between -2,5 (low government effectiveness) and 2,5 (high government effectiveness) was used to capture perceptions of the quality of public and civil services and the degree of its independence from political

pressures, the quality of policy formulation and implementation and the credibility of the government's commitment to such policies.

It is necessary to include some macroeconomic variables like inflation and long term interest rate. It is expected to have a negative impact on the economic growth of each country because inflation reduces the competitiveness on international trade and, consequently, the exportations.

It is important to have a GDP reference, such as the initial GDP or the GDP Logarithm to catch the influence of the GDP level of previous years. Economic growth on the poorer countries is faster than on, the richer ones so, the logarithm of the GDP is also included in order to control for convergence.

Table 3.1 – Variables' description and expected impact on GDP per capita

Variable	Description	Expected impact on GDPpc
GDP per capita (GDPpc)	GDP per capita growth rate	
Degree of Openness (OPEN)	% share on GDP of the sum of exports and imports	(+)
Initial GDP (GDP)	Initial GDP	(-)
Inflation (INF)	Inflation, consumer prices (annual %)	(-)
Interest rate (INT)	Long term interest rate	(-)

Gross fixed capital formation (GFCF)	Capital stock at constant 2011 national prices (in a million 2011 USD)	(+)
Government effectiveness (GOVEFF)	Government effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.	(+)
Government spending on primary expenses (GS)	Cash payments for operating activities of the government in providing goods and services. It includes compensation of employees (such as wages and salaries), interest and subsidies, grants, social benefits, and other expenses such as rent and dividends. (% of GDP)	(-)
Government spending on Education (GSEdu)	Government expenditure on education (% of GDP)	(+)
Tax Revenue (TAX)	Tax Revenue (% GDP)	(-)
Government spending on military (GSMil)	Government expenditure on military and national defense (% of GDP)	(-)

Source: World Bank, Penn World Table version 9.1 and OECD databases

3.3. Descriptive Statistics

Once all relevant variables have been defined within the scope of this investigation, the respective data is organized and summarized by calculating the means and measures of

variability, namely the standard deviation, maximum and minimum values. The following sections present the values of these parameters for both dependent and independent variables from 1985 to 2015.

3.3.1 Descriptive Statistics of Dependent Variable

It is important to have an idea of the growth of each studied country so, a table with the average per capita GDP (table 3.2) for each country during the studied period was built with information gathered from Penn World Table. Every time I refer the GDP per capita volume on this section, it is on USD of 2011, which is used as a term of comparison. Figure 3.1 also provides a better comparison of the averages for all studied countries as well as comparison with the OECD average.
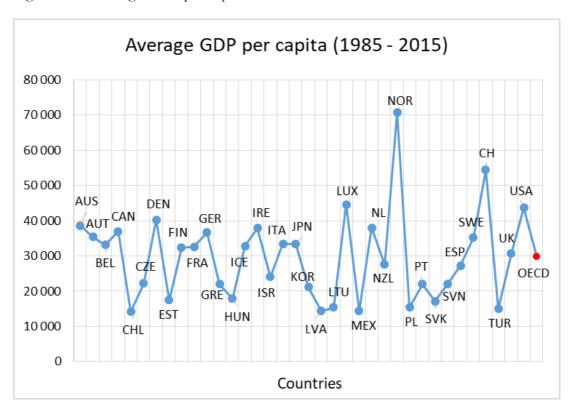
Figure 3.1 – Average GDP per capita between 1985 and 2015

Source: Penn World Table version 9.1.

Table 3.2 – Average GDP per capita for the period 1985 – 2015

Country	Average GDP per capita (2011USD)	Country	Average GDP per capita (2011USD)
Australia	**38.657,89**	Greece	**21.992,44**
Austria	**35.387,88**	Hungary	**17.909,26**
Belgium	**33.170,48**	Iceland	**32.835,20**
Canada	**36.981,34**	Ireland	**37.854,02**
Chile	**14.206,14**	Israel	**24.108,12**
Czech Republic	**22.232,20**	Italy	**33.490,53**
Denmark	**40.294,87**	Japan	**33.407,06**
Estonia	**17.512,41**	Korea	**21.211,78**
Finland	**32.279,07**	Latvia	**14.343,44**
France	**32.583,63**	Lithuania	**15.364,72**
Germany	**36.659,69**	Luxembourg	**44.605,95**
Mexico	**14.328,31**	Slovenia	**22.094,85**
Netherlands	**37.970,22**	Spain	**31.588,14**
New Zealand	**27.545,77**	Sweden	**35.250,92**
Norway	**70.739,68**	Switzerland	**54.356,41**
Poland	**24.852,90**	Turkey	**14.996,35**
Portugal	**22.037,53**	UK	**30.664,24**
Slovak Republic	**17.179,43**	USA	**43.701,22**

