Hacettepe University Graduate School of Social Sciences

Department of Economics

AN EMPIRICAL ASSESSMENT OF THE EFFECTS OF FISCAL DEVALUATION ON BILATERAL TRADE

Halis KIRAL

Ph.D. Dissertation

Ankara, 2016

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The dissertation titled "AN EMPIRICAL ASSESSMENT OF THE EFFECTS OF FISCAL DEVALUATION ON BILATERAL TRADE" prepared by Halis Kıral, was found successful and adequate, in scope and quality, as a thesis for the degree of Doctor of Philosophy in Economics, in the defense jury that was held on 28/10/2016.

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In memory of Oğuzhan Dura
(1973-2016)

ACKNOWLEDGMENTS

First and foremost, I would like to thank my adviser, Prof. Dr. Lütfi Erden for all the help, guidance and encouragement that he provides in all phases of this study. I would never have been able to finish my dissertation without his guidance. It has been an honor to be his Ph.D. student.

I am also deeply grateful to thank Assoc. Prof. Çağlar Özdemir, Asst. Prof. Barış Alpaslan, A. Koray Kazancı and Müge Odabaş for giving feedback to me.

I would like to express my deepest gratitude to my mother and father, like every difficulties in my life, I cannot complete this process without their support and pray.

I want to express my deepest gratitude to my wife, Pınar, who has shared most of the burden of my Ph.D. studies, and for her patience and compassion. I also would like to say “I am sorry” to my son, Enis. I know that I have stolen many valuable weekends from him for this thesis.

ABSTRACT

KIRAL, Halis. *An Empirical Assessment of the Effects of Fiscal Devaluation on Bilateral Trade*, Ph.D., Ankara, 2016.

The central objective of this thesis is to investigate empirically the effects of fiscal devaluation on bilateral trade. The idea of the tax policy tools to have the capability to mimic the effects of currency devaluation to gain external competitiveness dates back to gold standard age. However, the novelty that comes with the concept of a fiscal devaluation is that these fiscal policy tools are used in a budget-neutral way. Therefore, a fiscal devaluation is a fiscal policy option of a tax shift which envisages, in general terms, a shift from indirect taxes to direct taxes, and specifically, a shift from employer's social contribution to the value added taxes by preserving budget balance. A fiscal devaluation may ensure a less expensive export and a more expensive import and thus, this might result in some effects comparable to the effects of currency devaluation to gain external competitiveness. In this thesis, employers' social contribution and value added tax, which stand as the factors that represent typical fiscal devaluation, are embodied within the framework of a gravity model. The empirical model specified within this framework is applied to fixed effects vector decomposition technique in panel regressions for 22 OECD countries covering the 1980-2014 periods. The findings of this dissertation show that multilateral effects of fiscal devaluation improve trade balances due to dominant effects of reduction in employers' social contribution on export even though asymmetric results of value added tax variables might distort the success of a fiscal devaluation. This result is important as it indicates that the positive spill-over effects of a fiscal devaluation surpass the negative one.

Keywords: Fiscal Devaluation, Bilateral Trade, Gravity Model, Panel Data, Fixed Effects Vector Decomposition

ÖZET

KIRAL, Halis. *Mali Devalüasyonun Karşılıklı Dış Ticarete Etkileri Üzerine Ampirik Bir Değerlendirme*, Doktora, Ankara, 2016.

Bu tezin amacı mali devalüasyon olgusunun karşılıklı dış ticaret üzerindeki etkilerini ampirik olarak analiz etmektir. Vergi politikası araçlarının dış rekabet gücünün kazanılmasında döviz kuru devalüasyonunun etkilerini taklit edebileceği düşüncesinin izlerini altın standardı dönemine kadar sürmek mümkündür. Ancak mali devalüasyon kavramı ile gelen yenilik maliye politikası araçlarının bütçeye yük getirmeyecek şekilde kullanılmasıdır. Bu doğrultuda, mali devalüasyon genel olarak vergi yapısının dolaysız vergilerden dolaylı vergilere, özel olarak ise işveren sigorta priminden katma değer vergisine bütçe dengesini koruyacak şekilde kaydırılmasını öngören maliye politikası seçeneğidir. Mali devalüasyon ihracatın daha ucuz sağlayarak ve ithalatın daha pahalı olmasına neden olarak dış rekabet gücünün kazanılmasında döviz kuru devalüasyonunun etkilerini taklit edebilir. Tezde, bu amaca yönelik olarak mali devalüasyonu temsil eden faktörler olarak sosyal güvenlik işveren primi ve katma değer vergisi çekim modeli çerçevesine eklemlenecektir. Ampirik model 1980-2014 dönemini ve 22 OECD ülkesini kapsayan panel veriyle ve sabit etkiler vektör ayrıştırması yöntemi ile tahmin edilecektir. Tez sonucunda, katma değer vergisi değişkenlerinin asimetrik sonuçlarına rağmen, işveren sigorta primindeki azalışın ihracatı artırıcı etkisi sebebiyle mali devalüasyonun çoklu ülke uygulamaları durumunda dış ticaret dengeleri üzerinde olumlu etkilerinin daha fazla olacağı yönünde bulgulara ulaşılmıştır. Bu sonuç mali devalüasyon uygulanması durumunda uluslararası ticaretteki olumlu yayılma etkilerinin olumsuz etkilerinden daha fazla olması bakımından önemlidir.

Anahtar Kelimeler: Mali Devalüasyon, Karşılıklı Ticaret, Çekim Modeli, Panel Veri, Sabit Etkiler Vektör Ayrıştırması

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LIST OF ABBREVIATIONS

ESC: Employer's Social Contribution

ESCGDP: Employer's Social Contribution Revenue as a share of GDP

ESCTAX: Employer's Social Contribution Revenue as a share of Total Tax Revenue

FEVD: Fixed Effects Vector Decomposition method

GDP: Gross Domestic Product

OECD: The Organization for Economic Cooperation and Development

VAT: Value-Added Tax

VATGDP: Value-Added Tax Revenue as a share of GDP

VATTAX: Value-Added Tax Revenue as a share of Total Tax Revenue

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CHAPTER 1

INTRODUCTION

Fiscal devaluation is a tax shift from employer's social contributions (ESC) to the value-added taxes (VAT) in a budget-neutral way. This tax shift might have the capacity to mimic the effects of currency devaluation. The idea of a fiscal devaluation has recently drawn considerable interest in academic and policy circles especially after European sovereignty-debt crisis. As is known, those countries adopting fixed exchange rate, either through European Monetary Union or currency board, cannot adjust their exchange rates to attain price advantage in the competition of international trade. Instead of this adjustment, a budget-neutral fiscal policy option is a fiscal devaluation. In this respect, a fiscal devaluation may ensure a less expensive export and more expensive import, which, in turn, will raise the demand for domestic goods and contribute to decreasing foreign trade imbalances.

Although there are a number of theoretical and simulation-based studies on the subject over the last decade, the related literature lacks empirical evidence on the impacts of fiscal devaluations. The studies carried out by de Mooji and Keen (2012) and Franco (2011) are the exceptions. While Franco (2011) for Portugal uses a SVAR model, de Mooji and Keen (2012) employ panel regressions for OECD countries so as to analyze the influences of fiscal devaluation on output and trade. These studies empirically investigate the issue from the perspective of a single country unilaterally implementing a fiscal devaluation. However, the related theoretical literature points out the differing impacts of a fiscal devaluation based on whether it is implemented unilaterally, bilaterally or multilaterally. There can be several spillover impacts of a fiscal devaluation adopted in a single country such as beggar-thy-neighbor effect. Also, trade partners can choose tax competition, which may be detrimental to both countries. Moreover, if a fiscal devaluation is applied multilaterally, it may have a profound impact on its effectiveness. In this regard, it is important to pin down these questions

empirically, which is why this thesis focuses on the bilateral trade influences of fiscal devaluation implemented in a single country, country pairs and multi-countries.

In this thesis, fiscal devaluation hypothesis will be tested through empirical models designed within the framework of the gravity model. The factors representing fiscal devaluation such as ESC and the VAT will be embodied within the framework of the gravity model. Gravity models are employed commonly and successfully in the empirical literature investigating the determinants of bilateral trade. Thus, gravity models can serve as a suitable empirical framework in order to scrutinize the questions at hand. As far as we know, this dissertation is the first to examine a fiscal devaluation phenomenon in a well-specified empirical equations based on gravity models. This study contributes in the existing literature by addressing the effects of fiscal devaluation empirically with the gravity models as a strong empirical framework and by investigating the effects of a fiscal devaluation implemented multilaterally, bilaterally and unilaterally.

As is known, gravity equations include time variant and time invariant variables such as distance, border-sharing, language similarity and colonial ties. Handling the time-invariant variables, Plümper and Troeger (2007) proposes recently fixed effects vector decomposition technique. This method provides estimates that are unbiased and consistent in the existence of linear relationship between time-variant variables and cross-section fixed effects. In this regard, this technique has a superior advantage compared to other panel estimation methods such as fixed effects, random effects and Hausman-Taylor techniques.

This dissertation is organized in five chapters. Following the introduction, Chapter 2 reviews fiscal devaluation literature. It discusses the theoretical, simulation based studies and empirical studies conducted to analyze the effects of fiscal devaluation on international trade. Furthermore, it provides recent dissections in the theoretical and empirical literature on unilateral, bilateral and multilateral effects of fiscal devaluation.

Chapter 3 establishes the gravity model approaches. It firstly presents basic structure and empirical success of the gravity model. Secondly, it specifies theoretical foundation

of the gravity model in line with the main international trade theories. Then, it addresses the issue of the whether these theories are suitable for empirically explanation of bilateral trade flows. Thirdly, it provides the recent theoretical and empirical discussions on the gravity model. Finally, empirical literature using the gravity model on the effects of various tax policies is presented.

Chapter 4 specifies the empirical models, methods and results. In this thesis, we employ panel regression to analyze multilateral effects of a fiscal devaluation on bilateral trade for 22 OECD countries over the years from 1980-2014. As the factors representing typical fiscal devaluation, employers' social contribution and value added tax are embodied within the framework of the gravity model. Taking account of time-invariant variables, a three-stage fixed effects vector decomposition method is used. By this way, multilateral effects of a fiscal devaluation will be empirically analyzed for the first time in the literature. After estimating multilateral effects of a fiscal devaluation, we can also estimate effects of bilateral application of fiscal devaluation on country pairs to observe trade partners' reaction to the fiscal devaluation. Last but not least, we also estimate each country's parameter heterogeneity to determine whether fiscal devaluation is an appropriate policy option for any country in the sample.

Chapter 5 presents the conclusions of this thesis and recommendations for future research.

CHAPTER 2

FISCAL DEVALUATION

2.1. INTRODUCTION

Monetary and fiscal policies appear to be the tools used to achieve growth, development, stability and income distribution objectives of governments. Fiscal policy can be defined as a policy mechanism that can be utilized by governments, in order to affect the streamline of general economy through putting in use some fiscal tools such as taxation, public expenditure and debt policies. Fiscal policy works by means of the changes that are realized in macroeconomic indicators like national income, unemployment and inflation, due to the alterations made in the budget by governments with regard to the revenues collected and expenditures made. Fiscal policy affects the long-run production level of countries through intervening savings ratios. An expansionary fiscal policy, by means of leading to a decrease in government savings and thus total savings of a country, might diminish the country's future production capacity due to lower levels of investment and capital accumulation. Fiscal policy may also affect total demand levels through alterations in tax burden. Monetary policy on the other hand, affects various levels of the economy by means of shifting money supply, interest rate and exchange rate and presently is managed by central banks to a great extent, which stand as institutions that are relatively independent from political interventions (Pınar, 2006).

The global financial crisis that started in the United States in 2008 and incrementally spread over to the rest of the world has brought the efficiency and composition of monetary and fiscal policies into the agenda, in terms of these policies' capability to remove or diminish the effects of crises. The fact that the expected impacts could not have been observed in growth, employment and competitiveness despite the use of monetary policy tools such as quantitative easing and negative interest rate policy, has led the fiscal policy to return to *"a center stage as a macroeconomic tool"* (Blanchard

et al, 2010). On the other hand, when the foreign trade and budget deficit figures of the those countries which were affected by the crisis are taken into account, it reveals a requirement to give attention to the design and composition of fiscal policy and it also makes it explicit that the number of alternative options that can be used in the field of fiscal policy diminishes. One of the options, among those limited number of alternatives, is a fiscal devaluation.

Fiscal devaluation is a particular form of tax shift which envisages, in general terms, a shift from indirect taxes to direct taxes, and specifically a transfer from ESC to VAT in a budget-neutral way (Cavallo and Cottani, 2010; Franco, 2010; BoP, 2011; Orsini et al. 2014). Thus, it is an ex-ante budget neutral tax swap that replaces an origin-based tax (where it's produced) with a destination-based tax (where it's consumed) (Pereira, Pereira, and Rodrigues, 2014). This tax swap might have the capacity to mimic the effects of currency devaluation. Reducing the tax on employment results in lower labor costs, and thus, producer costs diminish. At the same time, increasing the taxes imposed on consumption results in a rise in price of imports (without causing any burden on export goods). Therefore, this tax swap might result in some effects comparable to the effects of currency devaluation to gain external competitiveness. In this respect, budget-neutral fiscal devaluation might ensure a less expensive export and a more expensive import which, in turn, results in a rise in the demand for domestic goods and make a contribution in reducing foreign trade imbalances (Lango, Patureauz and Sopraseuth, 2012).

The belief that the tax reforms have the capability to mimic the effects of currency devaluation dates back to gold standard age. Keynes (1931) stated as:

> *"Precisely the same effects as those produced by a devaluation of sterling by a given percentage could be brought about by a tariff of the same percentage on all imports together with an equal subsidy on all exports, except that this measure would leave sterling international obligations unchanged in terms of gold. (p.199)"*

Thus, Keynes (1931) argued that simultaneously applied import tariff and export subsidy would have the same impact as devaluation of sterling. However, the novelty that comes with the concept of fiscal devaluation is that the currency devaluation is capable of creating a comparable impact when fiscal policy tools are used in a budget-neutral way.

Much later, this idea is emphasized by Calmfors (1998) stating that variations in employer's payroll taxes can be a substitution for nominal devaluation in the EMU. Thus he proposes an alternative devaluation method for countries adopting the euro. Calmfors (1998) suggests reducing in employer's payroll taxes can be compensated with an increase in employee's social contributions, in income taxes or in VAT to preserve fiscal balance. He describes this policy option as an "internal exchange-rate changes" (p.11).

The idea of a fiscal devaluation has recently received a great attention in academic and political circles especially after European sovereignty-debt crisis (European Central Bank, 2011; Cavallo and Cottani, 2010; de Mooij and Keen, 2012, etc.). In line with Calmfors (1998) estimation, one of the reasons for high interest in the subject is the existence of some countries lacking the tools required for competitiveness due to dependency on monetary union or currency board. As is known, monetary policy tools are quite limited for the countries that are members of monetary union. Traditional (Mundellian) approach underlines that the fixed exchange rate or monetary union comes with a cost of losing use of monetary tools aiming at sustainability (Mundell, 1961). Therefore, when monetary policy tools are not considered as an option for the monetary union, production might be encouraged through deducting labor taxes or employer's social contribution, which in turn might lead these countries to achieve competitiveness.

Unlike a decrease in ESC, any decrease in labor income taxes does not have to mean competitive gain for domestic goods. The reason of this is that a rise in VAT decreases real wages, whereas a decrease in labor income taxes raises them. The two opposing directions offset their effects on after-tax wages. In contrast, a reduction in ESC reduces

marginal costs (IMF, 2014)[1]. Therefore, in the fiscal devaluation literature, it is emphasized that the factors representing fiscal devaluation are ESC and the VAT instead of labor taxes (Cavallo and Cottani, 2010; Farhi et al., 2011; Lango et al., 2012.; de Mooij and Keen, 2012, etc.)

Furthermore, a fiscal devaluation may also diminish distortions in the tax system. Shifting taxes from ESC (labor) to VAT (consumption) results in intertemporal choices (such as savings) be less distorted and this might lead to more capital accumulation. On the other hand, a tax swap from labor to consumption leads elders to pay a larger share of the tax bill. This approach seems quite reasonable taking into account the problem of the population aging in developed countries (Pereira et al., 2014). From the economic growth perspective, some studies show that consumption taxes are positively correlated with growth (growth-enhancing) and income taxes are negatively correlated with growth (growth-reducing) (Kneller et al., 1999; Widmalm, 2001; Padovano and Galli, 2002; Gemell et al., 2006; Arnold, 2008). In the scope of this thesis, since we focus on the effects of the fiscal devaluation on bilateral trade, effects of the direct and indirect taxes on economic growth, distributional effects of tax structure and behavioral responses to tax changes are beyond the scope of this study.

Similar to fiscal devaluation, European Union countries have implemented particularly budget-neutral temporary tax swaps for the last three decades. For example, Denmark implemented this policy option in 1988 (Calmfors, 1998) and Sweden in 1993 (IMF, 2012). Germany also increased VAT rate by 3 percentage points and reduced the unemployment insurance contributions simultaneously in 2007 (ECB, 2012). In recent years, in an effort to mitigate the impact of the global economic crisis of 2008, many OECD countries have launched employment incentives including a reduction in employment taxes. Additionally, in the second half of 2012, France balanced the spending resulted from the deduction in ESC with a 1.6 points increase in VAT rate and introduced a higher tax on capital gains with the aim of protecting low-income families. A similar practice was also adopted in the initial arrangements of IMF and Portugal (IMF, 2011). In brief, as a budget-neutral temporary tax swap, fiscal devaluation has

[1] If wages are fully flexibly, this effect would be absent.

recently been viewed as a policy option in several countries in order to gain external competitiveness (Farhi et al., 2013).

