

Foreign Direct Investment and Trade: substitutes or complements

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Abstract

The relationship of FDI and trade has attracted extensive attention from economists over the past few decades. A large portion of the existing empirical literature supports the theory of substitution, which argues that FDI flows have a negative effect on trade. Other studies find that the effect is positive, endorsing the theory of complementarity. This thesis addresses the problem of endogeneity that arises mainly because of reverse causality and proposes the corporate income tax rate as an instrument for FDI. The dataset consists of 32 countries, covering the 1995-2011 period. Bilateral country and year fixed effects are included in the 2SLS estimations. FDI flows appear to have a negative and significant effect on exports while the proposed instrument passes the necessary tests. The results suggest that the nature of the relationship between FDI and trade is substitutional.

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1 Introduction

In the second half of the 20th century, the world economy experienced a major globalization and internationalization process. According to the IMF (2005), globalisation is “*the increasingly global dimension of economic and financial transactions*” which is in turn distinguished between the ‘real’ globalisation achieved through trade integration and the ‘financial globalisation’ achieved through capital market integration. Due to increasing international competition, investing patterns changed, and economies got more involved in one another, causing a rapid increase of ‘real’ and ‘financial’ globalisation. Global trade counted for 27% of the world’s GDP in 1970 and this value grew up to 55% in 2010. FDI flows experienced an even more impressive growth. The ratio of global FDI over GDP was 5.5% in 1980 but it increased up to 30.5% in 2010. (Martinez et al. 2012).

The simultaneous increase of global trade and FDI, as well as the sharp decrease of both in 2008 due to the international financial crisis, suggests a correlation between the two indicators of globalisation. Correlation, however, does not imply causation which is what this thesis investigates. As a result of the rapid growth of both trade and capital market integration, the relationship of those two has attracted extensive attention from economists over the years. According to Kojima (1977) a firm invests abroad with the aim to obtain raw materials that are needed by the firm in the home country and thus FDI complements trade. In contrast, the theory of substitution argues that when trade barriers are high enough to disrupt trade, FDI is conducted in order to bypass those barriers (Mundell, 1957). Despite the vast number of empirical research papers on this subject, the nature of this relationship still remains ambiguous. Certainly, FDI can both complement and substitute trade at the same time, hence the issue of reverse causality, and thus the need to address endogeneity is extremely vital in this research.

The reason that FDI and trade have been on the spotlight of empirical research over the last decades is that they are widely believed to be two of the main forces of economic growth and thus determine economic policies adopted by governments worldwide. Jackson (2013) makes an argument in favour of the recent U.S. campaign¹ to attract more FDI as it would

¹ In 2013 U.S. president Barrack Obama launched the “Select USA” campaign (selectusa.commerce.gov) in order to convince foreign investors to select U.S.A. as the destination of their investments by providing incentives

create more jobs, increase wages and consequently create more tax revenue. The benefits of international trade for the importing country include the access to new markets for raw materials, which creates new production opportunities, and also a wider range of products available to consumers, thus decreasing prices and increasing social utility. So it is of vital importance to investigate the relationship of FDI and trade and understand whether a policy in favour of increasing FDI inflows would also affect the imports of a country and the benefits that come with trading.

The main contributions of this thesis to the existing literature on the relationship of FDI and trade come from the dataset constructed and the empirical methodology used. The dataset covers a long time period of 17 years with bilateral data for the 18 Eurozone countries, both as origin and destination, and 14 more origin countries outside the Eurozone. The instrumental variables (IV) approach is used to estimate the causal relationship of trade and FDI in order to overcome the problem of endogeneity and more specifically reverse causality. Exports is the dependent variable in the regression models of this thesis and FDI flows the independent variable. The instrumental variable tested and used for the FDI flows is the corporate income tax rate of the destination country.

The benchmark regressions, obtained in OLS, indicate that the effect of FDI flows on trade is insignificant. After introducing the IV, however, FDI flows become highly significant with a negative sign, supporting the arguments of substitutability. The validity of the instrument is tested and all tests indicate that the instrument is indeed valid. Further regressions are run to check the robustness of the model. These robustness checks include replacing independent variables with other proxies and testing different specifications.

The remainder of this paper is organised as follows. Section demonstrates the descriptive statistics of this paper based on the data used. Section 3 summarizes the existing literature on the subject, both theoretical and empirical. Section 4 discusses the methodology that is used and why IV regressions are chosen. Section 5 introduces the data collected and the variables used in the regressions. Section 6 presents the results and main findings of the empirical research and finally section 7 concludes the thesis.

2 Descriptive Statistics

In this section, the trends of our dependent variable (exports), independent variable of interest (FDI flows) and instrumental variable (corporate income tax rate) are discussed and presented. The following calculations are done by the author and the data sources are presented in table 8 in the appendix. The data we examine here cover the period between 1995 and 2011 and 32 countries in total.²

