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Tobias Zander

FDI Flows and the Effects of the Shadow Economy: Evidence from Gravity Modelling

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EUROPÄISCHES INSTITUT FÜR INTERNATIONALE WIRTSCHAFTSBEZIEHUNGEN (EIIW)/
EUROPEAN INSTITUTE FOR INTERNATIONAL ECONOMIC RELATIONS
Bergische Universität Wuppertal, Campus Freudenberg, Rainer-Gruenter-Straße 21,
D-42119 Wuppertal, Germany
Tel.: (0)202 – 439 13 71
Fax: (0)202 – 439 13 77
E-mail: welfens@eiiw.uni-wuppertal.de
www.eiiw.eu

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Summary:

This paper analyzes the question of if the size of shadow economy has an effect on foreign direct investment (FDI) flows and what effects, if any, there are. Since about 1990, FDI has become the second crucial pillar of economic globalization in OECD countries and worldwide; such FDI inward and outward flows contribute to higher per capita income and international technology transfer. To analyze this question, both fixed effects as well as dyadic fixed effects gravity models are used on an OECD-only dataset that allow for data on bilateral, bidirectional FDI flows for the years from 1992-2018. The empirical results suggest a positive effect of the shadow economy for FDI target countries and a negative effect for FDI origin countries. Additional findings via an interaction term show that the shadow economy can counteract negative effects of an increase in government size on FDI inflows. In a policy perspective, changes of the size of the shadow economy – typically taking place in periods of recession, in a high taxation environment or in the context of a pandemic shock – should be carefully monitored by economic policymakers as well as by policy monitoring international organizations such as the IMF and the EBRD. If a group of (OECD) countries decides to adopt anti-shadow economy economic policies, there will be pressure on other (OECD) countries to also adopt similar policies since the difference between the size of the shadow economy in the source country and the host country has a negative impact on FDI inflows. Thus, FDI could indirectly be a catalyst for reforms.

Zusammenfassung:

In diesem Beitrag wird die Frage untersucht, ob die Größe der Schattenwirtschaft einen Einfluss auf die ausländischen Direktinvestitionen (ADI/FDI) hat und wenn ja, welche Auswirkungen sie hat. Seit etwa 1990 sind die ausländischen Direktinvestitionen zur zweiten wichtigen Säule der wirtschaftlichen Globalisierung in den OECD-Ländern und weltweit geworden; solche Direktinvestitionszu- und -abflüsse tragen zu einem höheren Pro-Kopf-Einkommen und zum internationalen Technologietransfer bei. Um diese Frage zu analysieren, werden sowohl Fixed-Effects-Modelle als auch dyadische Fixed-Effects-Gravitationsmodelle auf einen reinen OECD-Datensatz angewendet, der Daten zu bilateralen, bidirektionalen FDI-Strömen für die Jahre 1992-2018 enthält. Die empirischen Ergebnisse deuten auf einen positiven Effekt der Schattenwirtschaft für FDI-Zielländer und einen negativen Effekt für FDI-Herkunftsländer hin. Zusätzliche Ergebnisse über einen Interaktionsterm zeigen, dass die Schattenwirtschaft den negativen Auswirkungen einer Vergrößerung des Staates auf die FDI-Zuflüsse entgegenwirken kann. Aus politischer Sicht sollten Veränderungen des Umfangs der Schattenwirtschaft – die typischerweise in Zeiten der Rezession, in einem Umfeld hoher Besteuerung oder im Zusammenhang mit einem Pandemieschock auftreten – von wirtschaftspolitischen Entscheidungsträgern sowie von internationalen Organisationen wie dem IWF und der EBWE, die die Politik überwachen, sorgfältig beobachtet werden. Wenn eine Gruppe von (OECD-)Ländern beschließt, wirtschaftspolitische Maßnahmen zur Bekämpfung der Schattenwirtschaft zu ergreifen, wird auf andere (OECD-)Länder Druck ausgeübt, ebenfalls ähnliche Maßnahmen zu ergreifen, da sich der Unterschied zwischen der Größe der Schattenwirtschaft im Herkunftsland und im Aufnahmeland negativ auf die FDI-Zuflüsse auswirkt. Somit könnten ausländische Direktinvestitionen indirekt ein Katalysator für Reformen sein.

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Tobias Zander, *M.Sc., Research Associate at Schumpeter School of Business and Economics and European Institute of International Economic Relations (EIIW), University of Wuppertal, Germany*

zander@wiwi.uni-wuppertal.de *www.eiiw.eu*

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1. Introduction

Total foreign direct investment (FDI) flows in 2021 amounted to 1.65 trillion US dollars (USD), thus showing a recovery from their exceptional low level in 2020 due to the Covid-19 pandemic with an increase of 718 billion USD, with developed economies accounting for more than 500 billion USD, or more than three quarters of total FDI flows (UNCTAD 2022b, 2022a). Compared to total FDI flows in 1990 of around 220 billion USD and it becomes obvious that FDI has grown very rapidly into a sizeable and important part of the world economy, particularly important in OECD countries, some Newly Industrialized Countries, and China. It is noteworthy that FDI is also associated with many benefits for the target economy (the recipient of the FDI flow so to say):

- FDI inflows contribute to capital accumulation (greenfield investment) and international technology transfer (via both greenfield FDI and international mergers & acquisitions). Thus, FDI inflows can result in job creation and access to new technologies, thus promoting labor productivity and possibly also economic growth in the respective host country.

- The introduction of new technologies also encourages the enhancement of human capital and skill upgrading where both effects also in turn raise domestic real income.

- FDI can also bring in advantageous spillover effects resulting from horizontal and vertical linkages in the host economy (OECD 2002).

Therefore, unsurprisingly, FDI has been and still is a popular and relevant topic in the research community (see, e.g., Zander (2021), Baier (2020), van Cuong et al. (2021), Huynh et al. (2020), Roeger and Welfens (2021)). A lot of research is done concerning the locational factors of countries that affect FDI flows using gravity models, and this paper follows this established approach.

The topic of the shadow - or underground - economy has also been a topic for quite some time in the economic literature. In the late 1970s, this topic started to first appear within a broader economic debate. Another thing observed at that time was the growth in the size of government and rising levels of taxation and higher tax rates; higher unemployment rates also increased the incentive for certain workers to seek additional income in the shadow economy in many OECD countries in the 1970s. This, combined with more regulation, led to growing incentives for individuals and corporations to enter the shadow economic sector in order to avoid taxes and regulations. Thus, at that time, a good case could be made for the shadow economy to be a growing concern (Tanzi 1999).