2.2. LITERATURE REVIEW ON FISCAL DEVALUATION

There has been a growing interest of theoretical and simulation-based studies which takes into consideration of the impacts of fiscal devaluation in recent years (Schmitt-Grohe and Uribe, 2011; Farhi et al., 2011; Lipinska and von Thadden, 2009; Langot, Patureau and Sopraseuth 2012, etc.). The subject has mostly been discussed within the framework of bilateral dynamic stochastic general equilibrium (DSGE) models under the condition that fiscal devaluation is applied unilaterally (BoP, 2011; In't Veld, 2011; ECB, 2012), while just a few studies have taken the subject to the scope of multilateral practices (EC, 2008; NBEA, 2013; Engler, Ganelli, Tervala, and Voigts (IMF), 2014). Although there are a number of theoretical and simulation-based studies on the subject over the last decade, the related literature lacks empirical evidence on the impacts of a fiscal devaluation. The studies of de Mooji and Keen (2012) with Franco (2011) are the exceptions.

2.2.1. Theoretical and Simulation-Based Studies

Theoretical discussions regarding fiscal devaluation mostly focus on the conditions under which a change in fiscal policy tools might have an impact similar to that of currency devaluation in an economy with various market imperfections and nominal price rigidities. The first study analyzing whether fiscal policy tools can be used instead of currency devaluation belongs to Berglas (1974). Berglas (1974) suggests that exogenous proportional changes such as devaluation, import tax, export subsidy and VAT exemption in export would have short-term effects on total consumption, relative prices of nontraded goods and real monetary balance, under the conditions where the prices are not fully flexible. He also argues that these effects will disappear in the long run. Long run effects on balance of payments, consumption and production are possible only if exogenous proportional increases are applied along with the selective taxes. Accordingly, it is underlined that, in the event of nominal rigidities, if a general tax like

VAT is applied together with import tax and export subsidy, it will be a perfect substitute for currency devaluation.

Schmitt-Grohe and Uribe (2011), on the other hand, add involuntary unemployment to the nominal rigidities stated by Berglas (1974). They argue that in the dynamic stochastic model with an open and a small economy, fiscal devaluation will have a similar impact as a nominal devaluation, only through payroll subsidy. Likewise, Correia (2011) suggests that, in terms of traded goods, the fiscal policy tools may have that effect in the event of the tools ensuring a decline in real payrolls and real exchange rates, which can be possible by means of subsidizing wages paid by a company to its employees or deducting taxes on wages (if paid by a company).

As opposed to Schmitt-Grohe and Uribe (2011), Farhi et al. (2011) argue that the payroll subsidy is not enough for fiscal devaluation to achieve the effects similar to those of currency devaluation. They use general equilibrium analysis including price rigidities with different rates, various asset market assumptions and devaluations, either expected or unexpected. Farhi et al. (2011) also argue that fiscal interventions in payrolls through VAT and subsidies by means of customs duties are usually inadequate to create effects similar to those of a nominal devaluation. They suggest that a sound fiscal devaluation practice which is supported by a certain fiscal policy combination is possible depending on alternative pricing assumptions and asset market imperfections.

Simulation studies on fiscal devaluation have apparently intensified in 2011 and after, when the effects of the global financial crisis were felt in Europe. Being one of the limited numbers of strategies for recovery, a number of fiscal devaluation studies are undertaken specifically for the cases of Portugal and Spain. In this literature, the impacts of a decrease in ESC and a simultaneous increase in VAT rates by 1% of GDP are estimated in a simulation within the framework of DSGE model. Among such simulations, the study conducted by Central Bank of Portugal (BoP, 2011) projects that, as a result of fiscal devaluation, output increases by 0.2-0.6% and the current account balance improves by 0.1-0.6%; but three years later, these effects on foreign trade balance disappear. The study conducted by the European Commission estimates that, as a result of fiscal devaluation, net export increases by 0.11% of national income in the

short-term, and this effect then steadily declines, yet employment and national income increase by 1% in the long run (five years after the reform) (In't Veld, 2011). The simulation conducted by European Central Bank projects that in the second year of fiscal devaluation, national income increases approximately by 0.2% (ECB, 2011). In a similar study conducted by Boscá, Doménech, and Ferri (2012) for Spain, it is estimated that a fiscal devaluation of a 1% of national income affects national income and employment similarly as a currency devaluation of a 10%. Their findings also show that this reform results in an improvement in current account balance up to 1.8% to 3.4% of national income.

Lipinska and Thadden (2012) using a DSGE model argue that a fiscal devaluation unilaterally implemented by one of two Eurozone countries has long-term effects, along with short-term effects considerably depend on the level two country's financial integration. They also find out that its short-term effect depends on the Eurozone-wide monetary policy, expectation of a possible fiscal policy reform and the elasticity of labor market. According to them, in the event of full integration of international financial markets, a fiscal devaluation applied by a single country has a little but not ignorable effect on national income and consumption in the long run. Another study on the long term effects of fiscal devaluation is conducted by Langot et al. (2012). They argue that a fiscal devaluation reduces market distortions (welfare-increasing effect) while it increases the prices of import goods and reduces purchasing power (welfare-reducing effect). However the long-term welfare-increasing effect of fiscal devaluation depends on the choice of optimal tax composition.

Simulation based studies on fiscal devaluation have mostly been discussed within the framework of bilateral DSGE models applied unilaterally, while just a few studies have taken the subject to the scope of multilateral practices (EC, 2008; NBEA, 2013; IMF, 2014). The first simulation working paper regarding the multilateral effects of a fiscal devaluation is the public finance report of European Commission published in 2008 (EC, 2008). This study is conducted considering two cases: (i) multilateral change in taxes in the direction of wage to consumption throughout the Eurozone; (ii) unilateral change in taxes only in a large Eurozone country (Germany) and taxes are unilaterally changed only in a small Eurozone country (Ireland). It is concluded that even though the

Eurozone countries have some gains when they apply unilateral fiscal devaluation, they gain more if they apply fiscal devaluation together in a coordinated way.

Another simulation study regarding the multilateral effects of a fiscal devaluation is carried by the Netherlands Economic Analysis Bureau (NBEA, 2013). In this study, fiscal devaluation is assumed to be implemented in France, Italy and Spain as a first scenario. It is assumed to be also implemented in Germany, the Netherlands and Belgium in addition to the initial countries as a second scenario. As a result of the study, it is concluded that unilateral implementation of this devaluation is an appropriate policy option for countries aiming to increase their national income. In a three-country scenario, the effect on national income seems to be the least if France, Italy and Spain change the taxes in a coordinated way. Contrary to EC (2008), Eurozone-wide implementation appears to be the least attractive choice for such countries. On the other hand, if the goal of a fiscal devaluation is an economic stimulation throughout the Eurozone, a large-scaled implementation seems to be the best alternative. This finding is important as it indicates that the positive spill-over effect surpasses the negative one (NBEA, 2013).

Lastly, IMF (2014) tries to find out a fiscal devaluation's international influence on trade balance, output and real exchange rate with using DSGE model. Two country groups are calibrated in a model to present "Southern European countries" and "Central-Northern European countries" in Eurozone. The results show a fiscal devaluation affects Southern European countries by developing trade balance, raising output and depreciating real exchange rate. On the other hand, the influences of a fiscal devaluation *"should not be overplayed"* (p.8). They show that the improvement of Southern European countries in trade balance, output and the current account balance is 0.2%, 0.2-0.6% and 0.1-0.6% of GDP respectively. Also, their real exchange rate depreciates by 0.4% in the short term. They discovered a powerful impact on output in a limited period of time. Influences along trade and the real exchange rate are in line with former studies such as Bank of Portugal (BoP, 2011) and European Central Bank (ECB, 2012). Table 1 introduces various simulation-based studies effect on GDP, trade balance and real exchange rate of a fiscal devaluation.

Table 1. Summary of the simulation-based literature on the long-term effect on GDP of a fiscal devaluation (worth 1 % GDP)

Country/ Region	Author(s)	Effect on GDP	Effect on Trade balance*	Effect on Real Exchange*
Portugal	Banco de Portugal (2011)	0.6	0.1-0.6	3
	European Central Bank (2012)	0.3	0.1-0.6	3
	European Commission (2011)	0.2-0.5	-	-
			-	-
Spain	European Commission (2013)	0.1	-	-
	Boscá, Doménech, and Ferri (2013)	0.6	-	-
			-	-
Southern European Countries	IMF (2014)	0.9-1.4	0.2	0.3
Euro Area	European Commission (2008)	0.2	-	-
	In't Veld (2011)	0.3-1	-	-
	Lipińska and von Thadden (2012)	0.1-0.2	-	-
France	European Commission (2013)	0.1	-	-
	Langot, Patureau, and Sopraseuth (2012)	0.1	-	-

*As a percentage of GDP.

Source: Pereira et al. (2014)

Table 1 shows that studies specifically on Portugal point to a long-term impact on GDP of between 0.2 and 0.6 percent, slightly higher than studies on Euro area that spans from 0.1 to 0.3 percent. Generally, the literature suggests a more conservative impact; the exception is IMF (2014). It points out a long-term impact on GDP of fiscal devaluation might be between 0.9 and 1.4 percent. BoP (2011) and ECB (2012) reached the same result for trade balance and real exchange rate effects of fiscal devaluation. According to their result, fiscal devaluation can improve the trade balance from 0.1% to 0.6% of GDP and depreciate the real exchange rate by 3% of GDP. In both studies, the effects of fiscal devaluation on the real exchange rate are estimated more optimistic than IMF (2014).

2.2.2. Empirical Studies

There are mainly two studies which fully test a fiscal devaluation phenomenon empirically (Franco, 2011; de Mooji and Keen, 2012). However, the study conducted by Poterba, Rotemberg and Summers (1986) is also important as it bases the existence of nominal rigidities underlined in theoretical discussions on empirical evidence, and as it reveals that fiscal devaluation can practically be implemented. Poterba et al. (1986) empirically prove the existence of nominal rigidities as basing it on the post-war time series of the UK (1963-1983 periods) and the USA (1948-1984 periods). Then, they also empirically indicate, in the event of nominal rigidities, the change in direct and indirect tax (tax composition) may have important effects on some macroeconomic variables such as payroll, price and national income in the short run.

Another study carried out by Keen and Syed (2006) examines the effects of corporate taxes and the VAT on export performance by means of employing panel data within a three year horizon for 27 OECD countries from 1967 to 2003, though it does not specifically focus on fiscal devaluation phenomenon. They find that VAT does not affect international trade (trade neutrality of VAT) even in the short run while corporate taxation affects exports in the short run, however, this effect declines to zero in the long run. Beck and Chaves (2011) extends the study of Keen and Syed (2006) by including eight years of data. By doing so, they allow consumption tax effects to be reflected in labor supply decisions, which affect labor costs and thus export volume. They find that the countries with lower tax export more. Thus, they conclude that *"when it comes to international trade, taxes matter"* (p.17). In a similar vein, Desai and Hines (2005) emphasize beyond that "received wisdom" that there is little empirical evidence on the trade neutrality of VAT. Nicholson (2010) also points out VAT might be trade-neutral when applied uniformly across the world. Nonetheless, in these studies, social contributions are not taken into account and simultaneous implementations of VAT policy in a budget-neutral way (fiscal devaluation) are ignored.

Franco (2011) and de Mooji and Keen (2012) explicitly examine the fiscal devaluation phenomenon empirically. De Mooji and Keen (2012) conduct panel data regression analysis regarding net export effect of a fiscal devaluation using data from OECD

countries. As a result of the study, they find that if 1% reduction in ESC rate as a share of national income is compensated by an increase in VAT, net export will increase by 3.44 % of national income. Furthermore, their results present that the positive effects of a fiscal devaluation on net export are minor and negligible for the countries outside Eurozone, while it is important for Eurozone countries. In addition, de Mooij and Keen (2012) conclude that fiscal devaluation have positive effects on Eurozone in the long run.

Another empirical study conducted on the effects of a fiscal devaluation belongs to Franco (2011), where the subject is examined within the framework of a structural VAR model specifically for Portugal. As a result of the study, he finds that fiscal devaluation leads to a decrease in import by 3.5% of national income and same rate of an increase in export, and thus, an increase national income by 7%.

Both de Mooji and Keen (2012) and Franco (2011) empirically investigate effects of a unilaterally implemented fiscal devaluation policy. As well known, possible reaction of trade partners of a country is of vital importance in order to achieve the expected results of a fiscal devaluation. Implementing such policy in a country may have some spill-over effects (e.g. beggar-thy-neighbor) on its trade partners. Trade partners may prefer retaliation or tax competition. Furthermore, possible effects of a fiscal devaluation on a country may be broad or limited depending on whether this policy is implemented bilaterally and/or multilaterally. Even if it has been stated that multilateral effects of a fiscal devaluation is of importance and this issue should be dealt with in the empirical studies (Lipinska and Thadden, 2009; Fiscal Monitor (IMF), 2011), within our knowledge, a relevant study has not been conducted until this time. To this end, this dissertation focuses on bilateral international trade effects of multilateral implementations along with country-specific effects of a fiscal devaluation.

In line with this purpose, this thesis analyzes bilateral international trade effects of a fiscal devaluation through setting up fiscal devaluation phenomenon within the gravity model. Gravity model offers a sound empirical ground for examining the country-specific effects of a fiscal devaluation on trade balance. It also provides a considerable

advantage for designing this policy in a way that will examine the effects of the implementation of such policy in country pairs or multiple countries.

In this thesis, the factors representing a fiscal devaluation (ESC and VAT) will be integrated into the framework of a gravity model. To the best of our knowledge, this dissertation is the first to analyze the fiscal devaluation phenomenon in a well-specified empirical equations based on gravity models. This way international trade effects of a fiscal devaluation when implemented in a single country, in country pairs or in multiple countries can be separated.

CHAPTER 3

GRAVITY MODEL
"As an Empirical Ground for a Fiscal Devaluation"

3.1. INTRODUCTION

Gravity model is a model in the international trade which derives its name from the Newton's law of universal gravitation. Newton's law states that: *"Any two bodies attract one another with a force that is proportional to the product of their masses and inversely proportional to the square of the distance between them."* In the context of international trade, the words "bodies" and "masses" correspond respectively to "countries" and "size of economies" (generally measured by GDP or per capita income). Distance can be among economic centers or capital cities of countries. Thus, the gravity model posits that size of economies has positive effects while, distance has negative effects on international trade flows (Piermartini and Teh, 2005; Metulini, 2013).

3.2. BASIC GRAVITY MODEL

Assuming that X_{ij} is the export of country j from country i , A is a constant term, Y_i and Y_j are country i's and country j's economic masses defined as GDP respectively, and $DIST_{ij}$ is the distance between two countries. International trade flows can be characterized by;

$$X_{ij} = A\frac{Y_i Y_j}{DIST_{ij}} \qquad (1)$$

Therefore, the large and geographically close countries engage in more bilateral trade. The logic behind this proposition is that large economies have a tendency in expending a great amount on imports because of possessing high purchasing power or income. Since large economies produce a great variety of products, these countries prone to attract large amount of other countries' expenditure. Thus, the bilateral trade is expected to be large when both economies are large (Krugman, Obstfeld and Melitz, 2012). On the other hand, the greater distance between countries means the smaller trade between them. The principal obstacles for the international trade are transportation and transaction costs that are *"at least partly related to the economic horizon of a country"* (Hamilton and Winters, 1992). Distance was initially used as a synonym for geographical distance between countries but then the term is expanded to include a variety of trade barriers including tariffs, taxes, transportation costs, and information costs (Starck, 2012).

According to Ward and Hoff (2005) gravity model is the standard representation of bilateral international trade. Anderson (1979) states this is the most successful model in explanation of bilateral trade of the preceding 25 years of the study. Rose (2000) emphasizes that the model *"has a remarkably consistent history of success as an empirical tool"* and he also adds (2004) *"the model seems reliable and fits the data well"*. Everett and Hutchinson (2002) define the model as the *"workhorse for empirical studies in the international trade"*. Leamer and Levinsohn (1995) also explain it as *"some of the clearest and most robust empirical findings in economics."* Properly defined the model could enlighten questions regarding international trade that are significant for policymakers (Piermartini and Teh, 2005).

3.3. GRAVITY MODEL OF TINBERGEN

The gravity model appeared in the 1960s as an empirical application (Mejia, 2011). Tinbergen (1962) and Poyhonen (1963) undertook the first econometric studies of trade flows based on the gravity equation (Deardoff, 1998). Tinbergen (1962) assumes the form of the gravity equation as following;

$$X_{ij} = A\frac{{Y_i}^{\alpha}{Y_j}^{\beta}}{{DIST_{ij}}^{\gamma}} \qquad (2)$$

where α, β and γ represent the elasticity of the exporting country's GDP, the elasticity of the importing country's GDP and the elasticity of distance respectively.