Source: Penn World Table version 9.1.

By analyzing table 3.2, it is possible to understand that, as expected, the less developed countries of the OECD (Chile, Estonia, Hungary, Latvia, Lithuania, Mexico,

Slovak Republic and Turkey) are the ones which present a lower GPD per capita across the years, in average. The vast majority of these countries mentioned before were the last countries to be admitted as members of OECD; the exception is Turkey. Although Turkey was one of the founding members, it is one of the countries with lower GDP per capita, averaging just 14.996,35 USD (prices of 2011 as a base term). Nevertheless, Turkey presents a steady growth of its GDP per capita, passing from 9.681,58 USD in 1985 to 23.806,05 USD in 2015.

On the other hand, Slovenia and Israel, both being admitted as a member of OECD in 2010, current GDP per capita averages higher than Greece, Korea and Portugal. The average, alone, may conceal some important evolutions over time. Korea is one of these cases, in 1985, it presented a level of just 7.574,80 USD which, across the years, suffered a considerable increase and on 2015 the GDP per capita level was 35.145,32 USD.

Over the years, OECD countries present a positive GDP per capita growth countries even though all of them suffered one or another setback, some more than others. As mentioned before there was at least one period where all OECD countries suffered these setbacks, it was at the end of the first decade of this century, during the European debt crisis.

3.3.2 Descriptive Statistics of Independent Variables

Table 3.3 shows, by country, the mean values for each explanatory variable analyzed as well as the mean values of each variable for all studied countries as a whole. It is possible to verify the following:

i) **Control variables**

The largest economies of the OECD in nominal terms (Canada, France, Germany, Italy, Japan, UK and USA) are the only countries that present an average GDP higher than the average of the OECD. However, over the years, some countries are showing signs that they are willing to fight for a place among the "greatest". There are at least three obvious cases, Australia, Korea and Spain. Among these three, Spain showed a very promising and steady growth until the end of 2008, having reached its peak so far, 1,625,225 Million USD. Since then, Spain had some ups and downs but stagnated and was not able to keep up with

the other two countries mentioned before because for these two the effects of the European Crisis were not so nefarious.

The two countries with higher average GDP are the ones with a lower degree of openness on average which shows that larger economies tend to produce more for internal markets. On the opposite side, Luxembourg has a high degree of openness, its average over the 31 years studied it is more than twice the average of 31 out of 36 countries. So, for Luxembourg, as the degree of openness is large, trade reveals a considerable influence on domestic activities.

As expected, on average, larger economies also have higher capital stocks. Giving a quick and very general look, when the capital stock decreases the GDP also decreases, it appears to exist a relationship between these two variables.

Countries with an independent and better quality of public and civil services and policy formulation and implementation and with a government committed to follow and conduct those policies are more trustworthy so, in general, they are more stable and have a steady growth. On the one hand, we have the Nordic countries of Europe and Switzerland as the best examples for countries that tend to be more trustful. On the other hand, we may find Turkey and Mexico, as the two most unreliable countries of the OECD in terms of having independent public and civil services. They have high levels of corruption when compared with the other members of OECD.

About one-third of the countries had problems controlling inflation; some reached high levels. The most critical were Slovenia, Lithuania, Latvia, Poland and Turkey, they presented a rise in prices of more than 40% over the 31 years studied. The first four had at least one year above 500%, and if we go even deeper, Slovenia and Lithuania reached more than 1000% on one year each. This happened around the time of the Persian Gulf War. On the side of the countries that were able to control inflation, the country that did a better job is Japan, never letting inflation go over 3.5% nor below -1.5%.