The corona (Covid-19) pandemic which induced a recession in many countries in 2020 and the following years and considering the concerns related to the Russian invasion of Ukraine in early 2022, coupled with inflationary pressure due to a global temporary shipping crisis – partly related to the Corona lockdowns in Shanghai and other Chinese ports in 2022 - and general distortions in sectoral global value chains, as well as the increasingly evident effects of climate change on the economy, has resulted in higher pressure on governments to step in and actively fight these crises. This, of course, usually means increased government spending which could,

in turn, lead to an increase in taxes (Nikopour et al. 2009). Therefore, the case can be made that the incentive to avoid taxes and regulations is growing once again. This also means that it is important to research the effects of tax evasion opportunities, such as the extent of the shadow economy, empirically since the shadow economy is an important part of the overall economic system and can affect every aspect of the economy (van Cuong et al. 2021). The costs associated with the shadow economy can include labor market distortions, the suboptimal provision of public goods, revenue losses due to the under-reporting of wages and production, and the reduced provision of and access to finance (Kelmanson et al. 2019). The Corona shocks in OECD countries have been found to contribute to the growth of the shadow economy (Schneider 2022).

Therefore, it is important to explore the linkages between FDI and the shadow economy as well as other drivers of FDI. Conducting such research can provide policymakers with the necessary empirical evidence and knowledge as both FDI and the shadow economy are important aspects of a country. If the goal is to attract FDI, does the shadow economy work against achieving that goal? It may be that the size of the shadow economy is considered by foreign investors as a signal of a rather poor institutional framework or inconsistent economic policy strategies. Is it important to reduce the shadow economy to be more attractive for multinational companies (MNCs)? Or is it the case that maybe the shadow economy – with its size signaling excess labor supply - offers opportunities for MNCs and therefore acts as a factor that may indeed attract FDI? This paper provides evidence to answer these questions by researching the effects of the shadow economy on FDI inflows through the use of a gravity model. There are relatively few empirical studies when it comes to the nexus of FDI flows and the shadow economy. Thus, this paper adds to the literature by making several contributions to the existing empirical frontier, namely by creating a new dataset for the gravity model analysis of shadow economy effects on FDI flows for OECD countries for the years 1992 – 2018, by giving new insights from state-of-the-art gravity modeling into the nexus of FDI and the shadow economy; and by including three interaction terms, which attempt to capture potential interactions between independent variables and the shadow economy.

The remainder of the paper is structured as follows: section 2 provides a brief review of the theoretical literature regarding the shadow economy, and FDI as well as empirical studies regarding the nexus of the shadow economy and FDI. Section 3 reviews the literature regarding the gravity model as well as the data, FDI determinants, and the specification of the model. Section 4 presents the results and additional considerations while section 5 concludes with economic policy implications.

2. Literature Review

In this section the relevant theoretical and empirical literature will be reviewed. The goal is to build a theoretical basis and use empirical evidence in conjunction with the theoretical literature to build hypotheses concerning the links between the shadow economy and FDI flows which can be tested in the present analysis.

Regarding the definition of the shadow economy, this paper follows the definition of Medina and Schneider (2018, p. 4): "Shadow economic activities may be defined as those economic activities and income earned that circumvent government regulation, taxation or observation. More narrowly, the shadow economy includes monetary and non-monetary transactions of a legal nature; hence all productive economic activities that would generally be taxable were they reported to the state (tax) authorities." Generally, the literature on the shadow economy identifies four overarching reasons when it comes to why one would be active in the shadow economy. The first is to avoid paying taxes (e.g., income or value-added taxes), the second is to avoid paying social security contributions, the third is to avoid compliance with certain labor market standards (e.g., minimum wages, maximum working hours, workplace safety regulation), with the fourth and last being to avoid certain administrative procedures. This also means that while these activities could be part of the national accounts, they do not show up due to their illicitness (Medina and Schneider 2018; Schneider and Buehn 2018; Schneider and Williams 2013).

Based on the reasons why one would be active in the shadow economy, Schneider (2008) identifies the main causes for an increase in the shadow economy as follows:

- Increase of the Tax and Social Security Contribution Burdens
- Intensity of Regulations
- Social Transfers
- Labor Market Standards
- Public Sector Services

Another relevant topic when talking about the shadow economy is the links with corruption. Regarding corruption, there are two strands in the literature the "grease the wheels" view and the "sand the wheels" view. Proponents of the former argue that corruption can lead to second-best solutions (Bardhan 1997) and can, for example, help circumvent business-hindering government policies or a badly working government in general (see, e.g., Leff (1964), Bayley (1966), Lui (1985), Beck and Maher (1986), Lien (1986)). Supporters of the "sand the wheels" view, on the other hand, argue that no matter the situation, corruption is always the worst choice. For example, while bribes might at times be used to circumvent bad policies, they might also be used to do so for sound policies and a government that accepts bribes also has a considerable incentive to create legislation in order to maximize the amounts of bribes they can receive (see, e.g., Kaufmann (1997), Rose-Ackerman (1997), Kaufmann and Wei (1999), Lambsdorff (2002)).

As one can see, the effect of corruption on the official economy is in theory still somewhat unsettled, therefore the relationship between corruption and the shadow economy is not clear either. Should corruption help economic growth and wealth, this in turn should ultimately lead to a decline in corruption and also a decline in shadow economy activity. Should corruption on the other hand harm the economy, this then would ultimately lead to more corruption and more incentive to do business in the unofficial economy (Schneider 2008; Schneider and Williams 2013). Although important, the main focus of this paper will be on the linkage between the shadow economy and FDI.

One of the early theories in International Economics stems from the neoclassical trade theory´s Heckscher-Ohlin model. The idea behind the theory is that countries differ in relative factor endowment which leads to international factor price differences and thus a clear specialization pattern in production and exports as well as imports. Following this logic, a capital-abundant country would specialize in capital-intensive goods production if it is highly endowed with capital (relative to labor) so that economic opening up leads to more production of the capital-intensive good and indeed also to exports of the capital-intensive goods produced; and if capital intensity is rather low, a country will specialize in labor-intensive production and exports after economic opening up; moreover, there could also be international capital movements to a country where returns on capital are higher until factor price equalization is achieved (Faeth 2009).

The traditional theory though made little distinction between FDI and international portfolio flows. Hymer (1960) was the first to find inconsistency between this approach and FDI data. In short, "[…] Hymer envisioned a world in which real (not financial) factors shape the location of multinational activity and financial flows are a mere consequence of the financial structure decisions of multinational firms."(Antràs and Yeaple 2014). After refinement by multiple authors (see Antràs and Yeaple (2014) for more), the result was Dunning´s OLI framework (Dunning 1977). Dunning looked more at the idea of what factors influence a firm's decision to invest abroad. He identified three broad advantages in his eclectic paradigm: Ownership (e.g., a firm's production processes), Location (e.g., market access), and Internationalization (e.g. lowering transaction costs) advantages. This became known as the OLI framework. These advantages can vary and depend on the characteristics of the country, industry, market, and the MNE itself (Faeth 2009).