To facilitate econometric estimations, one can take natural logs of the preceding equation;

$$lnX_{ij} = lnA + \alpha lnY_i + \beta lnY_j - \gamma lnDIST_{ij} + \varepsilon_{ij} \qquad (3)$$

3.4. GRAVITY MODEL OF LINNEMANN

Linnemann (1966) added more variables to the gravity equation. He proposed three set of interacting elements to determine the size of international trade; the exporter's supply, the importer's demand, and the cost of trade.

$$X_{ij} = e^{\alpha_0}{Y_i}^{\alpha_1}{N_i}^{\alpha_2}{Y_j}^{\alpha_3}{N_j}^{\alpha_4}{D_{ij}}^{\beta_3}e^{\sum_k \gamma^k P_{kij}} \qquad (4)$$

where Y refers country i's income, N_j is the population of country j, D_{ij} is the distance between two countries and P_{kij} refers dummy variables such as common language or trade blocs. Population represents the physical magnitude of an economy, that is, the larger economies are more self-sufficient.

3.5. EMPIRICAL SUPERIORITY OF THE GRAVITY MODEL

Since the gravity model equation was introduced by Tinbergen (1962), it has remained on the agenda as an empirical tool in international trade studies (Piermartini and Teh, 2005). There are mainly two reasons for the gravity model being popular among the

empirical trade economists. High explanatory power of the model in explaining bilateral trade flows can be considered as the first reason. Relatively easy adaptation of new variables into the model is the second reason why economists have used gravity model on a diverse scope of subjects. Both economic and non-economic factors can be easily added to the model. Tariffs, trade blocs, customs unions, monetary union and exchange rate mechanisms could be mentioned as economic factors whereas common or different languages, cultural and religious differences and colonial ties are examples of non-economic factors (Anderson and Wincoop, 2003; van Bergeijk and Brakman, 2010, Head, Mayer and Ries, 2010). In recent years, foreign direct and portfolio investment and migration also have been added the gravity model equations (Portes and Rey, 2005).

In the early and mid-1990s, the gravity model became very popular among the academicians and policy makers. Particularly, standing as one of the major turning points in world trade, the collapse of the iron curtain resulted in significant changes in the global trade flows. Erzan et al. (1992) and Havrylyshyn and Pritchett (1991) are examples of studies regarding this topic. Erzan et al. (1992) analyze that how changes in the former Council of Mutual Economic Assistance (CMEA) area affect international trade in manufactures. Havrylyshyn and Pritchett (1991) also examine the shift in the geographic direction of total trade by using the gravity model after the dismantling of the CMEA (the post-transition period).

The gravity models are also commonly used in order to analyze impacts of preferential trade agreements, membership of international organization and currency unions. Rose (2000) emphasizes on the role of currency unions, while Klein and Shambaugh (2006) expand the study including the contribution of fixed exchange rate regimes on trade flows. Furthermore, Adam and Cobham (2007) carry out in a detailed manner, the classification of de facto bilateral exchange rate arrangements' effects on the international trade by using the gravity model. Studies of Rose (2004), Feenstra et al. (2001), Eaton and Kortum (2002), Evenett and Keller (2002), Anderson and van Wincoop (2003) and Debaere (2003) are included in other seminal empirical studies using gravity models.

3.6. THEORETICAL FOUNDATION OF THE GRAVITY MODEL

Although gravity model is recognized in its empirical superiority and is successfully implemented to check the effects of various issues on trade, the lack of theoretical base and poor micro-foundation weakens the credibility of the model among academicians (Leamer and Levinsohn, 1994; Deardoff, 1998; Anderson and Wincoop, 2003; Piermartini and Teh, 2005; van Bergeijk and Brakman, 2010). The first formal attempt to provide a theoretical foundation to the gravity model is belong to Anderson (1979). Subsequent important contributions to this foundation can be mentioned in line with main international trade theories; (1) the Ricardian trade model, (2) the Heckscher-Ohlin model, and (3) Helpman-Krugman Model.

3.6.1. Gravity Model of Anderson

In his model, Anderson (1979) introduced many classes of goods flow between each country. In each commodity class, differentiation of goods is based on place of origin (Armington assumption). The assumption proposes that, irrespective of the price, a country will consume more or less each product from each country. For this reason, every good is traded; every country trade and national income can be formulized as the sum of the home and foreign demand for the unique good that each country produces. Thus larger countries import and export more (Piermartini and Teh, 2005). Anderson (1979) explains bilateral trade with Cobb-Douglas preference functions and then with CES preference function, assuming identical expenditure shares and gravity equation income elasticities of unity. He also modelled the trade costs as "iceberg costs[2]".

Anderson (1979) develops the pure expenditure system model, which is the basic gravity model based on Cobb-Douglas expenditure system. In this model, imports of goods *i* by country *j* can be denoted as;

$$M_{ij} = b_i Y_j \qquad (5)$$

[2] In the iceberg costs assumption, due to transportation cost, only some fraction of the shipped good can reach to its destination. That is, some fraction of the good is assumed to melt in the transition process in order to calculate the transportation cost (Samuelson, 1954).

where b_i is the fraction of income spent on the production of country *i* and Y_j is country *j's* income . The requirement that income must equal sales implies that;

$$Y_i = b_i(\sum_j Y_j) \qquad (6)$$

Solving (6) for b_i and substituting into (7), we obtain;

$$M_{ij} = \frac{Y_i Y_j}{\sum Y_j} \qquad (7)$$

Assume that countries produce tradable and non-tradable products. Country *j*'s demand for *i*'s tradable products is;

$$M_{ij} = \theta_i \emptyset_j Y_j \qquad (8)$$

where θ_i shows the expenditure of country *i*'s tradable products divided by *j*'s total expenditure on tradable products.. $\emptyset_j$ defines the percentage of country *j*'s expenditure on all traded products within total expenditure of this country. Country *i*'s trade equilibrium can be expressed as;

$$Y_i \emptyset_i = (\sum_j Y_j \emptyset_j)\theta_i \qquad (9)$$

Solving equation (9) for θ_i substituting into equation (10);

$$M_{ij} = \frac{\emptyset_i Y_i \emptyset_j Y_j}{\sum_j \emptyset_j Y_j)} = \frac{\emptyset_i Y_i \emptyset_j Y_j}{\sum_i \sum_j M_{ij}} \qquad (11)$$

According to Anderson (1979) *"taking on a log-linear form equation (11) is the deterministic form of the gravity equation with the distance term suppressed and a scale term appended"* (p.109). He took into account non-unitary income elasticities and his seminal work was the first to derive gravity from the Armington/CES preference

structure. The gravity model of Anderson (1979) can apply various international trade models including Ricardian, Heckscher-Ohlin, and Helpman and Krugman Model.

3.6.2. Gravity Model Based on the Ricardian Model of Comparative Advantage

The basic proposition of the Ricardian trade model is that international trades occur in case of differences between comparative advantages of countries (Gandolfo, 2014). The comparative advantages stem from differing technologies in production.

From this point of view, Eaton and Kortum (2002) develop the gravity model relying on the Ricardian model. Their model also incorporates differences in production technology and realistic geographical characteristics into general equilibrium. They try to capture both the driving force of the comparative advantage contributing the progress of trade and the inhibiting effect of the geographical obstacles (transport costs, tariffs, quotas, etc.). Eaton and Kortum (2002) model the trade costs as iceberg costs and assume that consumers maximize a CES utility function. According to them, bilateral trade flows can be formulated as;

$$x_{ij} = \frac{\left(d_{ij}/P_i\right)^{-\theta} x_j}{\sum_m^N \left(d_{im}/P_m\right)^{-\theta} x_m} Q_i \qquad (12)$$

where x_j is the total spending of country j on products, Q_i symbolizes exporting country i's total sales (income) and $\left(d_{ij}/P_i\right)^{-\theta}$ represents the world income $\left(d_{ij}/P_i\right)^{-\theta}$ is the geographical obstacles d_{ij} among i and j deflated by the importer's price level country P_j.

Eaton and Kortum (2002) state that *"the sensitivity of trade to costs and geographic barriers depends on the technological parameter θ (reflecting the heterogeneity of goods in production) rather than the preference parameter σ (reflecting the heterogeneity of goods in consumption)"* (p.1750). Their model shows that main sources of the specialization are geographic barriers and technology.

To show a relation among trade flows and price levels, the equation can be written as;

$$\frac{x_{ij}/x_i}{x_{ii}/x_i} = \left(\frac{P_i/d_{ij}}{P_j}\right)^{-\theta} \qquad (13)$$

As general prices of country *j* decline (as shown in higher P_i/P_j) or geographical barriers between the two countries increase shown in a higher d_{ij}), country *i*'s export share in country *j* decrease. When the comparative advantage lessens (shown by a higher θ) relative efficiency are more similar across goods.

By means of adjusting of input costs and state of technology, Eaton and Kortum (2002) obtain their final gravity equation;

$$\ln x'_{ij}/x'_{jj} = S_i - S_j - \theta m_n - \theta d_k - \theta b - \theta l - \theta e_h - \delta_{ij} \qquad (14)$$

where S_i stands as country *i*'s "competitiveness", m_n is the overall destination effect, d_k is the distance among countries, b is the border effect, l is the language effect, e_h is the trading area effect and δ_{ij} is the error term.

Eaton and Kortum (2002) emphasizes that theoretical framework of the international trade neglects the importance of the geographic barriers as a diminishing factor of the trade flows (inhibiting trade), although the gravity model literature has underlined them. They also emphasize that the role of the technology in the international trade (promoting trade).

3.6.3. Gravity Model Based on the Heckscher-Ohlin's Factor Proportion Model

As stated by Krugman, Obstfeld and Melitz (2012), the Heckscher-Ohlin's Factor Proportion theory points out that *"comparative advantage is affected by the interaction between nations' resources (the relative abundance of factors of production) and the technology of production (which influences the relative intensity with which different factors of production are used in the production of different goods)."*(p.80). Heckscher-Ohlin model suggests perfect production specialization (where every product is produced only in a country) and thus international trade takes place for products produced with different factor intensities (inter-industry trade) (Evenett and Keller, 2002).

Evenett and Keller (2002) derive a gravity equation by restricting the Heckscher-Ohlin model to a framework with two products, factors and countries. Without this limitation, in a frictionless world, multiple countries and suppliers might lead to an ambiguous result. Capital and labor intensity of two countries are different and, as a consequence, they export different goods. The bilateral volume of import hinges on not only GDP but also the proportion of the two goods in production (Fratianni, 2007). Accordingly, import of country i from country *j* is;

$$M_{ij} = (\gamma_i - \gamma_j)\frac{Y_i Y_j}{Y_w} \qquad (15)$$

where γ is the proportion of the two products. If γ is the proportion of the capital-intensive product and *i* is the country which is relatively prosperous in capital, and so $\gamma_i > \gamma_j$ and capital-intensive product export from *i* to *j*. If factor proportions are identical ($\gamma_i = \gamma_j$) there would be no trade in the Heckscher-Ohlin model.

On the other hand, Debaere (2005) raises two critical questions against Heckscher-Ohlin model. First, what might be the reason behind the fact that a great majority of the international trade that occurs among developed countries are in similar with regard to endowment and technology? Second, in terms of products, what might be the reason for most of the trade to exhibit an intra-industry feature? According to Debaere (2005) the Heckscher-Ohlin model fails to convincingly answer both questions. Moreover, Helpman and Krugman (1985) claim that Heckscher-Ohlin model cannot provide theoretical foundation for gravity model.

Deardorff (1998) refutes these arguments and derives the gravity equation from *"the two keys open doors to two different cases"* of the Heckscher-Ohlin's Factor Proportion Model, one with frictionless trade, that is, zero barriers to trade, and one without. In the frictionless trade, without trade cost, producers and consumers are neutral preferring among the various trading partners for homogenous products. Under the trade impediment condition, the Heckscher-Ohlin model would not be any distinct from other differentiated products model. He proved that bilateral trade is affected by both the absolute distance between two countries and the relative geographic position to other countries (Smarzynska, 2001). As Deardorff (1998) remarked *"the greater the elasticity of substitution among goods, the more trade between distant countries will fall short of the gravity equation and the more trade among close countries (and transactions within countries themselves) will exceed it."*(p.20).

3.6.4. Gravity Model Based on the Monopolistic Competition Model

The monopolistic competition model is the third classical model to explain the international trade (Krugman 1979, 1980; Helpman and Krugman, 1985; Helpman, 1987). This model is mainly developed on the basis of increasing returns, product differentiation, and imperfect competition. Using the Dixit and Stiglitz's (1977) model of monopolistic competition, Krugman (1979, 1980) concludes that there is no need for technological or factor endowment differences for international trade. Monopolistic competition model assumes that firms produce slightly differentiated final goods from that of their competitors. Therefore, this model mainly explains intra-industry trade.

To seek an answer whether the gravity model is in compliance with inter and intra-industry trade theories, the studies of Bergstrand (1985, 1989) are worth-mentioning. Bergstrand (1985) incorporates factor endowment variables of the Heckscher-Ohlin's Factor Proportion Model and taste variables of the Linder assumption[3]. He derives an equation for bilateral trade including price indexes by using GDP deflators. As in Anderson (1979), he utilizes CES preferences over Armington-differentiated goods.

$$PX_{ij} = \beta_0 (Y_i)^{\beta_1} (Y_j)^{\beta_2} (D_{ij})^{\beta_3} (A_{ij})^{\beta_4} u_{ij} \qquad (17)$$

where PX_{ij} is the "value" of country *i's* export to country *i*, Y_i is exporter's, Y_j importer's GDP and D_{ij} is the distance among economic hubs. A_{ij} is the other determinants affecting bilateral export and u_{ij} is the distributed error term.

In his subsequent studies, Bergstrand (1989, 1990) combines assumptions of the Heckscher-Ohlin's Factor Proportion and monopolistic competition theories. He supposes the exporter's income as GDP with regards to units of capital and its per capita GDP can be used as a proxy of capital-labor ratio (factor proportion and monopolistic competition theory). In terms of import, changes in the importer's income and per capita income mean alterations of expenditure capabilities and taste preferences implying monopolistic competition theory (Bergstrand, 1989; Starck, 2012). Distance is interpreted as the c.i.f. /f.o.b. factor. Bergstrand (1989) re-examines a gravity equation in the form of;

$$PX_{ij} = \beta_0 (Y_i)^{\beta_1} \left(\frac{Y_i}{L_i}\right)^{\beta_2} (Y_j)^{\beta_3} \left(\frac{Y_j}{L_j}\right)^{\beta_4} (D_{ij})^{\beta_5} (A_{ij})^{\beta_6} u_{ij} \qquad (18)$$

$$PX_{ij} = \beta_0 (Y_i)^{\beta_1} \left(\frac{K_i}{L_i}\right)^{\beta_2} (Y_j)^{\beta_3} \left(\frac{Y_j}{L_j}\right)^{\beta_4} (C_{ij})^{\beta_5} (T_{ij})^{\beta_6} (E_{ij})^{\beta_7} (P_i)^{\beta_8} (P_j)^{\beta_9} u_{ij} \qquad (19)$$

[3] According to Linder assumption; countries which belong to similar demand structures tend to trade with each other with differentiated goods (Linder, 1961).

where L_i is the population size, $\left(\frac{K_i}{L_i}\right)$ is the capital-labor ratio of country i, $\left(\frac{Y_j}{L_j}\right)$ is the importing country's income per capita j, C_{ij} is the c.i.f./f.o.b. transport factor, T_{ij} is the tariff rate, E_{ij} is the exchange rate, P_i and P_j are the prices of exporting and importing countries' respectively. The exchange rate index will imply changes in the exporter's currency value of a unit of importer's currency, since the common base period. Therefore, an increase in the index means an appreciation (depreciation) of the importer's (exporter's) currency from the base.

As an expected coefficient signs, an increase in importer *j*'s income, an appreciation of its currency, adjacency, and existence of preferential trade arrangement would rise (the value of) the trade from exporter *i* to importer *j*. The greater distance between these countries leads to a decrease in this flow.

3.7. EMPIRICAL STUDIES IN LIGHT OF MAJOR TRADE THEORIES ENCOMPASSING GRAVITY EQUATIONS

After outlining of the theoretical framework of the main international trade theories within the scope of the gravity model, the question of whether these theories are suitable for empirically explaining bilateral trade flows comes into prominence.

Based on the Ricardian trade model, Eaton and Kortum's (2002) approach incorporates *"(i) each country's state of technology, governing absolute advantage, (ii) the heterogeneity of technology, which governs comparative advantage, and (iii) geographic barriers"* into the model (p.1742). They analyze the different issues such as, the benefits from trade, the patterns of specialization based on technology and geography, the function of trade as a dissemination of the gains of new technology, and the consequences of tariff reductions. They use data on bilateral trade flows, prices, and geography for a cross-section of 19 OECD countries in 1990. They indicate that their empirical approach differs from those based on Heckscher-Ohlin model which ignores geographic barriers (by supposing trade as costless), technology (by assuming it is common all over the world), and bilateral trade volumes. Eaton and Kortum (2002)

conclude that all countries which engage in free trade, gain advantages, but the smaller ones have larger gains than big ones. Their results also indicate that distance significantly hinders bilateral trade even if its impact is reduced partially by a shared language. On the other hand, borders and the same trade area (the EC and EFTA) do not affect international trade significantly.

