

# Effect of volatility of foreign direct investment inflows on corporate income tax revenue volatility

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## Abstract

**Purpose** – This paper aims to examine how the volatility of foreign direct investment (FDI) inflows affects the volatility of corporate income tax revenue.

**Design/methodology/approach** – The study has used an unbalanced panel data set of 129 countries over the period 1981–2016 and the two-step system generalized methods of moment approach to perform the empirical analysis.

**Findings** – The main findings are that FDI volatility enhances the volatility of corporate income tax revenue in less advanced economies, but reduces it in relatively advanced countries. The positive corporate income tax revenue volatility effect of FDI inflows is far higher in non-tax haven countries than in tax haven countries. Additionally, FDI volatility exerts a higher positive effect on corporate income tax revenue volatility as countries experience greater dependence on natural resources. Finally, the positive effect of FDI volatility on corporate income tax revenue volatility is further amplified by higher FDI volatility.

**Research limitations/implications** – One important limitation of the present analysis is the use of aggregate FDI inflows because of the lack of data over a long period on greenfield FDI inflows and cross-border mergers and acquisitions FDI inflows. Therefore, an avenue for future research could be to explore separately the effect of the volatility greenfield FDI inflows and the volatility of cross-border mergers and acquisitions FDI inflows on the volatility of corporate income tax revenue, when long-time series data (covering many countries) would be available.

**Practical implications** – These outcomes particularly shed light on the role of FDI volatility on the volatility of corporate income tax revenue, particularly in countries that are highly dependent on natural resources. Foreign capital flows, notably FDI flows, play an essential role for countries' economic development through, inter alia, technology transfer, jobs creation and economic growth. Policymakers should aim to attract FDI, while also reducing their volatility, by designing and implementing policies and measures (such as those in favor of business environment improvement, property rights enforcement and political stability) that would assure foreign investors of the continuous high returns of their investments.

**Originality/value** – To the best of the author's knowledge, this is the first time this topic is being addressed empirically in the literature.

**Keywords** Corporate income tax revenue volatility, FDI volatility

**Paper type** Research paper



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**JEL classification** – F2, H1, H2

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## 1. Introduction

Much work has been performed on the effect of foreign direct investment (FDI) on host-countries' economic growth and development. In particular, some studies have explored the effect of FDI inflows on public revenue (Aslam, 2015; Bayar and Ozturk, 2018; Camara, 2019; Gnangnon, 2017; Okey and Nézan, 2013; Raff and Srinivasan, 1998), and notably on corporate income tax revenue (Gnangnon, 2017; Gropp and Kostial, 2000, 2001; Janský and Palanský, 2019; Nguyen *et al.*, 2014). However, to the best of our knowledge, the effect of FDI volatility on corporate tax revenue volatility has not been investigated in the literature, even though some studies have been conducted on the macroeconomic effect of FDI volatility (Lensink and Morrissey, 2006). The present paper aims to fill this gap in the literature by investigating the effect of the volatility of FDI inflows on corporate income tax revenue volatility. Addressing this topic is all the more relevant that FDI volatility is closely related to economic growth and development. For example, Choong and Liew (2009) and Lensink and Morrissey (2006) have reported that FDI volatility has exerted a negative effect on economic growth. In contrast, Bairagi (2017) has uncovered that the positive conditional volatility of FDI (because of innovative shocks or policy innovations) has positively affected economic growth and development in the Indian subcontinent. On another note, the instability of tax revenue, including of corporate income tax revenue can be associated with public expenditure volatility (Bleaney *et al.*, 1995; Ebeke and Ehrhart, 2012), which could in turn be detrimental to economic growth (Afonso and Furceri, 2010; Afonso and Jalles, 2012; Gong and Zou, 2002).

The analysis concerning the effect of FDI inflows volatility on corporate income tax revenue volatility has been performed using a panel data set of 129 countries (including both developed and developing countries) over the period 1981–2016. Results based on the two-step system generalized methods of moment (GMM) approach, have indicated that FDI volatility induces a higher volatility of corporate income tax revenue, with less advanced economies experiencing a higher corporate income tax revenue volatility effect of FDI volatility than do relatively more advanced countries. Moreover, we obtain that FDI volatility is associated with an increase in the volatility of corporate income tax revenue in countries that experience a greater dependence on natural resource rents.

The rest of the paper is structured as follows. Section 2 discusses how FDI volatility can influence corporate tax revenue volatility. Section 3 presents the model that helps investigate the issue under analysis. Section 4 discusses the appropriate econometric approach to estimate this model. Section 5 interprets empirical outcomes. Section 6 concludes the paper.

## 2. Discussion on the effect of foreign direct investment volatility on corporate tax revenue volatility

The effect of the volatility of FDI inflows on corporate income tax revenue volatility may not be straightforward. On the one hand, as FDI inflows can enlarge corporate income tax base through the entry of new firms or a rise in new investments by foreign investors (Gnangnon, 2017; Gropp and Kostial, 2000, 2001; Nguyen *et al.*, 2014), one can expect variability in FDI inflows to induce an instability of the corporate income tax base, and hence corporate income tax revenue volatility. In particular, volatility in FDI inflows would translate into the volatility of multinational firms' profits in the host country, and in turn, lead to a rise in the volatility of corporate income tax revenue. Meanwhile, in many developing countries, foreign investors are granted many tax incentives [e.g. free economic zones in which goods are in general exempt from duties and taxes, and where corporate taxes are low or zero – see Zee *et al.* (2002) and Fuest and Riedel (2009)]. This is particularly the case for countries that

are highly dependent on natural resources (Gajigo *et al.*, 2012). As a result, FDI inflows volatility might not significantly affect corporate income tax revenue volatility. Furthermore, in light of the positive effect of FDI flows on local firms, including through backward and forward linkages (Alguacil *et al.*, 2011; De Mello Jr, 1997; Figlio and Blonigen, 2000; Konara and Wei, 2017), one can expect that FDI inflows volatility would translate not only into the volatility of multinational firms' profits, but also into the volatility of domestic firms' profits. These two effects would, together, enhance the volatility of corporate income tax revenue. Finally, multinational firms could also engage in significant profit-shifting activities, including through the channels of debt shifting (Fuest *et al.*, 2011; Huizinga and Laeven, 2008), the location of intangible assets (Bryan *et al.*, 2017; Seabrooke and Wigan, 2015; Taylor *et al.*, 2015) and strategic transfer pricing (Davies *et al.*, 2018a; OECD, 2017; Peralta *et al.*, 2006). As a result, we can also expect that the volatility of FDI inflows in the host-country may induce a significant variability of corporate income tax revenue. This is particularly because of the fact that profit-shifting can lead to significant tax revenue losses, including corporate tax revenue losses (Janský and Palanský, 2019). Summing-up this discussion, we can expect FDI inflows volatility to lead to a higher volatility of corporate income tax revenue volatility, with this effect being higher in less advanced economies (such as developing countries) than in relatively advanced countries (such as more developed countries).

On the other hand, we would like to note that the present analysis has used data on aggregate FDI inflows, collected from the database of the United Nations Conference on Trade and Development (UNCTAD). The data set on aggregate FDI inflows includes not only the two main modes through which FDI inflows occur (i.e. greenfield FDI inflows and cross-border mergers and acquisitions) (Davies *et al.*, 2018b), but also reinvestments of earnings and debt. Statistics have shown that the bulk of greenfield FDI is hosted by developing countries, while developed countries are recipients of the majority of FDI in the form of cross-border mergers and acquisitions (Davies *et al.*, 2018b; Carril-Caccia and Pavlova, 2018). For example, according to Carril-Caccia and Pavlova (2018), in 2016 [1], nearly 21,000 FDI projects took place, with a volume of almost US\$1.8tn. Out of these projects, 215 cross-border mergers and acquisitions deals accounted for 55% of the total volume.

While aggregate FDI flows can vary over time, this does not necessarily mean that the tax base, in particular the corporate income tax base, is consistently affected by ups and downs changes in FDI inflows. In fact, the variability of FDI inflows from one year to another year does not necessarily signify that the economic activity of multinationals is also volatile, and consequently that the corporate income tax base is volatile. Specially, a lower volume of FDI inflows might not result in the shrinking of the corporate income tax base. Additionally, some studies (Becker and Fuest, 2010; Hebous *et al.*, 2011; Swenson, 2001) have shown that because host country taxes are capitalized in acquisition prices, greenfield FDI is more sensitive to taxes than FDI in the form of cross-border mergers and acquisitions. Mutti and Gruber (2004) have also shown empirically that foreign operations by multinationals of the USA geared toward export markets, rather than the domestic market, are particularly sensitive to host country taxation. This sensitivity is not only higher in developing countries than developed countries, but it also increases over time. Along the same line, Shirodkar and Konara (2017, p. 117) have confirmed the possible negative effect of the tax rate in the host country on subsidiary profit. Incidentally, not all FDI inflows are the outcomes of the creation of a new subsidiary in the host country, and cross-border merger and acquisitions that a country receives does not necessarily affect targeted firms' economic activities and their tax payments. In a nutshell, FDI inflows are not a proxy for multinationals' economic

activity through time, but could be used at best, as a proxy for the investment decisions of multinationals that start an economic activity.