Regarding long term interest rate, the usual suspect, Japan, did not let it vary too much, averaging 2.36% over 31 years. Iceland, by its turn, averaged 8.06% which, among other reasons, explains why Iceland also had the lowest capital stock over 31 years.

ii) Fiscal policy variables

Japan and Korea are the countries that have a lower ratio of GS on GDP, both having an average below 17% which is quite far from the 45% and 44.61% ratio that Hungary and France, respectively, spend on primary expenses.

At first sight and having in mind just the Government Spending on Education ratio on GDP, Turkey and Greece[2] seem to have been the countries that gave less importance to Education over the years even though in recent years they are giving more and more importance. Investing more in education started to be a trend in the last decade of the 20th century for the countries that had low investments in education. They are following the example of the Nordic countries of Europe because over the years they were the countries with higher averages of GSEdu, especially Denmark, which averaged 7.57%.

Regarding Government Spending on Military, Iceland spends such a residual amount that it is not even taken into consideration on the World Bank database. At the other end, Israel spent, on average, 9.69% of its GDP on military and similar over 31 years. This is due to the conflicts that are continually taking place in the Middle East.

Finally, concerning the percentage of Tax Revenues on GDP, Switzerland is the only country with levels below 10%, to be precise Switzerland exhibited an average of just 8.92% while Denmark was the only country over 30%, averaging 32.01%. Hence, the importance given to each policy varies from one country to another.

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[2] For both countries, there was no information for some years. We relied on the available data.

Table 3.3 – Independent variables' averages for the period 1985 – 2015

Country	Control Variables (CV)						Fiscal Policy Variables (FPV)			
	GDP	OPEN	GFCF	GOVEFF	INF	INT	GS	GSEdu	GSMil	TAX
Australia	635,370	38.48	2,396,777.88	1.74	3.55	7.47	25.05	5.04	1.97	22.52
Austria	262,657	83.20	1,419,335.45	1.76	2.16	4.79	43.43	5.42	1.01	23.58
Belgium	317,210	133.86	1,983,442.21	1.67	2.10	5.68	43.39	5.43	1.58	25.67
Canada	962,467	64.37	4,477,954.02	1.83	2.41	5.96	19.81	5.79	1.43	13.32
Chile	111,250	62.08	607,840.39	1.20	8.76	5.75	18.90	3.51	2.95	16.59
Czech Republic	119,708	107.09	1,663,446.78	0.89	4.91	3.73	35.46	4.11	1.58	14.88
Denmark	213,865	81.35	1,101,214.52	2.08	2.36	5.56	38.41	7.57	1.59	32.01
Estonia	13,668	141.12	124,085.46	0.94	11.68	*	33.38	5.47	1.57	18.75
Finland	168,613	66.10	817,916.67	2.10	2.34	5.85	35.85	6.17	1.51	22.10
France	1,802,388	50.15	9,585,866.73	1.52	1.96	5.65	44.61	5.09	2.77	21.30
Germany	2,482,179	60.83	12,910,149.71	1.63	1.80	4.86	29.65	4.62	1.72	11.02
Greece	176,639	48.31	1,430,276.73	0.60	7.55	7.55	43.85	2.75	3.23	19.68

Hungary	88,444	122.20	892,858.20	0.77	11.40	7.09	45.00	5.03	1.77	22.24
Iceland	10,649	76.03	38,674.59	1.78	7.93	8.06	30.63	6.62	**	22.97
Ireland	136,642	148.00	592,571.09	1.56	2.49	6.56	36.38	4.88	0.83	25.11
Israel	139,536	68.07	545,523.87	1.21	17.90	5.46	41.65	5.91	9.69	26.03
Italy	1,486,955	45.86	10,368,924.87	0.53	3.36	5.93	42.17	4.40	1.66	22.93
Japan	4,339,043	23.47	18,932,001.23	1.39	0.58	2.36	16.28	3.63	0.94	10.62
Korea	673,421	70.06	3,698,739.20	0.98	3.94	4.71	16.85	3.38	3.07	13.75
Latvia	18,328	97.96	252,717.24	0.64	50.81	5.50	43.24	5.42	1.11	20.62
Lithuania	27,099	113.06	208,439.59	0.70	67.55	5.30	35.33	5.07	0.97	18.82
Luxembourg	30,585	256.66	130,303.68	1.78	2.11	3.89	35.32	3.77	0.68	24.21
Mexico	680,886	48.76	5,118,015.88	0.22	22.21	7.66	17.79	4.24	0.52	10.37
Netherlands	542,451	118.79	2,857,872.60	1.87	1.91	5.01	41.90	5.10	1.74	21.42
New Zealand	89,531	57.56	302,074.04	1.78	3.69	7.87	33.97	5.89	1.67	29.15
Norway	246,384	70.12	971,058.66	1.90	2.87	6.57	35.39	6.84	2.08	24.77
Poland	284,651	71.16	1,280,693.24	0.59	40.18	5.72	37.77	4.94	2.09	17.74

