Resources bless BRICS

Sebri, Maamar and Dachraoui, Hajer

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Maamar Sebri[a,b,c1]

Email: maamar.sebri@gmail.com

[a] Faculty of Economics and Management and LaREMFiQ, University of Sousse, Tunisia
[b] Shaqra University, Saudi Arabia
[c] Economic Research Forum (ERF), Egypt

Hajer Dachraoui [d]

Email: hajer.dachraoui@gmail.com
[d] Faculty of Economics and Management and MOFID, University of Sousse, Tunisia

Abstract

The rise of the BRICS (Brazil, Russia, India, China and South Africa) as resource-rich countries has triggered the question on the blessing feature of the natural resources wealth. Whatever natural resources are abundantly available in a country or not, it is the rational use and control that may turn it into a blessing rather than a curse. This paper investigates the determinants of capital flight in BRICS countries during the period 2001-2017 while putting a greater emphasis on the role of natural resource rents. The empirical evidence is based on the panel-ARDL regression model estimated with PMG procedure. The econometric analysis reveals that natural resources exert a negative and significant effect on capital flight, indicating that the larger natural resource rents, the less capital flight. This gives support for the natural resource bless hypothesis. Empirical results show also that capital flight is determined by macroeconomic and institutional factors as well. However, the disaggregated analysis by natural resource components and the short-run estimates by individual countries show some disparities that cannot be overlooked. Despite the large benefits of natural resources wealth, curbing the capital flight waves remains a key challenge that faces the BRICS grouping in order to ensure that profits are maximized for the good of countries.

Keywords: BRICS; Capital flight; Natural resources; Panel-ARDL; Pooled Mean Group (PMG)

[1] Corresponding author.

1. Introduction

With a total output of 23.2 per cent of the world's gross domestic product (GDP) in 2018, a population of 41 per cent of the global population in 2015 (ORF, 2019), and more than 25 percent of the world's land, the BRICS is the cluster of the most powerful emerging economies. Coined first in 2001 as BRIC (Brazil, Russia, India, and China) by Jim O'Neill of Goldman Sachs, the acronym was subsequently reconfigured into BRICS in December 2010 with the joining of South Africa. The club regroups the most powerful emerging countries with China is the second biggest economy in the World, followed by India. Russia, Brazil and South Africa occupy also advanced rankings. Over the last years, economic growth rates of the BRICS countries went at a faster pace and exceeded those of most individual G7 countries or the G7 as a group (Salzman, 2019). The group is well economically heterogeneous and each member has its own economic growth pillar. China economy is largely based on manufacturing; India relies on service sector with a particular emphasis on IT, while the remaining three countries' economies are essentially based on the revenues from their abundant natural wealth. The BRICS countries have also taken advantage of globalisation. While China and India present themselves as leading countries in global supply chain, Brazil, Russia and South Africa benefit likewise from globalization which facilitates to them selling their abundant natural resources.

A common feature to international status is that the five BRICS countries are all well-endowed with various types of mineral and/or energy resources. This leads to label them as 'resource powers' (Wilson, 2015). Table 1 presents the BRICS' shares of world production and proven reserves for selected minerals and energy sectors. It is clear that while the five countries show significant disparities in shares for most resources, the group as a whole considerably contributes to the world production and reserves of these resources.

Since 1990s and for about two decades, many factors have helped integrating the BRICS countries, such as high rates of international demand, trade liberalisation, lower global interest rates, and the sustained increase in commodity prices (Cubeddu et al., 2014). This tremendous growth has brought many economic and social benefits such as raise in investment, reduction in poverty and inequalities. However, this growth enjoyment has regressed since 2010, and growth has slowed from around 9 percent in 2010 to only about 4 percent in 2015 (World Bank, 2016). Many factors have contributed to this recession, including domestic, external, as well as cyclical and structural factors. First, the fall in commodity prices seems a primary determinant of growth slowdown especially in Brazil, Russia, and South Africa, which largely rely on their abundant resources wealth. Second, the weaknesses in international trade, especially the declining import demand, hold after the global financial crisis is also a significant factor. Compared to its trend before the crisis, global trade had fallen 20 percent by 2014 (World Bank, 2016).

Table 1. BRICS' share of select world minerals and energy sectors, 2012.

	Iron ore		**Bauxite**		**Coal**		**Crude oil**		**Natural gas**	
	Share world production / share proven reserves (%)									
Brazil	13.6	18.2	13.2	9.3	-	1.0	2.6	1.2	0.6	0.2
Russia	3.6	14.7	2.2	7.1	4.1	21.1	12.4	6.8	19.1	24.7
India	4.9	4.8	7.4	1.9	8.7	7.5	1.0	0.4	1.2	0.8
China	44.7	13.5	18.2	3.0	53.0	13.8	5.0	1.4	3.0	1.7
South Africa	2.2	0.6	-	-	3.9	6.9	-	-	-	-
BRICS	**69.0**	**51.8**	**41.0**	**21.3**	**69.7**	**50.3**	**21.0**	**9.8**	**23.9**	**27.4**

Source: Wilson (2015).

In front of the widespread success achieved by BRICS countries, many issues still persist and continue bleeding their growth. The large illicit financial flows (capital flight)[2] are among these issues. According to Global Financial Integrity report (GFI, 2015), the five BRICS countries occupy the lion share of the average illicit financial flows from developing and emerging countries during the period 2004-2013, and are ranked first in exporting illicit money. China leads the way, followed by Russia in the second rank, India is fourth, Brazil sixth and South Africa is seventh. The illicit financial flows tend to include many types of activities, such as smuggling, bribery by international companies and tax evasion, but trade misinvoicing constitutes the foremost channel for illegally moving capital (GFI, 2020). The following Figure 1 shows the increasing trend of cumulative illicit financial flows for the five countries during the period 2004-2013.