Other models try to explain FDI dynamics using the concepts of horizontal FDI, vertical FDI, and the Knowledge-Capital (KC) Model. "Vertical MNEs engage in trade and seek to exploit international factor price differentials whereas horizontal MNEs seek to save trade costs by serving markets locally" (Baltagi et al. 2007). Based on earlier work (see Markusen et al. (1996) and Markusen (1997)) Carr et al. (2001) develop the so-called "Knowledge-Capital model" which combines vertical and horizontal modes of MNE entry. The authors create a 2x2x2 model with three basic assumptions: firstly, knowledge-generating activities can be separated from production; secondly, these activities are skilled-labor-intensive and - thirdly - knowledge-based activities have a joint-input character. The first and second assumptions lead to the motivation for vertical FDI (access low wages), whereas the third assumption delivers a motivation for horizontal FDI (access markets). This results in the horizontal firm being active in countries of a similar size and with similar relative factor endowments whereas vertical firms have an incentive to headquarter in countries with an abundance of skilled labor and have production in a country where skilled labor is relatively scarce.

Bergstrand and Egger (2007) extend the KC model into a three-factor, three-country, two-good model allowing now for physical capital as a third factor of production in addition to knowledge capital (skilled and unskilled labor). The assumption that physical capital is mobile leads to MNEs endogenously choosing *"[…] the optimal allocation of domestic physical capital between home and foreign locations to maximize profits […]*" (Bergstrand and Egger 2010). This means that their "Knowledge-and-Physical-Capital model" actually has FDI. In their 2010 paper, Bergstrand and Egger create a more general version of their 2007 model, by constructing a three-factor, three country, three good model thereby providing a theoretical rationale for estimating gravity equations for bilateral FDI flows (as well as bilateral final goods trade flows and bilateral intermediate goods trade flows) (Bergstrand and Egger 2010).

The empirical literature examining the relationship between FDI and the shadow economy is relatively limited. The following papers represent, to the best of the author's knowledge, all empirical studies examining FDI and shadow economy.

Nikopour et al. (2009) examine the relationship between the shadow economy and FDI using Granger causality analysis. For this, they first estimate a panel and then look for causality. The authors use data for 145 countries and 5 data points (1999/2000, 2001/2002, 2002/2003, 2003/2004, 2004/2005). Using a system GMM estimation, they find in all specifications in their panel data model, a positive and significant effect of the shadow economy on FDI inflows. They then use Granger causality tests and find that the shadow economy Granger causes FDI inflows in all models finding support for one of their hypothesis that a higher shadow economy causes higher FDI inflows (Nikopour et al. 2009). Davidescu and Strat (2015) examine the relationship between the shadow economy and FDI for Romania using two different causality analysis methods (Granger and Toda-Yamamoto) over the period 2000-2010. Their findings reveal a short-run causality from FDI to the shadow economy. The authors argue that, due to FDI stimulating economic activity, tax reforms may be possible and lower taxes would lead to less incentive for individuals to engage in the shadow economy.

Ali and Bohara (2017) use a gravity model to explore the effects of the shadow economy on FDI inflows for 34 OECD countries from 1999 to 2007. Their results show a positive relationship between the shadow economy and FDI inflows indicating that MNCs are motivated to take advantage of the shadow economy. Huynh et al. (2020) investigate the relationship between FDI, shadow economy, and institutional quality for 19 developing Asian countries between 2002 and 2015. Focusing on their findings regarding the FDI-shadow economy nexus, the authors find that FDI has a negative impact on the size of the shadow economy. Additionally, an improvement in institutional quality from FDI increases the negative impact of FDI on the shadow economy. In the most recent study, van Cuong et al. (2021) investigate the effect of the shadow economy on FDI for 158 countries for the period from 2003-2018. Therefore, they investigate total FDI as well as greenfield investments and cross-border M&As. Their findings show no clear effect on total FDI inflows, but a positive effect on greenfield investments and a negative effect on cross-border M&As.

Based on the theoretical and empirical literature presented in this chapter, the following hypotheses are stated here:

1) The shadow economy is expected to attract FDI, therefore a positive sign for FDI inflows can be expected.

2) The difference in the size of the shadow economy between two countries is expected to have a negative sign, as countries with similar levels of the shadow economy are expected to engage in more FDI with each other; MNCs from, for example, country 1 – with a large shadow economy – will find investing abroad in other countries with a relatively high level of shadow economic activity as representing economic conditions in a crucial field which are not very different from the conditions in the source country so that established business models can be transplanted to subsidiaries abroad in a rather easy way; moreover, international transaction costs for intra-company trade should be relatively small which would make vertical FDI particularly attractive in some sectors.

3) Inflation typically leads to government intervention, including anti-inflation measures which, following the logic of the Phillips curve, will temporarily raise unemployment rates (e.g., in the case of reduced government spending); hence inflation interacts with the shadow economy in a way that the effective labor supply from unemployed workers will increase. As inflation reduces real income in many countries with no wage indexation or weak trade unions, there is also an incentive for workers from the official economy to seek additional hours of work in the shadow economy in order to restore the previous real income growth.

4) The size of the government, proxied by government consumption as a percentage of GDP, is expected to interact with the shadow economy as a larger government can lead to a larger shadow economy (Zhanabekov 2022). Therefore, a positive sign is expected.

5) Finally, a crisis dummy for the transatlantic banking crisis (as a proxy for the Global Financial Crisis of 2007/08) is interacted with the shadow economy in that a significant international crisis affects both FDI and the shadow economy. Therefore, a positive sign is expected.

3. Gravity Model of FDI and Specification

The broader theoretical foundation and has been discussed in section 2. Here we will focus more on the specification of the gravity model and best practices.

The gravity model has a long history in science apart from the field of physics[1]. Ravenstein (1885) and Zipf (1946) were the earliest adopters of a gravity model followed by Tinbergen's (1962) adoption with regard to trade between countries[2]. The next big innovation with regard to the gravity model of trade came in 2003 with the famous "gravity with gravitas" paper by Anderson and Van Wincoop (2003). Building on the early intuition of the gravity model that the size of the country correlates positively with trade while the distance between countries correlates negatively with trade, Anderson and Van Wincoop introduced two new additional variables: outward and inward multilateral resistance (Benedictis and Taglioni 2011). The former captures the fact that exports from country i to country j depend on trade costs across all possible export markets while the latter captures the dependence of imports into country i from country j on trade costs across all possible suppliers. In the words of Shepard (2016): "[…] *this model picks up the fact that changes in trade cost on one bilateral route can affect trade flows on all other routes because of relative price effects."* (Shepherd 2016)

Based on the aforementioned "gravity with gravitas" paper, Anderson et al. (2019) derive a structural gravity system for FDI, in particular for FDI stocks. Their model includes an equation for FDI and two multilateral resistance terms (one for the origin country and one for the target country). The main properties of the system are that FDI is related to the size of the host and origin countries' respective GDPs, is inversely related to FDI barriers, it links FDI to trade via a multilateral resistance term, and lastly, there is a relationship between the FDI stock and technology capital.[3]

There have been additional advances regarding FDI gravity, namely dyadic fixed-effects and the Poisson-Pseudo-Maximum-Likelihood (PPML) estimation methods. Baldwin and Taglioni (2006) argue for the use of time-invariant pair dummies (dyadic fixed effects) when it comes to estimating gravity equations. They caution though that this means that the coefficients of interest will only be identified on their time variation, meaning that there needs to be a significant enough time variation in the policy variable one is trying to estimate (one also cannot include time-invariant parameters, e.g., distance). Egger and Pfaffermayr (2003) also advocate for using bilateral fixed effects (dyadic fixed effects) and time fixed effects (two-way model) rather than country (importer and exporter) fixed effects and time fixed effects (three-way model). Head and Ries (2008) also use dyadic fixed effects in their gravity equation for FDI.