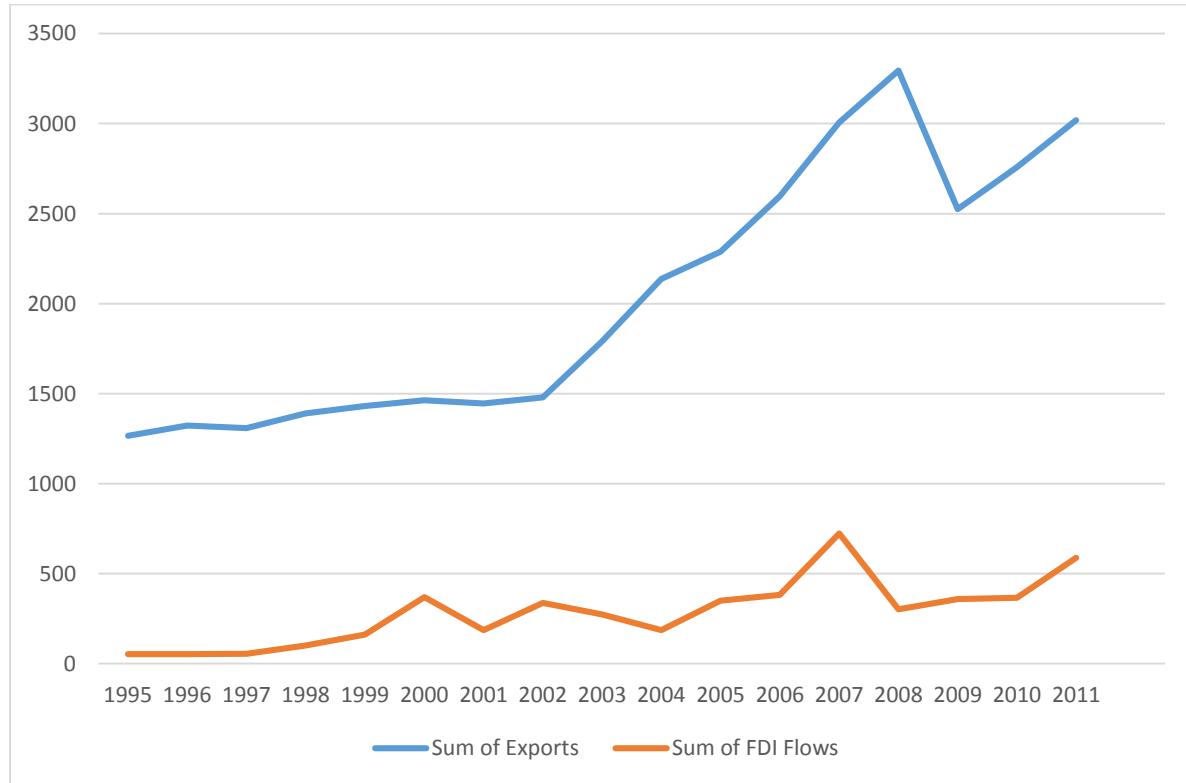
2.1 Exports and FDI trends

In Figure 1, we can see that the value of exports from 1995 to 2002 increased steadily by 17% over these 7 years. Then in the next 6 years, from 2002 to 2008, it increased greatly by 123% up until the global crisis of 2008. Between the fall of 2008 and the spring of 2009, exports collapsed by 23%, signalling the largest decline since World War 2. The reason for this was the 2008 global financial crisis which lowered the demand for trade globally. As the global economy recovery began in 2009, exports in 2011 nearly reached the pre-crisis peak of 2008 after achieving a 10% average annual growth rate.

A similar trend can be observed for FDI flows with the financial crisis of 2008 being the major factor here as well. FDI flows reached their peak in 2007 after increasing significantly from their stagnant levels in the mid nineties by over 1000%. Then we can see in Figure 1 that there was a sharp decline in 2008 and only in 2011 there are signs of recovery. The main reasons for the FDI recession were the liquidity constraints to multinational corporations, the risk aversion imposed by the economic crisis to multinationals and the linkage between economic growth, which decreased significantly, and FDI flows.

² 18 origin and destination countries: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia, and Spain. Plus 14 more origin countries: Japan, South Korea, Russia, USA, Canada, Australia, Hungary, Czech Republic, Denmark, Norway, Sweden, Switzerland, Turkey and United Kingdom

Figure 1: Exports and FDI

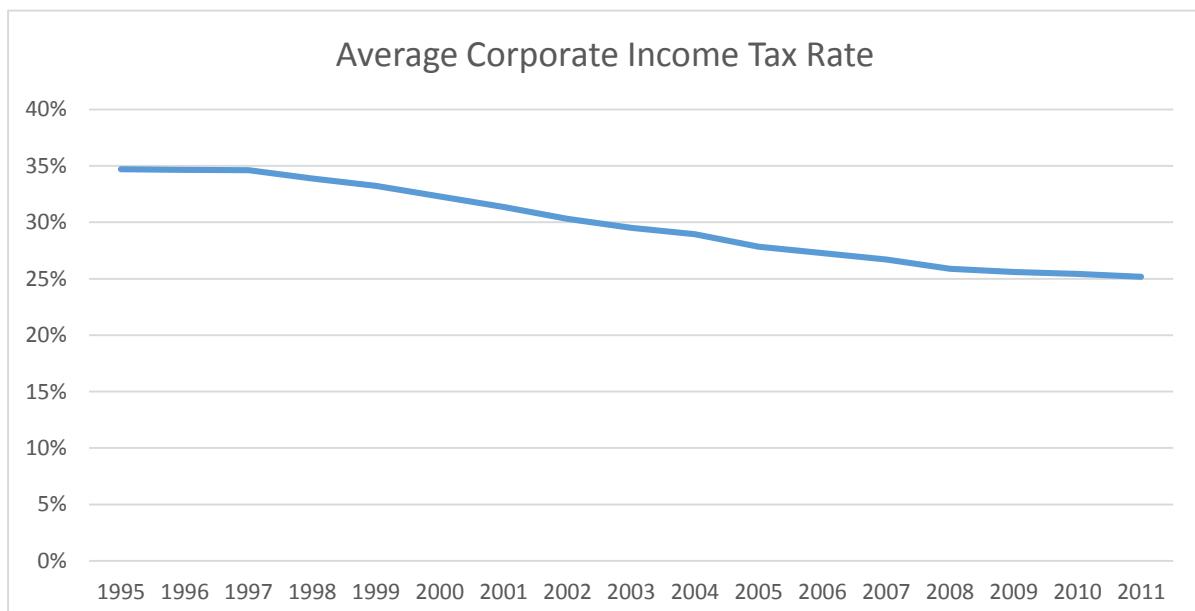


Source: OECD database. Calculations done by the author.

2.2 Corporate Income Tax Rate trend

It is also interesting to note that, for all the countries included in our estimations, the average corporate income tax rate has decreased by 10% since 1995. This trend is visible in Figure 2 below.. According to the OECD (2011), “*the trend towards a reduction of corporate income tax rates started with the tax reforms in the United Kingdom and the United States in the mid-1980s which broadened the tax base and cut statutory rates. Corporation tax rates have continued to be cut in recent years.*”

Figure 2: Corporate Income Tax Rate



Source: OECD database. Calculations done by the author.

3 Literature Review

Over the last few decades, many studies have been conducted about the relationship between FDI and trade but there is no united conclusion about the nature of this relation. A large portion of the existing literature demonstrates a significant negative correlation, implying FDI and trade to be substitutes while others come up with the opposite results. Substitution theory argues that FDI is an alternative method to exports of penetrating foreign markets. Firms have two options that would allow them to enter a foreign market, export their goods or invest in a foreign affiliate and produce the goods abroad. In this sense, FDI seems to substitute trade. The theory of complementation supports that there are two main mechanisms through which FDI affects trade positively. The first is intra-firm relations by exporting intermediate goods to the foreign affiliate in order to be assembled abroad. The second is the *proximity advantage*³, the increase of demand for foreign products due to the local production of a good from a foreign firm. This particular complement relation is labelled as demand complementarity.

