Timing in international treaties to fight illicit financial outflows from developing countries: Evidence using a DID with multiple time periods.

Work in progress: version 22/11/2020

Nibontenin Yeo [ab] Michaël Goujon [a]

[a] Université Clermont Auvergne, CNRS, IRD, CERDI, France

[b] Corresponding author

Abstract

Although numerous jurisdictions cooperate to fight illicit financial flows, they have gained ground and become a real concern, particularly for developing countries suffering from outflows. In this paper, the causal effect of bilateral information exchange agreements on illicit financial outflows is explored on a sample of 88 developing countries over the period 2004-2013 using a new non-parametric method of Difference-in-Differences with multiple time periods, controlling for correlates of IFFs. We found that increasing cooperation is effective against illicit financial outflows, but only after at least three years under cooperation.

Keywords: Illicit Financial Flows, Information exchange agreements, Cooperation, Difference-in-Differences, Group time effect, Dynamic effect.

I-Introduction

According to the Global Financial Integrity, illicit financial outflows represent a cost of about US $1.26 trillion per year for emerging countries. They have significantly hindered domestic resources mobilization in developing countries for several decades (Kar and Spanjers, 2015), with detrimental consequences on macroeconomic stability and development outcomes. More broadly, corruption, smuggling, tax evasion, money laundering and terrorism financing are becoming a global concern (IMF, 2020). Over the past decades, many jurisdictions have joined efforts and several regional and international institutions have been established under separate agreements to combat and eradicate illicit financial flows (IFFs). The Global Forum on Transparency and Exchange of Information (GFT) is an international institution gathering 158 countries aiming to implement a transparency mechanism on tax and information exchange. With the same focus, the Financial Transparency Coalition (FTC) works for transparency, accountability, and a sustainable financial system, through country reports, automatic exchange of information, and data sharing. FTC argued that IFFs decrease the global economy by 4% each year, and the Sub-Saharan economy by 7.2% per year. The Centre for Budget and Governance Accountability (CBGA) analyses government policies towards transparency and accountability. Besides, the Financial Action Task Force (FATF), an inter-governmental body gathering more than 200 countries and territories worldwide, aims to prevent illegal financial activities. The FATF's actions are based on standards and recommendations to ensure a well-defined national legislature and set up a robust regulatory system to counter illicit financial activities in member countries. The European Union (EU) similarly developed an Anti-money laundering framework to promote cooperation against IFFs.

Last but not least, NGOs and other entities have engaged in advocacy against IFFs for poverty alleviation. For instance, Oxfam calls for strengthening trade regulation, correcting inconsistent tax policy, challenging collusion, and corporate greed. The Tax Justice Network, focusing on the role of tax havens, estimates global loss related to tax havens at $189 billion a year.

Bilateral cooperation to fight against international IFFs relies mostly on bilateral information exchange agreements, as part of the national anti-evasion policies. Bilateral information exchange agreements may take the forms of information-on-request, or information shared automatically that have been installed later. Information-on-request

agreements allow countries to request information related to IFFs from partner countries. Although numerous jurisdictions cooperate to fight illicit financial flows, they have gained ground and become a real concern, particularly for developing countries suffering from outflows.

IFFs channels are mutating on multiple forms, and the number of destination countries is increasing. Many small economies developed financial mechanisms such tax facilities and banking opacity to attract tax evaders. Tax havens or offshore financial centers have arisen during the last decades, in a highly competitive financial business operating under the weak global financial supervision. The recent development of digital technologies facilitate IFFs through money transfers online, mobile banking, cryptocurrency, e-commerce, etc.

The seemingly uncontrolled upward trend in IFFs, the development of tax havens and the increasing number of financial scandals raise the debate on the effectiveness of global and bilateral cooperation and actions to eradicate IFFs.

Previous studies on the effect of international cooperation on IFFs are usually based on simple regression techniques that would highlight correlations more than causation. To the best of our knowledge only one study (see eg., Casi, Spengel and Stage, 2020) employed a proper methodology by using event studies and difference-in-differences analysis. Moreover, usual approaches are typically static. Even if they stated that information exchange agreements are effective against IFFs, they do not reveal at which time horizon treaties become effective. Yet, the dynamic effect may depend on the length of cooperation but also be time and group-specific.

In this paper, we attempt to measure the dynamics in cooperation effect over time for a selected panel of emerging economies, by focusing on the length of exposure to cooperation and taking into account the time and group heterogeneity. We use a new non-parametric method of Difference-in-Differences with multiple time periods recently developed by Callaway and Sant'Anna (2020). The causal effect of bilateral information exchange agreements on IFFs is explored on a sample of 88 developing countries over the period 2004-2013.

The rest of the paper is divided as follows: section 2 reviews previous studies on IFFs and introduce how we attempt to fill some gaps. Section 3 presents the framework that

connects international cooperation and illicit financial flows. Section 4 and 5 presents the data and results of the tests of the model. Section 6 concludes with some recommendations.

II-Literature review

II-1-Defining and estimating IFFs

Over the past few decades characterized by financial crises, the academic literature on illicit financial activities has grown. Different definitions, concepts and methodologies are used to define and measure illicit funds (Aziani, 2018; OECD, 2014). This variety of approaches is firstly caused by the illegality and the multiple ways taken by fraud connected with financial activities (corruption, tax evasion, trade misinvoicing, money laundering, etc.). Kirchler and al. (2003) define tax evasion as individual and corporate illegal behavior related to income underreporting to minimize income tax. Such activities should be differentiated from tax avoidance, which is not always illegal. Strumpf (2017) illustrates tax optimization or tax avoidance practices by a case study on strategic plane owners. Cobham (2005) highlights domestic tax evasion from the shadow economy that is beyond the control of the tax administration. The author argues that the total cost of these leakages is around US$385 billion annually for developing countries. Moreover, IFFs related to tax evasion undermine development outcomes (Fuest and Riedel, 2010; Cerqueti and Coppier, 2011). In many developing countries, officials perceive bribery to deduce taxable income with important development damages (D'Souza, 2012). According to Huang and Li (2015) bribery leads to inefficiencies in government spending allocation because it may reduce investment dedicated to public infrastructures. Following the same ideas, Keefer and Khemani (2002) argue that corruption reduces the efficiency of government spending for economic development. Buchanan (2004) focuses on money laundering, i.e. making criminal profits legal through complex types of cross border transactions and numerous financial institutions. Schooner (2010) argues that money is laundered through three stages that consist of (i) placing criminal money in financial institutions, (ii) moving money in another country or financial institutions to hide its illicit origin, (iii) reinvesting money in other economic activities.

Originally, IFFs referred to capital flight, which embraces all financial flows leaving a territory for political matters or tax optimization purposes (World Bank, 2017). However,

this definition of IFFs would be misleading because money may fly following legal decisions and actions, such as pursuing higher investment returns or hedging currency risk (Tax Justice Network, 2020). Other attempts to define IFFs were consequently developed. For instance, the OECD (2014) considers IFFs as financial flows generated by methods, practices, and crimes used to transfer money abroad by breaking national and international laws. This last definition covers various IFFs such as money laundering, international bribery, and tax evasion.

Given the multiplicity of practices and the nature of illegality, measuring IFFs presents several challenges for researchers and policymakers. Collin (2019) reviewes different conceptual frameworks and identified eight methods used in the empirical literature for measuring IFFs. First, the balance-of-payment method or hot-money-narrow method is based on detecting abuse, fraud, or errors related to cross-border capital movements (Johannesen and Pirttilä, 2016; Kar and Spanjers, 2015; Henry, 2012). The trade gap analysis approach, mostly used by the Global Financial Integrity (GFI), estimates the gap in mirror statistics on the declared price and the quantity of goods between origin countries and destination countries (Nicolaou-Manias, 2016). This method is simple and easy to implement but gaps may also come from errors in recording prices and quantities or differences in tax administration systems (Nitsch, 2016; Collin, 2019).