From what has been documented above, a paradoxical status seems to describe BRICS countries whereby economic growth is accompanied by an increasing capital flight. It is worthy, therefore, from a development policy perspective, to investigate this relationship and

[2] The terms 'illicit financial flows' and 'capital flight' are used interchangeably in this study.

uncover the drivers of the capital flight waves occurred in these growing economies. This paper focuses on this last point by putting a greater emphasis on the effect of natural resource rents on capital flight. Both theoretical as well as empirical literature has largely studied the role of natural resources on economic growth. In particular, empirical researches try to answer a fundamental question of whether natural resources are curse or blessing for the economic development (Van Der Ploeg and Poelhekke, 2017; Venables, 2016; van der Ploeg, 2011; Frankel, 2010, Ben-Salha et al. (in press), etc.). Contrarily, very little attention has been paid to the relationship between capital flight and natural resources as will be shown in the subsequent section.

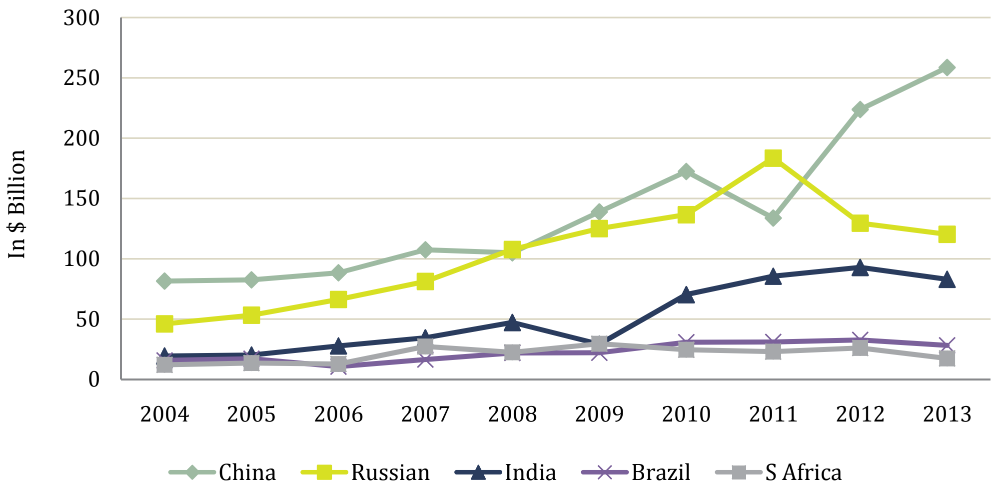

Figure 1. Cumulative illicit financial flows from the BRICS countries from 2004 to 2013.

Source: Jaiswal (2016)

Therefore, the main contribution of this study is to show whether the capital flight is positively or negatively related to resource rents in BRICS countries, which are endowed with diversified and abundant natural resources. The second contribution is that this empirical framework deals with the BRICS countries on which no previous study has been performed despite the importance of such a question for this group as outlined in the introduction. The remainder of this study proceeds as follows. Section 2 provides a theoretical background on the determinants of capital flight and on its relationship with natural resources. Section 3 presents the data and methodology. While Section 4 reports empirical findings, the last section shows some conclusions and policy implications.

2. Theory and background literature

Following the main scope of this study, which assesses the effect of natural resources on capital flight in BRICS countries, it is reasonable to split the background section into two main strands, namely capital flight determinants, and the relationship between capital flight and natural resources.

2.1 Determinants of capital flight

Since the pioneering works on capital flight, a fundamental question has been addressed: what are the drivers of this phenomenon? Researchers try to answer this question in order to give some guidelines on how to fight it. Primary studies have mainly been undertaken on the Latin American countries with the works of Cuddington (1987), Dooley (1988), Pastor (1990), etc. After that, several studies have been performed on other countries or regions from the world, in particular, the African and Asian countries. In empirical evidence, different variables have been identified as significant drivers of capital flight. Most of them include macroeconomic, fiscal, and institutional variables (Ndikumana and Boyce, 2003). For instance, the determinants of capital flight from Latin American countries were studied by Cuddington (1987) who performed the time series analyses of seven Latin American countries spanning from 1974 to 1984 and found that capital flight is significantly affected by debt flows, past capital flight, inflation, real exchange rate and US interest rate. Dooley (1988) and Pastor (1990) considered pooled data for five and eight Latin American countries, respectively. Their empirical results confirm most of findings already reached by Coddington (1987). Fatehi (1994) focused on the effect of political variables on capital flight in seventeen Latin American countries and concluded that capital flight is positively affected by political instability.

Identifying the determinants of capital flight from Sub-Saharan African (SSA) countries has gained also a particular attention of researchers (Hermes and Lensink (1992); Murinde et al., 1996; Lensink et al., 1998; Ndikumana and Boyce, 2003; Fedderke and Liu, 2002; Collier et al., 2004; Ndikumana et al., 2015; Efobi and Asongu, 2016; Asongu et al., 2019, etc.). Earlier studies (Hermes and Lensink (1992); Murinde et al., 1996; Lensink et al., 1998) focused particularly on macroeconomic, and risk and returns on investment variables as done in the case of Latin American studies Ndikumana and Boyce (2003). Other researchers such as Ndikumana and Boyce (2003), Fedderke and Liu (2002) and Collier et al. (2004) are among the first who included the political and institutional variables in the case of studies on African countries. They reached out that capital flight tends to decline with political stability in SSA countries. More recently, Efobi and Asongu (2016) and Asongu et al., (2019) assessed the effects of terrorism on capital flight in African countries using panel data techniques such as Generalised Methods of Moments and quantile regressions. They found that capital flight increases with terrorism dynamics.

Other studies have been conducted on various groups of Asian developing countries, including Chunhanchinda and Sirodom (2007) and Brada et al. (2011). Indeed, researches on the determinants of capital flight in developing countries in general have also been undertaken by for example Kant (1996), Lensink et al. (2000), Reinhart and Rogoff (2004) and Le and Zak (2006). Furthermore, some studies have been performed only on individual countries such as Uganda (Olopoenia, 2000), Tanzania (Nyoni, 2000), Kenya (Ng'eno, 2000), Philippines (Boyce, 1992, 1993), China (Ljungwall and Wang, 2008; Cheung and Qian, 2010).