Naturally there is also a number of papers that present mixed results, highlighting the complexity of this relationship. These papers focus -like most of the following studies- more on the US and Japanese economies because of data availability. Swenson (2004), for example, investigates US FDI and exports, and his results suggest that the nature of their relationship depends on the different industry level of exports that are being examined. More specifically, he finds that FDI and trade are substitutes at the product level and complements at the manufacturing level. Very similar results are found by Wang (2007) and Bedassa (2003) when examining China and Japan respectively.

³ The term was first used by Brainard, S. Lael in *An Empirical Assessment of the Proximity-Concentration Tradeoff Between Multinational Sales and Trade*, American Economic Review 87, pp520-44 (1997)

3.1 Trade and FDI as substitutes

The substitution effect between FDI and international trade was first supported by Nobel Prize winner Mundell (1957), who used a general Heckscher-Ohlin model to show that an increase in trade barriers will stimulate capital movement, implying a substitutional relationship. The general idea behind this argument is that trade between countries is observed when there is a difference in factor endowments and factor prices. If these factor endowments become mobile, differences in factor endowments will decrease and as a result, trade flows between countries will also drop. Such a substitutive relation implies that an increase in FDI would cause a decrease in trade, an idea that has been adopted by many economists the following years and proven econometrically.

One example of the papers supporting this conclusion is published by Blonigen (2001), who suggests that the exported goods are substitutes to the goods that would be otherwise produced by the multinational's affiliate. Head & Ries (2001), by using year and firm fixed effects for 932 Japanese exporting firms, make an argument for substitutability concluding that "*...it would be incorrect to interpret a simultaneous rise in exports and foreign investment resulting from an exogenous increase in foreign demand as evidence of a complementary effect*", meaning that correlation does not equal causation. More specifically, it is found that firms like Toyota, Sony and Nissan substitute their exports with FDI by setting up plants abroad. The need for intermediate products for the plants abroad to assemble the final good is covered by independent suppliers in the host country and not the parent firm, as it is more efficient to do so.

Both of the above papers argue that a substitution effect between exports and FDI exists for the car mobile industry in the U.S. and Japan. These results are confirmed by Kimino et al (2007) for Japan where inward FDI from 17 origin countries is found to be substituted by trade, and also by Helpman et al (2004) who uses data on US exports and FDI in 38 and 52 industries and finds that firms tend to substitute FDI sales and exports. The FDI in this case is also called "market seeking FDI". Due to high trade costs or barriers to trade, firms choose to participate in the foreign market by investing in a new factory plant abroad rather than exporting their goods. Further empirical research that supports the argument of substitution can also be found in Pain & Wakelin (1998) and Gopinanth et al (1999).

3.2 Trade and FDI as complements

The theory of complementarity is based upon two main arguments. The first argument is that the investing firm in the destination country may require additional inputs from the source country and thus an increase in FDI flows will cause more exports due to intra-firm trade (Blonigen , 1997). The second is that the production of a specific product in a foreign market may lead to an increased demand for similar products that are not produced in the destination country. In this case, customer loyalty generates more exports.

The first attempt to define this relationship empirically was made by Lipsey and Weiss (1981) who apply the gravity model on a dataset of 44 destination countries with 14 different industries for US outward FDI and exports. They found that production in a foreign affiliate increases the total demand of goods. These goods are either intermediate products required for product assembly in the host country or final products. The presence of a firm in a foreign country producing one specific good can lead to increased sales for all the products in its product portfolio through more efficient distribution, brand advertisement and sales services. Consequently, this leads to more exports with no significant difference between developed and developing countries. However, the econometric method that is used is rather outdated for our standards, since it uses a simple OLS regression of trade on multination activity. Brainard (1997) goes one step further by using random and fixed country effects as well as a generalized TOBIT model with the results not changing significantly compared to Lipsey's and Weiss' findings .

Graham (1999) and Pantulu & Poon (2003) both examine US and Japan FDI and find that FDI has a positive and significant effect on exports, even though their datasets are limited to only 3 years, which could cast a doubt over the validity of their findings. When using a wider dataset with over 10 years each, Wilamowski & Tinkler (1999) and Kimura & Kiyota (2006) confirm the positive effect of FDI on trade for US and Japan. Similar results are found by Martinez et al. (2012) and Filippaios & Kottaridi (2014) for the European Union countries and central and eastern European countries respectively. Other studies that argue for the complementarity of outward FDI and exports include Markusen (1983), Yu & Zhao (2008) and Alguacil & Orts (1999).

3.3 Trade, FDI and endogeneity

Despite the abundance of papers dealing with this issue, the main problem in examining the relation between FDI and trade, which is endogeneity, is rarely addressed. Makki and Somwaru (2004) as well as Xuan and Xing (2008) try to tackle this problem by instrumenting FDI with its lagged values. This practice, explained in more detail in section 4, is not an appropriate solution as these instruments are generally weak and invalid (Murray, 2010). The main contribution of this thesis to the existing literature is examining and addressing the problem of endogeneity, especially reverse causality. This is done by instrumenting FDI with the corporate income tax of the destination country. As it is shown in section 4 after providing the theoretical reasoning and running the necessary tests, the corporate income tax rate of the destination country appears to be a valid instrument. Besides that, bilateral data from 1995 to 2011 is used, which is a sufficient time period for capturing the effect that FDI outflows and stock have on exports.

3.4 FDI and Corporate Income Tax Rate

The effect of the corporate tax rate on FDI also concerns this thesis as this relationship is vital for proving the instrument's validity. While the empirical research at its early stages (Hartman (1984) and Young (1988)) found no significant effect of taxes on FDI, later research from Cassou (1997), Desai et al (2004) and Buettner & Wamser (2008) demonstrates the negative and significant effect of statutory corporate income taxes on FDI inflows.