Portugal	146,594	65.03	1,539,953.75	1.08	5.17	5.90	38.23	4.64	2.11	19.95
Slovak Republic	53,907	133.48	407,064.03	0.77	6.24	4.39	40.59	4.09	1.68	17.64
Slovenia	31,821	118.83	255,591.03	0.97	90.95	4.44	40.54	5.36	1.41	19.49
Spain	854,340	49.59	5,981,012.03	1.29	3.69	7.29	20.28	4.18	1.77	14.77
Sweden	338,675	73.48	1,554,787.16	1.96	2.60	6.06	35.37	6.63	1.83	24.84
Switzerland	380,735	96.58	1,759,275.38	1.96	1.37	3.31	17.47	4.89	1.11	8.92
Turkey	389,048	43.00	2,881,294.74	0.17	41.89	*	23.53	2.65	3.10	15.15
UK	1,832,137	52.48	8,043,580.60	1.71	2.98	6.23	35.80	4.72	2.72	24.57
USA	10,502,843	23.68	41,530,117.48	1.58	2.70	5.49	21.49	4.95	4.18	10.62
OECD	899,592	81.29	4,295,694.79	1.30	12.25	5.67	33.37	5.11	2.08	19.67

Notes: (i) There were no values regarding long term interest rate neither for Estonia nor for Turkey (*); (ii) There were no values regarding government spending on military for Iceland, most likely because the value is very residual (**)

Source: World Bank, Penn World Table version 9.1 and OECD databases

4. Methodology, data analysis and interpretation

4.1. Methodology

The objective of this study is to analyze the impact of fiscal policy on economic growth. In this case, we want to analyze the behavior of GDP per capita (GDPpc) and identify the variables that affect GDP per capita.

The model was estimated by using panel data methodology, contemplating time series and cross-sectional data which allows the analysis of the behavior of each variable by country and across time. The generic model is the following:

$$Y_{it} = \alpha + \beta_1 X_{1,it} + \beta_2 X_{2,it} + \cdots + \beta_k X_{k,it} + \varepsilon_{it}. \tag{4.1}$$

On equation (4.1), Y_{it} represents a dependent variable, α is the constant, $X_1, X_2, \ldots, X_k$ represent the independent variables, $\beta_1, \beta_2, \ldots, \beta_k$ are the regression coefficients, and ε is a random error term[3]. When dealing with panel data, the index i represents each of the 36 individuals (countries) ($i = 1, \ldots, 36$) and t represents each of the years of the studied sample ($t = 1, \ldots, 31$). In this case, the panel data is unbalanced, and the total panel (unbalanced) observations are 403.

Once the generic model is described, it is important to adapt it to the present study so that the interpretation of equation (4.1) is more straightforward and more intuitive. Hence, for this specific case, the model specification takes the following form:

$$Y_{it} = \alpha + \beta_1 C_{1,it} + \cdots + \beta_k C_{k,it} + \delta_1 FP_{1,it} + \cdots + \delta_p FP_{p,it} + \varepsilon_{it}. \tag{4.2}$$

On equation (4.2), Y_{it} represents the GDP per capita of the country on the current period, $C_1, \ldots, C_k$ represent the control variables and $FP_1, \ldots, FP_p$ represent the fiscal policy variables.