Researchers also approximate IFFs with international portfolio and deposit data, using assets transferred in foreign countries that are not declared to tax authorities in the jurisdiction of origin. For example, Zucman (2013) computed the gap between portfolio liabilities and assets as an estimation of hidden assets located in tax havens that is considered as illicit. However, this method can also produce confounding estimates when gaps rely mostly on measurement errors. The gravity model that is widely used in empirical studies to estimate spatial relationships (Anderson, 2011), can be applied to estimate IFFs resulting in cross-border financial flows (see eg., Perez and al., 2012). Last, other methods are based on estimating criminal activities that are assumed to be correlated with money laundering.

II-2-Information sharing cooperation (agreements) and IFFs

Outward-oriented or free-trade based development strategies necessitate international cooperation. Cooperation is defined as a joint action to achieve common objectives (Paulo,

2014). Either it delivers aid or builds an environment that favors exchange and shares knowledge between nations, through treaties and conventions, and even policy structures – international organizations - that goes beyond nations. Cooperation can help to avoid conflict and combat all kinds of unfair economic strategies.

Studies have flourished to question the effects of international cooperation on IFFs. Numerous methods are employed to measure and evaluate the effectiveness of this cooperation. The majority of the studies test whether cooperation through treaties influences the IFFs when countries join a regional or international group and further at which scale treaties may decrease IFFs.

Many scholars have highlighted that information sharing cooperation fail to reduce IFFs or that it may only generate relocation into banks located in non-cooperative jurisdictions instead of reducing tax evasion overall. Huizinga and Nicode'me (2004) show a little impact on international tax evasion, explained by the incomplete coverage of anti-evasion policies. The same argument is provided by Johannesen and Zucman (2014) in evaluating the G20 tax haven crackdown, using data on cross-border bank deposits and tax treaties. They found a relocation effect of international deposits in jurisdictions that were least compliant with OECD information exchange standards. Kemme and Steigner (2017) find a weak effectiveness of information sharing cooperation to counter OECD resident tax evasion. Using a fixed effects estimator on panel data, the authors stated that higher tax rate influence positively tax evasion that cannot be stopped only with information exchange agreements. With the same perspective, Menkhoff and Miethe (2019) examine the impact of information exchange cooperation in curbing tax evasion. Based on bilateral bank deposit data, the authors argue that cooperation failed to curtail tax evasion in the long-run for two types of agreements (on-request and automatic exchange of information). In addition, their study suggests that tax evaders use new disguises to hide their fraudulent financial transactions in tax havens; revealing a new form of adaptation of criminal financial activities.

Oppositely, some researchers have brought evidence that information exchange is efficient to fight against IFFs. Kudrle (2016) analyzes different international tax regimes such as double taxation conventions and cooperation through information exchange aimed to combat harmful tax practices. He argues that the efforts of the OECD and the G-20 to curb tax evasion would be significantly effective. Heckemeyer and Hemmerich (2018) share the

same view. Using an OLS regression and a Poisson fixed effect model, the authors find that portfolio investments from tax haven decline after information exchange treaties. Beer and al., (2019) test the impact of automatic exchange of information on cross-border tax evasion using a finite mixture model. Based on bilateral deposit data their result confirm that automatic exchange of information reduce significantly deposits in offshore jurisdictions.

Similarly, Casi, Spengel and Stage (2020) state that automatic exchange of information reduces cross-border deposits in offshore financial centers by 11.5%. Contrary to many previous studies on the subject, they used a causal analysis to test information exchange effect on cross border tax evasion, through event studies and difference-in-differences analysis. Their approach seem more accurate for impact evaluation of treaties than regression analysis that would highlight correlation rather than causation.

However, the above-mentioned studies did not consider the relative heterogeneity of the effect of international cooperation on IFFs and time effects. Their approaches are relatively statics while it would seem relevant to consider the dynamic effect of such cooperation and understand at which time horizon treaties become effective.

Here we take into account the timing of the arrangement and the length of the cooperation, but also group-specific heterogeneity. We assume that the period at which a country signed an agreement is important because domestic or international environment, that change over time, may influence cooperation outcome (Strachan, 2018). For instance, effectiveness of actions against illicit traffic at a given time period may depend on the political context. Furthermore, during the 2008's financial crisis, the international environment changed considerably with the reactions of the Organization for Economic Cooperation and Development (OECD) and of the G20 that compelled tax havens to increase transparency (Johannesen and Zucman, 2014).

III-Empirical framework

We use a strategy that aims to capture how cooperation through bilateral agreements on information exchange affects IFFs dynamically, depending on variation in timing, the length of the cooperation, and group-specific heterogeneity. Using a non-linear function, we model that the outcome variable is influenced by the policy intervention and the time at which the policy is implemented, and other control variables (Callaway et al., 2020; Callaway and Sant'Anna, 2019; Goodman-bacon et al., 2018; Abraham and Sun, 2018; Gibbons and al., 2018).

$$Z_{it} = \varphi(X_{it}, T_i, W_{it}) \quad (1)$$

Z denotes the outcome value (IFFs outflows), with i is the group specific (countries) index and t is the time index. φ is a non-linear function. X represents the treatment variable, a binary variable taking one if a group is treated (under information exchange agreement) and zero otherwise. T denotes the period of the first treatment (signature of the information exchange agreement). W is a set of control variables.

We use Difference-in-Difference (DID) with multiple time periods to estimate the causal effect of information exchange agreement on IFFs. This estimation strategy presents some advantages over traditional DID, such as Smith and Todd (2005), Heckman and al., (1998) that use two times periods (before and after treatment) and two groups (control and treatment group), which does not account for the dynamic of treatment effect across time and heterogeneity within both groups. Although the DID with multiple time periods has advantages in estimating the causal effect for specific groups and across time, the accuracy of this estimation technic relies on the "parallel trends" assumption. Here, we consider the conditional parallel trend assumption. This assumption states that the path of outcomes that units in group i would have experienced if they had not participated in the treatment is the same as the path of outcomes shown by units in the untreated group, *after conditioning on observed covariates* (Callaway et al., 2020). Wald pre-test allows the rejection or acceptation of the null hypothesis of the parallel trends.

Here we consider heterogeneous groups among the treated at different time periods. The group-time average treatment effects measure the causal effect of the policy intervention for each group at different periods, as follows:

$$ATT(i,t) = \mathrm{E}[Z_t(1)\text{-}Z_t(0) \mid G_i\text{=}1] \quad (2)$$

Equation (2) expresses the gap between the expected values of the treated group(s) compared to the control group(s).

ATT is then the group-time average treatment effect representing the average treatment effect for a cluster of countries i at period t ; i is the cluster index of countries; t denotes the time at which the treatment effect is assessed.

Z_t (1) is the value of the outcome for the treated group(s) at period t

$Z_t(0)$ is the value of the outcome for the control group(s) at period t

G represents a binary variable that equals one if the country belongs to cluster i, being a group of countries that is treated for the first time at the same year

G_i=1 indicates conditions under which country belongs to a given cluster.

Then, we consider the group-time effects as the effect of the policy intervention on the outcome variable for each specific group at a given time. The aggregation of the different group-time average treatment effects for clusters and periods generates the average or overall treatment effect of treated (ATT). The aggregation is firstly done for all groups treated at a specific time t, and second, across all different periods considered. Among several computational methods of ATT, this study applies dynamic effects (Callaway and Sant'Anna, 2018; Abraham and Sun, 2018). The dynamic effects method highlights variations of the average treatment effects with a length of exposure to the treatment. We assume that the wider the length of exposure, countries remaining under bilateral agreements of information exchange, the more IFFs will decrease. So, the method mentioned above is used to test this hypothesis.

$$ATT\ (w) = \sum_t^T \sum_i^M \psi_i [ATT(i,t)] (3)$$

$$\text{Where, } w = t - i + 1 \ (4)$$

$ATT\ (w)$ is the average treatment effect of treated at exactly w exposure length.