Evenett and Keller (2002) examine the Heckscher-Ohlin theory can explain the success of the gravity model. They estimate a data set for 58 countries of which GDPs' are above 1 billion U.S.D. as of 1985. Evenett and Keller (2002) points out that perfect specialization feature of Heckscher-Ohlin model cannot satisfactorily support the theoretical foundation of gravity models. On the other hand, their results suggest that an imperfectly specialized Heckscher-Ohlin model is suitable only for "North" (developed) and "South" (developing) country-pairs, but not for North-North country-pairs. As it is well known, capital-labor ratios are different for North-South pairs while they are similar for North-North pairs.

Helpman (1987) uses the gravity equation to test the monopolistic competition model empirically. Helpman's study is mainly based on the assumption of product differentiation and increasing returns. The study emphasize the effects of differential country size in order to capture intra-industrial trade flows among developed countries (see also Martínez-Zarzoso, 2003; Feenstra, 2004).

Helpman (1987) points out each country's share of production in the region as;

$$s_i = Y_i/(Y_i + Y_j) \quad \text{and} \quad s_j = Y_j/(Y_i + Y_j)$$

Therefore;

$$Y_i Y_j = s_i s_j (Y_i + Y_j)^2$$

Replacing this expression in equation (1), the equation becomes;

$$X_{ij} = A\,\frac{s_i s_j \left(Y_i + Y_j\right)^2}{DIST_{ij}} \qquad (20)$$

However, shares of countries' production sum equals to unity: $s_i + s_j = 1$. Taking the square of both sides of this expression yields $s_i s_j = \left[1 - (s_i)^2 - \left(s_j\right)^2\right]/2$. This is a statement which Helpman named as "**Size Dispersion Index"** (SDI). If one replaces the equation of SDI in equation (20) and takes the logarithm of both sides, gravity model can be expressed as follows;

$$lnX_{ij} = lnA + 2ln\left(Y_i + Y_j\right) + lnSDI_{ij} - lnDIST_{ij} \qquad (21)$$

Helpman (1987) applies the empirical test in this version of the gravity model for 14 OECD countries. He graphs the SDI volume of trade in comparison with GDP for these countries, observing that volume of trade and GDP variables increase over time. The results of the analysis points that the countries which are large, in similar size and close to each other engage in more trade, which is taken to reflect the characteristics of intra-industry trade.

Helpman (1987) makes significant contribution to the monopolistic competition model empirically (Debaere, 2005). This was the first test for OECD countries based on structural equation resulting from the theory. He also claims that the monopolistic competition model version of the gravity equation empirically shows close fit to bilateral trade.

3.8. RECENT EMPIRICAL AND THEORETICAL DISCUSSIONS ON THE GRAVITY MODEL

Having explained the theoretical foundations of the gravity model and empirical contributions of these foundations into the model, this section takes a look at recent theoretical and empirical discussions on the gravity model. Seminal studies of Anderson

and van Wincoop (2001, 2003, 2004) can be mentioned as a turning point of the recent discussion. They put forward the "multilateral resistance term" as a response of McCallum's (1995) paper in which he analyzes Canada-U.S. regional trade patterns. Apart from the multilateral resistance term, zero trade flows and trade costs take an important place in the theoretical and empirical literature in recent years.

3.8.1. An Empirical Puzzle: Border Effects in the Gravity Model

In his seminal essay entitled "National Borders Matter: Canada-U.S. Regional Trade Patterns", McCallum (1995) analyzes trade flows between Canadian provinces and U.S. states by estimating the following equation:

$$lnX_{ij} = \alpha_1 + \alpha_2 lny_i + \alpha_3 lny_j + \alpha_4 lnd_{ij} + \alpha_5 ln\delta_{ij} + \varepsilon_{ij} \qquad (22)$$

where y_i is GDP of region i and y_j is GDP of region j, d_{ij} refers to distance between two regions and δ_{ij} refers to a dummy variable which is 1 for inter-provincial trade and 0 for state-province trade. McCallum (1995) concludes that trade between Canadian provinces is 22 times larger than Canadian provinces and U.S. states (p.616). He emphasized that "national borders in general continue to matter". Obstfeld and Rogoff (2001) describe this result as the "**border puzzle",** which stand as one of the six major puzzles in international macroeconomics. This is called a puzzle simply because, intuitively, one expects that as the world becomes more globalized, the effect of distance on international trade should decrease (Dias, 2011).

To provide one possible explanation for this puzzle, Deardorff (1998) shows that bilateral trade flow is affected both by the absolute distance between two countries and by their geographical location relative to other countries. This is measured as the importing country's relative distance from exporting country compared with all importing countries' relative distance from the exporting country.

3.8.2. Theoretical Explanation of the Border Effects: Multilateral Resistance Terms

Anderson and van Wincoop (2001) introduce another possible explanation for the border puzzle. According to them, bilateral trade is affected by trade barriers which are bilaterally present, which is known as bilateral resistance; and is affected by, in Anderson and van Wincoop's (2001) terms, "Multilateral Resistance", which designates the relative average barriers that partners confront with all other trading partners (p.7).

Eicher and Christian (2011) emphasize that *"theoretical foundations of the flow of bilateral trade regressions developed by Anderson (1979), Bergstrand (1985), Deardorff (1998), Baier and Bergstrand (2001), Eaton and Kortum (2002), and Anderson and van Wincoop (2003) all highlight a role of some form of multilateral price indices"*. However, Anderson and Wincoop (2003) focus on the gravity model that should be based upon "relative" cost rather than "absolute" costs; otherwise a misspecification problem would occur. After this contribution, Anderson and van Wincoop's (2003) seminal paper has become the main reference for subsequent studies on the gravity model (van Bergeijk and Brakman, 2010).

According to Anderson and van Wincoop (2003), when remoteness variables are added, the equation (22) becomes;

$$lnX_{ij} = \alpha_1 + \alpha_2 lny_i + \alpha_3 lny_j + \alpha_4 lnd_{ij} + \alpha_5 REM_i + \alpha_6 REM_J + \alpha_7 ln\delta_{ij} + \varepsilon_{ij} \qquad (23)$$

in which the region's remoteness is;

$$REM_i = \sum_{m \neq j} {d_{im}}/{y_m} \qquad (24)$$

The remoteness variable represents to the *"average"* distance of region *i* from all trading partners apart from *j*. Although the remoteness variable is commonly used in the

literature; Anderson and van Wincoop (2003) believe it is completely *"at odds with the theory"*. Instead, they offer country specific price indices, which are abstract and unobservable to estimate border effects (Metulini, 2013, Bruynei, Magerman and Hove, 2013, Coe et al., 2002, Feenstra, 2004)

$$P_j^{1-\sigma} = \sum_i P_i^{\sigma-1}\,\theta_i t_{ij}^{1-\sigma} \qquad (25)$$

where P_j stands for consumer price index of j and σ is the elasticity of substitution among all products. If one defines world nominal income by $y^w = \sum_j y_j$, then income shares are given by $\theta_j = {}^{y_j}/_{y^w}$. Also they suppose that trade barriers are symmetric ($t_{ij} = t_{ji}$), that is, export and import trade costs are similar.

Anderson and van Wincoop (2003) claim that equation (25) *"provides an implicit solution to the price indices as a function of all bilateral trade barriers and income shares"* (p.9). After this contribution, the gravity equation becomes:

$$x_{ij} = \frac{y_i y_j}{y^w}\left(\frac{t_{ij}}{P_i P_j}\right)^{1-\sigma} \qquad (26)$$

Anderson and van Wincoop (2003) emphasize that the equation (26) could be simplified by equation (7) derived by Anderson (1979), by means of introducing significant contribution via price indices. According to them, the price indices are accepted as multilateral resistance variables, hinging on bilateral resistances t_{ij} . This means that an increase in trade barriers with all trading partners will lead to an increase in the index. Thus, if there is no trade barriers (all $t_{ij} = 1$) price indices become 1 from the equation (25).

The gravity model expresses that bilateral trade relies on trade barriers between an exporter country *i* and an importer country *j*, *"relative"* to barriers each countries encounter with other (potential) trade partners (multilateral resistance indices). From the

viewpoint of the importer *j*, for a given bilateral barrier between the countries, higher trade barriers between *j* and its other trading partners will diminish the relative price of goods from *i* and increase imports from *i*. In a similar manner, for a given bilateral barrier between *i* and *j*, higher trade barriers between *i* and its other trading partners lead to a lower demand for its products and, as a natural consequence, a lower supply price. In either case, the trade level between *i* and *j* will increase (Anderson and van Wincoop, 2003). With regard to empirical gravity model literature, this implies that the more remote country pairs is from the rest of the world, the higher trade will occur (Coe et al., 2002).

Anderson and van Wincoop (2003) model the trade costs (t_{ij}) as a function of trade barriers (transportation costs, borders, trade blocs, linguistic barriers, etc.);

$$t_{ij} = b_{ij} {d_{ij}}^{\rho} \qquad (27)$$

where d_{ij} refers to bilateral geographical distance and b_{ij} refers to two regions are located in the same country ($b_{ij} = 1$) or not;

$$(b_{ij} = 1 + tariff\ euivalent\ of\ the\ barrier_{ij})$$

.

Anderson and van Wincoop (2003) transform the theoretical gravity equation into a logarithmic form as;

$$lnX_{ij} = k + lny_i + lny_j + (1-\sigma)\rho lnd_{ij} + (1-\sigma)lnb_{ij} - (1-\sigma)lnP_i - (1-\sigma)lnP_j + \varepsilon_{ij} \qquad (28)$$

According to them the main difference between the equation (28) and McCallum's equation (22) is *"the two price index terms"* (p.14). The omitted multilateral resistance variables are functions of trade barriers (t_{ij}) from equation (25), trade cost from equation (27) and the tariff equivalent barriers (b_{ij}) . The multilateral resistance variables show similarity with the remoteness indexes (24) which represent the

"average distance of region i from all trading partners apart from j". The remoteness indexes, however, reflect only geographical trade resistance and do not contain border barriers (tariff equivalents to all other trading partners, etc.). Thus, "without border barriers the functional form is entirely disconnected from the theory" (Anderson and van Wincoop, 2003).

To obtain a similar expression to equation (22) by McCallum (1995) Anderson and van Wincoop (2003) modified equation (28) slightly as;

$$ln(X_{ij}/Y_iY_j) = k + (1-\sigma)\rho lnd_{ij} + (1-\sigma)lnb_{ij}(1-\delta_{ij}) - lnP_i^{1-\sigma} - lnP_j^{1-\sigma} + \varepsilon_{ij} \quad (29)$$

where δ_{ij} refers to a dummy variable equal to 1 for inter-provincial trade and 0 for trade within U.S. states and Canadian provinces. Anderson and van Wincoop (2003) emphasize that $lnP_i^{1-\sigma}$ and $lnP_j^{1-\sigma}$ are important to estimate effects of border barriers on bilateral trade (p.21).

Even though equation (29) seems simple, it is difficult to estimate. To gauge the multilateral resistance variables for empirical studies is still a major challenge (van Bergeijk and Brakman, 2010). Alternative methods to measure the multilateral resistance term are as follows:

i- Anderson and van Wincoop Method: In order to solve the multilateral resistance term, Anderson and van Wincoop (2003) suggest that estimation of the general equilibrium model using an iterative Non-linear least squares (NLS) procedure. The multilateral resistance terms are based upon two factors: trade costs and the terms themselves. These features lead to a circular dependence and result to difficulties in the empirical estimation due to endogeneity problem (Straathof, 2008; Baier and Bergstrand, 2009). To solve this problem, Anderson and van Wincoop postulate the symmetrical trade cost assumption ($t_{ij} = t_{ji}$). Therefore, this approach is suitable only for *"symmetric trade flows and a cross-sectional setting"* (Bruyne, Magerman and Hove, 2013). However, there are implementation challenges in case of asymmetric trade

flows (Behar and Nelson, 2012). There also exist computational difficulties for applying to a panel data and estimation difficulties of price terms (Bruynei, Magerman and Hove, 2013).

ii- Fixed Effects Method: Alternatively and the most widely used method to estimate equation (29) type of the gravity model is to use fixed effects, considering the (unobserved) price indexes (Feenstra, 2004). Fixed effects have been applied by various authors, such as Harrigan (1996), Redding and Venables (2000), Rose and van Wincoop (2001) and Feenstra (2004).

Because multilateral resistance variables in (29) are unobserved, instead of measuring them with respect to equation (25) and equation (27), Feenstra (2004) measures them using the coefficients of source and destination region fixed effects (region-specific fixed effects). Therefore, the equation (29) could be remodeled as;

$$ln(X_{ij}/Y_iY_j) = \alpha lnd_{ij} + \gamma(1-\delta_{ij}) + \beta_i^1\delta_i^1 + \beta_j^2\delta_j^2 + (1-\sigma)\varepsilon_{ij} \qquad (30)$$

where $\beta_i^1 = \ln(P_i)^{\sigma-1}$ and $\beta_j^2 = \ln\left(P_j\right)^{\sigma-1}$represent the exporter's and importer's variables to gauge multilateral indexes respectively. The indicator variable δ_i is 1 when *i* is the exporting region and 0 otherwise. δ_j is 1 when *j* is the importing region and 0 otherwise.

In response to McCallum's (1995) border puzzle, Feenstra (2004) estimates almost the same average border effect as Anderson and van Wincoop (2003). Both methods provide consistent estimates of the average border effect (Feenstra, 2004). Superior to Anderson and van Wincoop (2003) approach, relatively easy application to empirical studies ensures the fixed effects method more acceptation among academicians (Head and Mayer, 2013). But inability to retrieve the MRT to generate comparative statistics is mentioned as a main impediment of the fixed effects approach (Baier and Bergstrand, 2009).

iii- Baier and Bergstrand Method: Baier and Bergstrand (2009) offer an approach to estimate the multilateral resistance term using a Taylor series by the way of decomposing the effects of multilateral resistance term and of nonlinearity using OLS. As distinct from fixed effects method, this method allows to generate comparative statistics. They apply this method to McCallum (1995), Anderson and van Wincoop (2003) and Feenstra (2004) dataset assuming that asymmetric bilateral trade costs (Baier and Bergstrand, 2009) and also symmetric trade costs (Baier and Bergstrand, 2010).

$$lnx_{ij} = \beta_0 - \rho(\sigma-1)\ln\mathrm{DIS}_{ij} - \alpha(\sigma-1)BORDER_{ij} + \rho(\sigma-1)MWRDIS_{ij} + \alpha(\sigma-1)MWRBORDER_{ij} + \varepsilon_{ij} \qquad (31)$$

where $x_{ij} = X_{ij}/GDP_iGDP_j$ and "MWR" refers to multilateral and world resistance. They replace unobservable trade cost variable (t_{ij}) with DIS_{ij}. The dummy variable, $BORDER_{ij}$, is 1 if regions *i* and *j* do not have the similar nation.

$$MWRDIS_{ij} = \left[\frac{1}{N}\left(\sum_{j=1}^{N} lnDIS_{ij}\right) + \frac{1}{N}\left(\sum_{i=1}^{N} lnDIS_{ij}\right) - \frac{1}{N^2}\left(\sum_{i=1}^{N}\sum_{j=1}^{N} lnDIS_{ij}\right)\right] \qquad (32)$$

$$MWRBORDER_{ij} = \left[\frac{1}{N}\left(\sum_{j=1}^{N} lnBORDER_{ij}\right) + \frac{1}{N}\left(\sum_{i=1}^{N} lnBORDER_{ij}\right) - \frac{1}{N^2}\left(\sum_{i=1}^{N}\sum_{j=1}^{N} lnBORDER_{ij}\right)\right] \qquad (33)$$

By using Monte Carlo simulations, they show their method provide almost the same estimate as Anderson and van Wincoop (2003) and the fixed effects method of Feenstra (2004) (Baier and Bergstrand, 2009; Baier and Bergstrand, 2010).

Although there are different theoretical approaches to gauge the multilateral resistance term, Bruyne et al. 2013 remark the term *"remains a black box with many observable factors".* Thus empirical researchers have still difficulties in adding the multilateral resistances term into gravity equations to measure bilateral costs accurately. The most widely method used in the empirical studies is to add dummy variables to handle this problem. As Baldwin and Taglioni (2006) point out these dummy variables consist of natural trade costs (distance and common border), manmade trade costs (currency unions or trade agreements) and cultural trade costs (common language or colonial ties).

3.8.3. Zero Gravity Problem

Another problem recently received attention theoretically and empirically is the presence of zero bilateral trade flow. Evenett and Venables (2002) point out that the exporters sell more in today's world comparing with past, which they called "the geographic spread of trade". They show that the zero trade flows between developing countries have dropped one-third since 1970. Although there is an increase in the geographic spread of trade (Evenett and Venables, 2002), some authors (Anderson and vanWincoop, 2004; Haveman and Hummels, 2004; Helpman et al., 2008) emphasize that the presence and prevalence of zero trade flows still maintain its importance. As an example, Helpman et al. (2008) assert that almost 50 percent of 158 countries in the sample do not trade each other.

In a standard empirical gravity model, researchers generally prefer to truncate observations with zero trade or to substitute by a small positive constant value (Piermartini and Teh, 2005; van Bergeijk and Brakman, 2010). These methods are correct as long as the zero values are randomly distributed; otherwise, a selection bias problem would occur. To deal with this problem, Helpman et al. (2008) applied Heckman's (1979) two-stage sample selection correction model into international trade. Firstly, with a Probit equation, they investigate the likelihood of country *i*'s exports to *j*. Secondly, predicted probabilities of the Probit equation are used to estimate the gravity equation in log-linear form (Helpman et al., 2008).