PPML is an estimator developed by Silva and Tenreyro (2006) to deal with heteroskedasticity in gravity equations. It does so by estimating the equation in levels and not, as with OLS, in log-linearized form, which, according to the authors, is inconsistent in the presence of heteroscedasticity. Additionally, it allows for the inclusion of zero FDI (or trade) flows and it takes account of observed heterogeneity (Silva and Tenreyro (2006); Head and Mayer (2014);

[1] The gravity model is based on Newton's Law of Gravity

[2] A detailed history of the gravity model can be found in Benedictis and Taglioni 2011.

[3] For a more detailed explanation see Anderson et al. 2019.

Kareem et al. (2016)). Based on the original paper of Correia et al. (2019) the STATA command "ppmlhdfe" allows for a fast estimation of Poisson models with multiple high-dimensional fixed effects (HDFE). As Santos Silva and Tenreyro (2022) put it in their "The Log of Gravity at 15" paper*: "[…] PPML is efficient in the class of pseudo maximum likelihood estimators that are valid in models with fixed effects and are compatible with structural gravity models."* As Breusch-Pagan / Cook-Weisberg testing for heteroskedasticity confirms heteroskedasticity in the sample, PPML is chosen as the estimator for all models. Additionally, there are no serious correlation issues, see correlation matrix in Table 6 in the Appendix. Potential endogeneity between the independent variable and the variable of interest, the shadow economy, is avoided by lagging the shadow economy variable by one year.

The resulting gravity equation looks like this:

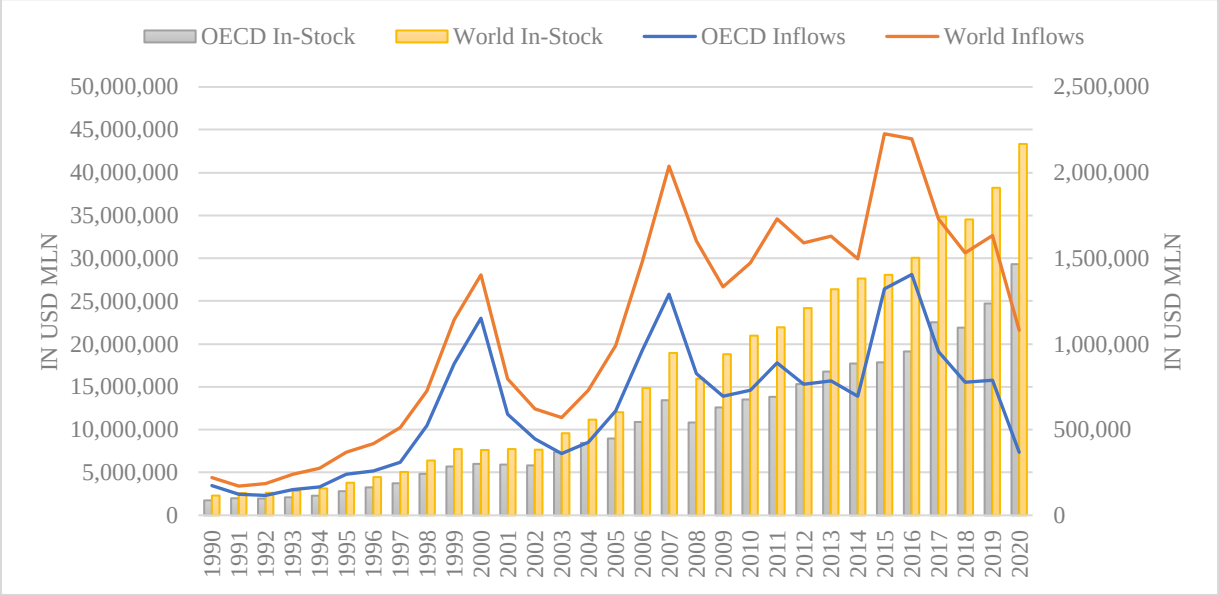
$$FDIflows_{odt} = \alpha_0 + \alpha_1 X_{ot-1} + \alpha_2 X_{dt-1} + \alpha_3 X_{dt-1} Z_{dt} + \gamma Z_{odt} + \delta_{od} + \delta_d + \delta_d + \tau_t + \varepsilon_{odt}$$

Where

- α_0 = regression constant
- $X_{o(t-1)}$ = lagged origin country shadow economy
- $X_{d(t-1)}$ = lagged destination/target country shadow economy
- $X_{d(t-1)}Z_{dt}$ = interaction terms for the target country
- Z_{odt} = set of control variables for both origin/destination countries (set includes time-invariant characteristics of country-pairs from the CEPII database for the country fixed effects regressions)
- δ_{od}, δ_{od}, δ_{od} = time-invariant country and country-pair fixed effects[4]
- τ_t = time fixed effects
- ε_{odt} = error term

[4] Of course, if country-pair fixed effects are used, country fixed effects are not included and vice versa