ψ denotes the weight of each group cluster over a specific period of time.

M and T are the total numbers of clusters and periods respectively.

The overall treatment effect using the dynamic effect approach is then the aggregation of all $ATT\ (w)$:

$$ATT = \frac{1}{T-1}\sum_{w=1}^{T-1} ATT\ (w) \qquad (5)$$

IV-Data

Illicit financial flows (IFFs)

Researches on the impact of international cooperation against IFFs mostly use specific kinds of financial assets, such as bank deposits in a tax haven and foreign portfolio investment (see eg., Casi et al., 2020; Menkhoff and Miethe, 2019; Johannesen and Zucman, 2014; Kudrle, 2016; Heckemeyer and Hemmerich, 2018). These measurements may be biased because all deposits in banks located in tax havens are not illicit, as Abbott (2000) argues.

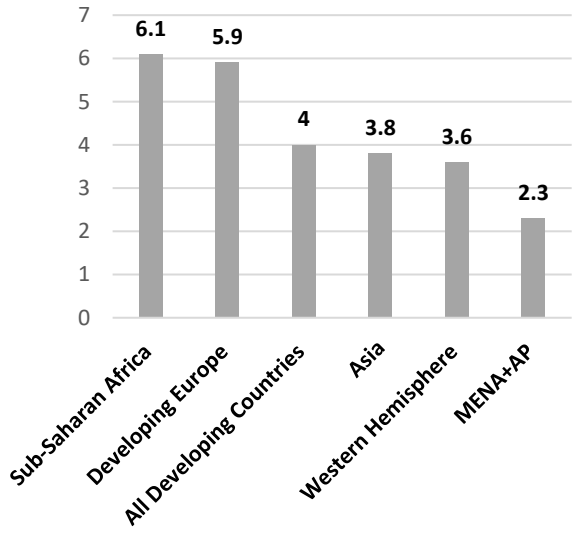
We collected IFFs data from the Global Financial Integrity (GFI) periodical reports. GFI estimates illicit financial outflows as deliberate misinvoicing in merchandise trade and leakage in the balance of payments using data from the International Monetary Fund (IMF). GFI estimates of IFFs cover various activities related to financial fraud (hidings the proceeds of crime, evading tariffs, taxes trough misreporting of transaction etc.). This large coverage makes such data suitable to study the effectiveness of cross-border information sharing. Forstater (2018a) argued that wider definitions of IFFs focus on not strictly illegal action like tax avoidance or strategic transfer pricing. Deliberate trade misinvoicing is a major channel of tax evasion and profit shifting (Cobham and Janský, 2017). The usage of GFI data has flourished in the recent academic literature (Forstater, 2018a , 2018b; Combes et al., 2019; Sow and Madden, 2020). They however only cover the period 2004-2013.

GFI's data on illegal financial outflows from developing countries show that Asia is the first region of origin with 38.8% of total IFFs from developing countries, followed by developing Europe at 25.5% (Kar and Spanjers, 2015). Five of the top ten countries of origin of the IFFs are located in Asia (China, India, Thailand, Indonesia, Malaysia). From 2004 to 2013, about 1.4 billion of dollars US flighted out from China. In developing Europe, Russia experienced

the highest capital flight with at least 1 billion dollars US. In the Western Hemisphere, Mexico heads with about 52.8 million dollars US. South-Africa is the top Sub-Sahara African country with about 20 million dollars US.

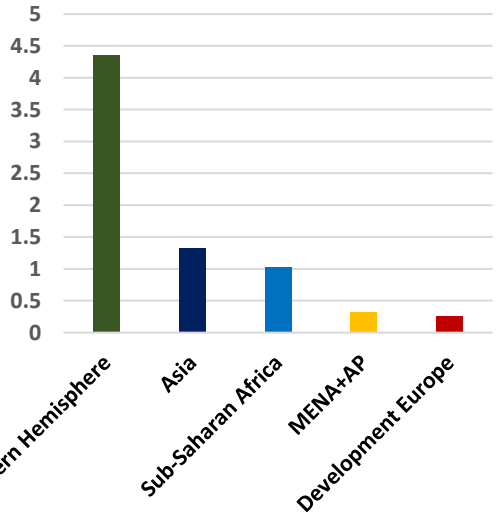
However, in percent of GDP, Sub-Saharan Africa and the Developing Europe are the most affected with respectively an equivalent of 6.1% and 5.9% of GDP from 2004 to 2013 (Figure 1).

Figure 1: Avearge Illicit Financial Flows (%GDP) by Regions



Source: GFI (2015) "IFFs from Developing Countries: 2004-2013

Figure 2: Average of information exchange agreements signed per country by region



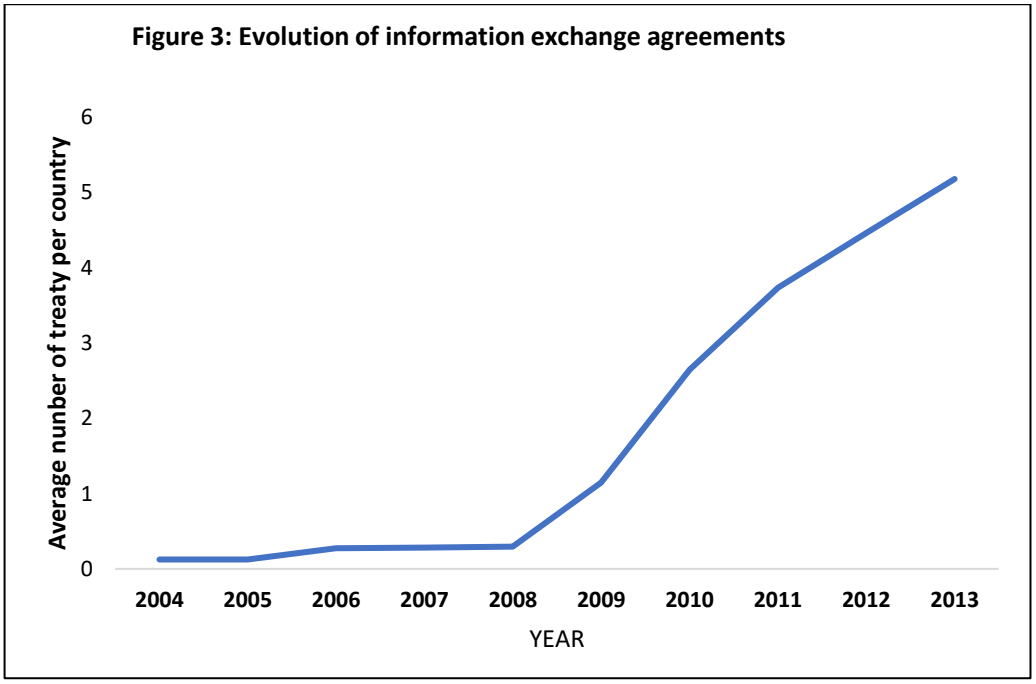
Source: OECD's Exchange of information portal

Information exchange agreements (IEAs)

International cooperation between selected countries is proxied by bilateral information exchange agreements collected from the Organization for Economic Cooperation and Development (OECD) database.

The OECD data on bilateral information exchange agreements covers information-on-request or information shared automatically. Here, the data used corresponds to the exchange of information on request (IEA). These agreements allow countries to request information related to IFFs from partner countries. IEA is a dummy variable equal to one if

a selected country signed a bilateral treaty and zero if not. We choose IEA rather than automatic exchange of information because most of the countries of our sample are not committed to automatic sharing of information, and this tool was initiated only in 2017.



Source: OECD's Exchange of information

Figure 3 above presents the evolution of information sharing agreements for 88 developing countries, measured as the average number of treaties per country, over the period 2004-2013. Information exchange cooperation increased insignificantly from 2004 to 2008. However, data show an important upward trend in cooperation from 2008 to 2013. Policymakers and researchers related this increased number of agreements to the international agenda against illicit financial activities after the 2008 financial crisis. In fact, more transparency was advocated as a panacea to curtail tax evasion and other illicit transactions. For instance, the OECD urge its country members to sign at least 12 treaties with other jurisdictions. Furthermore, non-comparative jurisdictions were systematically blacklisted. This initiative of the OECD aimed to put an end to illicit financial flows towards offshore financial center.