If aggregate FDI inflows reflect much more large cross-border mergers and acquisitions transactions in value (than greenfield FDI), it is possible that the corporate income tax base would not experience significant variability further to changes in aggregate FDI inflows, as such changes would be driven by variations in cross-border mergers and acquisitions FDI rather than greenfield FDI inflows. In contrast, if changes in aggregate FDI inflows are mainly driven by changes in greenfield FDI inflows, then the corporate income tax base could be severely affected and experience a significant volatility. The relationship between FDI inflows and corporate income tax volatility would be particularly significant in the event of disinvestment (i.e. when FDI values become negative): for example, positive values of greenfield FDI inflows would clearly entail greater economic activity in the host country and definitely affect the corporate income tax base. In contrast, negative [2] greenfield FDI inflows would be associated with a decline in economic activity and induce a shrinking of the corporate income tax base.

Overall, we hypothesize here that changes in FDI inflows driven by variations in cross-border mergers and acquisitions might not induce greater corporate income tax revenue volatility, whereas changes in FDI inflows driven by significant ups and downs movements of greenfield FDI inflows (including from positive to negative values or vice versa) would likely trigger significant volatility of corporate income tax revenue. As we will see later, the empirical analysis in the present paper covers the period 1981–2016. Unfortunately, the available data set on cross-border mergers and acquisitions FDI starts from 2000s, and therefore, prevents us from separating the effect of greenfield FDI inflows from that of cross-border mergers and acquisitions FDI inflows on corporate income tax revenue volatility, if we were to carry out the study over the period 1981–2016. Therefore, one limit of the paper is the use of aggregate FDI inflows, which includes not only greenfield FDI and cross-border mergers and acquisitions FDI, but also debt and reinvestments of earnings.

On another note, we can hypothesize that countries that are highly endowed with natural resources (endowment in natural resources is measured by the share of total natural resource rents in gross domestic product [GDP] of the FDI's host-country) would likely experience a higher volatility of corporate income tax revenue than countries relatively less endowed with natural resources [3]. This is because the latter countries do not have the administrative capacity to control the profit-shifting activities of multinational firms, and this can exacerbate the instability of corporate income tax revenue.

### 3. Empirical model

Building on the studies that have examined the determinants of tax revenue instability (Gnangnon, 2020; Gnangnon and Brun, 2019; Bleaney *et al.*, 1995; Ebeke, 2014; Ebeke and Ehrhart, 2012; Lim, 1983), we postulate a model specification that includes in addition to the main variable of interest (i.e. the volatility of FDI inflows), other factors that can influence the effect of FDI inflows volatility on corporate income tax revenue volatility. These factors include the volatility of the economic growth rate, denoted “GRVOL”; trade openness, denoted “TROPEN”; financial openness, denoted “FINOPEN”; the institutional quality proxied by the level of democratization, denoted “POLITY2”; the inflation volatility, denoted “INFLVOL”; and the real per capita income, denoted “GDPC”, which acts as a proxy for the development level. The computation of each of these variables is described in [Appendix 1](#).

In light of the foregoing, we consider the following model:

$$\begin{aligned}
\text{Log}(CTAXVOL)_{it} = & \alpha_0 + \alpha_1 \text{Log}(CTAXVOL)_{it-1} \\
& + \alpha_2 \text{Log}(FDIVOL)_{it} + \alpha_3 \text{Log}(GRVOL)_{it} + \alpha_4 \text{Log}(TROPEN)_{it} \\
& + \alpha_5 \text{FINOPEN}_{it} + \alpha_6 \text{POLITY2}_{it} + \alpha_7 \text{Log}(INFLVOL)_{it} \\
& + \alpha_8 \text{Log}(GDPC)_{it} + \gamma_t + \mu_i + \omega_{it}
\end{aligned} \tag{1}$$

The subscripts  $i$  and  $t$  represent, respectively, a country and the time-period. The model is estimated using an unbalanced panel data set of 129 countries (comprising both developed and developing countries – see [Appendix 2](#)) over the period 1981–2016. Non-overlapping sub-periods of five years (1981–1985, 1986–1990, 1991–1995, 1996–2000, 2001–2005, 2006–2010 and 2011–2016) have been used in the analysis. Thus, the volatility variables have been computed over these sub-periods (see [Appendix 1](#)), and the average of the other variables have been calculated over these sub-periods. The dependent variable “CTAXVOL” is the indicator of the volatility of the total corporate income tax revenue. It has been computed as the standard deviation of annual growth rate of the total corporate income tax revenue, expressed as a share of GDP, over non-overlapping sub-periods of five year. The variable “FDIVOL” is the main variable of interest in the analysis. It is primarily measured by the volatility of the real FDI inflows (constant US\$ 2010 prices), which is denoted “FDICSTVOL.” For robustness check, we have alternatively measured this variable by the volatility of FDI (% GDP). This volatility variable is denoted “FDIGDPVOL.” We have applied the natural logarithm to all variables (except “FINOPEN” and “POLITY2”) so as to reduce their high skewness.

$\alpha_0$ – $\alpha_8$  are coefficients to be estimated;  $\mu_i$  are countries’ time invariant specific effects; and  $\omega_{it}$  is an idiosyncratic error-term.  $\gamma_t$  are period dummies, and represent global shocks that affect countries’ corporate tax revenue instability. The descriptive statistics associated with all variables used in model (1) are provided in [Appendix 3](#).

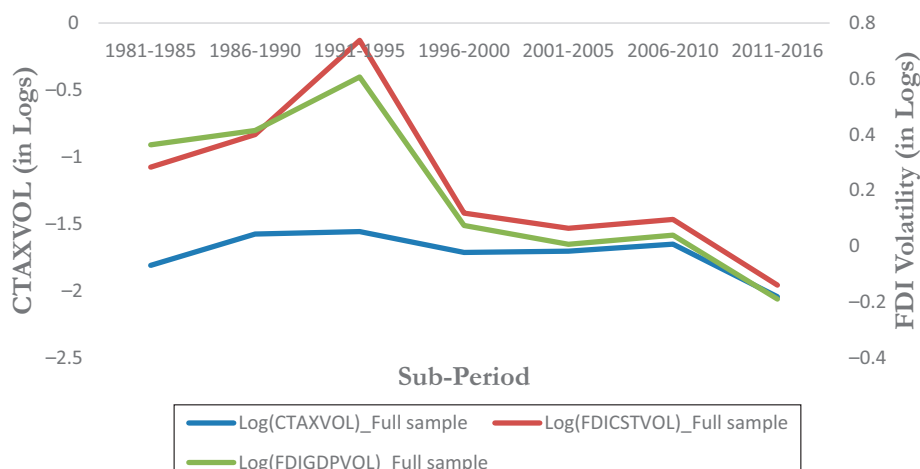
We expect countries with a higher development level to have greater administrative capacity to manage and reduce corporate income tax revenue instability, than can do countries with a lower development level. Similarly, we expect a rise in economic growth volatility and inflation volatility to be associated with higher corporate income tax revenue instability. Incidentally, [Ehrhart \(2011\)](#) has underlined how good institutional quality can help induce foreign investors to comply with their tax revenue obligations. The provision of many tax incentives to promote FDI inflows results in higher corruption and business opportunities that induce socially unsuccessful profits ([Zee et al., 2002](#)). These might ultimately result in changes in corporate income tax revenue; in particular as in such a case, tax incentives would reduce corporate income tax revenue. We expect an improvement in the institutional quality to be associated with a lower instability of corporate income tax revenue. It is important to underline that our proxy for the institutional quality is the level of democracy [4] based on competitiveness of political participation, the openness and competitiveness of executive recruitment and constraints on the chief executive (denoted “POLITY2”) (see [Appendix 1](#) for more details on this indicator, which is extracted from the Polity IV Database, [Marshall et al., 2018](#)).

Concerning the corporate income tax revenue volatility effect of trade openness, we argue that it can translate through macroeconomic outcomes, including aggregate income, consumption, employment, salaries and prices ([Ahmed and Suardi, 2009](#); [di Giovanni and Levchenko, 2009](#); [Kim et al., 2016](#)). For example, greater trade openness can reduce output volatility by enhancing sectoral specialization ([Calderon et al., 2006](#)),

while it can also affect positively economic growth volatility (di Giovanni and Levchenko, 2009; Kose *et al.*, 2006; Mireku *et al.*, 2017; Razin *et al.*, 2003). On another note, greater financial openness (i.e. capital account liberalization) is associated with higher risk sharing, and hence with a lower economic growth volatility (Bekaert *et al.*, 2006; Calderon *et al.*, 2005; Haddad *et al.*, 2013). Financial openness may also result in sudden stops, capital flight and ultimately in crises and a collapse in domestic production (Mendoza, 1991; Calvo and Mendoza, 1996; Arellano and Mendoza, 2002). In the same vein, Meller (2013) has found that financial openness decreases output volatility in countries with low financial risk, but induces a high volatility of output in countries with a high financial risk.