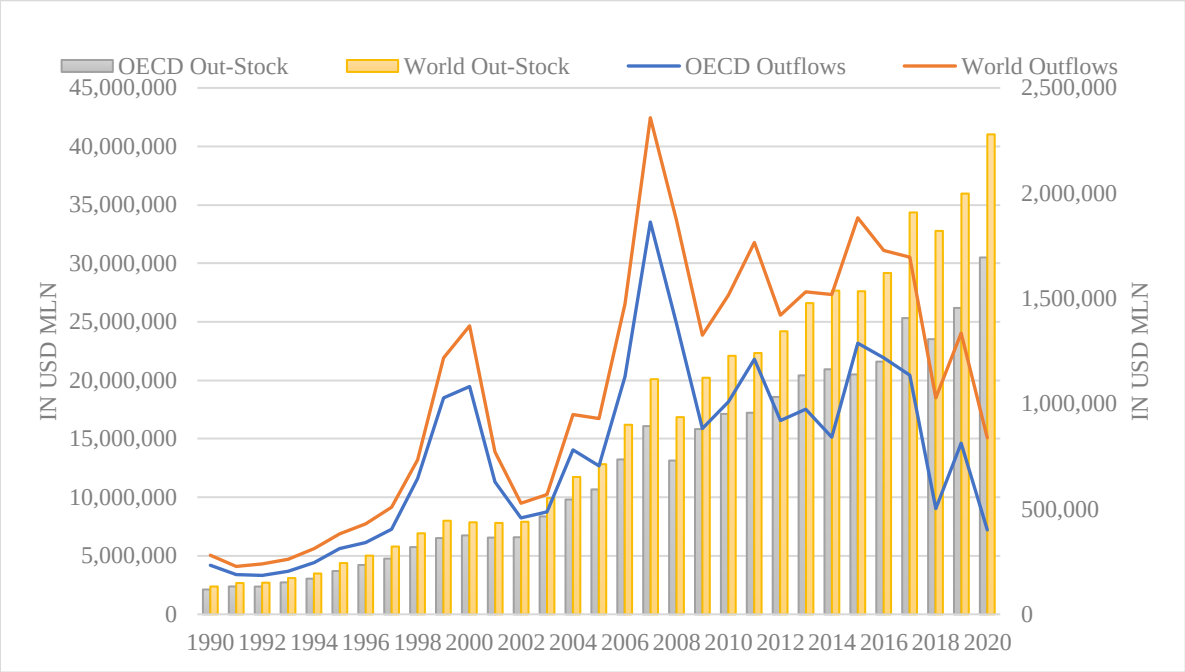
Figure 1: FDI Inflows and Inward Stock for OECD countries and the World from 1990-2020



Source: Own representation based on data available from UNCTAD (https://unctadstat.unctad.org/EN/Index.html)

Figures 1 and 2 show the development of inward and outward flows and stocks, respectively, for OECD countries in comparison with the world total. The overall trend is that FDI stocks are growing for both the OECD group of countries and world economy. FDI flows in comparison are more volatile and in the late 2010s are exhibiting more of a decline compared to the early and mid-2000s. Also, OECD countries stand for the majority of FDI flows and FDI stock in the world, albeit the proportion of OECD-related FDI is declining as other non-OECD countries increase investment.

Figure 2: FDI Outflows and Outward Stock for OECD countries and the World from 1990-2020



Source: Own representation based on data available from UNCTAD (https://unctadstat.unctad.org/EN/Index.html)

In the following empirical analysis, bilateral FDI flow data from the OECD is used due to it being compiled more uniformly and it being less aggregated as compared to UNCTAD data, resulting in more data points. Moreover, looking at Figures 1 and 2 and especially the world inflows and outflows, one can see that in these graphs, which are made with UNCTAD data, there is a difference but there should not be a difference in terms of world inflows and outflows and this is most likely a problem with data quality. Therefore, data from the OECD is preferred (Baier 2020).

The selection of the data and variables for the gravity model is based on the empirical and theoretical literature. As Faeth (2009) puts it: *"[…] FDI should not be explained by single theories but more broadly by a combination of ownership advantages or agglomeration economics, market size and characteristics, cost factors, transport costs and protection and risk factors and policy variables*."

Therefore, following research from Faeth (2009), Blonigen (2005), Blonigen and Piger (2014), and Eicher et al. (2012) regarding FDI determinants as well as previous empirical literature, real GDP, distance, cultural variables, agglomeration effects, inflation, a transatlantic banking crisis dummy, and openness are included, furthermore government consumption as a proxy for government size, following Zhanabekov (2022), is also included.

Data for real GDP, inflation, and openness comes from the World Bank, time-invariant country-pair characteristics come were taken from CEPII, data on the shadow economy comes from Medina and Schneider (2019) and is estimated using the MIMIC approach (see their paper for more details on this), agglomeration effects data is from the OECD database, government

consumption data was taken from the Penn World Tables 10, and data on the financial crisis dummy comes from Laeven (2018). Details regarding the definition and source of the variables can be found in the following Table 1.

Table 1: List of Variables

Variable	Definition	Source
inflow	FDI inflow, from origin to target in current USD; Negative values to zero, excluding missing values	OECD FDI database; BMD3 data 1992-2012, BMD4 data 2013-2018
ln_target_gdp	Real GDP of FDI target country in USD	World Bank
ln_origin_gdp	Real GDP of FDI origin country in USD	World Bank
ln_dist	Distance between two countries	CEPII GeoDist Database by Mayer and Zignago (2011)
contig	dummy variable indicating whether the two countries are contiguous	CEPII GeoDist Database by Mayer and Zignago (2011)
comlang_off	dummy variable indicating whether the two countries share a common language	CEPII GeoDist Database by Mayer and Zignago (2011)
colony	dummy variable indicating whether the two countries have ever had a colonial link	CEPII GeoDist Database by Mayer and Zignago (2011)
openness	Total import plus total export of FDI target country, divided by its GDP	World Bank
ln_agglo_target	Agglomeration effects (inward FDI stock) in the target country lagged by 1 year	OECD
target_gov_100	Share of government consumption at current PPPs multiplied by 100[5]	PWT 10.0 by Feenstra et al. (2015)
target_inflation	Annual inflation based on Consumer Price Indices	OECD
target_fin_cri	Dummy describing whether a country was experiencing a systemic banking crisis as an effect of the transatlantic banking crisis	Laeven (2018)
shadow_target	Size of the shadow economy of the target country, in % of GDP	Medina and Schneider (2019)
shadow_origin	Size of the shadow economy of the origin country, in % of GDP	Medina and Schneider (2019)
shadow_diff	Absolute difference between size of the shadow economy of target and origin country	Medina and Schneider (2019)
S_inf	Interaction term for the target country between inflation and shadow economy	Medina and Schneider (2019) and OECD
S_gov_100	Interaction term for the target country between government consumption and shadow economy	Medina and Schneider (2019) and Feenstra et al. (2015)
s_cri	Interaction term for the target country between financial crisis dummy and shadow economy	Medina and Schneider (2019) and Laeven (2018)

Source: Own representation

[5] The original values are between 0 and 1. Multiplying by 100 makes the interpretation of the estimates easier.

In total, the resulting dataset has 19,921 observations for the years from 1992-2018 for 35 OECD countries excluding Luxembourg[6]. Missing values get treated by deletion and negative values are set to zero following the methodology in Welfens and Baier (2018). Summary statistics can be found in Table 2.