Figures 1 and 2 indicate that countries with few treaties experienced high IFFs in share of GDP. More precisely, the Western Hemisphere has the highest average of treaty per country (4.3 treaties) followed by Asia (1.3 treaties) and Sub-Saharan Africa (1.02 treaties). In average, countries in Developing Europe and MENA+P have signed less than 1 treaty. Of

the six regions, Sub-Saharan Africa and Developing Europe respectively rank 1st and 2nd regarding the amount of IFFs in percent of GDP and present the smallest number of treaties (ranking respectively 4th and 6th).

Additional control variables

Other covariates of IFFs, or control variables, are used as conditions for the parallel trends assumption to hold. GDP growth (GDPGTH) in the origin country is likely to prevent capital flight and decrease IFFs. IFFs may be generated by rent from natural resources (RESSRENTE) as suggested by the works on capital flight from Tanaka (2020), Muhanji and al., (2019), Ndikumana and Sarr (2019), Sovacool (2016). Following Hermes and Lensink (2001) and Lensink and al., (2000), inflation (INFL) is used as an indicator of macroeconomic stability and price distortions that may cause IFFs. Foreign direct investment inflows (FDI) can proxy the attractiveness of a country business environment and may appear to be a significant determinant for IFFs. Perez et al. (2012) find that FDI has a facilitating role in money laundering and illegal capital flight in transition economies. GDPGTH, RESSRENTE, INFL and FDI data are from the World Development Indicators database (WDI).

Besides information exchange, the degree of freedom or restrictions on the cross-border movements of capital can impact IFFs. We use an updated version of the Chinn-Ito index of financial openness or of country degree of capital account openness (KAOPEN) (Chinn and Ito, 2006).

The quality of the governance, institutions and policies in the country of origin may also influence IFFs outflows. The World Bank Institute published the Worldwide Governance indicators (WGI), six well-known indicators to measure governance. We select the indicators of political stability (PVE) and control of corruption (CCE). PVE measures the perceptions of the likelihood of political instability and politically motivated violence, including terrorism. While CCE captures perceptions of the extent to which public power is exercised for private gain. These indicators are ranged from -2.5 (worst governance) to 2.5 (best governance).

Sample

Data covers 88 developing countries from Africa, Asia, Europe, and Latin America over 2004-2013. These countries are selected based on data availability of the main variables IFFs and IEAs. The sample is first divided into two groups, the treated group and the control group. The control group sample comprises 45 countries that have never been involved in cooperation through IEAs. 43 are treated countries that have signed agreements with other jurisdictions at different years. We define three clusters-periods: 13 countries signed their first IEAs over 2004-2007, 16 countries over 2009-2010 and 14 over 2011-2013 (Figure 4).

The clusters-periods are designed in order to get a minimum of observations in the treated groups to compute the treatment effect using DID with multiple time periods. For instance, only Argentina signed its first treaty in 2004 and Brazil, Costa Rica, Guatemala, and El Salvador signed in 2006. They are grouped into the cluster 2004-2007. Countries that signed their first treaty before 2004 such as Aruba, Antigua, and Barbuda or Columbia, also join the 2004-2007 treated group. On the other side, countries that have signed their first treaty after 2014 (for instance the United Arab Emirates and Bulgaria that signed their first treaty in 2015) are part of the "control group" because they have not signed any treaty for the entire study period. Cluster 1 is group of countries with first treaty between 2004-2007, cluster 2 is group of countries with first treaty between 2009-2011 and cluster 3 is group of countries with first treaty between 2011-2013.

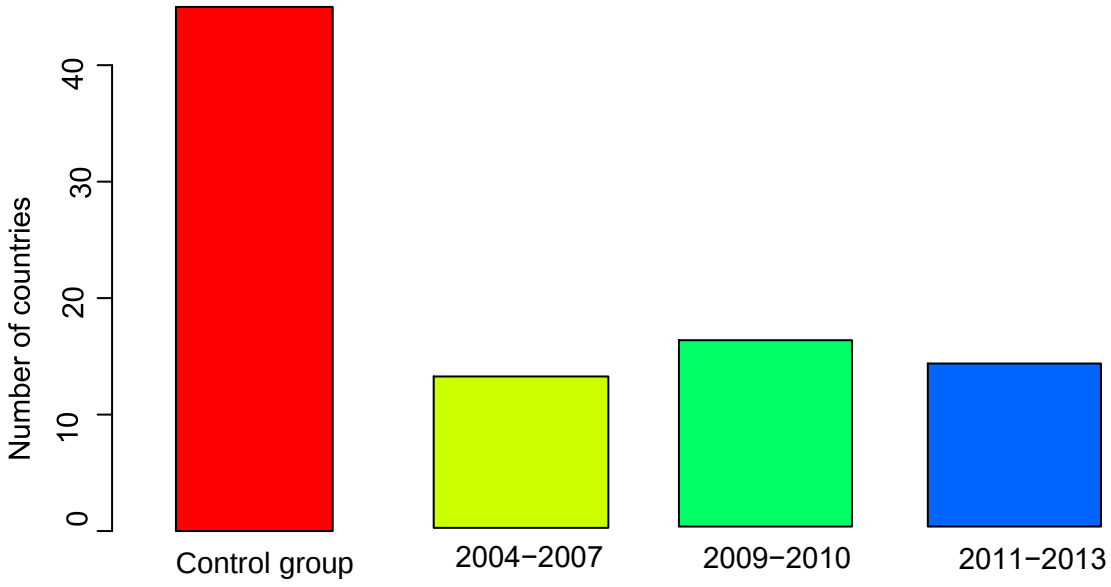
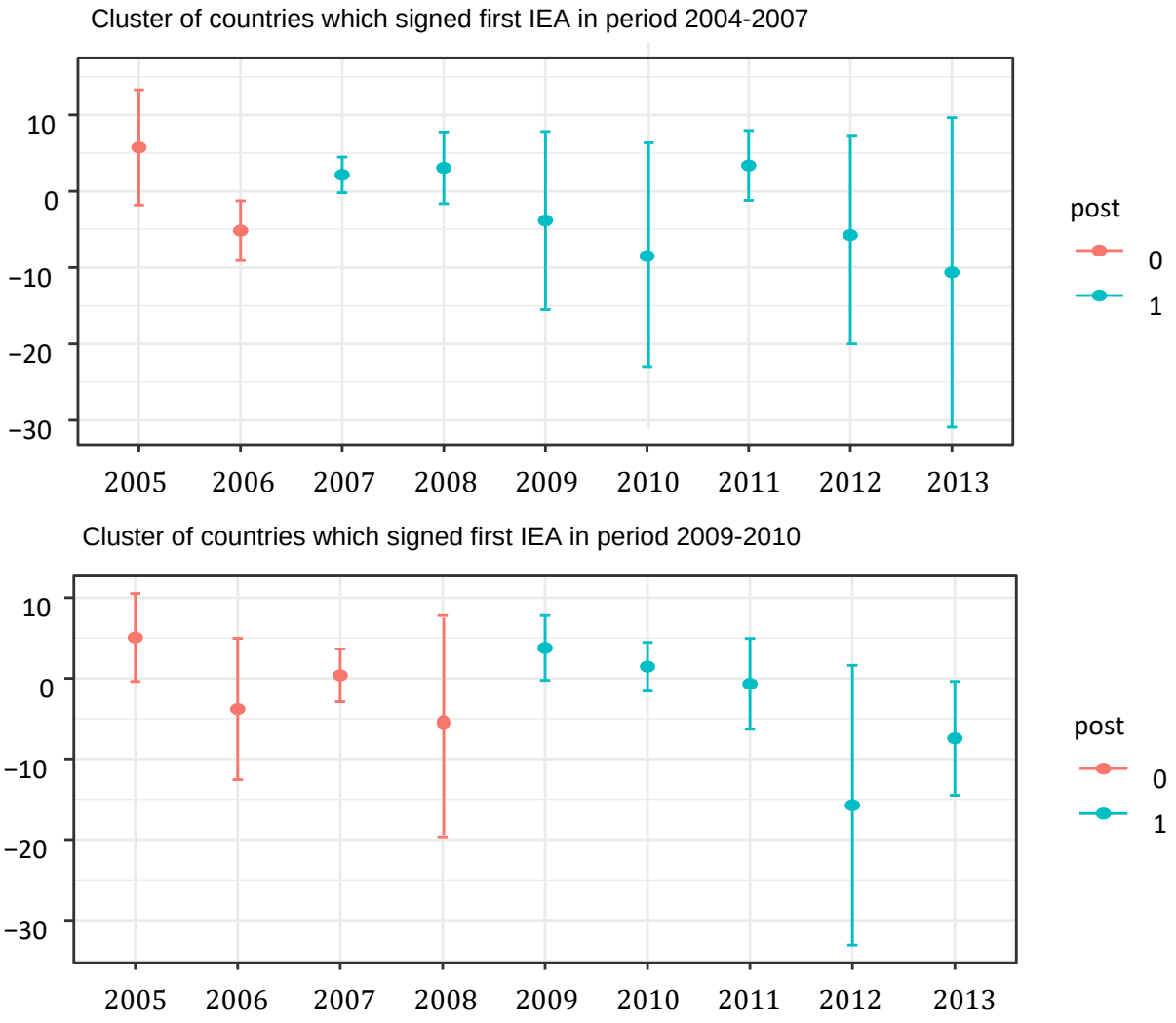