In this case, the relevant control variables (C_m with m = 1, …, 6) of equation (4.2) correspond to the following variables, lnGDP, lnOPEN, lnGFCF, lnGOVEFF,

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[3] Not observable random variable that reunites multiple factors with influence on the dependent variable, whose effects are not perceived by the independent variables nor by the independent term. This disturbance reflects erratic and accidental effects that, by themselves, are independent and identically distributed.

(lnGOVEFF[2]) and M. This M variable represents the macroeconomic variables INF and ln INT which will be introduced separately. The ln refers to the natural logarithm, the logarithm to the base of the mathematical constant e.

By its turn, Fiscal Policy variables (FP_p with $p = 1, \ldots, 4$) correspond to GS, GSEdu, GSMil and TAX. All these variables were described in table 3.1. Adapting equation (4.2):

$$lnY_{it} = \alpha + \beta_1 lnGDP_{it} + \beta_2 lnOPEN_{it} + \beta_3 lnGFCF_{it} + \beta_4 lnGOVEFF_{it} + $$
$$+ \beta_5 (lnGOVEFF)^2_{it} + \beta_6 M_{it} + \delta_1 GS_{it} + \delta_2 GSEdu_{it} + \delta_3 GSMil_{it} + $$
$$+ \delta_4 TAX_{it} + \varepsilon_{it}. \qquad (4.3)$$

Panel data methodology permits the estimation of pooled Ordinary Least Squares (OLS), fixed effects and random effects models. According to Clark and Linzer (2015), the choice between random or fixed effects consists of a trade-off between skewness and variance, respectively. With fixed effects, the estimates are highly dependent on the sample selection; there is an inherent error associated with the randomness of data. On this investigation, as the sample is similar to the population, opting for fixed effects minimizes the referred error and avoids skewness problems from the random effects. So, all the models exposed in table 4.1, except the pooled OLS, were estimated by fixed effects for the countries between 1985 and 2015.

Three diagnostics tests are fundamental to assess which of the previously mentioned specifications is the most adequate. The first is the fixed effects F-test that selects pooled OLS models versus fixed effects models. The second, the Hausman test, decides between the use of fixed effects models and random effects models. The last is the Breush-Pagan test that assesses if the fixed effects model is more appropriate than the pooled OLS. The fixed effects F-test[4] allowed the rejection of the absence of fixed effects for countries and periods. Hence, the estimation by fixed effects is the most suitable.

For the different estimated models on table 4.1 we performed the Hausman test with fixed effects for the countries or for the time periods. The null hypothesis was always rejected

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[4] On table 4.1, for each fitted model, the fixed effects F-test was performed, and it is visible on the "Countries and periods F-test" row.

for a significance level of 1%, which means that the specification by fixed effects was the most adequate.

We also performed the Breush-Pagan test which corroborated the decision of estimating with fixed effects.

4.2. Data analysis

Five models were estimated following the conditions mentioned in section 4.1. The first two models (A and B) only used the control variables, except the macroeconomic variables inflation and long term interest rate. Model C is the fitted model with all the control variables present on model A and B as well as the studied fiscal policy variables. Models D and E were estimated with all the variables of model C adding up the macroeconomic variables not included until then. Inflation was included in model D and long term interest rate on model E.

The Wald F-statistic values reported in table 4.1, for the models A through E, indicate their overall significance, for a level of significance of 1%.

Furthermore, to check which better model fits our data, we used inference to study the possible redundancy of the explanatory variables. If we compare model A and B, using statistic inference, we get a Wald-F statistic value of 9.4933 meaning that the null hypothesis is rejected, for a level of significance of 1%. Therefore, we can conclude that model B, by containing GOVEFF and $GOVEFF^2$ variables, provides a better fit to the data than model A. From model B to C, there was also an improvement, so, the four fiscal policy variables are jointly significant. On this case, the Wald F-statistic value was 10.8488, with a p-value of 0.0000.

Models D and E were the models that included the macroeconomic variables, but on both models, each macroeconomic variable was not statistically significant. On model D, the Wald F-statistic presented a value of 0.5957 with a p-value of 0.4407 while for model E, the Wald F-statistic value was 1.6957 with a p-value of 0.1937.

In conclusion, the most suitable fitted model for interpretation is model C.