Table 2: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
inflow	19,921	870.8507	4160.598	0	116455.9
ln_target_GDp	19,921	12.91563	1.550208	8.735297	16.84138
ln_origin_GDp	19,921	12.94874	1.545505	8.412493	16.84138
ln_dist	19,921	7.946185	1.171336	4.087945	9.88258
contig	19,921	0.076552	0.265887	0	1
comlang_off	19,921	0.07098	0.256799	0	1
colony	19,921	0.042618	0.202	0	1
openness	19,921	0.828095	0.410089	0.158103	2.274019
ln_agglo_target	19,921	11.56087	1.567041	4.761071	15.87529
t_gov_100	19,921	18.32627	4.849986	6.701139	33.75782
target_fin_cri	19,921	0.097485	0.296625	0	1
target_inflation	19,921	3.391009	7.334535	-4.4781	105.215
shadow_targett	19,921	16.35916	6.597208	5.1	35.8
shadow_oriigin	19,921	15.6613	6.431412	5.1	35.8
S_inf	19,921	75.93527	241.228	-52.8416	3661.482
S_cri	19,921	1.428171	4.622596	0	23.1
s_gov_100	19,921	304.1229	146.8873	36.63355	757.1332

Source: Own representation

[6] Luxembourg is excluded due to it being a major outlier in the dataset.

4. Results

In this section, the results from the gravity model regressions are presented. The regressions are done using the PPML estimator (Stata command: ppmlhdfe) with country- and time-fixed effects as well as another regression with country-pair and time fixed effects. The reason for estimating both types of fixed effects is that dyadic fixed-effects do not allow for time-invariant dyadic variables such as distance. It also helps to show the differences in estimation results between the three-way and the two-way model.

Table 3 shows the results for the country and time fixed effects PPML regressions. Model 1 is simply a baseline model. It confirms the gravity intuition that market size (GDP) is positively correlated with FDI and distance is negatively correlated with FDI. This can also be seen as confirmation that the model behaves as expected. Other variables of interest are trade openness, which shows a positive effect, and government size (proxied by government consumption) which expresses a negative sign. In Model 2, the variables for the shadow economy are introduced and both are statistically significant. For the target countries, a positive effect is found and for the origin countries, a negative effect is found. The other control variables remain roughly unchanged. In Model 3, the variable for the difference between target and origin shadow economy is introduced, which shows a negative sign and is statistically significant at the 1% level. Interpreting the results for the shadow economy variables in Models 2 and 3, we get a 17.3% increase in FDI inflows for target countries when the shadow economy in the target country increases by 1% and a -11.75% decrease in FDI outflows from host countries when their shadow economy increases by 1%. For Model 3 and the shadow economy difference variable, we get a -3.9% decrease in FDI flows between countries when the difference in their respective shadow economies increases by 1%.

Model 4 introduces interaction terms for the three variables that potentially interact with the shadow economy variable. These are inflation, the banking crisis dummy, and the government size variable all for the target country. Two interaction terms show statistical significance, with the shadow*gov term being significant at 10% and the shadow*crisis term at 5%. Both show a positive sign for their effect. This would mean that the effect of the shadow economy on FDI increases by **0.338%** for every 1% increase in gov consumption. In other words, the greater government consumption, the larger the effect of the shadow economy on FDI inflows. The shadow*crisis interaction term follows the same interpretation in that for target countries that are experiencing a financial crisis, the effect of the shadow economy on FDI increases by **3.7%.** The interaction term for shadow*inflation is negative but not statistically significant.

Table 3: PPML Country- and Time-Fixed Effects Results

VARIABLES	(1) Model 1	(2) Model 2	(3) Model 3	(4) Model 4
ln_target_gdp	0.838***	1.277***	0.801***	1.294***
	(0.304)	(0.326)	(0.305)	(0.329)
ln_origin_gdp	1.129***	0.807**	1.104***	0.807**
	(0.365)	(0.407)	(0.371)	(0.404)
ln_dist	-0.447***	-0.447***	-0.460***	-0.447***
	(0.0808)	(0.0810)	(0.0812)	(0.0810)
Contig	-0.111	-0.112	-0.0926	-0.110
	(0.190)	(0.190)	(0.191)	(0.190)
comlang_off	0.302**	0.300**	0.296**	0.298**
	(0.136)	(0.137)	(0.129)	(0.137)
colony	0.266*	0.266*	0.276*	0.267*
	(0.145)	(0.145)	(0.141)	(0.145)
openness	1.617***	1.832***	1.565***	1.974***
	(0.396)	(0.411)	(0.400)	(0.425)
ln_agglo_target	0.249*	0.284**	0.250*	0.235*
	(0.129)	(0.127)	(0.129)	(0.126)
t_gov_100	-0.0548**	-0.0638**	-0.0530**	-0.124***
	(0.0258)	(0.0261)	(0.0258)	(0.0404)
target_inflation	0.000866	-0.00374	0.00322	0.0564
	(0.00546)	(0.00541)	(0.00544)	(0.0494)
target_fin_cri	0.116	0.118	0.106	-0.269
	(0.0902)	(0.0904)	(0.0906)	(0.192)
shadow_target		0.160***		0.150***
		(0.0402)		(0.0558)
shadow_origin		-0.125**		-0.127**
		(0.0577)		(0.0573)
S_inf				-0.00196
				(0.00153)
s_cri				0.0370**
				(0.0161)
s_gov				0.00337*
				(0.00188)
shadow_diff			-0.0398***	
			(0.00927)	
Constant	-20.32***	-23.02**	-19.12**	-22.34**
	(7.700)	(9.011)	(7.847)	(9.094)
Observations	19,921	19,921	19,921	19,921

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4 shows the results for the countrypair and time fixed effect PPML regressions. Models 5 to 8 repeat models 1 to 4 but with dyadic fixed effects instead of importer/exporter fixed effects. As is the norm when using dyadic fixed effects, time-invariant variables get dropped (such as distance, etc.). Moreover, the number of observations falls because ppmlhdfe drops 841 observations due to them being singletons. This is done to guarantee that the PPML estimator converges. Generally, most variables remain the same when it comes to significance and only vary slightly in their point estimate (usually slightly lower) except for origin_GDP

which loses statistical significance in models 6 and 8, when the shadow economy variables get introduced. Also, the variable shadow_diff in model 7 is no longer statistically significant (while the sign stays the same), which means that the time-variant part of the variable (since it is dyadic) is not statistically significant. The variables shadow_target and shadow_origin exhibit the same signs and significance levels as in the previous estimations, findings for the two interaction terms, s_inflation, and s_gov, are also basically the same, except that s_gov is now significant at the 5% level as compared to the 10% level before. Overall, the results point to robust and good findings coming from the gravity model.