Figure 4: Sample size for each group according to year of signature of the first treaty

V-Results

The result of the Wald pre-test of the parallel trends assumption provides a p-value of 0.66, meaning that we fail to reject the hypothesis that the trend of IFFs for treated group and control group would have been the same if the treated had not signed any agreement. This also confirms that the chosen estimation method is relevant.

Figure 5 displays the estimates of the yearly Average Treatment Effect of the Treated (ATT) for the three clusters (2004-2007; 2008-2009; 2011-2013), under the parallel trend assumption, i.e. when controlling for different covariates which are assumed to influence IFFs. Red and blue lines report estimates of pre-treatment and of treatment within a 95% confident band.



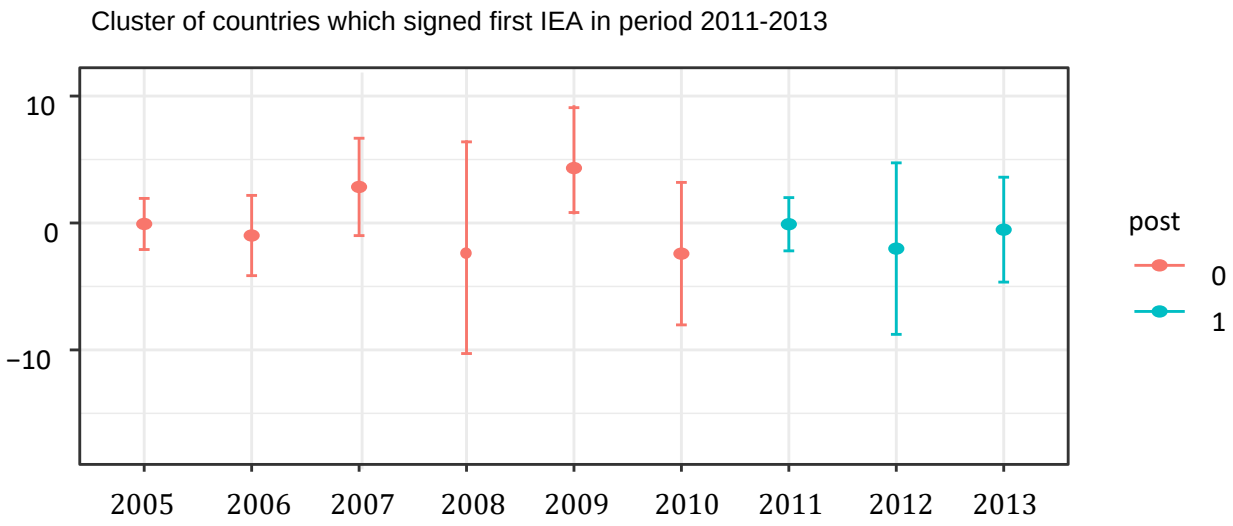


Figure 5. Group-Time Average Treatment Effects of IEAs on IFFs

For the clusters 2004-2007 and 2009-2011, the effect of IEAs on IFFs show a similar pattern over time with a negative impact at the fourth year after but are poorly significant on the whole period. For the cluster 2011-2013, the impact of IEAs is not significant during the first three years.

Table 1 and Figure 6 reports the 3-cluster average effects of IEAs against IFFs depending on the number of years after the first agreement. More precisely, considering the length of exposure, the fourth, fifth and seventh years show negative ATT that are significant at 5% or 10% level. The estimated effects indicate that one or two years after the signature of an agreement the amount of IFFs does not decrease. The negative impact of IEAs of IFFs appears only after the third year following the first agreement ($w = 3$). Nevertheless, this effect is not yet significant. Following the third year, the effect remain negative but become more significant. For instance, the IFFs decrease by 12 percentage points four years after the first agreement ($w = 4$). This effect is significant at 5% level. This suggest that treaties are effective when a country spends at least three years under cooperation.

Table 1. Average treatment effect by length of exposure

Dynamic Treatment Effects		
Length of treatment exposure (w)	***ATT (w)***	***SE***
1	**2.0192316**	**0.9120863****
2	0.8087342	1.844171
3	-1.586004	2.2152922
4	**-12.4866275**	**8.102213****
5	**-2.5916562**	**2.5497348***
6	-5.7497632	10.7427945
7	**-10.6267239**	**10.0838173***

***** 5% , * 10% significant level***

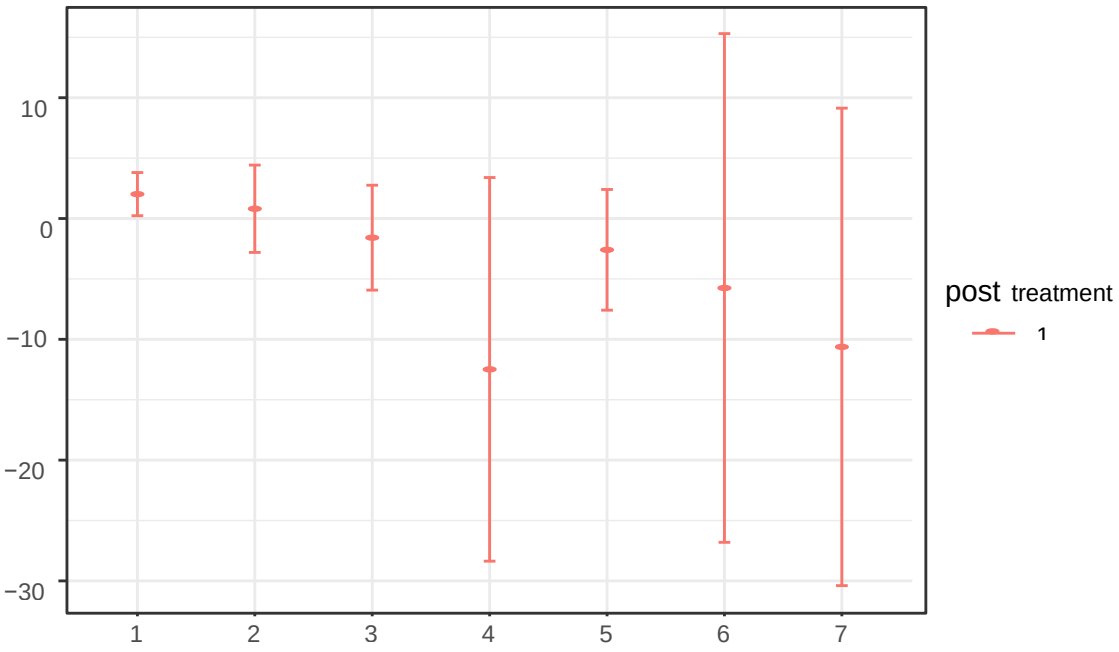


Figure 6. Average treatment effect by length of exposure to cooperation

The aggregated effect of IEAs on IFFs is estimated with the overall treatment effect (table 2), recalling that out of the 88 selected countries, 43 are treated countries and 45 non-treated countries (never been involved in cooperation through IEAs over the period). The overall ATT indicate that IEAs significantly decrease IFFs by about 4 percentage points. The algorithm used to compute these effects provides simultaneously the results for other

aggregation procedures available in the DID with multiple time periods package (simple, selective and calendar)[1]. As stated above, this paper use the dynamic procedure.