3.8.4. Actual Trade Cost Problem

Trade costs are very comprehensive since they contain all costs from producing a good to delivering it to a final consumer (Anderson and van Wincoop, 2004). To measure trade costs accurately, the actual data has to be known in detail such as; complex structure of geography, real transportation network, the characteristics of infrastructure, direct policy instruments (tariff, quotas, and other trade barriers etc.), tax and insurance policy (Limao and Venables, 2001; Anderson and van Wincoop, 2004). In addition to actual cost, dummies might be considered for islands, landlocked countries and common borders to show the idea that transportation costs decrease for neighboring countries while they increase for landlocked countries and islands. Moreover, several dummies can be used dummies for common language, colonial ties, and cultural similarities in order to gauge information costs (Piermartini and Teh, 2005).

Although it is important to measure trade costs accurately, according to Anderson and van Wincoop (2004), it is hard to say that the quality of existing measures is sufficient to measure it correctly. They also state that transportation costs could be easily improved compared to other components of trade costs. Furthermore, Anderson and van Wincoop (2004) point out trade costs are almost 170-per cent of the mill price of manufactured goods for industrialized countries. This 170-per cent consists of 55-percent local distribution (internal) costs, 74-per cent international trade costs (border effects), and remaining 21-per cent stand for transportation costs. However, the actual transportation costs have been taken into consideration in a limited number of research, including Limao and Venables (2001); Combes and Lafourcade (2005). These studies emphasize that it is rather challenging to measure actual transportation costs since they differ among goods (Piermartini and Teh, 2005). Because of its difficulties to measure actual transport cost, researchers generally use distances as a proxy for transport cost.

Leamer and Levinsohn (1995) remark a distance elasticity of -0.6, while Overman et al (2003) estimate it to be between -0.9-1.5. Another important study regarding trade costs is carried out by Disdier and Head (2008). They analyze 1467 distance effects from 103 studies by using meta-analysis of gravity-equation estimates. They conclude that the

mean effect is about 0.9. In other words, a 10% rise in distance reduces bilateral trade approximately 9%. This study shows that the importance of distance has not decreased over time. Most striking, they also prove that distance effect declined slightly between the years of 1870 and 1950 and then it started to increase. This argument was first mentioned by Leamer's (1993). He emphasized that distance elasticities did not dramatically fall from 1970 to 1985. Hummels (2007) also points out that the matter of distance in the international trade has shown little improvement over the last 40 years. All these studies show that distance is still matter for international trade, that is, the world is still not *"flat"*.

3.8. EMPIRICAL LITERATURE USING THE GRAVITY MODEL ON THE EFFECTS OF TAX POLICIES

Gravity model is used to estimate effects of tax burdens on the international trade (Beck and Chaves, 2011; Nicholson, 2010). Beck and Chaves (2011) examine the long-run impact of changes in consumption, labor income and capital income on bilateral exports in gravity model with panel data from 25 OECD countries. They conclude that higher taxes lead to a decline in international trade flows, that is, "*when it comes to international trade, taxes matter"* (p.17). Nicholson (2010) investigates the effects of other countries' VATs and the US corporate income tax on the US trade. By applying gravity model to panel data, he concludes that other countries' VATs diminish trade volume of the US but its effects alter across sectors. In a similar vein, he finds the U.S. corporate income tax leads to a reduction in trade volume of the US.

Balding and Dauchy (2013) test the long term effects of corporate income taxes on international trade. Although standard gravity models assume that trade barriers are symmetric between countries, they use corporate income taxes (CIT) as an asymmetric barrier effecting international trade through a change in the price of imports and exports. Balding and Dauchy (2013) analyze effects of CIT on international trade by taking into consideration the data of OECD countries between 1981 and 2008. Contrary to Beck and Chaves (2011), they conclude that corporate income tax rates do not affect international trade.

Folfas (2011) investigates the determinants of intra-EU direct capital flows by using gravity model including corporate income tax variables from 1990 to 2009. Folfas (2011) proves in his study that differences in corporate tax rates are significant to determine foreign direct investment between EU–27 Member States, while regional integration is not statistically significant. He demonstrates that tax avoidance including transfer pricing continues to be one of the most important means of maximizing net profit. He also concludes that countries with simpler and lower taxes attract more direct capital.

All these studies show that gravity models are employed commonly and successfully in the empirical literature measuring the effects of tax policy on international trade flows. Thus, gravity model can serve as a suitable framework for empirically scrutinizing the impacts of a fiscal devaluation on bilateral trade.

CHAPTER 4

EMPIRICAL MODELS, METHODS AND RESULTS

4.1. INTRODUCTION

In this thesis, we employ panel regression to analyze multilateral effects of a fiscal devaluation on bilateral trade for 22 OECD countries over the years from 1980-2014. Since they represent a typical fiscal devaluation, ESC and VAT are embodied within the gravity model framework. Therefore, a fiscal devaluation will be examined by means of using the gravity model. As is known, time-invariant variables including distance, border-sharing, language similarity and colonial ties are of vital importance to analyze international trade flows in the gravity model. However, the fixed effects model cannot be used to predict the model because time-invariant variables have perfect multicollinearity with country-fixed effects. Thus, taking into account the time-invariant variables, a three-stage fixed effects vector decomposition method developed by Plumper and Troeger (2007) is used.

By this way, multilateral effects of a fiscal devaluation will be empirically analyzed for the first time in the literature. After estimating multilateral effects of a fiscal devaluation, we can also estimate effects of bilateral application of a fiscal devaluation on country pairs to observe trade partners' reaction to the fiscal devaluation. Last but not least, we also estimate each country's parameter heterogeneity to determine whether a fiscal devaluation is an appropriate policy option for a country in the sample.

In the regression ESC and VAT are estimated as statutory rates and revenue ratios (as a percentage of GDP and as a percentage of total tax revenue). The logic behind using three variables is to measure different sides of changing a fiscal devaluation instruments.

4.2. SPECIFICATION OF THE EMPIRICAL MODELS

As specified in the previous chapter, a generic empirical gravity equation that is commonly adopted in the related literature can be written as;

$$lnY_{ij} = \alpha_1 + \alpha_2 lngdp_i + \alpha_3 lngdp_j + \alpha_4 lnpop_i + \alpha_5 lnpop_j + \alpha_6 lndist_{ij} + \alpha_7 lang_{ij} + \alpha_8 col_{ij} + \alpha_9 cont_{ij} + \theta_{ij} + \mu_t + u_{ij,t} \quad (34)$$

where Y_{ij} shows bilateral trade between country i to j. Usual explanatory variables are GDP, population and observable (time-invariant) fixed effects such as distance, language similarity, colonial tie and border sharing. θ_{ij}, μ_t and $u_{ij,t}$ represent country-pair unobservable fixed effects, time fixed effects and random error term respectively.

The expected sign of GDP for exports and imports are positive. A higher GDP means a higher productive capacity for the exporting country and a higher purchasing power for the importing country (Ekanayake et al., 2010; Jordaan and Kanda, 2011). As a proxy for market size, the coefficient of population is ambiguous. It can be expected to be positive due to economies of scale or to be negative due to absorption effect. Economies of scale are simply based on the idea that a big country exports and/or imports more than a small country (Krugman, 1980). On the other hand, absorption effects indicate that a country exports and/or imports less when it has a large population (Endoh, 1999; Martinez-Zarzoso, 2003; Moinuddin, 2013). In this case, an increase in population cause a reversed effect on traded goods. As a proxy for transport costs, the expected sign of the distance is negative. The greater distance between countries means the smaller trade between them. The variables of common language, colonial ties, border-sharing and Eurozone membership are expected to be positively correlated with bilateral trade.

Since the aim of the thesis is to observe effects of a fiscal devaluation, gravity equation (34) needs to be modified accordingly. As discussed previously, ESC and VAT variables can be taken to represent fiscal devaluation.

When, in a country, a reduction in ESC can be reflected to producer prices exactly (without increasing profit shares), its exported goods might become cheaper, which in turn might increase export of the country by means of a decrease in ESC. On the other hand, decreased ESC may lead to decrease in prices of domestic products produced and sold, without affecting prices of imported goods and hence the import of the country. Also, since VAT is a destination-based tax in essence, it is not expected to have any effects the export of the country. However, increased VAT may put a contractionary pressure on import by increasing both prices of domestic and imported goods, which in turn might decrease import of the country (de Mooji and Keen, 2012). Shortly, while ESC is related to export, VAT is to import. Therefore, we divide total bilateral trade in gravity equation into bilateral export and import components, in order to clearly measure effects of a fiscal devaluation. Integrating ESC to bilateral export and VAT to bilateral import, gravity equation (34) can be extended to specify the following empirical equations;

$$lnX_{ij,t} = \alpha_1 + \alpha_2 lngdp_{i,t} + \alpha_3 lngdp_{j,t} + \alpha_4 lnpop_{i,t} + \alpha_5 lnpop_{j,t} + \alpha_6 lnESC_{i,t} + \alpha_7 lndist_{ij} + \alpha_8 lang_{ij} + \alpha_9 col_{ij} + \alpha_{10} cont_{ij} + \alpha_{11} eurozone_{ij} + \theta_{ij} + \mu_t + u_{ij,t} \quad (35)$$

$$lnM_{ij,t} = \beta_1 + \beta_2 lngdp_{i,t} + \beta_3 lngdp_{j,t} + \beta_4 lnpop_{i,t} + \beta_5 lnpop_{j,t} + \beta_6 lnVAT_{i,t} + \beta_7 lndist_{ij} + \beta_8 lang_{ij} + \beta_9 col_{ij} + \beta_{10} contg_{ij} + \beta_{11} eurozone_{ij} + \vartheta_{ij} + \tau_t + \varepsilon_{ij,t} \quad (36)$$

where X_{ij} denotes bilateral exports and M_{ij} bilateral imports. In the equation (35), θ_{ij}, μ_t and $u_{ij,t}$ and in the equation (36) ϑ_{ij}, τ_t, $\varepsilon_{ij,t}$ represent country-pair fixed effect, time fixed effects and random error term respectively. It is worth noting that gross domestic product (gdp) and population (pop) are time variant variables while distance (dist), language similarity (lang), colonial ties (col), border-sharing (contg) and membership of the Eurozone (eurozone) are time invariant explanatory variables.

The multilateral effects of a fiscal devaluation can be obtained from α_6 and β_6 coefficients. Prior expectation is that $\alpha_6 < 0$ and $\beta_6 < 0$. Since a fiscal devaluation is a tax shift from ESC to VAT in a budget-neutral way, to see the effect on bilateral trade of a decline in ESC and a rise in VAT simultaneously, one needs to calculate;

$$-\left(\frac{\partial lnX_{ij}}{\partial lnESC_i}+\frac{\partial lnM_{ij}}{\partial lnVAT_i}\right)=-(\alpha_6+\beta_6) \qquad (37)$$

At this point, it is important to note that a percentage point changes in both ESC and VAT simultaneously do not necessarily imply or guarantee budget-neutral tax swap. However fiscal devaluation policy requires that such a tax swap be undertaken in a budget neutral manner. No matter how one measures ESC and VAT variables in practice, there is no way of guaranteeing budget-neutrality as a result of changes in both ESC and VAT at the same time. Therefore, in an effort to come closer to representing the effects of budget-neutral changes in tax policy (fiscal devaluation), we experiment with three definitions of ESC and VAT. Namely, ESC and VAT are measured as (statutory) rates, revenue ratios as a percentage of GDP and revenue ratios as a percentage of total tax revenue.

In the event of measuring ESC and VAT as statutory rates, one needs to hypothesize that a simultaneous decrease in ESC and increase in VAT by a percentage point implying budget-neutrality. Since tax rates do not change very frequently, they are less likely to be in a relationship with the business cycle. Therefore, as Arnold (1998) and de Mooji and Keen (2012) pointed out using tax rates rather than revue ratio may prevent endogeneity problem between tax variables and bilateral trade. Despite this advantage, statutory rates should be fortified with revenue ratios to come closer the concept of budget-neutrality.

Lastly, ESC and VAT as a share of total tax revenue are important variables in terms of budget neutrality. Decrease in ESC can lead to reduction in public budget revenue and increase in VAT can compensate this reduction. Thus, we also add variables of ESC and

VAT as a percentage of total tax which is being a closer indicator for the concept of budget-neutrality.

Multilateral effects of a fiscal devaluation can be measured by the sum of partial derivatives given in (37) using three definitions one at a time. It is noteworthy to emphasize that it is not necessary for all countries in the sample to apply fiscal devaluation simultaneously or in a coordinated manner to gauge multilateral effects.

Furthermore, effects of fiscal policy instruments on exports or imports can be observed contemporaneously in the same period or with a delay. Since this argument might be valid for fiscal devaluation, we add the lagged ESC and VAT variables to the empirical models (35 and 36) to observe delayed impacts of fiscal devaluation variables on bilateral exports and imports.

Next, we would like to analyze a case in which a fiscal devaluation is implemented bilaterally by trading partners. As discussed previously, relative policy measures in trading partners may affect the impact of fiscal devaluation implemented in a country. Since trade partners can choose tax competition or coordination, it is important to measure possible relative behavior of trade partners. Thus we need to check the effects of bilateral application of fiscal devaluation on country pairs to observe trade partners' reaction to the fiscal devaluation. To this end, we use relative ESC and VAT variables of trading partners and thus redefine the equation (35) and (36) as follows;

$$lnX_{ij} = \gamma_1 + \gamma_2 lngdp_i + \gamma_3 lngdp_j + \gamma_4 lnpop_i + \gamma_5 lnpop_j + \gamma_6 ln(ESC_i/ESC_j) + \gamma_7 lndist_{ij} + \gamma_8 lang_{ij} + \gamma_9 col_{ij} + \gamma_{10} cont_{ij} + \gamma_{11} eurozone_{ij} + \alpha_{ij} + \mu_t + u_{ij,t} \quad (38)$$

$$lnM_{ij} = \delta_1 + \delta_2 lngdp_i + \delta_3 lngdp_j + \delta_4 lnpop_i + \delta_5 lnpop_j + \delta_6 ln(VAT_i/VAT_j) + \delta_7 lndist_{ij} + \delta_8 lang_{ij} + \delta_9 col_{ij} + \delta_{10} cont_{ij} + \delta_{11} eurozone_{ij} + \vartheta_{ij} + \tau_t + \varepsilon_{ij,t} \quad (39)$$

Here γ_6 indicates that a relative competitive performance in export country *i* might gain, given a decrease in ESC of country *i* relative to country *j* by 1 unit in equation (38), while δ_6 indicates that a contraction import of country *i* might be affected, given an increase in VAT of country *i* relative to country *j* by 1 unit in equation (39).

Finally, we focus on the effect of a fiscal devaluation if implemented unilaterally. It is reasonable to expect that the effect of a fiscal devaluation varies from country to country. For this reason, we also estimate slope parameter heterogeneity to determine whether a fiscal devaluation is an appropriate policy option for a country (unilateral implementation) in the sample. To do so, we define a dummy variable (D_i) that takes a value of one for country *i* and of zero otherwise and insert the interaction of dummy variable with $lnESC_i$ and $lnVAT_i$ to specify the following equations

$$lnX_{ij} = \varphi_1 + \varphi_2 lngdp_i + \varphi_3 lngdp_j + \varphi_4 lnpop_i + \varphi_5 lnpop_j + \varphi_6 lndist_{ij} + \varphi_7 lang_{ij} + \varphi_8 col_{ij} + \varphi_9 cont_{ij} + \varphi_{10} eurozone_{ij} + \varphi_{11,i} D_i lnESC_i + \alpha_{ij} + \mu_t + u_{ij,t} \quad (40)$$

$$lnM_{ij} = \omega_1 + \omega_2 lngdp_i + \omega_3 lngdp_j + \omega_4 lnpop_i + \omega_5 lnpop_j + \omega_6 lndist_{ij} + \omega_7 lang_{ij} + \omega_8 col_{ij} + \omega_9 cont_{ij} + \omega_{10} eurozone_{ij} + \omega_{11,i} D_i lnVAT_i + \vartheta_{ij} + \tau_t + \varepsilon_{ij,t} \quad (41)$$

4.3. EMPIRICAL METHODS

In this thesis, we employ panel regression to analyze the effects of a fiscal devaluation on bilateral trade for 22 OECD countries. As is well-established in the empirical literature, it is important to model unobserved country specific effects in panel data analyses. In this regard, country specific effects can be modeled as fixed or random effects. The fixed effects model (FEM) might be more appropriate in situations where countries selected in a predetermined way, while the random effects model (REM) might be more proper in situations where countries randomly drawn from a larger sample (Egger, 2000; Martinez-Zarzoso and Nowak-Lehmann, 2003). Since we select 22 OECD countries, we expect that FEM is more appropriate. As a common practice in

the empirical literature, we also use the Hausman test to check which model can be preferred. When the results turn out to suggest the use of FEM, another issue is to deal with perfect collinearity between unobservable fixed effects and observable fixed effects in gravity equations such as distance, border-sharing, language similarity and colonial ties. The use of FEM wipes out all observable time-invariant variables. To handle the time-invariant variables, we use fixed effects vector decomposition (FEVD) method proposed by Plumper and Troeger (2007). The ability of FEVD method to estimate unbiased and consistent estimator for time-variant and time-invariant variables in existence of linear relationship between time-variant variables and cross-section fixed effects, is its superior advantage compared to other panel estimation methods which are fixed effects, random effects and Hausman-Taylor techniques.