Most of the literature presented above confirms that capital flight waves are significantly influenced by some macroeconomic variables such as inflation and economic growth, and risk and returns to investment variables such as interest rate, exchange rate, risk premium on external debt, returns on foreign vs. domestic assets. Political and institutional variables, and other factors such as terrorism and conflicts are also significant drivers. However, despite major regularities across empirical studies, differences in the measurement of capital flight and differences in econometric techniques and specifications lead sometimes to contradictory results (Ndikumana and Boyce, 2003).

2.2 Capital flight and natural resources

The relationship between capital flight and natural resources has just gained a special focus over the last years. Empirical evidence proves that most developing countries, in particular the African countries, that show high level of capital flight are in fact resource-rich (Ndikumana, 2015), but what about the rest of countries or group of countries? This paper tries to answer this question in the case of BRICS grouping. The subsequent analysis presents the reasoning from the literature that deals with the relationship between capital flight and natural resources. It is argued that many transmission channels can explain this relationship (Ndikumana and Sarr, 2019) from which the quality and effectiveness of governance and institutional framework, and trade misinvoicing are the most important. First, the corruption in the natural resources management is a development problem rather than just one problem (Kolstad and Soreide, 2009). The large revenues generated by natural resources lead to rent-seeking and embezzlement of the corrupt political and public administration elites and policy makers who generally deposit the embezzled funds overseas in foreign accounts. Second, the natural resources sector is generally managed by multinationals and local firms with large complexity of technological and financial processes. Therefore, they tend to not declare the real figures to the official authorities and they benefit from opportunities for trade misinvoicing. Meanwhile, by bribing the decision-makers, they award lucrative contracts and tax evasion (Mpenya et al., 2016).

With regard to empirical literature, the number of studies investigating the effect of natural resources on capital flight remains delimited and no confirmed robust econometric evidence of a direct impact of natural resources on capital flight (Ndikumana and Sarr, 2019). For instance, using a sample of 30 African countries over the period 1970-2015, Ndikumana and Sarr (2019) examined the triangular relationship among foreign direct investment, capital flight and natural resource rents. Empirical results indicate, among others, that capital flight increases with the natural resource rents and the quality of institutions does not mitigate this link. Ndikumana and Boyce (2011) included the share of fuel exports in the total country's exports as a proxy to natural resources using a sample of 30 sub-Saharan African countries from 1970 to 2004. The authors found no robust results for this variable and its interaction with policy variable neither in sign nor in statistical significance terms. The case of Cameroun and Zimbabwe have been investigated by Mpenya et al. (2016) and Kwaramba et al. (2016), respectively. Their studies showed that natural resources exert a positive effect on capital flight through the trade misinvoicing mechanism. According to the authors, a bad governance coupled with the dominance of the sector by foreign corporations still the main causes of capital flight through the tax evasion and other forms of corporate malpractices.

Studies dealing with the relationship between capital flight and natural resources in other countries out of the African continent are very scarce. For instance, Ljungberg and Friedl (2014) used data for a large panel of 178 countries over the period 1972-2008. The authors found that natural resources exert a positive effect on capital flight and attributed this to rent-seeking mechanism. Demashi (2013) focused on identifying the determinants of capital flight from 21 resource-rich developing countries between 1990 and 2011. Empirical results suggest that an increase in natural resource rents results in accelerated capital flight.

The aforementioned literature overview obviously shows that the relationship between capital flight and natural resources has not widely been investigated; and most studies have been conducted in the case of African countries. The current empirical work tries to fill this gap by setting up the relationship framework in the case of BRICS countries.

3. Data and methodology

3.1. Data

Following the main objective of this study, the capital flight is regressed against the natural resource rents and other explanatory variables for the five BRICS countries. Data spans from 2001 (year of the first labelling of the grouping) until 2017. The capital flight variable is constructed based on the residual method of the World Bank (1985) and using data from both the International Monetary Fund and World Bank databases. The residual method, which remains the most used method of capital flight measurement, was developed by the World Bank in 1985 (World Bank, 1985). It uses the balance of payments and international assets data to calculate the capital flight series. Accordingly, capital flight is obtained as the difference between the sum of the net increase in external debt adjusted for exchange rate fluctuations and the net inflow of foreign investment, and the sum of current account deficit and the change in foreign exchange reserves. That is, Kant (1998) defined the capital flight as the inability of a country to finance the uses of funds (i.e., the current account deficit plus the change in foreign exchange reserves) by the sources of funds (i.e., the net increase in external debt plus the net inflow of foreign investment). The detailed algorithm of computing the capital flight series is provided in the Appendix. In the regression model, the capital flight variable is included as percentage of GDP.

The explanatory variable of interest is the total natural resource rents as share of GDP. In addition, disaggregated types of total natural resources are also considered. Given the share of various types in the total natural resources across BRICS countries, we use oil rents, natural gas rents and we aggregate the remaining types (coal, forest and mineral rents) into one type called other rents. The disaggregation of total natural resources is crucial in this kind of studies because each type may face a particular exposure to capital flight (Ndikumana and Sarr, 2019).

Following the capital flight literature, various control variables could be included in the regression models in the current study: economic growth, inflation rate, exports, external debt stock and institutional variables. For instance, economic growth may either increase or reduce capital flight depending on whether it is a broad-based growth or a growth that focuses on particular sectors, respectively (Efobi and Asongu, 2016). An increase in inflation is expected to be positively correlated with capital flight. Inflation is an indicator of macroeconomic stability and shows how a country manages its monetary policy and its economy in general. A high inflation leads to reduce assets attractiveness denominated in domestic currency compared to those denominated in foreign currency (Ndikumana and Boyce, 2003). Inflation rate as well as real GDP growth rate are include with lagged terms in the regression models. The same positive correlation is also expected between external debt stock and capital flight. An increase in external borrowing may increase the risk of a debt crisis and may reflect an instability of macroeconomic environment in a country. This would, therefore, constitutes an incentive for capital flight. In the current study, we employ the change in debt stock to GDP ratio adjusted from exchange rate fluctuations as used by Ndikumana and Sarr (2019) and Ndikumana and Boyce (2003, 2011).