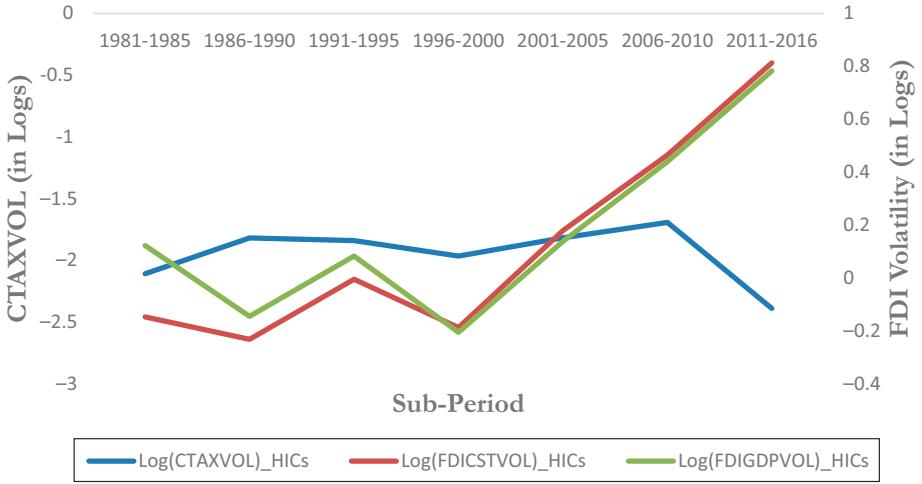
Figures 1–3 display the developments of FDI volatility indicators (using each of the indicators of FDI volatility) and corporate income tax revenue volatility, respectively, over the full sample, the sub-sample of high-income countries (HICs) and the sub-sample of other countries in the full sample, denoted non-HICs that we consider here as “developing countries.” The selection of these two groups of countries is based on the World Bank’s classification of countries. We observe across these three figures that the two FDI volatility indicators are strongly correlated. Not only have these two indicators tightly evolved, but they have also moved in the same direction with the indicator of corporate income tax revenue volatility. After an upward movement between 1981–1985 and 1991–1995, the indicators have progressively declined to reach their lowest values at the end of the period (i.e. 2011–2016). Similar patterns are observed for the sub-sample of developing countries. However, for HICs, the indicator of corporate income tax revenue volatility has moved in an opposite direction to the two indicators of FDI volatility. Specially, the latter have experienced ups and downs movements between 1981–1985 and 1996–2000, and have since then being on a rising trend, and reached their highest values in 2011–2016. At the same time, corporate income tax revenue volatility has been declining, particularly between 2006–2010 and 2011–2016.

Figures 4 and 5 present the correlation pattern between FDI volatility (using each of the indicators of FDI volatility) and corporate income tax revenue volatility,



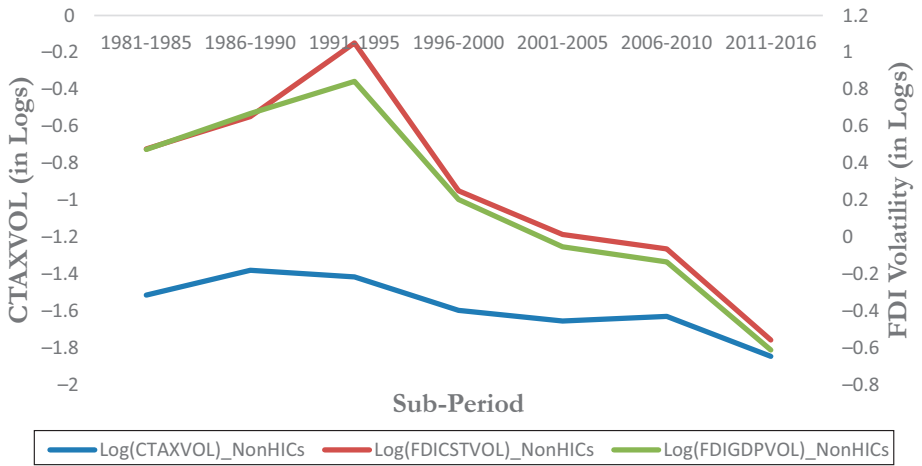
**Figure 1.**  
Evolution of FDI  
volatility and  
corporate tax revenue  
volatility over the full  
sample

Source: Author



**Figure 2.** Evolution of FDI volatility and corporate tax revenue volatility over the sub-sample of HICs

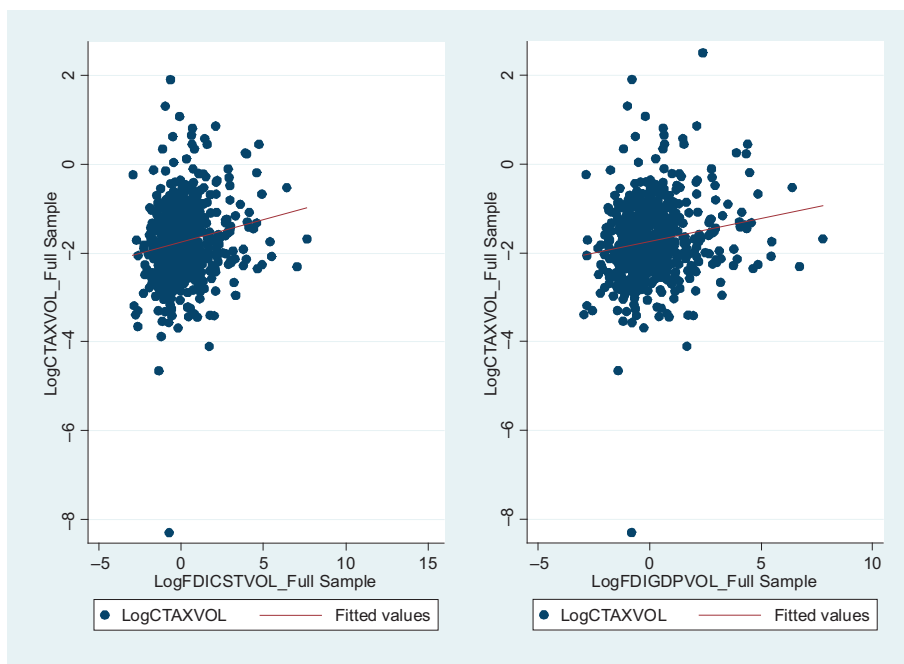
Source: Author



**Figure 3.** Evolution of FDI volatility and corporate tax revenue volatility over the sub-sample of non-HICs (i.e. developing countries)

Source: Author

respectively, over the full sample (Figure 4) and the sub-samples of HICs and non-HICs (Figure 5). Both figures clearly show the existence of a positive correlation between these two variables, although some outliers [in particular countries for which  $\text{Log}(\text{CTAXVOL}) \leq -0.4$ ] appear in the figures. Outlier countries include Czech Republic, Egypt, Arab Republic and Uzbekistan. We will take into account these outliers in the empirical analysis.



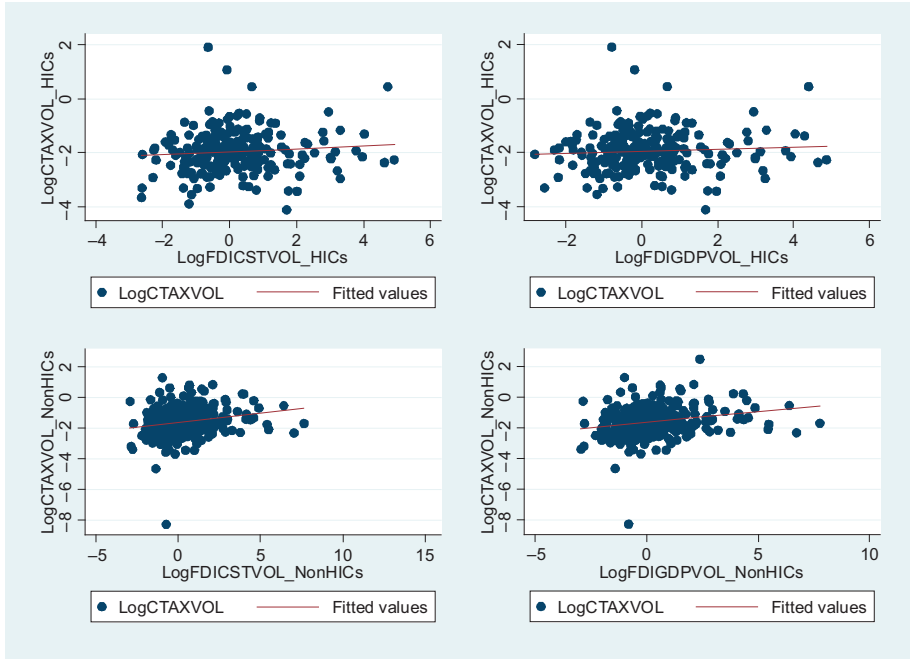
Source: Author

**Figure 4.**  
Correlation pattern  
between FDI  
volatility and  
corporate tax revenue  
volatility over the full  
sample

#### 4. Estimation strategy

In terms of estimation strategy, model (1) is estimated using the standard GMM approach proposed by [Blundell and Bond \(1998\)](#). This estimator is suitable for dynamic panel data set like ours, that is, with a small-time dimension and a large cross-section. Indeed, this estimator helps to solve several endogeneity concerns. The latter include the correlation between the one-period lag of the dependent variable and countries' specific time invariant effects [the so-called Nickell bias ([Nickell, 1981](#)) if the model were to be estimated using for example the within fixed effects]. Another endogeneity problem being dealt with by the GMM approach is the bi-directional causality between the dependent variable and many regressors, including the volatility of FDI inflows, the economic growth volatility, trade openness, financial openness and the institutional quality. For example, the reverse causality from the dependent variable to the FDI inflows volatility can arise from the fact that countries that experience higher volatility of corporate income tax revenue may be willing to implement policies that would reduce such volatility, and these policies might entail the mitigation of the volatility of FDI inflows [5]. These policies can also involve reducing trade openness and financial openness degrees if the latter are associated with a greater exposure of the country to high degrees of external shocks. Finally, as institutional quality can be associated with lower instability of total tax revenue ([Gnangnon, 2020](#)), and eventually lower instability of corporate income tax revenue, then one can also expect governments to improve the quality of their institutions so as to reach this objective. In light of these, in the regressions based on the two-step system GMM estimator, we treat as endogenous the variables measuring the volatility of FDI inflows, economic growth