This thesis uses the corporate income tax rate of the destination country as a determinant of FDI, showing that the corporate income tax rate has a negative and significant effect on FDI inflows. At the same time it is shown that the corporate income tax rate does not affect imports, something that makes it a possible valid instrument that should be considered in the specifications. Driven by the controversial literature on the subject of complementarity and substitutability of FDI and trade and the absence of valid treatment for the issue of endogeneity, this thesis contributes by proposing the corporate income tax rate of the destination country as an instrument for the FDI directed in that country.

4 Methodology

4.1 Gravity model

Most of the research papers mentioned in section 2 have used the gravity model to analyse the determinants of trade. The traditional gravity model for trade⁴ has been used by many economists over the past decades. It has been used to evaluate the impact of originally distance and economic size, and later many other variables from trade agreements to political stability on bilateral trade between countries. Modified versions of this model have also been used in migration and investment studies. This thesis uses an extended gravity model, including FDI flows besides the traditional proxies for economic size, political stability and geographic distance.

The extended gravity model for the benchmark regression takes the following form:

$$\begin{aligned} \ln \text{Exports}_{ij,t} = & a_0 \ln \text{GDP}_{i,t-1} + a_1 \ln \text{GDP}_{j,t-1} + a_3 \ln \text{GDPpc}_{i,t-1} + a_4 \ln \text{GDPpc}_{j,t-1} + a_5 \ln \text{PS}_{i,t-1} + \\ & a_6 \ln \text{PS}_{j,t-1} + a_7 \ln \text{TC}_{ij,t-1} + \beta \ln \text{FDI}_{ij,t-1} + \gamma_{ij} + \gamma_t + \varepsilon_{ij,t} \end{aligned} \quad (1)$$

where i denotes the origin/source country, j the destination/host country and t the year. All variables are in natural logarithms (abbreviated as ln) and all independent variables are lagged one year. GDP is the Gross Domestic Product of each country, GDPpc is the Gross Domestic Product per capita, PS is the Political Stability, TC represents the bilateral Trade Costs, FDI represents the Foreign Direct Investment flows and ε denotes the standard error term. A negative sign for β , indicates that FDI and trade are substitutes while a positive sign indicates that there are complements.

Bilateral country fixed effects (γ_{ij}) as well as year fixed effects (γ_t) are also included in the model. The bilateral country fixed effects are included to control for any unmeasured time-invariant country-pair characteristics that could affect the volume of bilateral exports. The year fixed effects control for any international unmeasured factors that could impact all country-pairs the same, in a given year, and capture common trends such as the synchronized trade collapse in 2009 following the global financial crisis. Also, the error terms of each country-

⁴ The first gravity model was used by Jan Tinbergen in *Shaping the World Economy: Suggestions for an International Economic Policy*, New York: Twentieth Century Fund (1962)

pair are likely to be correlated over time so standard errors clustered at the country level are used in all estimations in order to prevent the issue of heteroskedasticity and serial correlation. These standard errors relax the OLS assumption that standard errors are independent, thus making them more reliable.

4.2 Endogeneity

Ideally the error term and FDI are contemporaneously uncorrelated ($E[\varepsilon|FDI]=0$) thus giving us an unbiased estimate for β . When the independent variable and the error term are indeed uncorrelated then the following holds:

$$E[Exports/FDI]=E[(\beta FDI + \varepsilon)/FDI]=\beta FDI+E[\varepsilon/FDI]=\beta FDI$$

So the true causal effect of FDI on trade is captured by the basic OLS estimation only when:

$$E[\varepsilon/FDI]=0 \quad (2)$$

The only way we can be sure that this condition holds is in case of a randomized experiment, otherwise it remains just an assumption. There are three reasons that can lead to the violation of (2). The first one is the omitted Variable Bias which occurs when other determining factors of Exports that are related to FDI are not being included in the regression. The second is the measurement error which occurs when FDI flows are measured with error. Finally, the third and most dominating in this specification is reverse causality which means that exports have a causal effect on FDI. In all of these cases of endogeneity, the estimate of β we obtain is biased ($E[\hat{\beta}] \neq \beta$) and not fit for any interpretation.

4.3 Instrumental Variable Approach

The solution to the endogeneity problems lies in finding an appropriate variable that can be used as an instrument and then using the Instrumental Variables approach to estimate the effect of FDI on Exports. A suitable instrument must be related to FDI but not ε and only related to Exports through FDI. A common mistake is to use lagged values of the endogenous variable as an instrument. This is a problematic practice, as the strong assumption that lagged values do not affect the current value of the independent variable is imposed (Angrist & Krueger, 2001). The violation of the assumption of zero correlation with the independent

variable is enough to incapacitate the instrument. The instrument proposed in this thesis is the Corporate Income Tax Rate (CITR) of the destination/host country (CITR_j).

As shown in Tables 1 and 2, CITR_j affects Exports only through FDI and so it is possible to filter out the changes in FDI that are not related to ϵ and thus estimate the true causal effect of FDI on Exports. The model is estimated by using the Two Stage Least Squares (2SLS)⁵ technique and afterwards the validity of the instrument is tested. The estimation is done in two stages, first by filtering out the variation of FDI which is not correlated with ϵ , using the following reduced form equation:

$$\ln FDI_{ij,t-1} = \delta \ln CITR_{j,t-1} + \nu_{t-1} \quad (3)$$

and then by regressing the resulting fitted values of FDI obtained from (3) on Exports in equation (1). So instead of regressing the endogenous variable of FDI flows on Exports, the exogenous fitted values of FDI flows obtained from the first stage (3) are used. This way we ensure that condition (2) holds, given that the instrument chosen is valid. Econometrically, the most widely used test for the validity of an instrument is the F-statistic on the excluded instruments from the 1st stage regression. The rule of thumb is that an F-statistic of over 10 indicates that the instrument is valid as it is significantly related to the independent variable. The proposed instrument passes the threshold of 10 for the F-statistic. It is also tested and found to have no direct effect on Exports.

⁵ The 2SLS estimation method was introduced independently first by Theil in *Repeated least-squares applied to a complete equation systems* (1953) and Sargan in *Estimation of economic relationships using instrumental variables* (1958)

5 Data

This thesis uses bilateral data for the 18 Eurozone countries⁶ (not including Lithuania which adopted the Euro on the 1st of January in 2015 and 6 other countries that are using the Euro as their currency but are not in the Eurozone⁷) for 17 years, over the 1995-2011 period. Besides the 18 Eurozone countries, 14 more are included as origin countries. These 14 additional countries are either major investors or exporters or other European countries. These countries are Japan, South Korea, Russia, USA, Canada, Australia, Hungary, Czech Republic, Denmark, Norway, Sweden, Switzerland, Turkey and United Kingdom.