According to Rault et al. (2009) the problem of simultaneous determination (endogeneity bias) is the most basic problem in the gravity model due to an unobserved individual heterogeneity. However, FEVD takes account of unobserved portion of cross-section effects and captures the potential of endogeneity bias in the second stage (Srivastava et al., 2013). Therefore, FEVD allows for eliminating the endogeneity bias due to excluding observed or unobserved fixed effects and getting more robust results (Caporale et al., 2008).

In order to explain how FEVD technique works, consider the following generic panel regression;

$$Y_{it} = X_{it}\beta + TINV_i\delta + \alpha_i + \varepsilon_{it} \qquad (42)$$

where Y, X, TINV, α and ε represents dependent variable, time-variant independent variable matrix, observable time-invariant factor matrix, unobservable cross-section fixed effects and the error term respectively.

According to Plumper and Troeger (2004, 2007), FEVD method consists of three stages as follows:

i. Observable time-invariant variables are left out. The model is estimated by fixed effects method and the cross-section fixed effects are obtained. That is, estimate the $Y_{it} = X_{it}\beta + \alpha_i + \varepsilon_{it}$ by FEM and obtain unobservable fixed effects, $\hat{\alpha}_i$.

ii. Define the cross-section regression $\hat{\alpha}_i = \mu + TINV_i\delta + \eta_i$ in which cross-section fixed effects are dependent variable while observable time-invariant variables are independent variables. Residuals $\hat{\eta}_i$ from estimating this cross-section regression represent unobservable fixed effects. In consequence, we can decompose observable and unobservable fixed effects.

iii. After inserting both observable time-invariant factors and the residuals (unobservable fixed effects) obtained in the course of second stage into the model, the models will be estimated by least squares method (pooled-OLS, POLS) in the third stage.

$$\mathrm{Y_{it}} = \mathrm{X_{it}}\beta + \mathrm{TINV_i}\delta + \varphi\hat{\eta}_\mathrm{i} + \varepsilon_\mathrm{it} \qquad (43)$$

Through this method, it is possible both to control cross-section fixed effects and to analyze effects of observable and time-invariant variables. The third stage (POLS) provides necessary conditions to produce an effective method estimator. The third stage also allows to control for multi-collinearity by applying the AR(1) Prais-Winston transformation (Plümper and Troeger, 2007; Rault et al. 2009). Plümper and Troeger (2004, 2007) prove that FEVD generates more efficient estimator with the Monte Carlo simulations.

4.4. DATA DESCRIPTIONS AND SOURCES

Panel data used in the analyses cover 22 OECD countries over the years from 1980-2014. Data availability constrains us to select 22 OECD countries. Given the available data on VAT and ESC, the numbers of countries in the sample decline to 22.

The data on ESC and VAT are taken from OECD Revenue Statistics. The data on ESC statutory rates are compiled from OECD Employer Social Contribution Rates Table, while ESC revenues as a percentage of GDP and total tax revenue are from OECD classification 2200. The data for VAT is obtained from OECD Revenue Statistics, OECD classification 5111.

The data on bilateral trades are taken from IMF's Direction of Trade Statistics (DOTS). OECD database provides the data on GDP and population. As for the gravity model variables such as distance, language similarity, colonial ties and border-sharing are obtained from Centre d'Études Prospectives et d'Informations Internationales (CEPII) datasets. Distance variable reflects the distance between km squared of the two capital cities. Language similarity is a dummy taking the value of 1 if two countries have similar formal language and of zero otherwise. In a similar vein, dummies of colonial ties and border-sharing take a value of one if two countries are contiguous and in a colonial relationship, respectively.

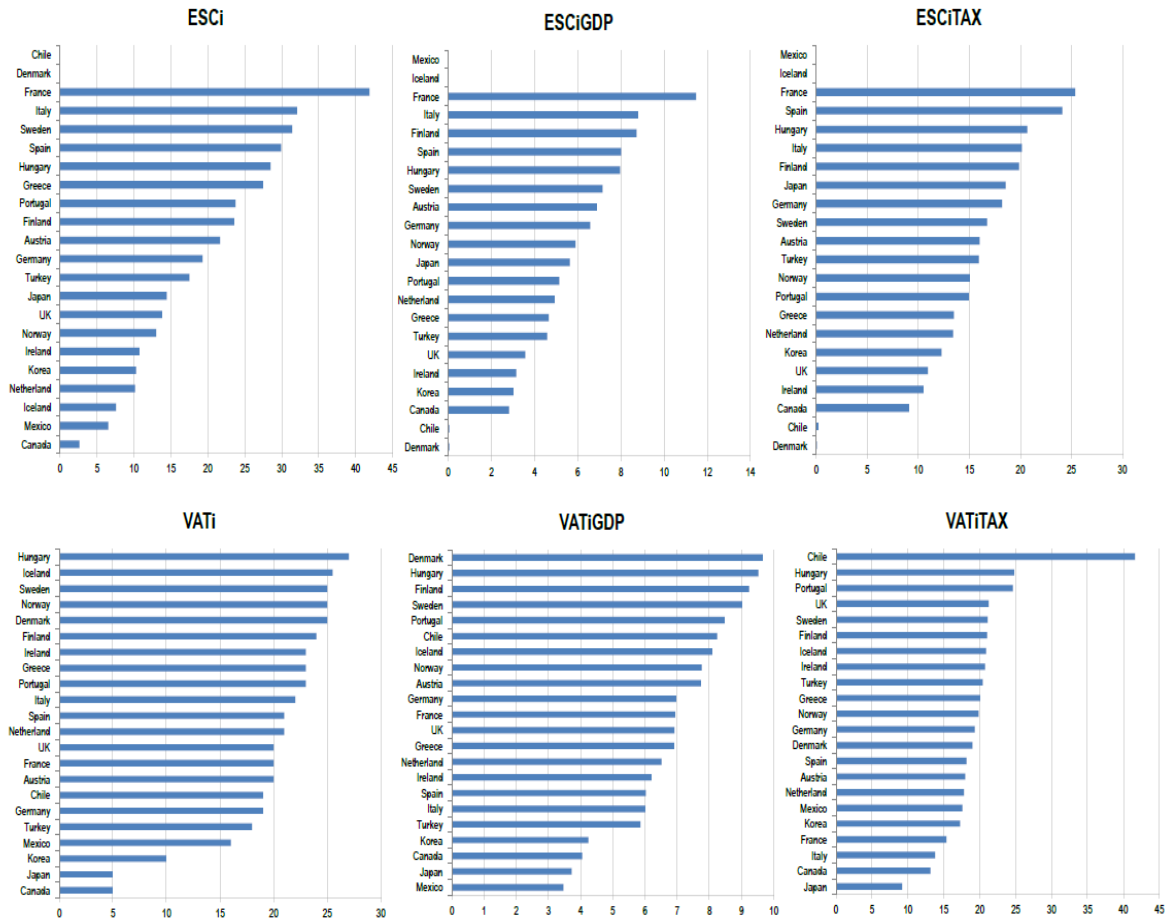
Table 2 reports the summary statistics of the variables of ESC and VAT as a typical tool of a fiscal devaluation. ESC rates vary up to 51% with an average of almost 21%; VAT rates lies between 5% and 30% with an average of almost 18%. ESC revenue as a percentage of GDP reaches up to 14%, while this ratio ranging from 2.41% to 9.68% for VAT. ESC revenue as share of total tax revenue varies up to 30.31%; whereas VAT revenue as a share of total tax revenue varies from 6.87% to 42.67%.

Table 2. Summary Statistics of Empirical Data

	Obs.	*Mean*	*Median*	*Max.*	*Min.*	*Std. Dev.*
Statutory tax rates						
ESC_%	6985	20.56	21.63	51.00	0.00	12.19
VAT_%	6985	18.19	19.00	30.00	5.00	5.13
In percent of GDP						
ESC_GDP	6985	5.84	5.35	14.00	0.00	3.21
VAT_GDP	6985	6.46	6.77	9.68	2.41	1.67
In percent of total tax revenue						
ESC_TAX	6985	15.67	15.74	30.31	0.00	6.92
VAT_TAX	6985	19.50	18.83	42.67	6.87	6.18

Figure 1 also illustrates each country's ESC and VAT variables in terms of rates and revenue ratios. In terms of all different definitions, France has the highest ESC rates. Italy, Sweden and Spain are among the countries having high ESC rates, whereas Canada and Iceland are the countries having low rates of ESC. While countries have a much wider dispersion for ESC variables, they have a narrower dispersion for VAT variables especially in statutory rates. Except for Canada, Japan, Mexico and Korea, countries have close VAT rates to each other. However, Chile has extremely high rate of VAT as a share of total tax revenue comparing to other countries.

Figure 1- ESC and VAT Variables for Sampled Countries



4.5. EMPIRICAL RESULTS AND DISCUSSIONS

For empirical analyses, we apply panel regression techniques to panel data for 22 OECD countries over 1980-2014. As mentioned previously, fixed effects model (FEM) is more appropriate then random effects model (REM) when the sample is not selected randomly. This is the case in this study in which the choice of 22 OECD countries are made according to the data accessibility and thus the sample of countries included into the analyses is not completely randomly selected. Nevertheless, we also use the Hausman test to observe if FEM or REM can be preferred. The results of the Hausman test show that FEM is more appropriate than REM[4]. Since gravity models include observable time-invariant fixed effects as well, we need to decompose the observable

[4] See Appendix A-2.

and unobservable fixed effects to overcome perfect collinearity problem. In so doing, we adopt FEVD technique to estimate empirical gravity equations (35, 36, 38, 39, 40 and 41)

As discussed previously, the purpose of this thesis is to analyze the impact on bilateral trade of a fiscal devaluation separately when implemented multilaterally, bilaterally and unilaterally. Thus, we first investigate multilateral effects of a fiscal devaluation by estimating equations (35 and 36). Secondly, we examine the effects of bilateral application of fiscal devaluation, by estimating equations (38 and 39). Lastly, we estimate equations (40 and 41) to observe if the slopes of fiscal devaluation variables are heterogeneous across country-pairs, which enables us to investigate the effects of a fiscal devaluation when implemented it unilaterally.

4.5.1 Multilateral Effects of Fiscal Devaluation on Bilateral Trade

We estimate equations (35) and (36) one at a time by FEVD technique in order to see the effects on bilateral trade of fiscal devaluation when implemented multilaterally. Table 3 presents the results from estimating equation (35) that shows the impact of ESC on bilateral exports. The slope coefficient of ESC indicates the effects of ESC on bilateral exports when all countries in the sample reduce their ESC rates by 1% simultaneously. When estimating equation (35), we use three definitions of ESC; as a statutory rate in the first column, ESC revenue as a share of GDP in the second column and ESC revenue as a share of total tax in the third column of Table 3.

We first look at the success of the standard gravity variables in explaining bilateral exports and then focus on the effects of ESC. As seen in Table 3, GDP and population as typical gravity model time variant variables enter the model significantly. The coefficients of the GDP of country *i* and country *j* are positive, as expected, and statistically significant at the 1% level. On the other hand, populations of both country *i* and country *j* have a negative impact on the total export. This result shows that absorption effects have been observed rather than economies of scale. Therefore, increase in population causes a reversed effect on traded goods (Endoh, 1999; Martinez-

Zarzoso, 2003; Moinuddin, 2013). The coefficients of all time-invariant variables are statistically significant at the 1% level. They also have the expected sign except colonial ties only in the first column where statutory rate is used as a definition of ESC. While distance is negatively correlated with export, common language, border-sharing and Eurozone membership are positively correlated with export.

We now turn to focusing on the effects of ESC as a typical tool of the fiscal devaluation. As shown in Table 3, all definitions of ESC variable, as tax rates and two different revenue ratios, have significant negative effects on bilateral exports. This result is consistent with a fiscal devaluation policy expectation. All coefficients of ESC are statistically significant at the 1% level. The first column shows that a percentage point reduction in ESC rate might increase total exports by 0.12%. The second column of the Table 3 reports results using ESC revenue as a share of GDP rather than statutory tax rates. The coefficients of ESC are also significantly negative. If all countries in the sample decrease 1% of their ESC as a percentage of GDP, their total exports might increase by 0.05%. The third column presents results of the ESC revenue as a share of total tax. The coefficient of the ESC is still negative and statistically significant. Its effects on exports seem little further than effects of ESC as a percentage of GDP. These results show that a reduction in ESC rates seems to increase bilateral exports, regardless of the definition of ESC.

Table 3- Multilateral Effects of ESC on Exports

	DEFINITIONS OF FISCAL DEVALUATION VARIABLES		
VARIABLES	**STATUTORY RATE**	**PERCENTAGE OF GDP**	**PERCENTAGE OF TOTAL TAX REVENUE**
GDPi	1.576***	1.386***	1.399***
	(0.0266)	(0.0202)	(0.0197)
GDPj	2.235***	2.205***	2.180***
	(0.0254)	(0.0187)	(0.0184)
POPi	-1.939***	-0.776***	-1.095***
	(0.0828)	(0.0743)	(0.0738)
POPj	-1.236***	-1.683***	-1.392***
	(0.0821)	(0.0610)	(0.0607)
ESC	-0.120***		
	(0.0197)		
ESCGDP		-0.0499***	
		(0.00693)	
ESCTAX			-0.0262***
			(0.00423)
DIST	-0.739***	-0.639***	-0.651***
	(0.00378)	(0.00274)	(0.00270)
LANG	1.135***	0.323***	0.341***
	(0.0218)	(0.0176)	(0.0174)
COL	-0.0764***	0.720***	0.650***
	(0.0249)	(0.0175)	(0.0172)
CONTG	0.737***	0.695***	0.650***
	(0.0146)	(0.0113)	(0.0112)
EUROZONE	0.0398***	0.162***	0.132***
	(0.0109)	(0.00894)	(0.00888)
Eta[5]	0.976***	1.020***	1.020***
	(0.00182)	(0.00238)	(0.00223)
Constant	15.78***	5.641***	6.384***
	(0.0307)	(0.0223)	(0.0220)
Observations	10,360	13,033	13,197
R-squared	0.954	0.953	0.954

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

[5] Eta is representing the unexplained part of the estimated unit effects (Plümper and Troeger, 2007).

Table 4 presents the results from estimating equation (36) that shows the impact of VAT on bilateral imports. The slope coefficient of VAT indicates the effects of VAT on bilateral imports when all 22 OECD countries increase their VAT rates by 1%. As for the performance of the standard gravity variables, the results are rather similar to those form equation (35). The coefficients of GDP of country *i* and country *j* are positive and statistically significant at the 1% level while population of both country *i* and country *j* has negative impact on the total imports as such in ESC. All time-invariants have the expected sign and they are statistically significant at the 1% level. The sign of the distance are negative whereas, the effects of common language, colonial ties, border-sharing and Eurozone membership are positive.

When we take a glance at the effects of VAT as a second tool of a fiscal devaluation, the signs of the coefficients of VAT differ with respect to the definitions of VAT. The first column of Table 4 reports the results using the statutory VAT rates. The coefficient of VAT is significantly negative at the 1% level. The result indicates that a percentage point increase in VAT rates decreases bilateral imports by 0.12%. The second column reports the result using VAT revenue as a percentage of GDP. The coefficient of VAT variables is significant at the 1 % level. However, the signs of VAT variables become positive in contrast to statutory VAT rates. Therefore, if all countries in the sample increase their VAT as a share of GDP by 1%, their total imports might increase by 0.4%. The third column indicates the results of VAT revenue as a percentage of total tax. The coefficient of VAT is insignificant unlike statutory rate and as a share of GDP of VAT.

Our empirical analysis remarks that increasing in VAT statutory rates can lead to a decrease in imports. However, an increase in VAT revenue as a share of GDP can increase imports. This asymmetric result of the VAT variable can distort the success of a fiscal devaluation. Lastly, according to our result, increasing in VAT revenue as a share of total tax revenue does not affect imports. Along with these findings, the results of this study also contribute the international trade and fiscal policy literature analyzing whether VAT is trade neutral or not. In their seminal paper, Feldstein and Krugman (1990) assert that VAT is inherently trade neutral. On the other hand, Desai and Hines

(2005) emphasize that there is little empirical evidence on the trade neutrality of VAT beyond the "received wisdom". As Nicholson (2010) points out VAT might be trade neutral when applied uniformly across the world. He also suggests that effects of VAT on import should be analyzed by sectorial-based approach. Thus, the sign and magnitude of VAT variables can vary by sectors. The results of our study show that VAT is not trade neutral and it can have positively or negatively effects on imports. However, VAT might be trade neutral only for the definition of VAT as a share of total tax revenue[6]. Thus, the signs of the coefficients of VAT might differ with respect to the definitions of VAT.

Possible determinants of VAT on international trade are suggested by Desai and Hines (2005) and Franco (2011). Desai and Hines (2005) claim that the structure of VAT on traded sectors and non-traded sectors induce effects of VAT on international trade. Elasticity of substitution between traded and nontraded goods lead to change possible effects of VAT on imports. On the other hand, Franco (2011) emphasizes that elasticity of substitution between domestic and foreign goods also impact the sign and magnitude of VAT on imports. Inelasticity of substitution between domestic and foreign goods means consumers are unwilling to shift their consumption from foreign goods to domestic goods even increasing relative prices of foreign goods[7].

[6] Taking into consideration lagged value of VAT as a share of total tax revenue, the coefficient of VAT variable becomes significant at the 1% level. See Appendix A.
[7] Saito (2001) finds this elasticity about 0.9 for OECD countries.