**Figure 5.** Correlation pattern between FDI volatility and corporate tax revenue volatility over sub-samples

Source: Author

volatility, trade openness, financial openness and institutional quality. The use of this estimator entails the estimation of a system of equations, where an equation in differences is combined with an equation in levels, and where lagged first differences are used as instruments for the levels equation, and lagged levels are used as instruments for the first-difference equation. The regressions have used a maximum of three lags of dependent variable as instruments, and three lags of endogenous variables as instruments. The consistency of the two-step system GMM estimator is assessed by performing three diagnostic tests. These include the Arellano–Bond test of first-order serial correlation (AR[1]) in the error term; the Arellano–Bond test of no second-order autocorrelation (AR[2]) in the error term; and the standard Sargan–Hansen test of over-identifying restrictions (OID), which determines the validity of the instruments used in the regressions. Furthermore, we report the number of instruments used in the regressions, given that a higher number of instruments than the number of countries may make the diagnostic tests less powerful (Roodman, 2009).

Even though the two-step system GMM approach is our primary estimator, we nevertheless present the outcomes of the estimation of model (1) (without the one-period lag of the dependent variable – but only with “FDICSTVOL” as a measure of FDI volatility) using standard econometric estimators, namely, the fixed effects and the feasible generalized least squares estimators. The outcomes of these estimations are presented in Table 1, even though they will likely be biased in light of the endogeneity concerns highlighted above. Nevertheless, such results can be useful for the sake of comparison with those obtained when using the two-step system GMM estimator.

**Table 1.**  
Effect of FDI  
volatility on  
corporate tax  
revenue volatility

Variables	FE Log(CTAXVOL) (1)	FGLS Log(CTAXVOL) (2)
Log(FDICSTVOL)	0.0337(0.0257)	0.0419 *** (0.00745)
Log(GRVOL)	0.146 *** (0.0498)	0.167 *** (0.0220)
Log(TROPEN)	-0.265 (0.215)	0.00532 (0.0288)
FINOPEN	-0.00132 (0.00199)	-0.000198 (0.000391)
POLITY2	0.00538 (0.0126)	-0.0131 *** (0.00220)
Log(INFLVOL)	0.0990 *** (0.0376)	0.137 *** (0.0151)
Log(GDPC)	0.00270 (0.216)	0.00609 (0.0119)
Constant	-1.051 (1.822)	-2.289 *** (0.147)
Observations – countries	621 – 129	620 – 128
Within $R^2$	0.103	
Between $R^2$	0.1026	
Overall $R^2$	0.1234	
Pseudo $R^2$		0.4213

**Notes:** \* $p$ -value < 0.1; \*\* $p$ -value < 0.05; \*\*\* $p$ -value < 0.01. Robust standard errors are in parenthesis. For the fixed-effects based regression, standard errors have been clustered at the country-level. The Pseudo  $R^2$  has been calculated for FGLS-based regression, as the correlation coefficient between the dependent variable and its predicted values. Estimators: FE and FGLS with common AR(1) coefficient for all panels

The empirical analysis based on the two-step system GMM estimator is conducted as follows. Column 1 of Table 2 reports the estimations' results of model (1), using "FDICSTVOL" as the measure of the variable "FDIVOL." Column 2 of the same table reports the estimates that allow examining whether the outlier countries identified above influence the outcomes reported in column 1 of Table 2, in particular the results concerning the effect of FDI inflows volatility on corporate income tax revenue volatility. To that effect, we estimate a specification of model (1) in which we include a dummy variable, denoted "DUM" (which takes the value "1" for outlier countries, and "0" otherwise) as well as its interaction with the variable "FDICSTVOL." If the introduction of these two variables in the model leads to a significant change in the coefficient of the variable "FDICSTVOL" (both in terms of magnitude, sign and statistical significance), then the new specification of model (1) should definitely include these two variables. Otherwise, for the rest of the analysis, we can estimate model (1) as it stands, i.e. without taking explicitly into account the outliers, given that they do not influence the effect of FDI inflows volatility on corporate income tax revenue volatility. As we will see later in the discussion of the empirical results, outliers do not significantly influence the effect of FDI volatility on corporate income tax revenue volatility. Column 3 of Table 2 reports the outcomes arising from the estimation of a variant of model (1) in which the variable "FDICSTVOL" is replaced with the variable "FDIGDPVOL," as a measure of "FDIVOL."

We report in columns 1 and 2 of Table 3 the outcomes of the estimation of two different other specifications of model (1) (i.e. with "FDICSTVOL" and "FDIGDPVOL" as the two different indicators of the dependent variable "FDIVOL") that allow investigating the effect of FDI volatility on corporate income tax revenue volatility in HICs vs developing countries. These results arise from the estimation of two specifications of model (1) that include the dummy "HIC" alongside its interaction with each of the variables "FDICSTVOL" and "FDIGDPVOL." This dummy represents HICs, and takes the value 1 when a country is considered by the World Bank as a HIC, and "0" otherwise. Likewise, columns 3 and 4 of Table 3 contain the outcomes of the estimation of two different other specifications of

Variables	Log(CTAXVOL) (1)	Log(CTAXVOL) (2)	Log(CTAXVOL) (3)
Log(CTAXVOL) <sub>t-1</sub>	0.0758 *** (0.0186)	0.0729 *** (0.0208)	0.0813 *** (0.0192)
Log(FDICSTVOL)	0.113 *** (0.0336)	0.0822 ** (0.0335)	
DUM *[Log(FDICSTVOL)]		-0.0106 (0.111)	
DUM		-0.698 ** (0.285)	
Log(FDIGDPVOL)			0.129 *** (0.0290)
Log(GRVOL)	0.100 ** (0.0492)	0.0501 (0.0493)	0.0795 * (0.0435)
Log(TROPEN)	-0.540 *** (0.0928)	-0.468 *** (0.0925)	-0.468 *** (0.0938)
FINOPEN	0.00468 *** (0.00141)	0.00426 *** (0.00155)	0.00520 *** (0.00132)
POLITY2	-0.0193 *** (0.00733)	-0.0247 *** (0.00761)	-0.0136 ** (0.00692)
Log(INFLVOL)	0.185 *** (0.0299)	0.174 *** (0.0278)	0.177 *** (0.0266)
Log(GDPC)	-0.130 *** (0.0440)	-0.136 *** (0.0434)	-0.182 *** (0.0377)
Constant	1.368 *** (0.489)	1.210 ** (0.499)	1.441 *** (0.413)
Observations – countries	498 – 129	498 – 129	489 – 128
Number of instruments	95	107	95
AR1 ( <i>p</i> -value)	0.0000	0.0000	0.0000
AR2 ( <i>p</i> -value)	0.5334	0.4900	0.7105
OID ( <i>p</i> -value)	0.4870	0.6224	0.4489

**Notes:** \**p*-value < 0.1; \*\**p*-value < 0.05; \*\*\**p*-value < 0.01. Robust standard errors are in parenthesis. In the two-step system GMM estimations, the variables “FDICSTVOL,” “FDIGDPVOL,” “GRVOL,” “TROPEN,” “FINOPEN” and “POLITY2” have been considered as endogenous. Time dummies have been included in the regressions. The regressions have used three lags of the dependent variable as instruments, and three lags of endogenous variables as instruments. The variable “DUM” is a dummy variable representing outlier countries, and takes the value “1” for outlier countries (that is countries with [Log(CTAXVOL)] <= -0.4), and “0” otherwise. Outlier countries are Czech Republic, Egypt, Arab Republic and Uzbekistan. Estimator: two-step system GMM

**Table 2.**  
Effect of FDI  
volatility on  
corporate tax  
revenue volatility

model (1) (i.e. with “FDICSTVOL” and “FDIGDPVOL” as the two different indicators of the dependent variable “FDIVOL”) that allow assessing how the effect of FDI volatility on corporate income tax revenue volatility varies across countries. This analysis is performed by estimating specifications of model (1) that include the interaction between the variable “GDPC” with each of the variables “FDICSTVOL” and “FDIGDPVOL.”

We present in columns 1 and 2 of Table 4 the outcomes arising from the estimation of two other specifications of model (1) (i.e. with “FDICSTVOL” and “FDIGDPVOL” as measures of the dependent variable “FDIVOL”) that help investigate whether and if so, to what extent, the effect of FDI volatility on corporate income tax revenue volatility depends on countries’ reliance on natural resources, measured by the share of natural resource rents in GDP. To that end, the two model specifications include the variable “RENTTOT” (in natural logarithm) (which measures the share of natural resource rents in GDP) as well as its interaction with each of the FDI volatility variables. Total natural resources rent (% GDP) is the sum of oil rents (% GDP), mineral rents (% GDP), natural gas rents (% GDP), coal rents (% GDP) and forest rents (% GDP). We expect the magnitude of the positive effect of FDI volatility on corporate income tax revenue volatility to increase as countries become increasingly dependent on natural resources.