To control for some mechanisms of capital flight mainly the trade misinvoicing and rent-seeking, we include the ratio of exports to GDP. Some studies consider trade openness instead (Efobi and Asongu, 2016). Ndikumana and Boyce (2003) pointed out that including exports in the regression model as a determinant of capital flight is a relevant feature since it accurately allows testing for the above mentioned capital flight channels. Finally, the quality of governance and institutions impact on capital flight is assessed via the incorporation of two indexes: control of corruption and Polity2 in separate specifications. The control of corruption index, which is obtained from the World Bank's Worldwide Governance Indicators (WGI), reflects perceptions of the extent to which public power is exercised for private gain. It ranges from -2.5 (weak governance) to 2.5 (strong governance). The Polity2 index, which is taken from the Polity IV project database, measures the extent of regular institutional constraints on executive power. It ranges from -10 (strongly autocratic) to 10 (strongly democratic). Table 2 provides some descriptive statistics, sources, and short definitions for all the variables.

Table 2. Definition and descriptive statistics of variables.

Variable	Description	Source	Mean	Std.dev
Flight	Ratio of capital flight to GDP	Authors' calculation based on data from WDI and IFS	-1.976	6.027
Total rents	Total natural resources rents (% of GDP)	World Bank (WDI)	6.786	5.115
Oil rents	Oil rents (% of GDP)	World Bank (WDI)	2.764	3.698
Gas rents	Natural gas rents (% of GDP)	World Bank (WDI)	0.885	1.778
Other rents	Forest + mineral + coal rents (% of GDP)	World Bank (WDI)	4.021	2.357
Growth	Real GDP growth rate (annual %)	World Bank (WDI)	5.045	3.827
Inflation	Consumer price index (2010 = 100) (annual %)	UNCTADStat	95.150	28.193
Export	Export of goods and services as % of GDP	World Bank (WDI)	23.980	7.519
Debt	Change in debt (adjusted for exchange rate fluctuations) as % of GDP	Authors' calculation based on data from WDI and IFS	1.564	2.549
Corruption control	Control of corruption index	World Bank (WGI)	-0.337	0.420
Polity2	Polity2 index	Polity IV project database	4.741	6.129

3.2. Methodology

To assess the impact of natural resources on capita flight, a dynamic heterogeneous panel regression as panel-ARDL model is specified and estimated with the Pooled Mean Group (PMG) procedure (Pesaran et al., 1997; 1999). Over these years, the PMG technique is being increasingly applied in empirical researches based on panel data, despite its appearance since more than twenty years. It has gained a special focus because it accounts for both averaging and pooling. First, to handle the individual heterogeneity issues in panel data, the Mean Group (MG) procedure can be used. The latter consists in estimating the individual equations and averaging the corresponding parameter estimates (Pesaran and Smith, 1995). Second, the cross sections may be also pooled and estimated by for example a Dynamic Fixed Effects procedure (DFE). The latter allows the intercepts to vary across units (i.e., countries, regions, etc.), but restricts slope parameters to be the same. The PMG technique is proposed as an intermediate between the MG and the DFE estimation procedures. While it imposes identical long-run coefficients, it allows short-run coefficients to vary across units. This is of great utility since, in the short run, unit-specific characteristics may prove to be significant factors. Following Pesaran et al. (1999), the ARDL (*p, q,q,…q*) model relating the dependent variable *(Flight)* and a vector of explanatory variables may be specified as follows:

$$Flight_{it} = \sum_{j=1}^{p} \lambda_{ij}\, Flight_{i,t-j} + \sum_{j=0}^{q} \gamma'_{ij} X_{i,t-j} + \alpha_i + \varepsilon_{it} \qquad (1)$$

Where X (k×1) is the vector of explanatory variables described in Table 2; α_i represents the specific fixed effects; λ_{ij} are scalars; γ_{ij} are k×1 coefficient vectors and ε_{it} are the error terms that are independently distributed across *i* and *t* with 0 means and variances σ_i^2.

Pesaran et al. (1999) suggests rearranging equation (1) into an error correction model specified as follows (equation 2) that will be estimated using the PMG procedure:

$$\Delta Flight_{it} = \emptyset_i\, (Flight_{i,t-1} - \beta'_i X_{it}) + \sum_{j=1}^{p-1} \lambda^*_{ij} \Delta Flight_{i,t-j} + \sum_{j=0}^{q-1} \gamma'^{*}_{ij} \Delta X_{i,t-j} + \alpha_i + \varepsilon_{it} \qquad (2)$$

where $\emptyset_i = -\left(1 - \sum_{j=1}^{p} \lambda_{ij}\right)$; $\beta_i = \sum_{j=0}^{q} \gamma_{ij} / \left(1 - \sum_{j=1}^{p} \lambda_{ij}\right)$;

$\lambda^*_{ij} = -\sum_{m=j+1}^{p} \lambda_{im}; with\ j = 1, \dots p-1;$ $\gamma^*_{ij} = -\sum_{m=j+1}^{q} \gamma_{im}; with\ j = 1, \dots q-1$

and $i = 1, \dots N$

In equation (2), $\emptyset_i$ denotes the error correction term (ECT). The corresponding estimated coefficient is expected to be negative and statistically significant. The speed of adjustment towards the long-run equilibrium is given by the inverse of the absolute value of $\emptyset_i$. The vector β_i indicates the long-run effects of the explanatory variables on the *Flight* variable. The vector γ^*_{ij} shows the short-term coefficients, that differ across countries, and reflects the extent to which each country's capital flight responds to the exerted shocks. The estimated model is based on an ARDL (1, 1, …,1). The choice of the lag length for the ARDL model is based on the Schwarz information criterion, while imposing a maximum of one lag in the estimation step. Two main reasons reside behind the choice of a maximum of one lag, namely the limited number of observations and the relatively higher number of variables taken in the model.