Table 4.1 – Estimation results for the models

Independent variables	Pooled OLS	Fitted model A	Fitted model B	Fitted model C	Fitted model D	Fitted model E
ln GDP	0.1062 (0.025)***	0.1800 (0.033)***	0.1531 (0.032)***	0.1185 (0.033)***	0.1191 (0.033)***	0.1160 (0.033)***
ln OPEN	-0.0731 (0.055)	0.1068 (0.045)**	0.0790 (0.043)*	0.1092 (0.042)***	0.1066 (0.042)**	0.1075 (0.042)**
ln GFCF	-0.0754 (0.025)***	0.4342 (0.055)***	0.4600 (0.053)***	0.5647 (0.056)***	0.5611 (0.057)***	0.5783 (0.059)***
ln GOVEFF	0.0836 (0.048)*		0.1021 (0.025)***	0.0906 (0.024)***	0.0900 (0.024)***	0.0911 (0.024)***
(ln GOVEFF)²	0.0708 (0.057)		0.0423 (0.013)***	0.0321 (0.013)**	0.0322 (0.013)**	0.0337 (0.013)***
GS	-0.0096 (0.003)***			-0.0040 (0.001)**	-0.0042 (0.001)***	-0.0035 (0.001)**
GSEdu	0.0555 (0.021)***			0.0170 (0.007)**	0.0167 (0.007)**	0.0151 (0.007)**
GSMil	-0.0797 (0.016)***			-0.0512 (0.014)***	-0.0505 (0.014)***	-0.0515 (0.014)***
TAX	0.0055 (0.004)			0.0091 (0.003)***	0.0092 (0.003)***	0.0088 (0.003)***
INF					-0.0010 (0.002)	
ln INT						-0.0157 (0.013)
Sample size	403	403	403	403	403	403
Adjusted R²	0.2815	0.9797	0.9807	0.9826	0.9826	0.9827
Wald F-statistic	18.5022 (0.000)	389.8981 (0.000)	393.3588 (0.000)	407.1495 (0.000)	399.5496 (0.000)	400.8406 (0.000)
Countries and periods F-test		363.7468 (0.000)	340.1201 (0.000)	338.5477 (0.000)	315.9133 (0.000)	335.5034 (0.000)

Notes: (i) In parenthesis and under each estimate it is mentioned the corresponding robust standard errors, using the cross-section weights (Panel Corrected Standard Errors) method; (ii) The symbols ***,**,* indicate the level of significance, namely at 1%, 5% or 10%; (iii) The Wald F-statistic tests the global significance of the regression, where the value inside parenthesis gives up the p-value; (iv) In the F-test, the value in parenthesis gives us the p-value.
Source: Estimates obtained with data from World Bank, Penn World Table version 9.1 and OECD databases.

4.3. Interpretation

Regarding the control variables, across the five fitted models, GFCF presented the highest estimates, and it is significant for a level of 1%. From fitted model C, we can state that an increase of 1% on GFCF corresponds to an estimated increase of 0.56% on the GDP per capita, *ceteris paribus*[5], corresponding to an estimate elasticity of GFCF of GDP per capita of 0.56. This estimate confirms the first neoclassical theories (Solow, 1956) idea that capital accumulation and capital stock levels have a positive impact on economic growth.

Contrary to the expected, the initial GDP had a positive impact on GDP per capita, even though its magnitude decreased as variables were added. This may indicate that if more significant variables are included, the impact may continue to decrease and eventually become negative. An increase of 1% of the initial GDP implies an estimated increase of 0.12%.

As expected, the degree of openness showed a positive impact on the dependent variable; that is, an increase of 1% on the degree of openness represented an estimated impact of 0.11% on the GDP per capita. This corroborates the idea presented by David Ricardo in 1817 that international trade showed a positive impact on economic growth.

Government efficiency presented a positive estimated effect of $(0.0906 + 0.0642 \times \ln \text{GOVEFF})$% on GDP per capita, this is the expected variation for a 1% increase on government efficiency. Hence, the estimated effect and also, the elasticity depends on the value of the GOVEFF. If we use the mean of GOVEFF that corresponds to 1.3833, the effect will be 0.11%. For the minimum value on the sample, we get -0.03% and for maximum the value will be 0.15%. We can conclude that the estimated impact of GOVEFF is negative for values of GOVEFF smaller than 0.24 and positive for higher values.