Following Auty (1997, 2001) and Isham *et al.* (2005), we also decompose total natural resource rents into point source-type natural resource rents (denoted “POINTRENT”), and diffuse natural resources rents (denoted “DIFFUSERENT”). “Point source resources” are defined as those where ownership is concentrated and exploitation is capital intensive, and “Diffuse natural resources” include those where associated property rights are likely to be more widely dispersed across society and where investment barriers are more modest

Variables	Log(CTAXVOL) (1)	Log(CTAXVOL) (2)	Log(CTAXVOL) (3)	Log(CTAXVOL) (4)
Log(CTAXVOL) <sub>t-1</sub>	0.0691 *** (0.0142)	0.0638 *** (0.0139)	0.0595 *** (0.0134)	0.0736 *** (0.0131)
[Log(FDICSTVOL)] *HIC	-0.295 *** (0.0465)	-0.181 *** (0.0486)	-0.0915 *** (0.00911)	-0.0519 *** (0.00869)
[Log(FD(GDPVOL)] *HIC				
[Log(FDICSTVOL)] *Log(GDPC)				
[Log(FD(GDPVOL)] *Log(GDPC)				
Log(FDICSTVOL)	0.173 *** (0.0277)		0.842 *** (0.0702)	
Log(FD(GDPVOL)		0.133 *** (0.0270)		0.538 *** (0.0636)
HIC	0.375 *** (0.136)	0.523 *** (0.120)		
Log(GRVOL)	0.0917 *** (0.0348)	0.0982 *** (0.0326)	0.139 *** (0.0324)	0.142 *** (0.0324)
Log(TROPEN)	-0.403 *** (0.0687)	-0.279 *** (0.0765)	-0.438 *** (0.0664)	-0.324 *** (0.0643)
FINOPEN	0.00224 ** (0.00112)	0.00363 *** (0.00109)	0.00318 *** (0.00114)	0.00275 *** (0.00102)
POLITY2	-0.0149 *** (0.00520)	-0.0183 *** (0.00470)	-0.0127 ** (0.00496)	-0.0250 *** (0.00331)
Log(INFLVOL)	0.187 *** (0.0236)	0.160 *** (0.0209)	0.168 *** (0.0233)	0.167 *** (0.0228)
Log(GDPC)	-0.115 ** (0.0511)	-0.194 *** (0.0484)	-0.0137 (0.0368)	-0.0347 (0.0344)
Constant	0.574 (0.486)	0.681 (0.489)	-0.124 (0.424)	-0.241 (0.386)
Observations – countries	498 – 129	489 – 128	498 – 129	489 – 128
Number of instruments	109	109	109	109
AR1 ( <i>p</i> -value)	0.0000	0.0000	0.0000	0.0000
AR2 ( <i>p</i> -value)	0.6804	0.7119	0.6134	0.6922
OID ( <i>p</i> -value)	0.4373	0.3278	0.4381	0.4707

**Notes:** \**p*-value < 0.1; \*\**p*-value < 0.05; \*\*\**p*-value < 0.01. Robust standard errors are in parenthesis. In the two-step system GMM estimations, the variables “FDICSTVOL,” “FD(GDPVOL),” “GRVOL,” “TROPEN,” “FINOPEN,” “POLITY2” and the interaction variables have been considered as endogenous. Time dummies have been included in the regressions. The regressions have used three lags of the dependent variable as instruments, and two lags of endogenous variables as instruments. Estimator: Two-step system GMM

**Table 3.**  
Effect of FDI  
volatility on  
corporate tax  
revenue volatility for  
varying development  
levels

**Table 4.**  
Effect of FDI  
volatility on  
corporate tax  
revenue volatility for  
varying shares of  
natural resource  
rents in GDP

Variables	Log(CTAXVOL) (1)	Log(CTAXVOL) (2)	Log(CTAXVOL) (3)	Log(CTAXVOL) (4)	Log(CTAXVOL) (5)	Log(CTAXVOL) (6)
Log(CTAXVOL) <sub>t-1</sub>	0.0910 *** (0.0205)	0.0746 *** (0.0186)	0.0884 *** (0.0183)	0.0853 *** (0.0167)	0.0887 *** (0.0193)	0.0807 *** (0.0217)
[Log(FDICSTVOL)] * [Log(TOTRENT)]	0.0736 *** (0.0167)					
[Log(FDIGDPVOL)] * [Log(TOTRENT)]		0.1115 *** (0.0145)	-0.0271 (0.0207)			
[Log(FDICSTVOL)] * POINTRENT				0.0488 ** (0.0234)	0.0893 *** (0.0294)	0.106 *** (0.0288)
[Log(FDIGDPVOL)] * POINTRENT						
[Log(FDICSTVOL)] * DIFFUSERENT			0.146 *** (0.0447)	0.0521 (0.0441)	0.00434 (0.0371)	-0.0124 (0.0379)
[Log(FDIGDPVOL)] * DIFFUSERENT	0.0536 ** (0.0239)	0.0483 ** (0.0238)				
Log(FDICSTVOL)		0.0470 * (0.0240)				
Log(FDIGDPVOL)	0.0531 ** (0.0250)		0.121 *** (0.0450)	0.0926 ** (0.0467)		
POINTRENT						
DIFFUSERENT					0.256 *** (0.0757)	0.336 *** (0.0749)
Log(GRYVOL)	0.158 *** (0.0424)	0.154 *** (0.0433)	0.198 *** (0.0477)	0.192 *** (0.0490)	0.133 *** (0.0424)	0.0664 * (0.0376)
Log(TROPEN)	-0.241 *** (0.0826)	-0.236 *** (0.0944)	-0.480 *** (0.0913)	-0.385 *** (0.0877)	-0.552 *** (0.0954)	-0.524 *** (0.0971)
FINOPEN	0.00449 *** (0.00123)	0.00583 *** (0.00141)	0.00542 *** (0.00147)	0.00634 *** (0.00148)	0.00524 *** (0.00151)	0.00585 *** (0.00143)
POLITY2	-0.0124 (0.00925)	0.00377 (0.00918)	-0.0177 * (0.00997)	-0.00514 (0.0120)	-0.0238 *** (0.00792)	-0.0131 (0.00800)
Log(INFLVOL)	0.152 *** (0.0295)	0.173 *** (0.0276)	0.155 *** (0.0304)	0.172 *** (0.0290)	0.178 *** (0.0282)	0.202 *** (0.0281)
Log(GDPC)	-0.0685 * (0.0395)	-0.111 *** (0.0416)	-0.0835 * (0.0498)	-0.151 *** (0.0560)	0.0290 (0.0558)	0.0301 (0.0522)
Constant	-0.411 (0.488)	-0.263 (0.542)	0.597 (0.592)	-0.151 (0.546)	-0.132 (0.532)	-0.413 (0.498)
Observations - countries	498 - 129	489 - 128	498 - 129	489 - 128	498 - 129	489 - 128
Number of instruments	95	95	95	95	95	95
ARI ( <i>p</i> -value)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AR2 ( <i>p</i> -value)	0.9216	0.6785	0.5366	0.8211	0.7108	0.9637
OID ( <i>p</i> -value)	0.5808	0.6669	0.5730	0.6638	0.2497	0.2641

**Notes:** \**p*-value < 0.1; \*\**p*-value < 0.05; \*\*\**p*-value < 0.01. Robust standard errors are in parenthesis. In the two-step system GMM estimations, the variables "FDICSTVOL," "FDIGDPVOL," "RENTTOT," "POINTRENT," "DIFFUSERENT," "GRVOL," "TROPEN," "FINOPEN," "POLITY2" and the interaction variables have been considered as endogenous. Time dummies have been included in the regressions. The regressions have used three lags of the dependent variable as instruments, and two lags of endogenous variables as instruments. Estimator: Two-step system GMM

(Stevens and Dietsche, 2008, p. 62). As oil, gas and mineral deposits can exhibit, to a greater or lesser extent, the attributes of point source resources (Stevens and Dietsche, 2008, p. 62), we compute the indicator “POINTRENT1” as the sum of oil rents (% GDP), mineral rents (% GDP) and natural gas rents (% GDP). As a result, the indicator “DIFFUSERENT1” has been computed as the sum of coal rents (% GDP) and forest rents (% GDP) [see also other studies such as Baldwin (1956), Bulte *et al.* (2005) and Mavrotas *et al.* (2011) for the distinction between point-source resources and diffuse natural resources]. We opt for this decomposition of total natural resource rents into point-resource rents and diffuse resource-rents because the literature has pointed out that the dependence on point-source-type natural resource hampers economic performance through its adverse effect on institutional development, including both governance and democracy (Bulte *et al.*, 2005; Isham *et al.*, 2005; Mavrotas *et al.*, 2011). In contrast, these effects are much less strong in countries that are highly dependent on diffuse natural resources (i.e. for example, countries that rely primarily on livestock and agricultural produced by small family farms). Therefore, while we expect that FDI volatility could exert a higher positive effect on corporate income tax revenue volatility in both countries dependent on point-resource countries and countries dependent on diffuse natural resources, the magnitude of the effect for point-resource countries might be higher than that of diffuse natural resources dependent countries. As the indicators “POINTRENT1” and “DIFFUSERENT1” contain zero values, while concurrently displaying a high skewness, we have transformed each of them using the method proposed by Yeyati *et al.* (2007) (see Appendix 1 for further details). The transformed indicators are labeled “POINTRENT” and “DIFFUSERENT.”