The empirical strategy followed in this study consists in estimating many specifications. First, we estimate a separate regression model for each type of natural resources described in the data sub-section (total rents, oil rents, natural gas rents, and other rents) using the same explanatory variables. Second, for robustness check purposes, two specifications: (1) and (2) are estimated for each regression model of the four natural resource components according to the included institutional variable. Specification (1), which is the baseline specification, considers the control of corruption variable while specification (2) considers the polity2 variable.

4. Empirical results

This section is devoted to present the estimation results, but first it begins by a preliminary analysis of the cross-sectional dependence and integration properties of the variables.

4.1 Cross-sectional dependence and integration properties

Among the nice features of the PMG estimator is the possibility of estimating equation (2) while the incorporated variables are stationary (I(0)) or containing a unit root (I(1)). However, before conducting unit root tests, we proceed first by testing the cross-sectional independence in heterogeneous panels. The econometric literature offers a number of tests, including the Lagrange Multiplier (LM) test by Breusch and Pagan (1980); the bias-adjusted LM test by Pesaran et al. (2008); and the CD test by Pesaran (2004). Each test is applied in specific conditions such as those related to the size of N and T. When $T > N$, the LM test, developed by Breusch and Pagan (1980), may be used. This is obviously the case of the current study where $T=17 > N=5$. If cross-sectional dependence exists, then it is appropriate to use the second generation of unit root tests; if not, the first generation of unit root tests is sufficient. The results of the LM test are presented in Table 3. The results are presented for each regression model of the natural resource components and according to the included institutional variable.

Table 3. Results of the Breusch-Pagan LM test of cross-sectional independence.

specification	**(1) Control of corruption**		**(2) Polity2**	
	LM-statistics	*p-value*	*LM-statistics*	*p-value*
Total rents	10.27	0.4172	10.70	0.3814
Oil rents	13.18	0.2140	11.95	0.2887
Gas rents	10.96	0.3609	8.92	0.5388
Other rents	10.21	0.4220	9.03	0.5284

Results of the LM test show that the null hypothesis of cross-sectional independence among countries could not be rejected for all specifications. Therefore, it is reasonable to follow the analysis with the first generation panel unit root tests such as the LLC test (Levin et al., 2002), IPS test (Im et al., 2003), HT test (Harris and Tzavalis, 1999), Breitung test (Breitung, 2000; Breitung and Das, 2005), Fisher-type test (Maddala and Wu, 1999; Choi, 2001) and LM-Hadri test (Hadri, 2000). It is argued that, under the alternative hypothesis, the Fisher-type and IPS tests relax the restrictive assumption of LLC test that the *p*-values from unit root tests for each cross-section *i* must be the same for all series (Maddala and Wu, 1999; Baltagi, 2005). Moreover, when N is small, as in our case, these two tests perform better. Results of the IPS and Fisher-type tests are presented in Table 4. They indicate that we have a mix of stationary and nonstationary variables. Therefore, we continue estimating equation (2) with the PMG estimator. The corresponding results are depicted in Table 5 for the long-run estimates, and Table 6 and Table 7 for the short-run estimates.

Table 4. Results of unit root tests.

	Fisher-type test statistic		**IPS test statistic**	
Variable	***level***	***First difference***	***level***	***First difference***
Flight	33.448***	124.249***	-2.584***	-7.787***
Total rents	13.874	113.020***	-1.068	-8.441***
Oil rents	5.906	70.922***	0.379	-6.143***
Gas rents	21.935**	76.381***	-2.656***	-3.690***
Other rents	20.725**	115.022***	-2.143**	-7.557***
Growth	18.513**	96.676***	-0.492	-4.462***
Inflation	0.032	19.436**	6.896	-1.361*
Export	12.352	76.403***	-1.029	-6.872***

Debt	40.149***	99.075***	-3.609***	-5.849***
Corruption control	7.204	106.446***	-1.971**	-5.790***
Polity2	0.3019	-2.8418***	n.a	n.a

***, ** and * indicate the statistical significance at the 99%, 95% and 90% confidence levels, respectively. The Fisher-type test shown here is the inverse chi-squared P statistic of Maddala and Wu (1999) which is suitable in case of finite N and T (Maddala and Wu, 1999; Baltagi, 2005), except for Polity2 variable where the inverse normal Z statistic is used. The null hypothesis of each test is that all panels contain unit roots. Lag lengths were determined by the Bayesian Information Criterion (BIC).

4.2 Estimation results and discussion

A first look at Table 5 shows that the coefficient of the error correction term (ECT) is always negative and statistically significant. These coefficients are inferior to 1 in absolute value, which confirms the long-run equilibrium relationship between the dependent variable and explanatory variables. The estimated ECTs exhibit coefficients ranging from -0.83 to -0.50, which is equivalent to speeds of adjustment ranging from 1.2 to 2 years. This suggests that each variable responds quite swiftly to deviations from the long-run equilibrium.