Table 4: PPML Country-pair- and Time-Fixed Effects Results

	(1)	(2)	(3)	(4)
VARIABLES	Model 1	Model 2	Model 3	Model 4
ln_target_gdp	0.806***	1.256***	0.782**	1.273***
	(0.307)	(0.327)	(0.316)	(0.329)
ln_origin_gdp	0.919***	0.595	0.902***	0.595
	(0.350)	(0.391)	(0.350)	(0.387)
Openness	1.536***	1.754***	1.503***	1.888***
	(0.391)	(0.406)	(0.396)	(0.420)
ln_agglo_target	0.237*	0.274**	0.240*	0.228*
	(0.129)	(0.126)	(0.130)	(0.126)
t_gov_100	-0.0566**	-0.0664**	-0.0558**	-0.131***
	(0.0258)	(0.0263)	(0.0260)	(0.0399)
target_inflation	0.000340	-0.00426	0.00116	0.0587
	(0.00539)	(0.00534)	(0.00535)	(0.0490)
target_fin_cri	0.128	0.129	0.122	-0.204
	(0.0897)	(0.0898)	(0.0890)	(0.195)
shadow_target		0.167***		0.149***
		(0.0402)		(0.0559)
shadow_origin		-0.126**		-0.127**
		(0.0577)		(0.0574)
S_inf				-0.00204
				(0.00152)
s_cri				0.0322**
				(0.0164)
s_gov				0.00370**
				(0.00184)
shadow_diff			-0.0214	
			(0.0351)	
Constant	-19.71***	-22.62***	-19.05***	-21.92**
	(7.221)	(8.464)	(7.253)	(8.513)
Observations	19,080	19,080	19,080	19,080

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Regarding the hypotheses from section 2:

1) The shadow economy is expected to attract FDI, therefore a positive sign for FDI inflows is expected.

   - This hypothesis is accepted, as the shadow economy target country variable in both models is positive and significant and confirms the results of Ali and Bohara (2017). This also means that economies with a larger shadow economy receive more FDI.

   - Regarding the results for the origin country, here the sign of shadoworigin is negative which means that countries with a larger shadow economy send less FDI abroad. This might reflect the negative impact of the shadow economy on the profits of MNCs in the respective country – a lack of equity capital then becomes a problem for leveraged potential international M&A projects (assuming imperfect international capital markets so that the relative size of equity capital is relevant).

2) The difference in the size of the shadow economies between two countries is expected to have a negative sign, as countries with similar levels of the shadow economy are expected to engage in more FDI with each other.

   - In the three-way model this hypothesis is accepted as the variable is significant and the sign is negative but in the dyadic fixed-effects model this finding cannott be replicated. Therefore, the hypothesis can neither be accepted nor rejected.[7]

3) Inflation interacts with the shadow economy as inflation can be seen as a decline in real income and therefore increases the incentive to engage in shadow economy activities.

   - This hypothesis can neither be accepted nor rejected as both estimations have failed to produce statistically significant results that allow for a conclusive statement.

4) The size of the government, proxied by government consumption as a percentage of GDP, is expected to interact with the shadow economy as larger government can lead to a larger shadow economy (Zhanabekov 2022). Therefore, a positive sign is expected.

   - The hypothesis is accepted. In both models 4 and 8, the interaction term between the shadow economy and government consumption is positive, indicating that a larger government strengthens the effect of the shadow economy on FDI inflows. This could mean that the shadow economy allows for opportunities for MNCs in countries with big government (and presumably high taxes or distorting policies). Vice-versa, the shadow economy lessens the effect (negative sign of t_gov_100) of an increase in government consumption on FDI inflows

5) Lastly, a crisis dummy for the transatlantic banking crisis (as a proxy for the Global Financial Crisis) is interacted with the shadow economy in that a crisis affects both FDI and the shadow economy.

[7] One could argue for a tentative accept, but we will not do so here on the basis of the empirical evidence at hand.

- The hypothesis is accepted. Indeed, for countries that are experiencing a banking crisis, the effect of the shadow economy on FDI inflows is increased, indicating that the shadow economy might offer opportunities even in a crisis struck country.

Additional Considerations

In this paragraph, the paper discusses certain additional considerations that are not part of the main analysis, namely institutional distance and corruption.

For institutional distance, the absolute difference between the origin and target countries' economic freedom index scores from the Heritage Foundation is used (Kostova et al. 2020). For the corruption measure, the control of corruption index from the World Bank's World Governance Indicator series is used[8]. See the results of models with these variables in the Appendix. Both variables are tested only with dyadic fixed-effects and, in the case of corruption, for target countries. Institutional distance is not significant in the models, corruption is significant and negative, the shadow_target variable loses significance once the shadow_corruption interaction term gets introduced. The interaction term is not significant aside from model A4 and only at the 10% significance level. Shadow_origin stays significant (albeit at 10%). Signs are the same for both shadow economy variables. What is notable is that in models 1 to 3, the inflation_shadow interaction term becomes significant and negative, meaning that more inflation leads to a lower shadow economy effect on FDI but again this is only significant at the 10% level. One can see a positive sign at the 10% level for the corruption_shadow interaction term. This means that an increase in the corruption variable (which indicates lower levels of corruption) increases the shadow economy effect on FDI inflows and vice versa. This can be seen as an indicator that the shadow economy and corruption are substitutes, as suggested by Schneider (2008) for rich countries, since lower corruption levels increases the shadow economy effect and higher levels of corruption decreases it. Overall, the inclusion of the corruption variable and institutional distance variable did not result in robust findings and certainly more in-depth research is required here.

[8] It is transformed so as to have an index that goes from 0 (high corruption) to 5 (no corruption). Missing years are interpolated.

5. Conclusion and Economic Policy Implications

This paper explores the subject of the effect of the shadow economy on FDI flows. For this analysis, a dataset for 35 OECD countries from the years 1992 – 2018 was compiled and used in a state-of-the-art gravity model setting. For policymakers aiming to attract FDI, a sizeable shadow economy might not be a serious hindrance as the existence of the shadow economy does not deter FDI as the results of the gravity models have shown. The shadow economy seems to be recognized as an opportunity by MNCs rather than a risk. However, as the difference between the size of the shadow economy in the origin country i and destination country j has a negative impact on FDI, it is also clear that once a large group of (OECD) countries decides in favor of fighting the shadow economy – and the respective countries are successful in this policy – there will be a growing pressure on the other (OECD) countries to follow suit with a similar anti-shadow economy policy since those other countries will be afraid of losing out on potential FDI flows. From this perspective, FDI can be a transmission channel for similar policy strategies in a broad group of countries. To the extent that such anti-shadow economy policies, in the end, raise total factor productivity and bring significant efficiency gains, the broader picture and the relevant implications suggest that FDI and anti-shadow economic policies in some countries could contribute to major international welfare gains.

Moreover, an increase in government size seems to increase the shadow economy effect on FDI even further, the same is true in the case of a country experiencing a systemic banking crisis. A possible interpretation here is that a larger government is associated with a higher need for government financing which could mean higher taxes. As higher taxes lead to lower FDI inflows (see, e.g., Baier (2020)) the shadow economy and its potential for tax evasion might present an opportunity for MNCs to avoid these higher taxes. Regarding the systemic banking crisis effect, one could say that in uncertain markets and a struggling economy, the shadow economy presents MNCs with some kind of opportunity, possibly due to being able to employ people without having to pay labor taxes. This might even allow for people to earn an income and two-thirds of income made in the shadow economy is immediately spent in the real economy (Schneider 2008).