Table 2. Overall treatment effects

Overall Summary Measures of ATT	***ATT***	***SE***
Simple	-2.801691	3.242502
Selective	-2.54296	3.242502
Dynamic	**-4.316116**	**3.910179***
Calendar	-1.586031	2.489882

The results support a stability of the negative sign of the impact of IEAs on IFFs whatever the aggregation procedure. However, this global effect is significant only when we use the dynamic aggregation method. This implies that the heterogenous effects of IEAs on IFFs depend on the length of exposure to cooperation.

VI-Conclusion

International organizations and NGOs advocate more global transparency to combat illicit financial activities and many developed and developing countries have formed regional blocs or joined international cooperation for fighting IFFs. However, illicit funds channels are continuously spreading across the globe. Therefore, this raises questions about international cooperation's effectiveness.

This study applied a specific Difference-in-Differences (DID) estimation strategy to measure the causal effect of information exchange agreements (IEAs) on IFFs. The DID with multiple time periods allows us to estimate the dynamic effect regarding the number of years a country cooperate against IFFs and taking account of country heterogeneity. Tests are led on a sample of 88 developing countries over 2004-2013, that are gathered into three groups regarding the period of the settlement year of the first IEA (2004-2007, 2009-2010 and 2011-2013). Countries that had not signed any IEA (before and) over the whole period are the control, non-treated, group.

[1] Details about these procedures are available at Callaway and Sant'Anna (2020), Getting Start with the DID Package, July 04, 2020: https://bcallaway11.github.io/did/articles/multi-period-did.html

We found that IEAs are effective against IFFs. Signing an IEA allows a country to fight against IFFs outflows, but only after three years under the agreement and that the effectiveness increases with time.

Overall, for the set of treated countries, over the 2004-2013 period, cooperation through bilateral information exchange has decreased IFFs outflows by about 4%. This would indicate that countries should sign IEA to fight against IFFs but also that they should reduce the gap between treaties settlement and effective enforcement.

References

Abbott, J. (2000). Treasure island or desert island? Offshore finance and economic development in small island economies: The case of Labuan. *Development Policy Review*, *18*(2), 157–175. https://doi.org/10.1111/1467-7679.00105

Abraham, S., & Sun, L. (2018). Estimating Dynamic Treatment Effects in Event Studies With Heterogeneous Treatment Effects. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3158747

Anderson, J. E. (2011). The gravity model. *Annual Review of Economics*, *3*(May), 133–160. https://doi.org/10.1146/annurev-economics-111809-125114

Aziani, A. (2018). *Illicit Financial Flows An Innovative Approach to Estimation*. SPRINGER BRIEFS IN CRIMINOLOGY. *Springer International Publishing, 2018*

Beer, S., Maria, C., & Sébastien, L. (2019). Hidden Treasures: The Impact of Automatic Exchange of Information on Cross-Border Tax Evasion. *International Monetary Fund*, *JEL Classic*(IMF Working Paper Fiscal), 1–32.

Buchanan, B. (2004). Money laundering - A global obstacle. *Research in International Business and Finance*, *18*(1), 115–127. https://doi.org/10.1016/j.ribaf.2004.02.001

Callaway, B., C Sant, P. H., Bonhomme, S., Caetano, C., Calonico, S., Chen, X., … Xu and, H. (2020). Difference-in-Differences with Multiple Time Periods * "Difference-in-Differences with Multiple Time Periods and an Application on the Minimum Wage and Employment". We thank the Editor, the Associate Editor, two anonymous referees, 1–45. Retrieved from https://ssrn.com/abstract=3148250

Callaway, B., & Sant'Anna, P. H. C. (2019). Difference-in-Differences with Multiple Time Periods. *Working Paper*, 1–37. *Available at SSRN 3148250, 2019.*

Casi, E., Spengel, C., & Stage, B. M. B. (2020). Cross-border tax evasion after the common reporting standard: Game over? *Journal of Public Economics*, *190*, 104240. https://doi.org/10.1016/j.jpubeco.2020.104240

Cerqueti, R., & Coppier, R. (2011). Economic growth, corruption and tax evasion. *Economic Modelling*, *28*(1–2), 489–500. https://doi.org/10.1016/j.econmod.2010.07.006

Chinn, M. D., & Ito, H. (2006). What matters for financial development? Capital controls, institutions, and interactions. *Journal of Development Economics*, *81*(1), 163–192. https://doi.org/10.1016/j.jdeveco.2005.05.010

Cobham, A. (2005). Tax evasion, tax avoidance and development finance. *Queen Elizabeth House, Série documents de travail*, 129, 1-20..

Cobham, A., & Janský, P. (2017). WIDER Working Paper 2017 / 55 Global distribution of revenue loss from tax avoidance Re-estimation and country results, (March), 1–28. Retrieved from https://www.wider.unu.edu/publication/global-distribution-revenue-loss-tax-avoidance

Cobham, A., & Janský, P. (2017). Global distribution of revenue loss from tax avoidance. Cit, 09-20.

Collin, M. (2019). Illicit Financial Flows: Concepts, Measurement, and Evidence. *World Bank Research Observer*, *35*(1), 44–86. https://doi.org/10.1093/wbro/lkz007

Combes, J.L., Minea A. & Sawadogo P.N. (2019). Assessing the effects of combating illicit financial flows on domestic tax revenue mobilization in developing countries. *Etudes et Documents, 7, CERDI*

D'Souza, A. (2012). The OECD Anti-Bribery Convention: Changing the currents of trade. *Journal of Development Economics*, *97*(1), 73–87. https://doi.org/10.1016/j.jdeveco.2011.01.002

Forstater, M. (2018). Illicit financial flows, trade misinvoicing, and multinational tax avoidance: the same or different? *CGD Policy Paper*, (March). Retrieved from http://iffoadatabase.trustafrica.org/iff/illicit-financial-flows-trade-misinvoicing-and-multinational-tax-avoidance.pdf

Fuest, C., & Riedel, N. (2010). Taxe Evasion and Tax Avoidance in Devoloping Countries: The role of International Profit Shifting. *Centre for Business Taxation*.

Gibbons, C. E., Suárez Serrato, J. C., & Urbancic, M. B. (2018). Broken or Fixed Effects? *Journal of Econometric Methods*, *8*(1), 1–12. https://doi.org/10.1515/jem-2017-0002

Goodman-Bacon, A. (2018). Difference-in-differences with variation in treatment timing (No. w25018). *National Bureau of Economic Research*.

Heckemeyer, J. H., & Hemmerich, A. K. (2018). Information Exchange and Tax Haven Investment in OECD Securities Markets. *Available at SSRN 3029219*

Heckman, J. J., Lochner, L., & Taber, C. (1998). General Equilibrium Treatment Effects: A study of Tuition Policy. *National Bureau of Economic Research*, 1998.