4.2.1 The long-run estimates

With regard to effect of the explanatory variables on the dependent variable (*Flight*), an interesting finding is obtained for the natural resource rents, the variable of interest. The estimated coefficients associated with the total rents, oil rents (one specification), and other rents are negative and statistically significant. This means that, except natural gas rents, the remaining natural resource rents have a negative effect on capital flight in BRICS countries: the more resources rents, the less capital flight. The few empirical studies on the relationship between natural resources and capital flight especially in African countries (Ndikumana and Sarr, 2019; Mpenya et al., 2016; Kwaramba et al., 2016; Ndikumana and Boyce, 2011; Ljungberg and Friedl, 2014; Demashi, 2013) often show that natural resources exert a positive effect on capital flight; and attribute this to many mechanisms such as rent-seeking, corruption, tax evasion and trade misinvoicing. However, in the current study, natural resources seem to bless BRICS countries by reducing the capital flight waves. As explained earlier in this paper, BRICS countries are endowed with large and diversified natural resources wealth and have availed plentiful advantages from it. A common feature of uniting these countries is that they adopt a policy of resource nationalism. The latter indicates the situation in which the mining and energy sectors are highly and directly controlled by the state rather than being market-oriented (Simsek, 2018, Pryke, 2017; Wilson, 2015, 2017;

Vivoda, 2009). According to Wilson (2015, 2017), since 2000s, BRICS countries follow three main measures of resource nationalism: *i)* encouraging state-owned corporations and restrict foreign penetration; *ii)* controlling resources export, and *iii)* keeping affordable the domestic energy prices. Through these measures, especially, the strict control of resources export and restriction of foreign multinational penetration, one can find some explanations of the negative effect of natural resource rents on capital flight. In fact, the trade misinvoicing, the tax evasion and other forms of multinational corporations' malpractices, which were indicated as main channels of stimulating capital flight, seem being strictly controlled for in BRICS countries via the mechanisms of natural resource nationalism. On the one hand, the natural resource nationalism has gained a strong social support in most BRICS countries since a large share of natural resource revenues have been allocated for social spending programmes and enhancing the well-being of population. On the other hand, a political pressure on national state-owned corporations and a strict control on its activities have been undertaken in order to enhance the production capacity and squeeze new domestic investments and therefore maximize the assets for the social spending programmes. All of these measures seem to exert a curbing effect on the capital flight waves in BRICS countries. On the other hand, as recommended by Ndikumana and Sarr (2019) that it is crucial in this kind of studies to consider separately analyzing different types of natural resources because each one may face a particular exposure to capital flight, we find different results for natural gas rents. The latter shows a positive and significant coefficient meaning that capital flight increases with natural gas rents. However, the lion's share in the endowment and production of natural gas is occupied by Russia, which could mean that these results are skewed by the distribution of natural gas rents within BRICS members. This may lead to say that the curse effect of natural gas rents may be recorded only in Russia.

After discussing the results associated with the variable of interest, it is worth to highlight the findings regarding the other variables. First, the coefficient of the *Growth* variable is mostly positive and statistically significant. As mentioned earlier in this paper, the effect of economic growth is mixed in the literature of identifying the determinants of capital flight. On the one hand, what is naturally expected is a negative coefficient of the *Growth* variable, which means that the more economic growth, the higher overall returns to capital and domestic investment in the country and, therefore, the less capital flight. On the other hand, a positive coefficient may reflect a persistence of capital flight phenomenon during periods of high growth (Ndikumana and Sarr, 2019). This is confirmed by the high level of capital flight in BRICS countries while at the same time they are performing better and reaching high rates of economic growth. The results on *Inflation* variable are as expected. Positive and statistically coefficients are estimated for most specifications, meaning that capital flight increases with the increase of inflation rate. In fact, a high inflation is a signal of macroeconomic turmoil in a country. It leads to reduce assets attractiveness denominated in domestic currency compared to those denominated in foreign currency. This pushes, therefore, transferring a part of capital overseas. With regard to the *Export* variable, it is identified as a relevant determinant of capital flight. Export may affect capital flight in different ways. First, it constitutes a source of mispricing and foreign exchange. Second, it may boost rent-seeking, as main channel of capital flight, by elites and private interests (Ndikumana and Boyce, 2003). Its estimated coefficient is in most specifications negative and statistically significant, suggesting that an increase in exports leads to a decline in capital flight. This could be elucidated with reference to explanations of the negative effect of natural resources rents on capital flight that natural resources sector is strictly controlled for in BRICS countries in order to fight any type of rent-seeking and mispricing in resource exports. However, this variable variable presents also a positive and significant coefficient in the case of second specification for *other rents*. Indeed, the effect of export, and in general trade openness, on capital flight is still mixed in empirical studies (Asongu et al., 2019).

Empirical results indicate that capital flight in BRICS countries is positively influenced by the change in the debt stock variable (except one specification for oil rents). This means that the higher the change in external debt stock the higher capital flight, which provides a strong support for *debt-fueled capital flight* hypothesis as a strand of the revolving door phenomenon largely discussed in the debt-capital flight literature.[3] Briefly, this hypothesis occurs when external borrowed funds are re-exported overseas as private assets, increasing therefore the capital flight.

As per the quality of governance and institutions effect on capital flight, the obtained results are as expected for the two indexes (control of corruption and Polity2) separately included in different regressions. These two indexes show negative and highly significant coefficients in most specifications. First, corruption has been advanced as a main factor of capital leakages. In particular, in resource-rich developing countries, the rent-seeking, which is a main channel to capital flight, is fostered by corruption. The latter also causes, among others, money

[3] For more discussion on the revolving door phenomenon, readers would refer to Boyce (1992), Ndikumana and Boyce (2003, 2011) and Dachraoui et al. (2020).

laundering, private investments declining, market based competition and innovation preventing, which ultimately leads to economic growth collapse. The negative and statistically significant coefficient found in Table 5 suggests that a better control of corruption leads to reduce capital flight by impeding illicit acquisition and/or illicit transfer of capital abroad. The Polity2 index, used to test the robustness of results found out with the control of corruption index, confirms the aforementioned analysis. This index, which indicates the extent of regular institutional constraints on executive power, shows that the more democratic regime, the less capital flight in a country.

Table 5. Long-run estimates.