By including these 32 origin countries in our sample, the dataset accounts for almost all of the imports and FDI inflows for our 18 destination countries. Indicatively, for the year 2011, the dataset covers 68% of the total imports and 77% of the total FDI directed to the 18 destination countries in the dataset. The origin and destination countries were chosen according to the data availability based on the long time period required for capturing the causal effect of FDI on trade.

5.1 Exports, FDI and IV

The dependent variable is Exports and the data are collected from the OECD (Organization for Economic Co-Operation and Development) database and more specifically from the STAN Bilateral Trade Database by Industry and End-use category. The Exports data is equal to the grand total value of exports taking into account all of the sectors of primary and secondary industry. The value of annual exports ranges from practically zero, the Maltese exports to Estonia in 1995 is one of these low export volumes, to 113.9 billion US dollars for the German exports to France in 2011. The total annual exports reached their peak in 2008, with 3.3 trillion US dollars, and dropped the following year as a result of the 2008-09 global

⁶ In 1999, Austria, Belgium, Finland, France, Germany, Ireland, Italy, Spain, Portugal, Netherlands and Luxembourg adopted a single currency, the Euro. Later in 2001, Greece also joined the Eurozone, Slovenia in 2007 and the next year Cyprus. Slovakia became a member in 2009, Estonia in 2011 and Latvia in 2014. The above 18 countries were the EU member states as of 2014.

⁷ San Marino, Monaco, Andorra and the Vatican City have come to a monetary agreement with the Eurozone solely for the purpose of using the Euro as their national currency. Montenegro and Kosovo have no such agreement but are using the Euro as their national currency nevertheless.

financial crisis to 2.5 trillion US dollars. In 2011, trade almost recovered to its pre-financial crisis peak (3 billion US dollars).

The data for FDI flows, which is the independent variable of main interest in this estimation, is also collected from the OECD database. The International Monetary Fund (IMF)⁸ and OECD⁹ recognise a foreign investment as FDI if the investor has obtained control of over 10% of ordinary shares or voting stock in the firm. The FDI flows can take negative values as well, in the case of the disinvestment of assets. So whether the investor sells the shares held to a third party or the direct investment enterprise buys back its shares from the investor, this action is considered as a negative FDI flow. After summing up the flows of every investor to the host country, it is not uncommon that the disinvestments in a country over the period of one year are more than the investments, thus having FDI flows with a minus sign.

Similar to the exports, the total FDI flows in our dataset reached their peak before the financial crisis with 723 billion US dollars in 2007. The next year, they were cut almost in half, and in the last year of the sample, they rose up to 589 billion US dollars. The top 5 destination countries during the 1995-2011 period are France, Belgium, Netherlands, Luxembourg and Germany while at the bottom of this list we find Latvia. On the other hand, the major investors in our dataset are the United Kingdom, U.S.A. Netherlands, Germany and Luxembourg.

The instrumental variable used in this thesis is the central government corporate income tax rate. The data is collected from the OECD tax database¹⁰. Among the countries with the highest CITR we find Germany, Italy and France with CITR above 40%, found before 2000. In contrast, the lowest CITR is observed in Cyprus, Ireland and Slovakia between the 2002-2011 period.

5.2 Control Variables

In addition to our main control variable of interest, the extensive gravity model of this thesis also uses proxies for the supply and demand of trade commodities among countries. More specifically, GDP is used as a proxy for a country's economy and market size and GDP per capita is used as a proxy for the purchasing power of the country's population. The data for

⁸ IMF Balance of Payments Manual, 6th edition (BPM6), 2008

⁹ OECD Benchmark Definition of Foreign Direct Investment, 4th edition (Benchmark Definition), 2008

¹⁰ <http://www.oecd.org/tax/tax-policy/tax-database.htm>

GDP and GDP per capita for the 32 countries in our sample are collected from the United Nations Conference on Trade and Development (UNCTAD) database¹¹.

Factors such as geographical distance, common language and sharing a border should also be taken into account when estimating the causes of trade flows between countries. Besides using bilateral fixed effects to capture these time-invariant factors, the Trade Costs variable constructed by the World Bank and the United Nations Economic and Social Commission for Asia and Pacific (UNESCAP)¹² is also included in the regressions. The Trade Costs variable has the advantage of incorporating time-variant determinants of bilateral trade as well as the time-invariant factors mentioned above. The time-variant factors include logistics performance, international connectivity and transportation costs. Because of the time-variant factors incorporated, the variable constructed is also time-variant and fluctuates from 0.2 for Netherlands-Belgium in 2007 to 316.9 for Malta-Latvia in 2003. In theory, higher bilateral trade costs would result in less bilateral trade flows and as it is shown in Section 5, bilateral trade costs have a highly significant and negative effect on exports.

Another control variable included in the regressions is the Political Constraint Index (POLCON) produced by Witold J. Henisz¹³, as a proxy for the political stability of both the origin and destination country. POLCON measures the chances that a policy change can take place in a country by firstly, identifying the number of independent branches¹⁴ of government that have veto power over policy changes. Secondly, by taking into account the possible alignment on party composition of these branches and finally capturing the different preferences of the people within these branches. A more politically stable country strengthens the international competitiveness of its firms and is expected to import less goods from abroad and simultaneously export more (Srivastava and Green, 1986).

Trade Openness, which is used instead of GDP in the robustness checks, is downloaded from the World Bank database¹⁵ and is “*the sum of exports and imports of goods and services measured as a share of gross domestic product*”. It is used as a proxy for the economic size of trade in a country.

¹¹ <http://unctadstat.unctad.org/EN/>

¹² <http://data.worldbank.org/indicator/NE.TRD.GNFS.ZS>

¹³ *Polcon_2005 Codebook*, <https://mgmt.wharton.upenn.edu/profile/1327>

¹⁴ Executive, lower and upper legislative chambers

¹⁵ <http://data.worldbank.org/indicator/NE.TRD.GNFS.ZS>

6 Results

In this section, the results of the empirical analysis are presented. Bilateral country and year fixed effects are used in all the regressions as discussed in section 4. The significance level chosen to classify a variable as significant is the 5% level. First, the results for the benchmark regression (1) and the effect of corporate income tax rate (CITR) on exports are displayed in Tables 1 and 2. Second, the results for the IV regression along with the test for instrument validity are presented in Table 3 and finally the robustness checks in Table 4.