Henry, J. S. (2012). The price of offshore revisited. *Tax Justice Network*, 22, 57-168..

Hermes, N., & Lensink, R. (2001). Capital flight and the uncertainty of government policies, *71*, 377–381. *Economics letters*, 71(3), 377-381.

Huang, H., & Li, Z. (2015). Procurement auctions with ex-ante endogenous bribery. *Economic Modelling*, *47*, 111–117. https://doi.org/10.1016/j.econmod.2015.02.017

Johannesen, N., & Pirttilä, J. (2016). Capital Flight and Development. An Overview of Concepts, Methods, and Data Sources. *WIDER Working Paper*, *2016/95*(August), 16.

Johannesen, N., & Zucman, G. (2014). The end of bank secrecy? An evaluation of the G20 tax haven crackdown. *American Economic Journal: Economic Policy*, *6*(1 B), 65–91. https://doi.org/10.1257/pol.6.1.65

Kar, D., & Spanjers, J. (2015). Illicit Financial Flows from Developing Countries: 2004-2013, (December), 72. Retrieved from http://www.gfintegrity.org/wp-content/uploads/2015/12/IFF-Update_2015-Final-1.pdf

Keefer, P., & Khemani, S. (2002). The Political Economy of Public Finance. *Trends in the Sciences*, *7*(11), 75–76. https://doi.org/10.5363/tits.7.11_75

Kirchler, E., Maciejovsky, B., & Schneider, F. (2003). Everyday representations of tax avoidance, tax evasion, and tax flight: Do legal differences matter? *Journal of Economic Psychology*, *24*(4), 535–553. https://doi.org/10.1016/S0167-4870(02)00164-2

Kudrle, R. T. (2015). Tax havens and the transparency wave of international tax legalization. U. Pa. J. Int'l L., 37, 1153.

Lensink, R., Hermes, N., & Murinde, V. (2000). Capital flight and political risk. *Journal of international Money and Finance*, 19(1), 73-92.

Menkhoff, L., & Miethe, J. (2019). Tax evasion in new disguise? Examining tax havens' international bank deposits. *Journal of Public Economics*, *176*, 53–78. https://doi.org/10.1016/j.jpubeco.2019.06.003

Muhanji, S., Ojah, K., & Soumaré, I. (2019). How do natural resource endowment and institutional quality influence the nexus between external indebtedness and welfare in Africa? *Economic Systems*, *43*(1), 77–98. https://doi.org/10.1016/j.ecosys.2018.08.005

Ndikumana, L., & Sarr, M. (2019). Capital flight, foreign direct investment and natural resources in Africa. *Resources Policy*, *63*(June), 101427. https://doi.org/10.1016/j.resourpol.2019.101427

Nicolaou-Manias, K., & Wu, Y. (2016). Trade mispricing for five African countries. *GEG Africa Policy Brief-ing, October, Global Economic Governance Africa. http://www. gegafrica. org/publications/trademispricing-for-five-african-countries..*

Nitsch, V. (2016). Trillion dollar estimate: Illicit financial flows from developing countries (No. 227). *Darmstadt Discussion Papers in Economics*.

Organisation for Economic Co-operation and Development. (2014). *Illicit Financial Flows from Developing Countries: Measuring OECD Responses*. OECD Publishing, 2014. https://doi.org/10.1787/9789264203501-en

Paulo, S. (2014). *International Cooperation and Development: A Conceptual Overview*. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.2430206

Perez, M. F., Brada, J. C., & Drabek, Z. (2012). Illicit money flows as motives for FDI. *Journal of Comparative Economics*, *40*(1), 108–126. https://doi.org/10.1016/j.jce.2011.03.007

Schooner, H. M., & Taylor, M. (2010). Global bank regulation: principles and policies/Heidi Mandanis Schooner, Michael W. Taylor.

Smith, J. A., & Todd, P. E. (2005). *Does matching overcome LaLonde's critique of nonexperimental estimators? Journal of Econometrics* (Vol. 125). https://doi.org/10.1016/j.jeconom.2004.04.011

Sovacool, B. K. (2016). Countering a corrupt oil boom: Energy justice, Natural Resource Funds, and São Tomé e Príncipe's Oil Revenue Management Law. *Environmental Science and Policy*, *55*, 196–207. https://doi.org/10.1016/j.envsci.2015.09.015

Strachan, A. (2018). Relationship between regional cooperation and political stability and prosperity.

Strumpf, K. (2012). *Tax Flights*. Lincoln Institute of Land Policy.

Tanaka, S. (2020). When tax incentives drive illicit behavior : The manipulation of fuel economy in the automobile industry ☆. *Journal of Environmental Economics and Management*, *104*, 102367. https://doi.org/10.1016/j.jeem.2020.102367

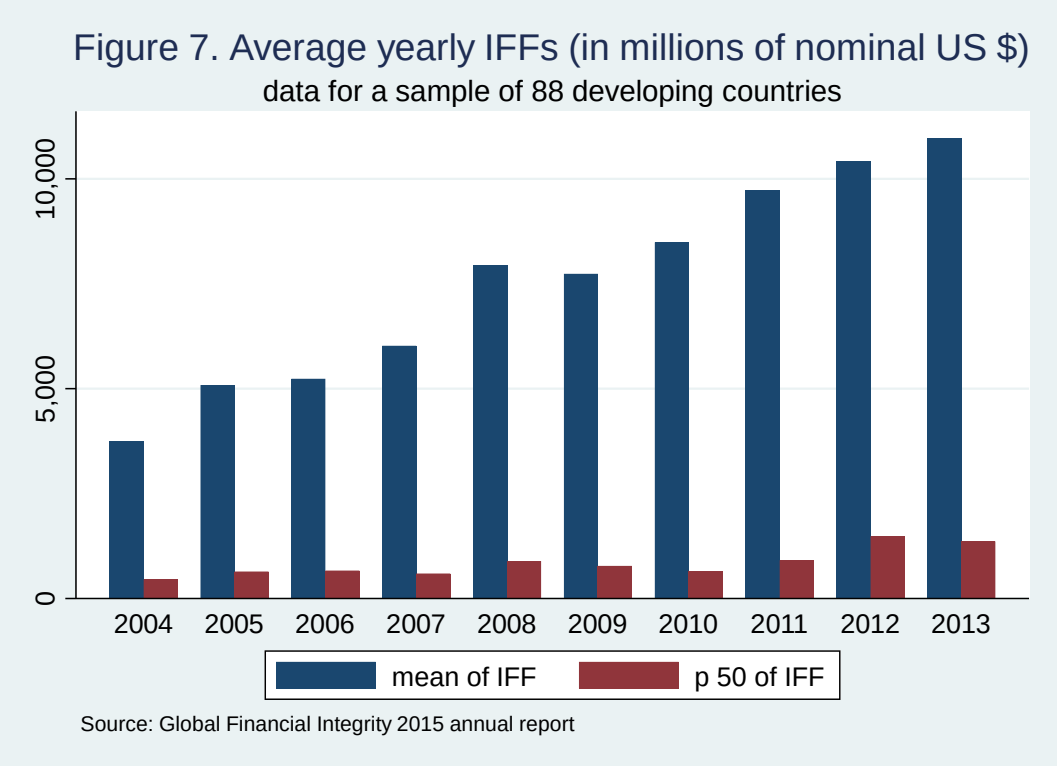
World Bank. (2017). The Word Bank - Annual Report 2017, 80. Retrieved from http://pubdocs.worldbank.org/en/908481507403754670/Annual-Report-2017-WBG.pdf