	Total		*Oil*		*Gas*		*Other*	
Variable	**(1)**	**(2)**	**(1)**	**(2)**	**(1)**	**(2)**	**(1)**	**(2)**
ECT	-0.7643***	-0.8397***	-0.3940	-0.5025***	-0.6644***	-0.6619***	-0.8014***	-0.8090***
	(0.2308)	(0.2723)	(0.2619)	(0.0667)	(0.2159)	(0.1759)	(0.2499)	(0.2508)
Rents	-0.479***	-0. 639***	12.367***	-1.978**	2.712**	2.530	-0.500***	-0.179
	(0.0858)	(0.2029)	(1.7551)	(0.9527)	(1.0636)	(1.6151)	(0.0797)	(0.2788)
Growth	0.721***	0.477***	-1.707***	1.252**	0.967***	0.479**	0.612***	-0.123
	(0.1581)	(0.1612)	(0.1032)	(0.5903)	(0.1617)	(0.2324)	(0.1576)	(0.1534)
Inflation	0.029**	0.001	0.184***	-0.020	0.051***	0.0315	0.029**	0.0235**
	(0.0140)	(0.0109)	(0.0138)	(0.0400)	(0.0104)	(0.0230)	(0.0132)	(0.0098)
Export	-0.803***	0.217	-2.105***	-1.723***	-1.553***	-0.379	-0.620***	0.245**
	(0.1561)	(0.1339)	(0.1984)	(0.3388)	(0.1301)	(0.2505)	(0.1349)	(0.1179)
Debt	0.068	1.157***	-0.779***	0.413	0.108	0.8605***	0.139	1.178***
	(0.1281)	(0.1534)	(0.0852)	(0.2990)	(0.1208)	(0.1958)	(0.1334)	(0.2025)
Corruption control	-7.715***	-	-7.125***	-	-5.089***	-	-7.312***	-
	(1.2200)		(1.6730)		(1.1842)		(1.1806)	
Polity2	-	-7.438**	-	-1.711	-	-4.410**	-	-5.921***
		(3.049)		(2.0210)		(1.7584)		(2.1401)
Log-likelihood	-128.70	-145.79	-123.73	-147.96	-126.80	-150.03	-132.36	-145.03

***, ** and * indicate the statistical significance at the 99%, 95% and 90% confidence levels, respectively. Standard-errors are in parentheses.

4.2.2 The short-run dynamics

The estimation results in the short-run are presented in Table 6. In terms of statistical significance, the estimated coefficients are not as satisfactory as in the long-run. Most variables lost their significance with comparison to the long-run estimates. This can be attributed to the lack of a short-run dynamics between the dependent variable and the explanatory variables, as well as the fact that the impact of some macroeconomic variables is generally not immediate. For instance, the variable of interest is only significant in just one specification among eight. This means that natural resource rents have no instantaneous effect on capital flight. For the remaining variables, inflation rate and change in debt stock as percentage of GDP usually keep their coefficient signs estimated in the long-run despite their weak statistical significance. The real GDP growth rate and export of goods and services as percentage of GDP variables show opposed coefficient signs as compared to those obtained in the long-run. This confirms the conflicting results on the effect of these variables on capital flight as identified in previous studies (e.g., Ndikumana and Sarr, 2019; Efobi and Asongu, 2016; Ndikumana and Boyce, 2003; Henry, 1996; Murinde et al., 1996). The real GDP growth exhibits a negative coefficient in the short-run, suggesting that economic growth is a limiting factor of capital flight. Economic growth increases the overall returns to capital and domestic investment, and boosts residents' confidence in the local economy, which prompts them to not transfer their capital abroad and, therefore, capital flight decreases. The coefficients of *Export* variable turn out to be positive and significant in the short-run compared to the long-run estimates. This indicates that in the short-run the strict regulations undertaken on resources export have no effect on preventing mechanisms of capital flight such as export mispricing and rent-seeking.

Table 6. Short-run estimates.

	Total		***Oil***		***Gas***		***Other***	
Variable	**(1)**	**(2)**	**(1)**	**(2)**	**(1)**	**(2)**	**(1)**	**(2)**
Δ *Rents*	0.216 (0.2759)	-0.600 (0.5267)	-1.478 (3.0553)	-1.427 (1.9977)	-21.202 (28.1317)	-31.177 (19.191218)	-0.189 (0.3169)	-1.225** (0.5182)
Δ *Growth*	-0.449*** (0.1045)	-0.182 (0.1143)	0.588 (0.7262)	-0.313 (0.2366)	-0.307*** (0.1094)	-.171* (0.0918)	-0.370*** (0.1362)	0.065 (0.1027)
Δ *Inflation*	-0.010 (0.1690)	0.2563 (0.1964)	0.135 (0.3920)	0.472 (0.3584)	0.317 (0.2150)	0.243*** (0.0841)	0.007 (0.1289)	-0.013 (0.1009)
Δ *Export*	0.673* (0.4171)	0.536 (0.5156)	0.346 (0.4631)	0.811** (0.4237)	1.163*** (0.2256)	0.571** (0.2423)	0.819* (0.4459)	0.438 (0.4265)
Δ *Debt*	0.420*** (0.1932)	0.042 (0.2040)	0.644*** (0.1584)	0.507*** (0.0812)	0.391* (0.2045)	0.167*** (0.0478)	0.444* (0.2523)	0.114 (0.1714)
Δ *Corruption control*	7.158 (12.0480)	-	-2.149 (6.0849)	-	2.566 (8.8439)	-	7.143 (11.7432)	-
Δ *Polity2*	-	0.889 (0.8892)	-	0.699 (0.6993)	-	0.803 (0.8038)	-	0.884 (0.8843)
Constant	12.750* (7.2567)	46.312** (16.576)	9.295 (7.5524)	23.493*** (8.3848)	16.937* (9.6082)	20.158** (9.7961)	8.835 (6.3236)	31.016*** (11.7705)

***, ** and * indicate the statistical significance at the 99%, 95% and 90% confidence levels, respectively. Standard-errors are in parentheses.