6.1 Benchmark Regression

Table 1 presents the estimation of the benchmark equation (1). In the baseline equation, FDI flows are found to have no significant effect on Exports. Also, all control variables, with the exception of Trade Costs, are insignificant as well. Trade Costs are highly significant and have the expected sign. In this simple OLS regression, before using the proposed instrument, the conclusion we get is that FDI flows have no direct effect on Exports.

Variables that were expected to have a strong effect on bilateral trade, like GDP and GDP per capita, are found insignificant in the benchmark regression. In column 2 of Table 1, the Trade Costs are removed from the estimation in order to check whether they affect the significance of the other control variables. When Trade Costs are not included in the OLS estimation, the significance of the rest of our control variables remains the same. That means that Trade Costs do not affect the significance of the other control variables on exports. Removing the Trade Costs from the equation, had no effect on the coefficient of FDI flows.

Table 1: Benchmark Regression

Dependent Variable:	Exports	
	1	2
GDP of origin country	0.218 (0.634)	0.0807 (0.643)
GDP of destination country	0.213 (0.643)	0.0677 (0.656)
GDP per capita of origin country	1.050 (0.649)	1.168 (0.656)
GDP per capita of destination country	0.864 (0.669)	1.041 (0.686)
Political Stability of origin country	0.00234 (0.0411)	-0.0133 (0.0415)
Political Stability of destination country	0.0540 (0.0415)	0.0588 (0.0424)
Trade Costs	-0.224*** (0.0744)	
FDI Flows	0.00932 (0.00622)	0.00951 (0.00636)
Observations	3,751	3,751
R-squared	0.546	0.537
Number of paired	513	513
Bilateral Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes

Robust standard errors in parentheses ***/** denote significance at the 1% and 5% confidence level. All variables are in logs and all independent variables are lagged for the period of one year.

6.1 Corporate Income Tax Rate and Exports

In Table 2 we check whether the corporate income tax rate has a direct effect on exports in order to determine its suitability as an instrumental variable. Column 1 of Table 2 presents the results when the CITR of both destination and origin country is included in the model of the original equation (1). The CITR of the destination country is found to have no direct effect on Exports. CITR of the origin country has a significant and negative effect on Exports, indicating that a higher CITR in a country damages the exporting capabilities of this country's firms.

In column 2, we see that the CITR of the destination country remains insignificant when removing the CITR of the origin country from the regression. This check confirms that the insignificance of CITR of destination country in column 1 is not driven by the highly significant CITR of origin country. Finally, we include both CITR rates and FDI flows in our estimation. The results are similar to column 1. The CITR of the origin country has a significant effect on our dependent variable while the CITR of the destination country remains insignificant. Also, FDI flows remain insignificant as in Table 1.

Throughout all of our estimations, Trade Costs remain highly significant, being our most robust control variable. The rest of our control variables have no significant effect on exports, with the exception of GDP per capita of origin country which is significant in columns 1 and 3 of table 3. It is of vital importance that the CITR of destination country remains insignificant for these tests as it will be used in the following 2SLS regressions as our instrumental variable.

Table 2: Corporate Income Tax Rate and FDI

Dependent Variable:	Exports		
	1	2	3
GDP of origin country	-0.133 (0.630)	0.241 (0.638)	-0.167 (0.627)
GDP of destination country	0.297 (0.624)	0.352 (0.618)	0.250 (0.627)
GDP per capita of origin country	1.320** (0.633)	1.047 (0.650)	1.327** (0.631)
GDP per capita of destination country	0.831 (0.660)	0.789 (0.656)	0.859 (0.661)
Political Stability of origin country	-0.000595 (0.0406)	0.00186 (0.0407)	-0.00193 (0.0405)
Political Stability of destination country	0.0554 (0.0417)	0.0545 (0.0417)	0.0569 (0.0413)
Trade Costs	-0.211*** (0.0718)	-0.224*** (0.0737)	-0.210*** (0.0720)
Tax Rate of origin country	-0.251** (0.125)		-0.247** (0.124)
Tax Rate of destination country	0.133 (0.0794)	0.141 (0.0796)	0.140 (0.0792)
FDI Flows			0.00969 (0.00624)
Observations	3,751	3,751	3751
R-squared	0.550	0.547	0.551
Number of paired	513	513	513
Bilateral Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes

Robust standard errors in parentheses ***/** denote significance at the 1% and 5% confidence level. All variables are in logs and all independent variables are lagged for the period of one year. Regressions 1 and 2 are run using Table's 1 column 4 sample.

6.3 IV Regression

The results of the previous section can be summarized in two major conclusions. The first one is that FDI flows from country i to j appear to have no effect on the exports from country i to j . The second is that the CITR of the destination country has no direct effect on exports. This satisfies one of the required conditions concerning the validity of CITR as an instrumental variable. The other two are that the CITR is related enough to FDI flows and that it does not affect Exports through any other variable. The first condition is satisfied in Table 5, the first stage of the IV regression, where the CITR of destination is found to have a significantly negative effect on FDI flows. The last condition can not be proven econometrically and the assumption that CITR does not affect Exports through another variable has to be made.

It has to be noted that there may still be problems of endogeneity since there could be other factors, not controlled in this specification, that are correlated with CITR and affect Exports. Future research should look into this matter and include variables that could fit into this description to further investigate the validity of the proposed instrument and minimize the endogeneity problem.

Table 3 presents the results of the IV regression and the tests concerning the validity of the proposed instrument. The findings presented on Table 3 support the theoretical framework of substitution between FDI and trade. After filtering out the variation of FDI which is not correlated with ϵ (equation (3)) and then regressing the resulting fitted values of FDI on Exports (equation (1)) the coefficient of the FDI flows is negative and significant. More FDI flows from country i to country j result in less exports from country i to j . The significance of our control variables has remained the same. Trade Costs have a strong negative impact on Exports, as expected, and it is the most robust variable in the model.