As mentioned in the introduction, FDI comes with several benefits but, on the other hand, the shadow economy also comes with certain drawbacks. Thus, for policymakers aiming to combat the shadow economy efficiently, a fair and equitable tax regime seems necessary[9]. Moreover, it is important for the government to be able to collect taxes so as to maximize its tax revenue. Additionally, to reduce incentives for corporations to engage in the shadow economy and tax evasion, a country could impose heavy sentences for accountants engaged in facilitating tax evasion. Over time though, the shadow economy in OECD countries has reduced while FDI has grown. So, countries can reap the benefits of FDI while slowly working on improving the welfare situation for people thereby reducing the incentive to be active in the shadow economy. It is beyond the scope of this paper to assess if the FDI positives outweigh the shadow economy negatives or vice versa.

[9] For exampke, in Greece, the unique geography of the country makes it very costly to administer and collect all taxes (see Papanikos 2015)

Overall, there are both positive and negative effects and it is up to policymakers to decide, which effects outweigh the other. The shadow economy is not necessarily a bad thing for a country, so focusing on policies that reduce regulation, make doing business easier, and a social security and tax burden that leaves people with more than just a livable income, as well as robust and trustworthy institutions seems to be the best way to move forward, which ultimately will result in fewer incentives to engage in the shadow economy and a better economic climate overall for all economic actors.

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Appendix

Table 5: Regressions for the Additional Considerations Section, PPML Dyadic Time Fixed Effects

VARIABLES	(1A) Model 1	(2A) Model 2	(3A) Model 3	(4A) Model 4
ln_target_gdp	1.353***	1.466***	1.537***	1.506***
	(0.354)	(0.352)	(0.354)	(0.349)
ln_origin_gdp	0.673	0.708	0.708*	0.679
	(0.442)	(0.436)	(0.428)	(0.427)
openness	1.864***	1.948***	2.021***	2.008***
	(0.435)	(0.433)	(0.434)	(0.435)
ln_agglo_target	0.234*	0.209	0.219	0.224*
	(0.136)	(0.134)	(0.133)	(0.133)
t_gov_100	-0.131***	-0.122***	-0.122***	-0.120***
	(0.0407)	(0.0417)	(0.0422)	(0.0421)
target_fin_cri	-0.216	-0.288	-0.284	-0.293
	(0.199)	(0.206)	(0.205)	(0.208)
target_inflation	0.0784	0.0836	0.0804	0.0790
	(0.0517)	(0.0514)	(0.0514)	(0.0515)
shadow_target	0.167***	0.165***	0.0411	0.0311
	(0.0618)	(0.0616)	(0.0854)	(0.0880)
shadow_origin	-0.123**	-0.117*	-0.116*	-0.118*
	(0.0613)	(0.0607)	(0.0610)	(0.0610)
S_inf	-0.00290*	-0.00310*	-0.00273*	-0.00267
	(0.00163)	(0.00162)	(0.00163)	(0.00163)
S_cri	0.0332**	0.0363**	0.0348**	0.0353**
	(0.0168)	(0.0171)	(0.0168)	(0.0170)
s_gov_100	0.00340*	0.00282	0.00349*	0.00335*
	(0.00184)	(0.00194)	(0.00199)	(0.00195)
inst_distance	0.0122			0.0128
	(0.0110)			(0.0112)
target_coc		-0.409**	-0.839**	-0.863***
		(0.202)	(0.330)	(0.335)
s_corr			0.0326	0.0355*
			(0.0207)	(0.0213)
Constant	-24.53***	-24.74***	-24.38***	-23.55**
	(9.467)	(9.468)	(9.385)	(9.307)
Observations	17,412	17,412	17,412	17,412

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6: Correlation Matrix

	inflow	gdp_t	Gdo_o	ln_dist	contig	comlan~f	colony	openness	Agglo_t	t_go~100	Fin_cri	Inflation	Shadow_t	Shadow_	S_inf	S_cri	s_go~100
inflow	1																
ln_target_gdp	0.2024	1															
ln_origin_gdp	0.1912	-0.0174	1														
ln_dist	-0.0708	0.1128	0.1349	1													
Contig	0.1096	0.0605	0.0308	-0.4402	1												
comlang_off	0.1774	0.1168	0.1017	-0.0026	0.2858	1											
colony	0.1175	0.0682	0.0526	-0.0525	0.2131	0.3462	1										
openness	-0.0372	-0.5222	0.069	-0.2803	0.026	-0.0446	-0.0689	1									
ln_agglo_targ	0.2418	0.8209	0.0333	0.0249	0.0662	0.1693	0.0581	-0.127	1								
t_gov_100	-0.1213	-0.5046	0.0282	-0.1968	-0.0275	-0.1896	-0.0274	0.4201	-0.3499	1							
target_fin	0.0444	0.0225	0.0581	-0.0268	-0.0074	0.0251	0.0069	0.0957	0.1201	0.0744	1						
target_inf	-0.0362	-0.1029	-0.0184	0.0204	-0.0209	-0.048	0.0015	-0.1304	-0.2057	-0.0258	-0.0237	1					
shadow_targ	-0.1452	-0.2315	-0.0598	0.0618	-0.0704	-0.1712	-0.0478	-0.0769	-0.3761	0.135	-0.0851	0.4229	1				
shadow_orig	-0.1527	0.0063	-0.298	0.0229	-0.0464	-0.1268	-0.0224	-0.0469	-0.0305	-0.041	-0.0588	0.0179	0.0345	1			
S_inf	-0.0395	-0.0797	-0.02	0.0239	-0.0215	-0.0498	-0.0019	-0.1355	-0.1922	-0.0407	-0.0447	0.9902	0.4525	0.0168	1		
S_cri	0.0141	-0.0367	0.0536	-0.038	-0.0088	-0.0031	-0.0033	0.118	0.0478	0.1285	0.9401	-0.0188	0.0014	-0.053	-0.0345	1	
s_gov_100	-0.1587	-0.4587	-0.0213	-0.0823	-0.0558	-0.2115	-0.0512	0.1944	-0.4695	0.6451	-0.0136	0.2903	0.8147	0.0001	0.3022	0.0854	1

Table 7: List of countries

Australia	Korea, Republic of
Austria	Latvia
Belgium	Lithuania
Canada	Mexico
Chile	Netherlands
Czech Republic	New Zealand
Denmark	Norway
Estonia	Poland
Finland	Portugal
France	Slovakia
Germany	Slovenia
Greece	Spain
Hungary	Sweden
Iceland	Switzerland
Ireland	Turkey
Israel	United Kingdom
Italy	United States
Japan	

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