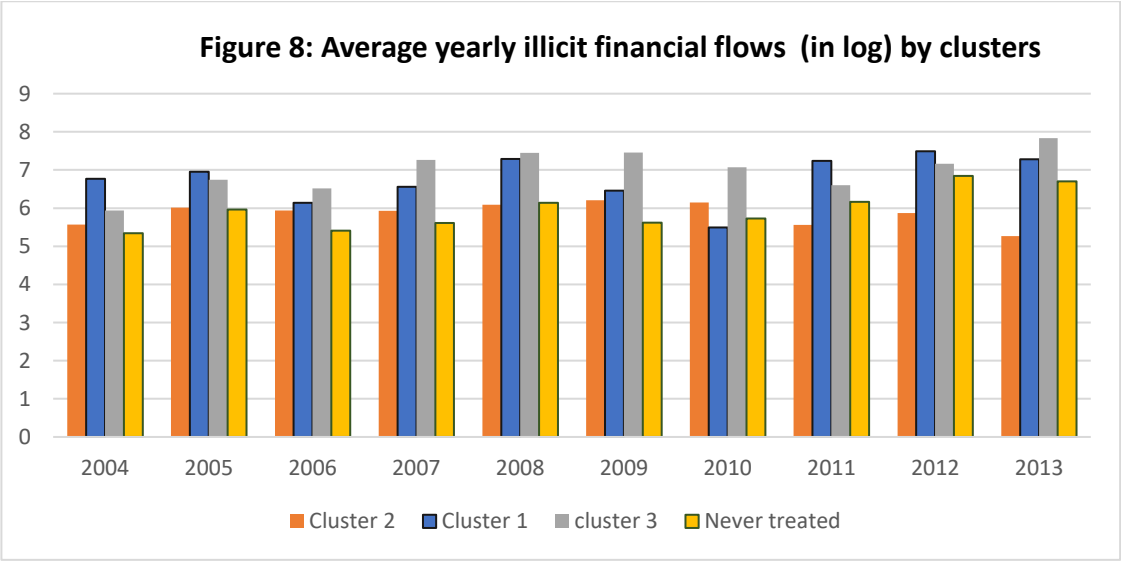
Zucman, G. (2013). THE MISSING WEALTH OF NATIONS : ARE EUROPE AND THE U . S . NET DEBTORS OR NET CREDITORS ? Author (s): Gabriel Zucman Source : The Quarterly Journal of Economics , Vol . 128 , No . 3 (August 2013), pp . 1321- Published by : Oxford University Press Stab, *128*(3), 1321–1364. https://doi.org/10.1093/qje/qjt012.Advance

https://www.imf.org/en/About/Factsheets/Sheets/2018/10/07/imf-and-the-fight-against-illicit-financial-flows#:~:text=Illicit%20financial%20flows%20(IFFs)%20refer,use%20(e.g.%20terrorist%20financing).

https://www.taxjustice.net/tag/illicit-financial-flows/

Appendix.





Source: Global Financial Integrity 2015 annual report

Table: 3 Group time average treatment effect of IEAs on IFFs

Group of treatment	*Time*	ATT_{it}	*SE*
2007	2005	5.7368671	4.016787
2007	2006	-5.1683907	2.072077
2007	2007	2.1474492	1.173134
2007	2008	3.0665782	2.389619
2007	2009	-3.8400888	5.934448
2007	2010	-8.4854062	10.974779
2007	2011	3.3764234	2.510293
2007	2012	-5.7497632	9.705153
2007	2013	-10.6267239	10.012834
2009	2005	5.0621344	3.137735
2009	2006	-3.8069322	4.300961
2009	2007	0.3736596	1.7791
2009	2008	-7.9387704	6.477167
2009	2009	3.7681284	1.909418
2009	2010	1.4489259	2.056814
2009	2011	-0.6822124	3.036721
2009	2012	-15.7376198	9.568868
2009	2013	-7.4407208	4.51219
2011	2005	-0.077575	1.106189
2011	2006	-0.9875846	1.656649
2011	2007	2.8413247	1.966725
2011	2008	-9.1935032	4.164218
2011	2009	6.510612	2.137682
2011	2010	-2.4161398	3.148419
2011	2011	-0.0985668	1.290463
2011	2012	-2.019483	3.93513
2011	2013	-0.5258298	2.469877

Table 4: Countries of the final sample

N°	Country	N°	Country	N°	Country	N°	Country
1	Aruba	23	Cape Verde	45	Kuwait	67	Poland
2	Albania	24	Costa Rica	46	Lebanon	68	Paraguay
3	United Arab Emirates	25	Djibouti	47	Liberia	69	Qatar
4	Argentina	26	Dominica	48	St. Lucia	70	Russian Federation
5	Armenia, Republic of	27	Dominican Republic	49	Lesotho	71	Rwanda
6	Antigua and Barbuda	28	Ecuador	50	Morocco	72	Saudi Arabia
7	Azerbaijan, Republic of	29	Egypt	51	Moldova	73	Senegal
8	Benin	30	Gabon	52	Madagascar	74	El Salvador
9	Burkina Faso	31	Georgia	53	Maldives	75	Seychelles
10	Bulgaria	32	Ghana	54	Mexico	76	Chad
11	Bahrain, Kingdom of	33	Grenada	55	Macedonia, FYR	77	Togo
12	Bahamas, The	34	Guatemala	56	Mongolia	78	Thailand
13	Bosnia and Herzegovina	35	Guyana	57	Mauritius	79	Trinidad and Tobago
14	Belize	36	Croatia	58	Malaysia	80	Tunisia
15	Brazil	37	Hungary	59	Niger	81	Turkey
16	Barbados	38	Indonesia	60	Nigeria	82	Tanzania
17	Botswana	39	India	61	Oman	83	Uganda
18	Chile	40	Jamaica	62	Pakistan	84	Ukraine
19	China, Mainland	41	Kazakhstan	63	Panama	85	Uruguay
20	Cote d'Ivoire	42	Kenya	64	Peru	86	St. Vincent and the Grenadines
21	Cameroon	43	Cambodia	65	Philippines	87	Samoa
22	Colombia	44	St. Kitts and Nevis	66	Papua New Guinea	88	South Africa

Table 5: Illicit Financial Outflows from the Top Ten Source Economies, 2004-2013 (Millions of nominal US dollars or in percent)

Rank	Country	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Cumulative	Average
1	China, Mainland	81,517	82,537	88,381	107,435	104,980	138,864	172,367	133,788	223,767	258,640	1,392,276	139,228
2	Russian Federation	46,064	53,322	66,333	81,237	107,756	125,062	136,622	183,501	129,545	120,331	1,049,772	104,977
3	Mexico	34,239	35,352	40,421	46,443	51,505	38,438	67,450	63,299	73,709	77,583	528,439	52,844
4	India	19,447	20,253	27,791	34,513	47,221	29,247	70,337	85,584	92,879	83,014	510,286	51,029
5	Malaysia	26,591	35,255	36,554	36,525	40,779	34,416	62,154	50,211	47,804	48,251	418,542	41,854
6	Brazil	15,741	17,171	10,599	16,430	21,926	22,061	30,770	31,057	32,727	28,185	226,667	22,667
7	South Africa	12,137	13,599	12,864	27,292	22,539	29,589	24,613	23,028	26,138	17,421	209,219	20,922
8	Thailand	7,113	11,920	11,429	10,348	20,486	14,687	24,100	27,442	31,271	32,971	191,768	19,177
9	Indonesia	18,466	13,290	15,995	18,354	27,237	20,547	14,646	18,292	19,248	14,633	180,710	18,071
10	Nigeria	1,680	17,867	19,160	19,335	24,192	26,377	19,376	18,321	4,998	26,735	178,040	17,804
Total of Top 10		262,994	300,565	329,526	397,912	468,623	479,289	622,435	634,524	682,086	707,765	4,885,718	488,572
Top 10 as Percent of Total		56.50%	57.30%	60.60%	56.90%	56.60%	64.20%	68.70%	63.00%	65.80%	64.90%	62.30%	
Developing World Total		465,269	524,588	543,524	699,145	827,959	747,026	906,631	1,007,744	1,035,904	1,090,130	7,847,921	784,792

Source: GFI, 2015 " Illicit financial flows from developing countries 2004-2013"