The Overidentification test, regarding the exogeneity of the instrument, can not be applied in our model as only one instrument is used. However, the Weak Identification test, which is equal to the F-test from the first stage regression, as well as the p-value of the Underidentification test indicate that the instrument is relevant. The F-Test of excluded instruments is 14.26, above the threshold of 10. This indicates that δ , the coefficient of CTR_j from equation (3), is significant enough to be used as an instrument for FDI flows.

Table 3: Corporate Income Tax Rate of destination country used as instrument for FDI

Dependent Variable:	Exports
GDP of origin country	0.962 (0.608)
GDP of destination country	1.251 (0.668)
GDP per capita of origin country	0.835 (0.547)
GDP per capita of destination country	0.248 (0.596)
Political Stability of origin country	0.0277 (0.0361)
Political Stability of destination country	0.0251 (0.0455)
Trade Costs	-0.235*** (0.0617)
FDI flows	-0.182** (0.0849)
Observations	3,751
Number of paired	513
Bilateral Fixed Effects	Yes
Year Fixed Effects	Yes
F-Test of excluded instruments	14.26
Underidentification	13.79
p-value (Underid.)	0.0002

Robust standard errors in parentheses ***/** denote significance at the 1% and 5% confidence level. All variables are in logs and all independent variables are lagged for the period of one year. For the Underidentification test, the Kleibergen-Paap rk LM statistic is used while for the Weak Identification Test, the Kleibergen-Paap rk Wald F statistic is used.

6.4 Robustness Checks

In this subsection, the robustness checks of the IV estimation are presented. The robustness checks consist of four different estimations presented in table 4. In the first check, Trade Openness (TO) is used instead of the variable of GDP. The TO variable is the sum of imports and exports of a country as a percentage of its GDP. It is used as a proxy of the economic size of trade in a country. The results of the first robustness check are shown in column 1 and reflect a similar result on the relationship of FDI and Exports. The only difference with our main results, lies in the significance of GDP per capita. This can be explained by the absence of GDP. TO is found to have a positive and significant effect on bilateral trade, as expected. This coefficient, however, is most likely driven by reverse causality, similar to FDI flows.

In the next two checks, in columns 2 and 3, the sample is split according to the geographical position of the origin country. The first sub-sample consists of European origin countries and the second sub-sample consists of non-European origin countries. FDI flows become insignificant in the first case in column 2, indicating that FDI flows have no impact on Exports inside Europe. In column 3, with the sub-sample that contains only non-European origin countries, the effect of FDI flows is the strongest we obtained in all of our estimations. From the -0.182 of the original IV estimation, by taking into account only non-European origin countries, the effect of FDI flows on Exports is almost tripled, to -0.376. As Mundel (1956) has pointed out in his substitution theory, the higher the trade barriers, the more capital will flow from one country to another to substitute trade. So it is expected that countries further away from Europe, will tend to substitute trade with FDI more intensely.

In the final check, the variable of main interest, FDI flows, is replaced by the FDI flows as a percentage of GDP in the destination country (FDI/GDP_j). This way, the effect of the relative volume of FDI on Exports is considered. The explanatory power of the control variables in the last column is equivalent to column 1, with Trade Costs and GDP per capita of origin and destination country being significant. FDI/GDP_j is negative, enhancing the findings of substitution. The robustness checks suggest that the substitute relation of FDI flows and Exports is robust in our model.

Table 4: Robustness Checks for IV regression

Dependent Variable:	Exports			
	<u>Trade Openness</u>	<u>European Origin Country</u>	<u>Non-European Origin Country</u>	<u>FDI/GDP</u>
GDP of origin country		0.520 (0.817)	1.899 (1.346)	
GDP of destination country		0.595 (0.659)	3.589 (1.841)	
Trade Openness of origin country	-0.255 (0.167)			
Trade Openness of destination country	0.371*** (0.122)			
GDP per capita of origin country	1.602*** (0.204)	0.528 (0.734)	1.562 (1.357)	1.679*** (0.227)
GDP per capita of destination country	1.441*** (0.217)	0.609 (0.555)	-1.985 (1.917)	1.248*** (0.179)
Political Stability of origin country	0.00161 (0.0311)	-0.0564 (0.0342)	0.123 (0.119)	0.00720 (0.0314)
Political Stability of destination country	-0.000938 (0.0449)	0.00776 (0.0381)	0.0993 (0.134)	0.0113 (0.0447)
Trade Costs	-0.219*** (0.0585)	-0.212*** (0.0635)	-0.209 (0.298)	-0.219*** (0.0593)
FDI Flows	-0.161** (0.0745)	-0.0525 (0.0910)	-0.376** (0.156)	
FDI/GDP of destination country				-0.166** (0.0771)
Observations	3,751	2,881	870	3,751
Number of paired	513	397	116	513
Bilateral Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes

Robust standard errors in parentheses ***/** denote significance at the 1% and 5% confidence level. All variables are in logs and all independent variables are lagged for the period of one year. The Corporate Income Tax Rate of the destination country is used as an instrument for FDI flows and FDI/GDP in all of the regressions. Trade Openness is the volume of total trade in a country as a percentage of GDP.

7 Conclusion

This thesis investigated the relationship between bilateral FDI flows and exports. The main objective was to address the problem of endogeneity and try to minimize this issue. Most studies ignore this problem and it is certain that such results are affected by endogeneity and most commonly, reverse causality. So it is crucial that endogeneity is correctly addressed and the necessary solution is acknowledged. The only way that the true causal effect can be obtained when estimating the effect of FDI on exports is by using the IV approach. This thesis proposes the Corporate Income Tax Rate of the destination country as a possible instrument for FDI flows. The validity of the proposed instrument is confirmed by the Underidentification and Weak Identification tests.

The estimations were made using a dataset of 32 countries over a period of 17 years. In a 2SLS estimation with bilateral country and year fixed effects, FDI flows have a negative and significant effect on exports. The results indicate that an increase of FDI flows will result in a decrease of exports to the destination country, confirming the traditional theory of substitution between FDI and trade. Trade Costs are also found to have a negative effect on exports, as expected. GDP per capita of both origin and destination country as well as Trade Openness of destination country appear significant and positively correlated with exports in some of the regressions run. Contrary to the traditional theory on trade, the rest of the control variables, GDP and Political Stability, do not seem to affect bilateral trade.