To examine empirically the extent to which the effect of FDI volatility on corporate tax revenue volatility depends on countries’ reliance on point-resources, or diffuse resources, we estimate several variants of model (1) (i.e. with each of the two FDI volatility variables) in which we interact each of the variables “POINTRENT” and “DIFFUSERENT” with each of the FDI volatility variables. The outcomes of the estimation of these specifications of model (1) are contained in columns 4–6 of Table 4.

We present in Table 5 the outcomes of the estimation of the specification of model (1) that allows assessing whether the findings on the effect of FDI volatility on corporate tax revenue volatility are the same in tax haven countries vs other countries in the full sample. The list of tax haven countries in the full sample is obtained from Dharmapala and Hines (2009). Specifically, we have used the definition of tax haven based on Hines and Rice (1994) and Diamond and Diamond (2002). This list includes Bahrain, Cyprus, Ireland, Jordan, Liberia and Switzerland. To obtain outcomes reported in Table 5, we construct a dummy variable that takes the value “1” for countries included in this list (of tax haven countries) and “0” for the other countries of the full sample. This dummy is then interacted with each of the FDI volatility variables, and the resulting models are estimated using the two-step system GMM estimator.

Finally, we check whether there is a non-linear relationship between FDI volatility and corporate income tax revenue volatility by estimating another specification of model (1) that includes the squared term of the variable “FDIVOL,” measured alternatively by “FDICSTVOL” and “FDIGDPVOL.” Results of these estimations are presented in Table 6.

## 5. Empirical outcomes

Results in column 1 of Table 1 [estimates based on the “fixed effects (FEs)” approach] show no significant effect (at the conventional levels) of FDI volatility on the volatility of corporate income tax revenue. However, results in column 2 of the same table (those based on the feasible generalized least squares (FGLS) estimator) show a positive and significant effect

**Table 5.**  
Effect of FDI  
volatility on  
corporate tax  
revenue volatility in  
tax haven countries  
vs non-tax haven  
countries

Variables	Log(CTAXVOL) (1)	Log(CTAXVOL) (2)
Log(CTAXVOL) <sub>t-1</sub>	0.0741 *** (0.0184)	0.0774 *** (0.0185)
Log(FDICSTVOL)	0.133 *** (0.0330)	
[Log(FDICSTVOL)]*HAVEN	-0.116 ** (0.0593)	
Log(FDIGDPVOL)		0.145 *** (0.0277)
[Log(FDIGDPVOL)]*HAVEN		-0.111 ** (0.0512)
HAVEN	0.0342 (0.279)	0.0258 (0.232)
Log(GRVOL)	0.118 *** (0.0410)	0.0984 *** (0.0364)
Log(TROPEN)	-0.475 *** (0.0912)	-0.414 *** (0.0935)
FINOPEN	0.00534 *** (0.00135)	0.00540 *** (0.00127)
POLITY2	-0.0176 ** (0.00736)	-0.0102 (0.00724)
Log(INFLVOL)	0.175 *** (0.0274)	0.174 *** (0.0260)
Log(GDPC)	-0.164 *** (0.0420)	-0.196 *** (0.0392)
Constant	1.313 *** (0.477)	1.265 *** (0.404)
Observations – countries	498 – 129	489 – 128
Number of instruments	109	109
AR1 ( <i>p</i> -value)	0.0000	0.0000
AR2 ( <i>p</i> -value)	0.5343	0.6940
OID ( <i>p</i> -value)	0.7892	0.8072

**Notes:** \**p*-value < 0.1; \*\**p*-value < 0.05; \*\*\**p*-value < 0.01. Robust standard errors are in parenthesis. In the two-step system GMM estimations, the variables “FDICSTVOL,” “FDIGDPVOL,” “GRVOL,” “TROPEN,” “FINOPEN,” “POLITY2” and the interaction variables have been considered as endogenous. Time dummies have been included in the regressions. The regressions have used three lags of the dependent variable as instruments, and two lags of endogenous variables as instruments. Estimator: Two-step system GMM

**Table 6.**  
Effect of FDI  
volatility on  
corporate tax  
revenue volatility for  
varying degrees of  
FDI volatility

Variables	Log(CTAXVOL) (1)	Log(CTAXVOL) (2)
Log(CTAXVOL) <sub>t-1</sub>	0.0655 *** (0.0159)	0.0798 *** (0.0145)
Log(FDICSTVOL)	0.0671 ** (0.0277)	
[Log(FDICSTVOL)] <sup>2</sup>	0.0202 *** (0.00468)	
Log(FDIGDPVOL)		0.107 *** (0.0310)
[Log(FDIGDPVOL)] <sup>2</sup>		0.0173 *** (0.00578)
Log(GRVOL)	0.0804 *** (0.0268)	0.0442 (0.0269)
Log(TROPEN)	-0.534 *** (0.0813)	-0.552 *** (0.0754)
FINOPEN	0.00396 *** (0.00105)	0.00573 *** (0.000940)
POLITY2	-0.0243 *** (0.00403)	-0.0237 *** (0.00613)
Log(INFLVOL)	0.177 *** (0.0231)	0.189 *** (0.0199)
Log(GDPC)	-0.0781 *** (0.0288)	-0.139 *** (0.0299)
Constant	0.910 ** (0.383)	1.431 *** (0.304)
Observations – countries	498 – 129	489 – 128
Number of instruments	109	109
AR1 ( <i>p</i> -value)	0.0000	0.0000
AR2 ( <i>p</i> -value)	0.5095	0.7315
OID ( <i>p</i> -value)	0.6267	0.5931

**Notes:** \**p*-value < 0.1; \*\**p*-value < 0.05; \*\*\**p*-value < 0.01. Robust standard errors are in parenthesis. In the two-step system GMM estimations, the variables “FDICSTVOL,” “FDIGDPVOL,” “GRVOL,” “TROPEN,” “FINOPEN,” “POLITY2” and the interaction variables have been considered as endogenous. Time dummies have been included in the regressions. The regressions have used three lags of the dependent variable as instruments, and three lags of endogenous variables as instruments. Estimator: Two-step system GMM

(at the 1% level) of FDI volatility on corporate income tax revenue volatility: a 1 percentage increase in FDI volatility is associated with a 0.04 percentage rise in corporate income tax revenue volatility. We note with respect to control variables that across the two columns, economic growth volatility and inflation volatility are positively associated with the volatility of corporate income tax revenue. The other control variables (with the exception of the institutional quality) do not significantly affect corporate income tax revenue volatility at the conventional levels. Results based on the FGLS approach show that the institutional quality appears to influence negatively and significantly corporate income tax revenue volatility, while for results based on the FE estimator, there is no significant effect of institutional quality on corporate income tax revenue volatility.

Turning to the two-step system GMM-based regressions (see [Tables 2–6](#)), we first note that across all columns of these tables, the requirements of the diagnostic tests of the two-step system GMM estimator are met. The coefficient of the one-period lag of the variable “CTAXVOL” is positive and significant at the 1% level, thereby validating the need for considering a dynamic model specification in the analysis. This also shows the persistence of the volatility of corporate income tax revenue over time. The nil hypotheses of the AR(1) and AR(2) tests are not rejected, which confirms the presence of the first-order serial correlation, and the absence of the second-order serial correlation. Finally, all *p*-values related to the OID test exceed 0.10. Additionally, as expected, the number of instruments used in the regressions is lower than the number of countries used in the analysis. All these results suggest that the two-step system GMM estimator is appropriate for conducting the empirical analysis.

Estimates in columns 1 and 2 of [Table 2](#) show that the coefficients of the variable “FDICSTVOL” are both statistically significant at the 1% level, and amount to 0.11 (in column 1) and 0.08 (in column 2). We conclude that when taking into account outliers in the regressions, the coefficient of the FDI volatility variable in column 2 is not significantly different from the one obtained in column 1 of the same table. Additionally, the interaction term related to the interaction variable “DUM\*[Log(FDICSTVOL)]” is not significant at the conventional levels. In light of all these findings, we conclude that outlier countries do not influence the outcome reported in column 1 of [Table 2](#) concerning the effect of FDI volatility on corporate income tax revenue volatility. Incidentally, the coefficient associated with the variable “FDICSTVOL” in column 1 of [Table 2](#) is almost triple of the coefficient of the same variable in column 2 of [Table 1](#). This is likely because of the endogeneity of the FDI volatility variable, and hence, justifies the use of the two-step system GMM approach in the analysis to handle the endogeneity concerns.

Results in column 3 of [Table 2](#) also indicate that the coefficient of the variable “FDIGDPVOL” is positive and significant at the 1% level. Interestingly, this coefficient, which amounts to 0.129 (i.e. 0.13), is quite similar to the coefficient reported in column 1 of [Table 1](#) (which is 0.11). In terms of magnitude of the impacts, we obtain that a 1 percentage increase in FDI volatility (measured by the volatility of real FDI inflows) is associated with a 0.11 percentage rise in corporate income tax revenue volatility; and a 1 percentage increase in FDI volatility (measured by the volatility of the share of FDI inflows in GDP) is associated with a 0.13 percentage increase in corporate income tax revenue volatility. As for control variables, results in columns 1 and 3 are quite similar (as are also those in column 2 of [Table 2](#)). Specifically, corporate income tax revenue volatility is driven positively by higher economic growth volatility, greater financial openness and higher inflation volatility. In the meantime, greater trade openness, an improvement in the institutional quality and the rise in per capita income are associated with lower corporate income tax revenue volatility.