Table 4- Multilateral Effects of VAT on Imports

	DEFINITIONS OF FISCAL DEVALUATION VARIABLES		
	STATUTORY RATE	**PERCENTAGE OF GDP**	**PERCENTAGE OF TOTAL TAX REVENUE**
VARIABLES			
GDPi	2.110***	2.124***	2.143***
	(0.0171)	(0.0169)	(0.0169)
GDPj	1.352***	1.283***	1.312***
	(0.0180)	(0.0175)	(0.0176)
POPi	-1.388***	-1.371***	-1.381***
	(0.0594)	(0.0582)	(0.0577)
POPj	-1.136***	-1.160***	-1.192***
	(0.0585)	(0.0573)	(0.0573)
VAT	-0.127***		
	(0.0236)		
VATGDP		0.237***	
		(0.0202)	
VATTAX			-0.00878
			(0.0216)
DIST	-0.519***	-0.460***	-0.490***
	(0.00246)	(0.00244)	(0.00244)
LANG	0.475***	0.449***	0.447***
	(0.0157)	(0.0155)	(0.0155)
COL	0.685***	0.734***	0.714***
	(0.0158)	(0.0157)	(0.0157)
CONTG	0.930***	0.978***	0.960***
	(0.0105)	(0.0103)	(0.0103)
EUROZONE	0.202***	0.225***	0.224***
	(0.00815)	(0.00808)	(0.00809)
Eta	0.936***	0.939***	0.941***
	(0.00188)	(0.00173)	(0.00174)
Constant	7.783***	7.343***	8.123***
	(0.0201)	(0.0199)	(0.0199)
Observations	12,995	13,207	13,207
R-squared	0.941	0.941	0.940

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Taken as a whole, to measure trade effects of a fiscal devaluation, we need to aggregate both ESC and VAT effects at the same time as in the equation (37);

$$-\left(\frac{\partial lnX_{ij}}{\partial lnESC_i}+\frac{\partial lnM_{ij}}{\partial lnVAT_i}\right)=-(\alpha_6+\beta_6)$$

Multilateral effects of the fiscal devaluation are divided into three main categories; statutory rates of ESC and VAT, revenue rates of ESC and VAT as a percentage of GDP and revenue rates of ESC and VAT as a percentage of total tax.

Table 5 shows that a percentage point reduction in ESC rates can increase bilateral exports and an increase in VAT rates can decrease bilateral imports. This result is consistent with a fiscal devaluation policy expectation.

Table 5- Multilateral Effects of Fiscal Devaluation as Statutory Rates

ESC	-0.120***
VAT	-0.127***
Total Effect on Trade Balance	**0,247**

Our empirical analysis remarks that if all 22 OECD countries decrease their ESC rates by a percentage point and increase their VAT rates by a percentage point; their net export might increase by 0.25%. Thus, the fiscal devaluation can succeed according to the statutory rates of ESC and VAT.

Table 6 presents the multilateral effects of the fiscal devaluation with ESC and VAT as a percentage of GDP. If all countries in the sample decrease 1% of their ESC revenue as a percentage of GDP, their total exports might increase by 0.05%. However, positive effects of VAT on import can distort the results of a fiscal devaluation. In this case, the result shows that the fiscal devaluation implemented in the countries has negative

bilateral trade effects in terms of ESC and VAT as a percentage of GDP. Therefore, this finding does not support to use of fiscal devaluation to attain trade competitiveness.

Table 6-Multilateral Effects of Fiscal Devaluation as a Percentage of GDP

ESC	-0.0499***
VAT	0.237***
Total Effect on Trade Balance	**-0,187**

Table 7 summarizes the bilateral trade effects of the fiscal devaluation implemented in the countries according to ESC and VAT revenue as a share of tax revenue. The table reports that the fiscal devaluation can improve trade balance even though insignificance of the VAT variable. Although this result seems to contradict with the previous one, we consider that the revenue ratio as a share of total tax revenue should be emphasized to a more extent since this ratio is thought to be a better indicator to reflect the concept of the budget-neutrality.

Table 7- Multilateral Effects of Fiscal Devaluation as a Percentage of Total Tax Revenue

ESC	-0.0262***
VAT	-0.00878
Total Effect on Trade Balance	**0.0262**

One might argue that the effects of fiscal policy tools might not be observed contemporaneously but imports and exports might respond to a change in fiscal policy with a delay. Taking into consideration lagged values of ESC and VAT variables, significant differences are not observed in the results[8].

[8] See Appendix A-1.

4.5.2 Bilateral Effects of Fiscal Devaluation on Bilateral Trade

After estimating equations (35) and (36) in order to observe effects of fiscal devaluation on bilateral trade when implemented multilaterally, we focus on the effects of fiscal devaluation when it is implemented bilaterally by trading partners. As is known, relative policy measures in trading partners may affect the impact of fiscal devaluation implemented in countries. Since trade partners can choose tax competition or coordination, it is important to measure possible relative behavior of trade partners. Thus, we need to check the effects of bilateral applications of fiscal devaluation on country pairs to observe trade partners' reaction to the fiscal devaluation. For this purpose, we use relative ESC and VAT variables of trading partners as $ln(ESC_i/ESC_j)$ and $ln(VAT_i/VAT_j)$.

The coefficient of ESC_i/ESC_j variable indicates that a relative competitive performance in the export of country *i* when a decrease in ESC of country *i* relative to country *j*. On the other hand, the coefficient of VAT_i/VAT_j variable indicates that a relative competitive performance in the import of the country *i* given an increase in VAT of country *i* relative to country *j* by 1 unit. Hence, it is possible to estimate bilateral effects of fiscal devaluations under the conditions of a similar or differentiating tax policy.

Table 8- Bilateral effects of ESC on Exports

	DEFINITIONS OF FISCAL DEVALUATION VARIABLES		
	STATUTORY RATE	**PERCENTAGE OF GDP**	**PERCENTAGE OF TOTAL TAX REVENUE**
VARIABLES			
GDPi	1.617***	1.271***	1.285***
	(0.0233)	(0.0192)	(0.0192)
GDPj	2.560***	2.195***	2.184***
	(0.0234)	(0.0193)	(0.0192)
POPi	-1.880***	-0.837***	-0.827***
	(0.0705)	(0.0701)	(0.0699)
POPj	-1.598***	-1.501***	-1.514***
	(0.0709)	(0.0702)	(0.0694)
ESCi/ESCj	**-0.0570*** **		
	(0.0128)		
ESCGDPi/ESCGDPj		**-0.0213*** **	
		(0.00481)	
ESCTAXi/ESCTAXj			**-0.0287*** **
			(0.00518)
DIST	-0.754***	-0.655***	-0.654***
	(0.00355)	(0.00264)	(0.00264)
LANG	0.393***	0.321***	0.314***
	(0.0191)	(0.0164)	(0.0164)
COL	0.864***	0.618***	0.628***
	(0.0223)	(0.0169)	(0.0169)
CONTG	0.718***	0.651***	0.654***
	(0.0123)	(0.0105)	(0.0105)
EUROZONE	0.0544***	0.113***	0.113***
	(0.00867)	(0.00815)	(0.00816)
eta	0.945***	0.996***	0.996***
	(0.00163)	(0.00229)	(0.00232)
Constant	15.68***	5.360***	5.346***
	(0.0284)	(0.0215)	(0.0215)
Observations	7,798	11,812	11,843
R-squared	0.954	0.958	0.958

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Accordingly, we estimate equations (38 and 39) one at a time by FEVD technique. Table 8 shows effects of time variant, time invariant and bilateral ESC variables (statutory rate and revenue ratios) on bilateral exports. Table 9 reports the effects of time variant, time invariant and bilateral VAT variables on bilateral imports. The coefficients of GDP of country *i* and country *j* are positive and statistically significant at the 1% level for bilateral export and import. Populations of country *i* and country *j* have negative impact on the total exports and imports. All time-invariants have the expected

sign and they are statistically significant at the 1% level. The effects of distance are negative whereas, the effects of common language, colonial ties, border-sharing and Eurozone membership are positive.

Table 9- Bilateral effects of VAT on Imports

	DEFINITIONS OF FISCAL DEVALUATION VARIABLES		
	STATUTORY RATE	**PERCENTAGE OF GDP**	**PERCENTAGE OF TOTAL TAX REVENUE**
VARIABLES			
GDPi	2.294***	2.336***	2.350***
	(0.0174)	(0.0168)	(0.0169)
GDPj	1.260***	1.232***	1.221***
	(0.0173)	(0.0168)	(0.0169)
POPi	-1.643***	-1.689***	-1.709***
	(0.0573)	(0.0559)	(0.0557)
POPj	-1.169***	-1.151***	-1.137***
	(0.0573)	(0.0559)	(0.0558)
VATi/VATj	**-0.110*** **		
	(0.0173)		
VATGDPi/VATGDPj		**0.193*** **	
		(0.0145)	
VATTAXi/VATTAXj			**0.135*** **
			(0.0153)
DİST	-0.459***	-0.468***	-0.467***
	(0.00234)	(0.00231)	(0.00231)
LANG	0.438***	0.450***	0.451***
	(0.0154)	(0.0153)	(0.0153)
COL	0.719***	0.688***	0.686***
	(0.0155)	(0.0153)	(0.0153)
CONTG	1.058***	0.979***	0.981***
	(0.00987)	(0.00957)	(0.00958)
EUROZONE	0.150***	0.181***	0.181***
	(0.00756)	(0.00747)	(0.00747)
eta	0.922***	0.929***	0.927***
	(0.00160)	(0.00161)	(0.00161)
Constant	10.60***	10.94***	10.98***
	(0.0190)	(0.0188)	(0.0188)
Observations	12,070	12,389	12,388
R-squared	0.943	0.943	0.942

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Instead of evaluating ESC and VAT separately, we prefer to report total effects of both variables in Table 10. As it is seen in the table, tax differentiation between trade partners affects the result of the fiscal devaluation policy. This means, in terms of ESC, the effect of ESC on bilateral trade is significant when ESC policies of countries differ

from their trade partners. On the other hand, the decreasing effect of VAT on imports, which stands as a required condition for fiscal devaluation to be adhered a complete success, varies according to different VAT definitions. If a country applies to a proportionate (statutory rate) increase in VAT while a similar policy is not being followed by its trade partners, that is, a proportionate differentiation is realized, an increase in the statutory rate of VAT can decrease the bilateral import of the country. Under similar conditions, an increase in VAT revenue ratio as a share of GDP can increase bilateral imports. These results are similar to the results of multilateral effects of the fiscal devaluation. Distinct from multilateral implementation, VAT variable as a share of total tax revenue becomes significant in the bilateral implementation. Thus, VAT can affect bilateral trade on the condition that there exists a tax differentiation between trade partners. However, it is observed that this effect leads to an increase in bilateral import contrary to the expectations accompanied with a fiscal devaluation. As mentioned in the multilateral implementation, we put more emphasize the ratio of as a share of total tax revenue since this ratio is thought to be a better indicator to reflect the concept of the budget-neutrality.

Table 10- Bilateral Effects of Fiscal Devaluation on Bilateral Trade

STATUTORY RATE	
ESC	**-0.0570*** **
VAT	**-0.110*** **
Total Effect on Trade Balance	**0.167**
AS A PERCENTAGE OF GDP	
ESC	**-0.0213*** **
VAT	**0.193*** **
Total Effect on Trade Balance	**-0,1717**
AS A PERCENTAGE OF TOTAL TAX REVENUE	
ESC	**-0.0287*** **
VAT	**0.135*** **
Total Effect on Trade Balance	**-0,1063**

4.5.3 Unilateral Effects of Fiscal Devaluation on Bilateral Trade

Finally, we focus on the effect of a fiscal devaluation if it is implemented unilaterally. It is reasonable to expect that the effect of a fiscal devaluation varies from country to country. For this reason, we also estimate slope parameter heterogeneity to determine whether a fiscal devaluation is an appropriate policy option for a country in the sample. To this end, we estimate equations (40 and 41) using FEVD. The results are reported in Tables 11, 12, and 13 for the definitions of ESC and VAT respectively as a statuary rate, as a share of GDP and as a share of total tax revenues.

As is known, a decrease in ESC may cause a reduction in the pre-tax nominal wage and thus marginal cost of production. The degree of the reduction in marginal cost is based on wage flexibility. If wages are fully flexible, the effect of a reduction in ESC might disappear (Gruber, 1995). Thus marginal cost might remain the same for employers. For this reason, even if multilateral and bilateral effects of a reduction in ESC might increase bilateral exports, the country specific effect of this reduction might be different in each country. According to our results, the coefficients of ESC variable have the expected signs for the majority of 22 countries. Specifically, 12 countries have the expected sign of ESC as a statutory rate of ESC, 14 countries have the expected sign of ESC as a share of GDP and 16 countries have the expected sign of ESC as a share of total tax revenue. Spain, Canada, Japan, Korea, Norway, England, France, Germany and Netherland have the expected effects by using ESC for three different ratios.

On the other hand, an increase in VAT rates is expected to increase the price of imports and leads to a decrease in imports of a country. According to our result, 11 countries have the expected sign of VAT as a statutory rate. Only 5 countries have the expected sign of VAT as a share of GDP. Lastly, 9 countries have the expected sign of VAT as a share of total tax revenue. Therefore, irrespectively of how VAT is measured, the coefficients of this variable have the expected sign for only three countries, which are Japan, Sweden, and England.

Table 11- Unilateral Effects of Fiscal Devaluation as a Statutory Rate of ESC and VAT

VARIABLES	ESC	VAT	TOTAL EFFECT
Turkey	0.0388*	0.388***	- 0.43
	(0.0201)	(0.0311)	
Portugal	4.471***	-0.0970***	- 4.37
	(0.0295)	(0.0341)	
Spain	-4.109***	-0.0325	**4.14**
	(0.0278)	(0.0286)	
Canada	-0.286***	0.0869**	**0.20**
	(0.0306)	(0.0428)	
Iceland	0.430***	-11.51***	**11.08**
	(0.0485)	(0.104)	
Japan	-0.375***	-0.402***	**0.78**
	(0.0284)	(0.0659)	
Korea	-1.762***	-5.42e-08	-1.76
	(0.0255)	(0.0338)	
Norway	-0.311***	-0.857***	**1.17**
	(0.0107)	(0.0442)	
Sweden	1.300***	-2.557***	**1.26**
	(0.00971)	(0.0372)	
England	-1.833***	-0.491***	**2.32**
	(0.0231)	(0.0287)	
Hungary	-2.231***	-1.630***	**3.86**
	(0.0163)	(0.0323)	
Denmark	-	0.819***	-
		(0.0391)	
Mexico	-0.338***	-0.404***	**0.74**
	(0.0268)	(0.0349)	
Finland	1.839***	-0.939***	-0.9
	(0.0150)	(0.0416)	
France	-1.697***	-1.681***	**3.38**
	(0.0167)	(0.0287)	
Germany	-0.195***	0.771***	-0.58
	(0.0190)	(0.0315)	
Greece	0.862***	0.00550	-0.86
	(0.0113)	(0.0335)	
Ireland	4.642***	0.306***	-4.95
	(0.0305)	(0.0441)	
Netherland	-0.189***	1.672***	-1.48
	(0.0138)	(0.0310)	
Italy	-0.420***	0.708***	-0.29
	(0.0137)	(0.0274)	
Austria	-	1.889***	
		(0.0369)	
Chile	-	-1.515***	
		(0.0311)	

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 12- Unilateral Effects of Fiscal Devaluation as a Share of GDP of ESC and VAT

VARIABLES	ESCGDP	VATGDP	Total effect
Turkey	0.792***	0.612***	-1.40
	(0.0282)	(0.0260)	
Portugal	-0.193***	-0.00553	**0.19**
	(0.0137)	(0.0321)	
Spain	-1.696***	0.555***	**1.14**
	(0.0128)	(0.0246)	
Canada	-2.046***	0.00834	**2.05**
	(0.0243)	(0.0406)	
Iceland		1.583***	-
		(0.0721)	
Japan	-2.277***	-0.255***	**2.53**
	(0.0210)	(0.0555)	
Korea	-0.225***	-0.279***	**0.50**
	(0.0201)	(0.0292)	
Norway	-0.571***	0.201***	**0.37**
	(0.0145)	(0.0430)	
Sweden	0.570***	-0.380***	-0.19
	(0.00996)	(0.0335)	
England	-2.879***	-0.242***	**3.12**
	(0.0243)	(0.0225)	
Hungary	-2.547***	2.993***	-0.45
	(0.0157)	(0.0330)	
Denmark	-0.0536***	0.657***	-0.60
	(0.00833)	(0.0367)	
Mexico	-	1.905***	
		(0.0407)	
Finland	0.438***	0.476***	-0.91
	(0.0105)	(0.0390)	
France	-0.904***	0.456***	**0.45**
	(0.0115)	(0.0201)	
Germany	-2.032***	0.820***	**1.21**
	(0.0175)	(0.0227)	
Greece	0.247***	-0.276***	**0.03**
	(0.0161)	(0.0329)	
Ireland	-1.779***	0.214***	**1.57**
	(0.0207)	(0.0439)	
Netherland	-0.0969***	1.773***	-1.68
	(0.0154)	(0.0309)	
Italy	1.525***	0.693***	-2.22
	(0.0156)	(0.0237)	
Austria	0.687***	0.386***	-1.07
	(0.0134)	(0.0341)	
Chile	-0.0816***	-0.0166	**0.08**
	(0.00804)	(0.0253)	