Robustness checks, using alternative independent variables and splitting the data sample according to the geographical position of origin countries, confirm the negative impact of FDI flows on exports. It is recommended for future research to expand the data sample and include as many country-pairs as possible. Future research should also try to come up with additional variables that could be related to CITR and exports and are not included in these specifications. This would further test the validity of the instrument and consequently the results presented in this thesis. Also it may be beneficial to look specifically at the exports of different product categories, raw material, intermediate or end-use products and the effect that FDI has on the trade of each of these products.

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APPENDIX

Table 5: First Stage IV Regression Results

Dependent Variable	FDI Flows
GDP of origin country	3.959*** (1.431)
GDP per capita of origin country	-1.162 (1.424)
GDP of destination country	4.933*** (1.319)
GDP per capita of destination country	-2.974** (1.301)
Political Stability of origin country	0.142 (0.128)
Political Stability of destination country	-0.161 (0.142)
Trade Costs	-0.0595 (0.127)
Tax Rate of destination country	-0.774*** (0.205)
Observations	3,751
Number of paired	513
Bilateral Fixed Effects	Yes
Year Fixed Effects	Yes

Robust standard errors in parentheses ***/**/* denote significance at the 1%, 5% and 10% confidence level. All variables are in logs and all independent variables are lagged for the period of one year.

Table 6: Summary Statistics

	Descriptive Statistics					
	Count	Min	Max	Mean	Median(p50)	St. Dev.
GDP of origin country	3751	4700.732	1.33E+07	1319370	386504.2	6.28E+12
GDP of destination country	3751	5980.838	3048688	791079.7	297833.6	8.16E+11
GDP per capita of origin country	3751	3281.281	88616.31	32292.36	34267.27	2.84E+08
GDP per capita of destination country	3751	4867.806	88616.31	30453.1	30500.2	2.56E+08
Political Stability of origin country	3751	0.113339	0.72	0.456523	0.473357	0.0130645
Political Stability of destination country	3751	0.153341	0.72	0.480871	0.493497	0.0111903
FDI Flows	3751	-59483.3	117839.4	989.9216	31.995	2.74E+07
Exports	3751	11	1.14E+08	5808015	1341068	1.37E+14
Trade Costs	3751	0.2	413.9	100.7062	94.1	2360.654
Corporate Tax of origin country	3751	0.1	0.568	0.292711	0.296	0.0061506
Corporate Tax of destination country	3751	0.1	0.568	0.298952	0.315	0.0077777
Trade Openness of country 1	3751	18.75639	333.5322	89.90947	74.96463	2867.437
Trade Openness of country 2	3751	44.64168	333.5322	104.0582	86.6722	3658.636

The GDP of origin and destination country is measured in billions of US dollars, The FDI Flows and Exports are reported in millions of US dollars,

Table 7: Origin and Destination Countries

Origin Countries	Freq.	Percent	Cum.	Destination Countries	Freq.	Percent	Cum.
AUS	112	3	3	AUT	240	6.39	6.39
AUT	141	3.79	6.79	BEL	159	4.27	10.66
BEL	89	2.36	9.15	CYP	152	4.06	14.72
CAN	114	3.02	12.17	ESP	280	7.45	22.17
CHE	154	4.11	16.28	EST	133	3.55	25.72
CYP	92	2.44	18.72	FIN	211	5.62	31.34
CZE	113	3	21.72	FRA	349	9.36	40.71
DNK	127	3.39	25.11	GER	309	8.22	48.93
ESP	120	3.18	28.29	GRE	160	4.24	53.17
EST	58	1.54	29.83	IRL	145	3.85	57.01
FIN	123	3.26	33.09	ITA	349	9.33	66.35
FRA	148	3.92	37.02	LAT	156	4.14	70.49
GBR	169	4.56	41.58	LUX	199	5.28	75.76
GER	137	3.63	45.21	MLT	72	1.91	77.67
GRE	90	2.39	47.6	NED	290	7.74	85.42
HUN	106	2.81	50.41	POR	266	7.11	92.52
IRL	128	3.39	53.81	SLO	84	2.23	94.75
ITA	148	4	57.81	SVK	197	5.25	100
JPN	139	3.77	61.58				
KOR	106	2.81	64.39	Total	3,751	100	
LAT	73	1.94	66.32				
LUX	114	3.05	69.37				
MLT	71	1.88	71.25				
NED	135	3.58	74.83				
NOR	145	3.92	78.76				
POR	114	3.02	81.78				
RUS	134	3.55	85.34				
SLO	67	1.78	87.11				
SVK	60	1.59	88.7				
SWE	160	4.27	92.97				
TUR	103	2.76	95.73				
USA	161	4.27	100				
Total	3,751	100					

Table 8: Variables Definition and Source

Variable	Definition	Source
GDP	Gross domestic product (GDP) is an aggregate measure of production equal to the sum of the gross value added of all resident institutional units engaged in production (plus any taxes, and minus any subsidies on products not included in the value of their outputs).	UNCTAD
GDP per capita	Gross domestic product (GDP) per capita is gross domestic product divided by population.	UNCTAD
FDI Flows	<p><u>For associates and subsidiaries:</u> FDI flows consist of the net sales of shares and loans (including non-cash acquisitions made against equipment, manufacturing rights, etc.) to the parent company plus the parent firm's share of the affiliate's reinvested earnings plus total net intra-company loans (short- and long-term) provided by the parent company.</p> <p><u>For branches:</u> FDI flows consist of the increase in reinvested earnings plus the net increase in funds received from the foreign direct investor.</p>	OECD
Exports	Exports of goods and services – merchandise trade comprise goods leaving the statistical territory of a country.	OECD
Trade Costs	The Trade Costs Dataset provides estimates of bilateral trade costs in agriculture and manufactured goods. Symmetric bilateral trade costs are computed using the Inverse Gravity Framework (Novy 2009), which estimates trade costs for each country pair using bilateral trade and gross national output.	World Bank

Table 8: Variables Definition and Source (Continued)

Corporate Income Tax Rate	Corporate Income Tax Rates are taxes levied by the government against profits earned by businesses during a given taxable period.	OECD
Political Stability	The Political Constraint Index Dataset is an endeavour to measure political constraint, that is, to identify underlying political structures and measure their ability to support credible policy commitments.	Witold J. Henisz
Trade Openness	Trade Openness is the sum of exports and imports of goods and services measured as a share of gross domestic product.	World Bank