Results in columns 1 and 2 of [Table 3](#) indicate that the interaction variables with the dummy “HIC” hold negative and significant coefficients at the 1% level. These suggest that FDI volatility exerts a higher effect in HICs than in developing countries. As the coefficients of the variables “[Log(FDICSTVOL)]” and “[Log(FDICSTVOL)]” are positive and significant at the 1% level, we deduce that the net effects of FDI volatility (“FDICSTVOL”) on corporate tax revenue income volatility in HICs and developing countries amount, respectively, to  $-0.122 (= -0.295 + 0.173)$  and  $+0.173$ . This signifies that in HICs, FDI volatility results in lower corporate tax revenue income volatility, while in developing countries, it induces a higher volatility of corporate tax revenue income. Specially, a 1 percentage increase in FDI volatility (measured by the volatility of real FDI inflows) induces a 0.12 percentage fall in corporate income tax revenue volatility in HICs; and a 1 percentage increase in FDI volatility (measured by the volatility of the share of FDI inflows in GDP) is associated with a 0.17 percentage increase in corporate income tax revenue volatility. Similarly, the net effects of FDI volatility (measured by the volatility of FDI in percentage of GDP) on corporate tax revenue income volatility in HICs and developing countries amount, respectively, to  $-0.05 (= -0.181 + 0.133)$  and  $+0.133$ . The above conclusion concerning the effect of FDI volatility (“FDICSTVOL”) on corporate tax revenue income volatility in HICs and developing countries also applies here. The difference in outcomes between developed and developing countries could be attributed to the differences in the relevance of greenfield FDI inflows and cross-border mergers and acquisitions FDI inflows: as noted above, developing countries tend to attract the majority of greenfield FDI, while cross-border mergers and acquisitions FDI tends to be located in developed countries. Given the greater sensitivity of greenfield FDI inflows (compared to cross-border mergers and acquisitions FDI) to taxes in the host countries, it is likely that FDI volatility induce higher FDI volatility in developing countries, while eventually reducing it in developed countries.

Results in columns 3 and 4 of [Table 3](#) confirm the findings in columns 1 and 2 of the same table. We note from the columns 3 and 4 that the interactions between each of the FDI volatility variables and the real per capita income hold negative and significant coefficients at the 1% level, while the FDI volatility variables have positive and significant coefficients at the 1% level. At least, these indicate that as countries develop, they experience a lower positive effect of FDI volatility on corporate income tax revenue volatility. We conclude that FDI volatility exerts a positive and significant effect on corporate income tax revenue volatility in countries whose real per capita income is lower than a certain threshold. For the other countries (i.e. those with a real per capita income higher than this threshold), FDI volatility is associated with lower corporate income tax revenue volatility. These thresholds amount to US\$9,918.8 [= exponential (0.842/0.0915)] for the regression-based on “FDICSTVOL” and US\$31,764 [= exponential (0.538/0.0519)] for the regression-based on “FDIGDPVOL.” The key message from this analysis is that less advanced economies experience a positive effect of FDI volatility on corporate income tax revenue volatility, while in relatively advanced economies, FDI volatility is negatively associated with corporate income tax revenue volatility.

We note from columns 1 and 2 of [Table 4](#) that the coefficients of the interaction variable between each of the FDI volatility variables and the total natural resource rents variable are positive and significant at the 1%, while at the same time, the coefficient of each of the FDI volatility variables is significant at the 5% level. We, therefore, conclude that regardless of the indicator of FDI volatility used, countries that are dependent on natural resources experience a higher positive effect of FDI volatility on corporate income tax revenue volatility, and the higher this dependence on natural resources, the greater is the positive (enhancing) effect of FDI volatility on corporate income tax revenue volatility. Results in

column 3 suggest that the interaction term of the variable “[Log(FDICSTVOL)]\*POINTRENT” is not significant at the 10% level. This indicates that the effect of FDI volatility (measured by FDICSTVOL) on corporate income tax revenue volatility does not depend on countries’ reliance on point-source natural resources. Meanwhile, the interaction term of the variable “[Log(FDIGDPVOL)]\*POINTRENT” is significant at the 5% level. This reveals that in contrast with the previous finding that is based on the volatility of real values of FDI inflows, the volatility of FDI inflows (% of GDP) on corporate income tax revenue volatility increases as the point-source resource rents rise. At the same time, the coefficients of “[Log(FDICSTVOL)]\*DIFFUSERENT” and “[Log(FDIGDPVOL)]\*DIFFUSERENT” are statistically significant at the 1% level, whereas the coefficients of “Log(FDICSTVOL)” and “Log(FDIGDPVOL)” are not significant at the conventional levels. In light of these, we conclude that the effect of FDI volatility (irrespective of the way it is measured) on corporate income tax revenue volatility consistently increases as the dependence on diffuse-natural resources rises.

Taking up now the outcomes displayed in Table 5, we note that the coefficients of both “Log(FDICSTVOL)” and “Log(FDIGDPVOL)” are positively significant at the 1% level, while the interaction terms related to the variables “[Log(FDICSTVOL)]\*HAVEN” and “[Log(FDIGDPVOL)]\*HAVEN” are both negative and significant at the 5% level. These outcomes suggest that irrespective of the way it is measured, FDI volatility exerts a higher negative effect on corporate income tax revenue volatility in tax haven countries than in non-tax haven countries. The net effects of FDI volatility (measured by “FDICSTVOL”) on corporate income tax revenue volatility in tax haven countries and non-tax haven countries amount, respectively, to 0.017 ( $= -0.116 + 0.133$ ) and 0.133. It, therefore, appears that the magnitude of the positive effect of the volatility of real FDI on corporate income tax revenue volatility is far higher in non-tax haven countries than in tax haven countries. A 1 percentage increase in FDI volatility (i.e. the volatility of real FDI inflows) is associated with a 0.017 percentage increase in corporate income tax revenue volatility in tax haven countries; and a 0.13 percentage rise in corporate income tax revenue volatility in non-tax haven countries. The same reasoning applies to results obtained based on the volatility of FDI (% GDP), with the net effects of FDI volatility on corporate income tax revenue volatility in tax haven countries and non-tax haven countries amounting, respectively, here to 0.034 ( $= -0.111 + 0.145$ ) and 0.145.

Finally, the estimates presented in columns 1 and 2 of Table 6 (using, respectively, “FDICSTVOL” and “FDIGDPVOL” as measures of “FDIVOL”) show positive and significant (at least at the 5% level) coefficients of the FDI volatility variables as well as the squared term of each these FDI volatility variables. In other words, there is a non-linear relationship between FDI volatility and corporate income tax revenue volatility, whereby the positive effect of FDI volatility on corporate income tax revenue volatility is further enhanced (amplified) by a higher volatility in FDI inflows.

Across Tables 3-6, results of control variables align, in general, with those presented in Table 2, notably in column 1 and 3 of this table.

## 6. Conclusion

In this paper, we have investigated the effect of FDI volatility on corporate income tax revenue volatility, using an unbalanced panel data set of 129 countries over the period 1981–2016. The findings have indicated that FDI volatility tends to enhance corporate income tax revenue volatility in less advanced economies, but reduce it in relatively advanced countries. These suggest that relatively advanced economies are more able to manage the volatility of FDI inflows so as to ensure that it does not translate into higher

volatility of the corporate income tax revenue. Furthermore, and interestingly, the positive corporate income tax revenue volatility effect of FDI volatility rises as countries experience a higher dependence on total natural resources: this effect seems to be more evident for countries that are dependent on diffuse natural resources than for countries that are dependent on point-source resources. Furthermore, FDI volatility induces a lower positive effect on corporate income tax revenue volatility in tax haven countries than in non-tax haven countries. Finally, the positive corporate income tax revenue volatility effect of FDI volatility is further enhanced (amplified) by a higher volatility in FDI inflows.

These outcomes particularly shed light on the role of FDI volatility on the volatility of corporate income tax revenue, particularly in countries that are highly dependent on natural resources and non-tax haven countries. They show that one way for policymakers to enhance the stability of corporate tax revenue (given the positive economic growth effect of the latter) is to ensure a stability of FDI inflows. Foreign capital flows, notably FDI flows, play an essential role for countries' (including developing countries) economic development through, *inter alia*, technology transfer, jobs creation and economic growth. Thus, policymakers should aim to attract FDI, while also designing and implementing policies and measures (such as those in favor of business environment improvement, property rights enforcement and political stability) that would assure foreign investors – in particular those engaged in developing countries – of the continuous high returns of their investments. This would contribute to avoiding sudden reversals of FDI inflows or disinvestments by foreign firms that could trigger a high volatility of corporate income tax revenue in developing countries.

One important limitation of the present analysis is the use of aggregate FDI inflows because of the lack of data over a long period on greenfield FDI inflows and cross-border mergers and acquisitions FDI inflows. Therefore, an avenue for future research could be to explore separately the effect of the volatility of greenfield FDI inflows and the volatility of cross-border mergers and acquisitions FDI inflows on the volatility of corporate income tax revenue, when long-time series data (covering many countries) would be available. It might also be useful to explore in the future (when data would be available) how the volatility of FDI inflows in natural resources sectors influences corporate income tax revenue volatility, particularly in natural resource-dependent countries.