It was important to have macroeconomic variables on the estimation but, unfortunately, both revealed not to be statistically significant so we will not interpret their estimates.

Evaluating the outcomes of the fiscal policy variables, the only variable that affected contrary to the expected was TAX, it was expected to have a negative impact like GS and GSMil, but the obtained estimates were positive. On this case, to a one percentage point

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[5] For the other interpretations, we will not mention it, but it is always *ceteris paribus*.

variation on TAX corresponds to an estimate change of 0.91%, approximately, on the GDP per capita. Folster & Henrekson (2001) and Muinelo-Gallo & Roca-Sagalés (2011) estimated a negative impact between TAX and economic growth.

Government spending and Government spending on Military showed having a negative impact on GDP per capita, for each percentage point variation on GS and GSMil it was estimated a variation of -0.4% and -5.12 %, respectively, on the GDP per capita. These estimates support the conclusions reached by Engen & Skinner (1992), Folster & Henrekson (2001), Muinelo-Gallo & Roca-Sagalés (2011) and Paparas, Richter & Paparas (2015) of a negative impact of GS and GSMil on economic growth.

Finally, in what concerns the Fiscal Policy Variables, Government Spending on Education revealed to have a positive effect on the dependent variable, so for each unit percentage point variation the GSEdu, the estimated impact on the GDP per capita was a 1.7% increase. For Benos (2009) and Paparas, Richter & Paparas (2015) GSEdu did not have a significant impact on economic growth. Although many studies refer that GSEdu should have a positive impact, there are few that were able to get positive estimates on their fitted models.

5. Conclusions

With this dissertation we wanted to evaluate and quantify the impact of fiscal policy on economic growth for the OECD countries between 1985 and 2015. One of the primary objectives common to all governments is achieving a sustainable economic growth so it was important to divide other studies' conclusions in three groups: fiscal policy has a (1) negative impact on economic growth; (2) no significant impact on economic growth or (3) a positive impact on economic growth.

From the studies we selected, we gathered data regarding the variables that are considered as being the most important to evaluate economic growth. Initially, we performed the descriptive analysis of these established variables and the ones we proposed, separately. With the collected data, we performed the estimations using panel data methodology, the one considered the most adequate. We adapted the generic model to our specific case and then we performed the diagnostics tests. These determined that the most suitable specification was fixed effects.

The estimates of three of the fiscal policy variables studied, government spending, government spending on military and government spending on education, corroborate the conclusions reached by other studies. The first two have negative impact on economic growth and the other has a positive effect on economic growth. Tax revenue was the only fiscal policy whose estimates had a contradictory effect to what was expected. In this case its estimates were positive. Hence, two fiscal policies had a positive effect and other two had a negative impact. Government spending on military estimate has such a strong negative impact that government spending on education cannot counter balance it alone.

We also confirmed that capital stock – capital accumulation – has as important role on economic growth. Higher stock capital levels, combined with a population with high levels of education, tend to generate higher levels of production. Therefore, governments should invest on infrastructures and equipment in order to be able to obtain higher levels of capital. At the same time, they should invest on their population, on the human capital. Investing for example on the education of the younger generations and providing trainings for the working population so that they can be keep up with the constant modernization and technologic progress.

All in all, through this study we determined government spending and government spending on military to be the fiscal policies with a negative impact on economic growth while government spending on education and tax revenue have a positive effect on the economy. Simultaneously, we verified that it is important to have a transparent and trustworthy government as its effectiveness may lead to a positive and steady impact on economic growth. In contrast, a corrupt or unreliable government may have the opposite effect.

Although this study was carried out for a considerable time period, some important data was not available, for example there was not complete data for the government effectiveness. The countries' sample size may mask the real impact of fiscal policy on their economic growth for some countries, in particular for those smaller countries. This doubt rises from the fact of the studied countries not being homogeneous.

Given the results and the heterogeneity of the studied countries we may question if there are not different limits on which the fiscal policies studied switch from positive to negative, or vice versa. So, a suggestion for a future investigation would be trying to understand if it possible for a country to have positive effects from all these fiscal policies studied at a certain point.

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