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 13- Unilateral Effects of Fiscal Devaluation as a Share of Total Tax Revenue of ESC and VAT

VARIABLES	ESCTAX	VATTAX	Total effect
Turkey	0.716***	-0.427***	-0.29
	(0.0184)	(0.0299)	
Portugal	-0.307***	0.0458	**0.31**
	(0.00976)	(0.0358)	
Spain	-1.369***	0.352***	**1.02**
	(0.0120)	(0.0306)	
Canada	-2.568***	-0.193***	**2.76**
	(0.0192)	(0.0395)	
Iceland	0.140***	1.881***	-2.02
	(0.0324)	(0.0866)	
Japan	-2.577***	-0.291***	**2.87**
	(0.0206)	(0.0511)	
Korea	-0.304***	0.626***	-0.32
	(0.0188)	(0.0295)	
Norway	-0.211***	0.490***	-0.28
	(0.0110)	(0.0524)	
Sweden	0.645***	-0.511***	-0.13
	(0.00958)	(0.0434)	
England	-1.920***	-0.225***	**2.15**
	(0.0190)	(0.0304)	
Hungary	-3.664***	2.459***	**1.21**
	(0.0203)	(0.0378)	
Denmark	-0.0307***	-0.763***	**0.79**
	(0.00579)	(0.0486)	
Mexico	-	1.062***	
		(0.0362)	
Finland	0.511***	0.677***	-1.19
	(0.00956)	(0.0486)	
France	-0.0733***	0.842***	-0.77
	(0.0126)	(0.0308)	
Germany	-2.348***	0.840***	**1.51**
	(0.0185)	(0.0326)	
Greece	-0.989***	0.474***	**0.52**
	(0.0101)	(0.0357)	
Ireland	-1.420***	-1.257***	**2.68**
	(0.0144)	(0.0521)	
Netherland	-0.0302**	0.929***	-0.89
	(0.0125)	(0.0359)	
Italy	-0.905***	-0.349***	**1.25**
	(0.0132)	(0.0328)	
Austria	0.778***	0.846***	-1.62
	(0.0117)	(0.0422)	
Chile	-0.298***	-0.301***	**0.60**
	(0.0232)	(0.0263)	

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 11 shows unilateral effects of the fiscal devaluation on net exports in terms of statutory rates of ESC and VAT. Spain, Korea, England, Hungary and France might increase their exports after a reduction in ESC rates. The fiscal devaluation might improve the trade balance of Iceland, Spain, Korea, England, Hungary and France. Contrary to Franco (2011), we conclude that a fiscal devaluation policy cannot improve trade balance of Portugal. Both ESC and VAT distort the account balance of the country.

Unilateral effects of the fiscal devaluation in terms of tax revenue as a share of GDP, Table 12 presents that Spain, Korea and England can improve their trade balance as in the previous result. Addition to these countries, Portugal, Canada, Norway, Germany and Chile can also benefit from the fiscal devaluation.

Table 13 illustrates that, unlike previous results, Greece, Ireland and Italy can utilize the fiscal devaluation in terms of tax revenue as a share of total tax revenue. Portugal, Canada, Germany and Chile can benefit from fiscal devaluation as in the previous result. Hungary also can improve trade balance with fiscal devaluation as in statutory rates of ESC and VAT. Spain and England can benefit from the fiscal devaluation for all different definitions of ESC and VAT.

When all results are evaluated together, we observe that Spain, Japan, Canada and England can be said to be the successful countries in terms of the fiscal devaluation for all different ratios. Given only Spain is the member of Eurozone in these countries, Eurozone membership does not matter for the success of a fiscal devaluation. Unlike de Mooij and Keen's (2012) suggestion, our empirical results show that Eurozone membership does not matter for the success of fiscal devaluation.

CHAPTER 5

CONCLUSION

Fiscal devaluation is a budget neutral tax swap envisaging a shift from ESC to the VAT. In order to ensure budget balance the deduction on ESC must be offset by increasing the VAT. This tax swap might have the capacity to mimic the effects of currency devaluation to gain external competitiveness by means of leading to a less expensive export and a more expensive import.

There has been a growing interest of theoretical and simulation-based studies on the fiscal devaluation in recent years especially followed by European sovereignty-debt crisis in which some countries lacked monetary tools required for competitiveness due to Eurozone membership. However, these studies have mostly been intensified in the framework of bilateral dynamic stochastic general equilibrium models under the condition that fiscal devaluation is applied unilaterally, while just a few studies have taken the subject to the scope of multilateral practices. Although there are a number of theoretical and simulation-based studies on the subject over the last decade, the related literature still lacks empirical evidence on the impacts of fiscal devaluation. The studies by de Mooji and Keen (2012) and Franco (2011) are the exceptions. Both these studies empirically estimate the effects of fiscal devaluation unilaterally. Thus, possible reactions of trade partners of a country, such as tax competition or some spill-over effects, are ignored. Furthermore, the possible influences of fiscal devaluation for a country may be broad or limited depending on whether this policy is implemented bilaterally and multilaterally. Therefore, these bilateral and multilateral effects are of vital importance to empirically investigate the actual effects of a fiscal devaluation. Within our knowledge, this dissertation focuses empirically on bilateral and multilateral effects of fiscal devaluation for the first time in the literature.

In order to estimate influences of fiscal devaluation empirically, gravity model can be a suitable framework. The gravity model is often used successfully in various subjects in international trade literature. Particularly in the literature, the factors estimated by the

gravity model are taken as basis in studying the trade effects of a political step and examined if this step has any trade effects above and beyond the gravity factors (customs unions, currency unions and free trade agreements, etc.). Moreover, gravity models are employed commonly and successfully in the empirical literature measuring that aims to measure effects of a tax policy on international trade flows. Thus, as a fiscal devaluation tool, ESC and VAT embodied within the framework of the gravity model. To the best of our knowledge, this thesis is the first to analyze the fiscal devaluation phenomenon in a well-specified empirical equations based on gravity models.

As is known, gravity equations include time variant and time invariant variables including distance, border-sharing, language similarity and colonial ties. To handle the time-invariant variables, we use fixed effects vector decomposition method. The method can estimate an unbiased and a consistent estimator for time-variant and time-invariant variables in existence of linear relationship between time-variant variables and cross-section fixed effects. This feature is its superior aspect to other panel estimation methods such as fixed effects, random effects and Hausman-Taylor techniques. The empirical analysis of this thesis covers the data of 22 OECD countries for the years 1980-2014.

The empirical results show that a reduction in ESC can increase the multilateral export for sampled countries. However, VAT can have positive or negative effects on imports. In accordance with the intended purpose of the fiscal devaluation, an increase in statutory rate of VAT might reduce imports. However, an increase in VAT revenue ratio (as a share of GDP or total tax revenue) might not reduce multilateral imports for sampled countries. These results underline three important points. Firstly, asymmetric effects of VAT might lead to decrease or eliminate the expected effects of a fiscal devaluation. Secondly, empirical results seem to differ with respect to the definition of ESC and VAT variables. Although possible effects of a fiscal devaluation can vary from statutory rates to revenue ratios, we consider that the revenue ratio as a share of total tax revenue should be emphasized to a more extent since this ratio is thought to be a better indicator to reflect the concept of the budget-neutrality. Lastly, even though asymmetric results of VAT variables distort the success of the fiscal devaluation, multilateral effects

of fiscal devaluations improve trade balances due to dominant effects of reduction in ESC on export. This finding is important as it indicates that the positive spill-over effect of the fiscal devaluation surpasses the negative one.

Together with multilateral effects, effects of bilateral fiscal devaluation are also important. Since trade partners can choose tax competition or coordination, it is important to measure possible relative behavior of trade partners. Thus, we analyze the effects of bilateral implementation of a fiscal devaluation on country pairs to observe trade partners' reaction against to this policy. Our empirical results show that tax differentiations between trade partners affect the result of fiscal devaluation policies. This means the effect of ESC on bilateral exports is significant when ESC policies of countries differ from their trade partners. On the other hand, the effect of VAT on imports varies for different definitions of VAT. If a country increases its statutory rate of VAT and a similar policy is not being followed by its trade partners, this leads to a decrease in bilateral import of the country. Under similar conditions, an increase in VAT as a share of GDP and total tax revenue (revenue ratios) lead to an increase in bilateral imports of the country. Therefore, the effect of ESC and VAT on bilateral trade is significant when ESC and VAT policies of countries differ from their trade partners. However, VAT variables in terms of revenue ratios can distort the bilateral trade balance in contrast to the expectations accompanied with a fiscal devaluation. As mentioned in the multilateral results, we put more emphasize the ratio of as a share of total tax revenue since this ratio is thought to be a better indicator to reflect the concept of the budget-neutrality.

As is known, a decrease in ESC may reduce the pre-tax nominal wage and thus marginal cost of production. The degree of the reduction in marginal cost is based on wage flexibility. If wages are fully flexible, the effect of a reduction in ESC might disappear. Thus marginal cost might remain the same for employers. For this reason, even if multilateral and bilateral effects of a reduction in ESC might increase bilateral exports, the country specific effect of this reduction might be different in each country. According to our results, the majority of 22 countries have been observed the expected sign for different definitions of ESC variables. Spain, Canada, Japan, Korea, Norway,

England, France, Germany and Netherland have the expected effects by using ESC for three different ratios. On the other hand, an increase in VAT rates is expected to increase the price of imports and a decrease in imports of a country. However, according to our result, irrespectively of how VAT is measured, the coefficients of this variable have the expected sign for only three countries which are Japan, Sweden, and England.

When we evaluate results of ESC and VAT together; Spain, Japan, Canada and England are among the successful countries in terms of the fiscal devaluation for all different definitions of ESC and VAT. Given only Spain is the member of Eurozone in these countries, Eurozone membership does not matter for the success of a fiscal devaluation.

The final contribution of this thesis is to enrich the international trade and fiscal policy literature that analyzes whether VAT is trade neutral or not. Our empirical results show that VAT is not trade neutral and it can have positively or negatively effects on imports. However, VAT might be trade neutral only for the definition of VAT as a share of total tax revenue in the multilateral implementation. Thus, the sign and magnitude of the coefficients of VAT might be different with respect to the definitions of VAT and from country to country.

Like other tax policy options, one of the purposes of a fiscal devaluation is to achieve a more efficient tax composition without damaging public finance structure. More efficient tax composition implies fewer economic distortions by improving labor utilization, broadening tax base and reducing tax distortion. In this respect, a fiscal devaluation can reduce distortions in the tax system. Shifting taxes from labor (ESC) to consumption (VAT) might lead to a less distorted intertemporal choice for saving and capital accumulation. Besides this choice, as a tax swap from labor to consumption, fiscal devaluation might lead elders to pay a larger share of the tax bill. Given the aging population problem in developed countries, this benefit seems quite reasonable in terms of budget balance.

Despite all these benefits, it should not be forgotten that a well-designed fiscal devaluation can only make a contribution to improve price or cost structure of external competitiveness. It can affect the intertemporal preferences by stimulating exports and punishing imports. However, non-price structures of external competitiveness are of vital importance to enhance country's external competitiveness in the long term. Thus, a fiscal devaluation should be thought as an element of a wider efficient tax reform package aimed at enhancing country's external competitiveness and improving macroeconomic performance.

Finally, we would like to underline two points for future research. Firstly, there may be possible effects of a fiscal devaluation on economic growth and employment. Although, as a labor tax, ESC is considered to be detrimental to growth, VAT can be considered to be a "growth-friendly" tax. Thus, there might be various effects of a tax shift from ESC to VAT depending on different sectors of an economy. In this scope, effects of a fiscal devaluation on economic growth and employment should be analyzed taking into account the different capital/labor intensity of sectors of an economy. From this viewpoint, effects of a reduction in ESC on exports might take place also at lower levels due to capital intensity of sectors, which might affect the success of a fiscal devaluation. Secondly, another important issue for future research is to investigate distributional effects of a fiscal devaluation. Given reduced rates or exemptions in VAT system, progressive or regressive effects of a fiscal devaluation on income distribution become important to analyze the macroeconomic effects of a fiscal devaluation.

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APPENDIX

A1- MULTILATERAL EFFECTS OF FISCAL DEVALUATION WITH THE LAGGED VALUES OF ESC AND VAT

Table A1- Multilateral effects of ESC on Exports with the Lagged Values of ESC

	Definitions of Fiscal Devaluation Variables		
	STATUTORY RATE	PERCENTAGE OF GDP	TAX REVENUE PERCENTAGE OF TOTAL
VARIABLES			
LGDPI	1.480***	1.348***	1.321***
	(0.0222)	(0.0209)	(0.0204)
LGDPJ	2.282***	2.300***	2.298***
	(0.0214)	(0.0194)	(0.0191)
LPOPI	-1.614***	-0.574***	-0.577***
	(0.0694)	(0.0762)	(0.0757)
LPOPJ	-1.654***	-1.936***	-1.887***
	(0.0689)	(0.0632)	(0.0629)
LESC	-0.104***		
	(0.0248)		
LESC(t-1)	-0.141***		
	(0.0249)		
LESCGDP		-0.0724***	
		(0.0190)	
LESCGDP(t-1)		-0.0103	
		(0.0189)	
LESCTAX			-0.0292***
			(0.00806)
LESCTAX(t-1)			-0.00710
			(0.00813)
LDIST	-0.683***	-0.629***	-0.620***
	(0.00311)	(0.00275)	(0.00272)
LANG	0.870***	0.293***	0.297***
	(0.0179)	(0.0176)	(0.0175)
COL	0.216***	0.779***	0.783***
	(0.0206)	(0.0176)	(0.0173)
CONTG	0.866***	0.731***	0.720***
	(0.0120)	(0.0113)	(0.0112)
EUROZONE	0.162***	0.200***	0.178***
	(0.00883)	(0.00883)	(0.00879)
Eta	0.964***	1.020***	1.020***
	(0.00169)	(0.00216)	(0.00223)
			(0.00813)
Constant	17.84***	5.687***	5.227***
	(0.0253)	(0.0224)	(0.0222)
Observations	9,988	12,619	12,762
R-squared	0.955	0.954	0.954

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A2- Multilateral Effects of VAT on Imports with the Lagged Values of VAT

	Definitions of Fiscal Devaluation Variables		
	STATUTORY RATE	**PERCENTAGE OF GDP**	**PERCENTAGE OF TOTAL TAX REVENUE**
VARIABLES			
LGDPI	2.190***	2.189***	2.221***
	(0.0176)	(0.0176)	(0.0176)
LGDPJ	1.321***	1.245***	1.273***
	(0.0185)	(0.0181)	(0.0181)
LPOPI	-1.498***	-1.469***	-1.497***
	(0.0608)	(0.0597)	(0.0593)
LPOPJ	-1.215***	-1.234***	-1.274***
	(0.0599)	(0.0588)	(0.0588)
LVAT	-0.119***		
	(0.0458)		
LVAT(t-1)	-0.00470		
	(0.0456)		
LVATGDP		0.206***	
		(0.0383)	
LVATIGDP(t-1)		0.131***	
		(0.0374)	
LVATTAX			-0.0431
			(0.0407)
LVATTAX(t-1)			0.147***
			(0.0391)
LDIST	-0.471***	-0.400***	-0.439***
	(0.00247)	(0.00245)	(0.00245)
LANG	0.455***	0.428***	0.429***
	(0.0157)	(0.0155)	(0.0155)
COL	0.708***	0.765***	0.728***
	(0.0159)	(0.0158)	(0.0158)
CONTG	1.039***	1.087***	1.072***
	(0.0105)	(0.0103)	(0.0103)
EUROZONE	0.227***	0.261***	0.259***
	(0.00806)	(0.00799)	(0.00799)
Eta	0.928***	0.930***	0.931***
	(0.00170)	(0.00155)	(0.00155)
Constant	9.901***	9.215***	10.15***
	(0.0202)	(0.0200)	(0.0200)
Observations	12,608	12,785	12,785
R-squared	0.941	0.942	0.941

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A3- Multilateral Effects of Fiscal Devaluation as Statutory Rates

ESC	-0.104***
ESC(t-1)	-0.141***
VAT	-0.119***
VAT(t-1)	-0.00470
Total effect (t)	**0,223**
Total effect (t-1)	**0.141**

Table A4- Multilateral Effects of Fiscal Devaluation as a Percentage of GDP

ESC_GDP	-0.0724***
ESC_GDP (t-1)	-0.0103
VAT_GDP	0.206***
VAT_GDP (t-1)	0.131***
Total effect (t)	**-0,134**
Total effect (t-1)	**-0,131**

Table A5- Multilateral Effects of Fiscal Devaluation as a Percentage of Total Tax Revenue

ESC_TAX	-0.0292***
ESC_TAX (t-1)	-0.00710
VAT_TAX	-0.0431
VAT_TAX (t-1)	0.147***
Total effect (t)	**0.0292**
Total effect (t-1)	**-0.147**

A2- HAUSMAN TEST RESULTS

Table A6- Hausman Test Results

Cross section random effects	ESC_%	ESC_GDP	ESC_TAX	VAT_%	VAT_GDP	VAT_TAX
Chi-Sp. Statistic	193.41	586.52	601.54	1073.36	634.06	1060.92
Chi-Sq. d.f.	6	5	5	5	6	5
Prob.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000