## Notes

1. As it would be seen later in the analysis, 2016 is the last year of our panel data set.
2. It is worth noting that our data set on FDI inflows used to compute FDI volatility (see Section 2) contains many negative values of FDI inflows.
3. According to [Boyce and Ndikumana \(2003\)](#), the resource sector is the main source of illicit financial flows. Additionally, the size of the rents at stake, the asymmetry between highly capacitated foreign companies and the governments, combined with the weak governance and the lack of transparency in states, result in non-negligible tax evasion and corruption in resource-rich countries.
4. Numerous studies have also used the level of democratization in a country as a proxy for the institutional quality. These include, for example, [Charron and Lapuente \(2010\)](#), [Desbordes and Verardi \(2017\)](#), [Guerin and Manzocchi \(2009\)](#), [Jensen \(2003\)](#), [Li and Resnick \(2003\)](#), [Oneal \(1994\)](#), [Rodrik \(1996\)](#) and [Sung \(2004\)](#).
5. For example, improving the institutional quality such as ensuring better business environment and enhancing the enforcement of property rights could help avoid sudden reversals of FDI inflows, and hence help dampen FDI volatility.

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#### **Further reading**

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**Table A1.**  
Definition and source of variables

Variables	Definition	Sources
CTAXVOL	Volatility of the total corporate income tax revenue. It has been computed as the standard deviation of annual growth rate of the total corporate income tax revenue, expressed as a share of GDP, over non-overlapping sub-periods of five year	UNU-WIDER Government Revenue Data set. See online: <a href="http://www.wider.unu.edu/project/government-revenue-dataset">www.wider.unu.edu/project/government-revenue-dataset</a>
FDICSTVOL	The variable represents the volatility of real FDI inflows (constant US\$ 2010 prices). It has been calculated by multiplying the FDI inflows (% GDP) by the real GDP (constant 2010 US\$) (Nagel <i>et al.</i> , 2015; Herzer, 2011). The volatility of FDI has been calculated as the standard deviation of annual growth of real FDI inflows over non-overlapping sub-periods of five year	Author's calculation based on data on FDI inflows (in percentage of GDP) from the UNCTAD database, and real GDP extracted from the World Development Indicators (WDI) of the World Bank
FDIGDPVOL	This variable is the volatility of FDI inflows, expressed as a share of GDP. The volatility variable has been calculated as the standard deviation of annual growth of the share of FDI inflows in GDP over non-overlapping sub-periods of five year	Author's calculation based on data on the ratio of FDI to GDP extracted from the UNCTAD database
TROPEN	This is the measure of trade openness. It is the share (%) of sum of exports and imports of goods and services in GDP	WDI
INFLVOL	Inflation volatility is calculated as the standard deviation of inflation rate over non-overlapping sub-periods of five year. The annual inflation rate (%) based on Consumer Price Index (annual %) where missing values have been replaced with values of the GDP deflator (annual %)	Author's calculation based on inflation data extracted from the WDI
GDPG	Per capita GDP (constant 2010 US\$)	WDI
GRVOL	Economic growth volatility is calculated as the standard deviation of the annual economic growth rate (growth rate of real GDP) over non-overlapping sub-periods of five year	Author's calculation based on inflation data extracted from the WDI
FINOPEN	This is the measure of de jure financial openness	This index has been computed by Chinn and Ito (2006) and updated in July 2019. Its value ranges between 0 and 1. We have multiplied this index by 100 so that its values range between 0 and 100. See: <a href="http://web.pdx.edu/~ito/Chinn-Ito_website.htm">http://web.pdx.edu/~ito/Chinn-Ito_website.htm</a>
RENTTOT		WDI

(continued)

Variables	Definition	Sources
POINTRENT	<p>It is the total natural resources rents (% GDP). It is the sum of oil rents (% GDP), mineral rents (% GDP), natural gas rents (% GDP), coal rents (% GDP) and forest rents (% GDP)</p> <p>This is the transformed measure of the point source-type natural resource rents, computed as the as the sum of oil rents (% GDP), mineral rents (% GDP) and natural gas rents (% GDP). The point source-type natural resource rents denoted "POINTRENT1" contains "0" values. Therefore, its transformed measure is as follows (Yeyati <i>et al.</i>, 2007):</p> $\text{POINTRENT} = \text{sign}(\text{POINTRENT1}) * \log(1 + \text{POINTRENT1}),$ <p>where POINTRENT1 refers to the absolute value of the variable "POINTRENT1"</p>	Author's calculation based on data extracted from the WDI
DIFFUSERENT	<p>This is the transformed measure of the diffuse natural resource rents, computed as the as the sum of coal rents (% GDP) and forest rents (% GDP). The point source-type natural resource rents denoted "DIFFUSERENT1" contains "0" values. Therefore, its transformed measure is as follows (Yeyati <i>et al.</i>, 2007):</p> $\text{DIFFUSERENT} = \text{sign}(\text{DIFFUSERENT1}) * \log(1 + \text{DIFFUSERENT1}),$ <p>where DIFFUSERENT1 refers to the absolute value of the variable "DIFFUSERENT1"</p>	Author's calculation based on data extracted from the WDI
POLITY2	<p>This variable is an index extracted from Polity IV Database (Marshall <i>et al.</i>, 2018). It represents the degree of democracy based on competitiveness of political participation, the openness and competitiveness of executive recruitment and constraints on the chief executive. Its values range between -10 and +10, with lower values reflecting autocratic regimes, and greater values indicating democratic regimes. Specifically, the value +10 for this index represents a strong democratic regime, while the value -10 stands for strong autocratic regime</p>	Polity IV Database (Marshall <i>et al.</i> , 2018)

Table A1.

**Table A2.**  
List of countries  
contained in the  
entire sample

Entire sample		HICs	
Albania	Cyprus	Pakistan	Australia
Argentina	Czech Republic	Papua New Guinea	Austria
Armenia	Cote d'Ivoire	Paraguay	Bahrain
Australia	Denmark	Peru	Belgium
Austria	Dominican Republic	Philippines	Canada
Azerbaijan	Ecuador	Poland	Chile
Bahrain	Egypt, Arab Rep.	Poland, RB	Switzerland
Bangladesh	Egypt, Arab Rep.	Portugal	UK
Belarus	El Salvador	Qatar	USA
Belgium	Equatorial Guinea	Romania	Uruguay
Benin	Eritrea	Russian Federation	
Bhutan	Estonia	Rwanda	
Bolivia	Finland	Senegal	
Botswana	France	Sierra Leone	
Brazil	Gambia, The	Slovak Republic	
Bulgaria	Georgia	Slovenia	
Burkina Faso	Germany	Solomon Islands	
Burundi	Ghana	South Africa	
Cabo Verde	Greece	Spain	
Cambodia	Guatemala	Sri Lanka	
Cameroon	Guinea-Bissau	Sudan	
Canada	Guyana	Eswatini	
Chile	Haiti	Sweden	
China	Honduras	Switzerland	
Comoros	Hungary	Tanzania	
Congo, Dem. Rep.	India	Thailand	
Congo, Rep.	Iran, Islamic Rep.	Togo	
Costa Rica	Ireland	Tunisia	
Croatia	Israel	Turkey	
	Italy	Turkmenistan	
	Jamaica	Uganda	
	Japan		
	Jordan		
	Kenya		
	Korea, Rep.		
	Kuwait		
	Kyrgyz Republic		
	Lao PDR		
	Latvia		
	Lesotho		
	Liberia		
	Lithuania		
	North Macedonia		
	Madagascar		
	Malawi		
	Malaysia		
	Mali		
	Mauritania		
	Mauritius		
	Moldova		
	Mongolia		
	Morocco		
	Mozambique		
	Namibia		
	Nepal		
	The Netherlands		
	New Zealand		
	Niger		
	Nigeria		
	Norway		
	Oman		
	Ukraine		
	UK		
	USA		
	Uruguay		
	Uzbekistan		
	Venezuela, RB		
	Vietnam		
	Zambia		
	Zimbabwe		
	Qatar		
	Slovak Republic		
	Denmark		
	Estonia		
	Finland		
	France		
	Germany		
	Greece		
	Hungary		
	Ireland		
	Israel		
	Italy		
	Japan		
	Korea, Rep.		
	Kuwait		
	Latvia		
	Lithuania		
	The Netherlands		
	New Zealand		
	Norway		
	Oman		
	Poland		
	Portugal		

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
CTAXVOL	621	0.2616569	0.4109418	0.000247	6.754
FDICSTVOL	621	10.781	98.676	0.054	2063.885
FDIGDPVOL	610	10.809	105.788	0.053	2370.18
RENTTOT	621	5.847	8.763	0.0027	62.895
POINTRENT	621	3.596	7.944	0	62.894
DIFFUSERENT	621	2.253	4.038	0	27.953
GRVOL	621	3.006	2.894	0.143	30.798
TROPEN	621	74.982	36.148	13.795	235.669
FINOPEN	621	51.875	35.77902	0	100
POLITY2	621	4.423	6.312	-10	10
INFLVOL	621	25.222	392.843	0.144	9730.51
GDPC	621	13230.74	17179.65	173.42	89690.41

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**Table A3.**  
Descriptive statistics  
on variables

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