4.2.3 The short-run dynamics by individual countries

As explained earlier in the methodology section, among the advantage of the PMG is the fact that it allows obtaining the short-run estimated coefficients per country. The associated results are presented in Table 7.[4] The individual estimated error correction terms for the five countries are negative and statistically significant in most cases. This confirms the presence of a long-run equilibrium relationship between capital flight and dependent variables. Two typical intervals are observed for the estimated error correction coefficients. First, most ECTs are between -1 and 0, indicating that the dependent variable (capital flight) monotonically converges to its long-run equilibrium. Second, four estimated error correction coefficients (one for China and three for South Africa) are between -2 and -1, suggesting that before converging to the equilibrium path, the error-correction process produces dampened oscillations around the long-run values of capital flight.

As for the estimation results in the short-run for the whole sample presented in Table 6, natural resource rents seem to have an insignificant or weak short-run effect in different countries. Few exceptions are shown for some countries where natural resource rents affect capital flight. For the remaining variables, the estimated coefficients of economic growth keep the negative sign estimated in Table 6, indicating that growth is a deterrent factor of capital flight. An exception is observed for China where a positive and significant coefficient is estimated, suggesting a persistence of capital flight phenomenon during growth episodes. This is confirmed by current facts since China leads the way of the average illicit financial flows from developing and emerging countries as revealed out in the Introduction section. The inflation rate coefficient is statistically significant in some specifications only and shows conflicting signs. While it keeps its positive sign in China and South Africa, an unexpected negative coefficient is estimated for Brazil and Russia in the short-run. With regard to export and change in external debt stock variables, they exhibit the same results as in the short-run for the sample as a whole. An increase in the export to GDP ratio and change in the external debt stock to GDP ratio leads to increase capital flight in different BRICS members. Finally, the control of corruption variable, which was insignificant in the short-run for the sample as a whole, shows now significant coefficients for most countries. In particular, the control of corruption help curbing the capital flight in China and South Africa, while it seems to have a

[4] In order to keep space and not overwhelm the reader with many large Tables, we present in Table 7 only the empirical results associated with the baseline specification (1) for which the control of corruption variable is incorporated in the regression model. The results for specification (2) are quite similar to those in Table 7.

positive effect in Russia. This could be explained by the fact that despite the increasing efforts of fighting corruption in Russia, capital flight still finds a way forward.

Table 7. Short-run estimates by individual countries.

Country		*ECT*	Δ *Rents*	Δ *Growth*	Δ *Inflation*	Δ *Export*	Δ *Debt*	Δ *Corruption control*	*Constant*
Brazil	Total	-0.7684*** (0.2102)	0.169 (0.6571)	-0.287* (0.1627)	-0.357 (0.2272)	1.756** (0.7346)	0.951** (0.4532)	-1.045 (4.4433)	6.777*** (2.4720)
	Oil	-0.2041*** (0.0656)	3.167*** (1.2156)	-0.453*** (0.1615)	-0.735*** (0.1947)	-0.0009 (0.5191)	0.127 (0.3522)	2.649 (3.8752)	2.486** (1.1336)
	Gas	-0.4037** (0.1603)	40.793 (59.8684)	-0.303* (0.1558)	-0.207 (0.2178)	1.368** (0.6322)	1.054*** (0.3827)	-0.818 (4.9704)	5.593** (2.2405)
	Other	-0.8804*** (0.1860)	-1.142 (0.8110)	-0.235* (0.1328)	-0.387 (0.2357)	2.235*** (0.5826)	1.231*** (0.3839)	0.236 (4.0509)	5.298** (2.2376)
Russia	Total	-0.9566*** (0.1279)	1.064*** (0.2915)	-0.210* (0.1099)	-0.422** (0.2036)	-0.281 (0.4715)	0.211* (0.1196)	48.291*** (6.5378)	17.199*** (4.4591)
	Oil	-0.0705 (0.0818)	0.099 (0.8756)	0.129 (0.2418)	0.100 (0.3724)	-0.844 (0.7871)	0.472** (0.2140)	14.495 (13.7144)	-6.703 (8.5150)
	Gas	-0.8264*** (0.1372)	-1.419 (0.9163)	-0.028 (0.1393)	0.086 (0.2610)	1.362** (0.5533)	0.443*** (0.1207)	28.213*** (8.4529)	15.066*** (5.6724)
	Other	-0.9811*** (0.1933)	0.456 (0.8562)	-0.027 (0.1379)	-0.105 (0.2585)	0.396 (0.5751)	0.146 (0.1516)	47.326*** (9.5613)	5.877 (4.6322)
India	Total	-0.3558** (0.1758)	-0.637 (0.7018)	-0.557* (0.3083)	0.358 (0.2350)	1.339*** (0.5139)	0.627** (0.3022)	0.759 (7.7864)	0.337 (5.4032)
	Oil	-0.0595 (0.1546)	0.502 (4.2304)	-0.258 (0.2639)	0.046 (0.2808)	0.580 (0.8976)	0.728** (0.3711)	4.414 (10.5512)	1.204 (2.9358)
	Gas	-0.1412 (0.1165)	23.057* (12.1258)	-0.367 (0.2970)	0.175 (0.2180)	0.711** (0.3449)	0.490* (0.2924)	4.390 (7.2126)	1.630 (1.5588)
	Other	-0.4162** (0.1972)	-0.678 (0.7581)	-0.537* (0.3115)	0.348 (0.2315)	1.226*** (0.4218)	0.595* (0.3018)	-0.2271 (7.8221)	-0.470 (1.4577)

China	Total	-0.2226 (0.1741)	0.055 (0.6952)	-0.393 (1.0869)	-0.003 (0.5626)	-0.287 (0.4388)	0.499** (0.2434)	13.270 (8.7643)	0.397 (1.7292)
	Oil	-1.4343*** (0.0599)	-13.488*** (0.7429)	3.462*** (0.1533)	1.587*** (0.1637)	1.959*** (0.1539)	1.035*** (0.0566)	-14.560*** (1.8520)	36.902*** (3.4801)
	Gas	-0.5443*** (0.1477)	-55.144 (38.9371)	-0.161 (0.4523)	0.470 (0.4288)	0.582 (0.4019)	0.142 (0.2336)	7.868 (5.9611)	8.035*** (2.8711)
	Other	-0.1387 (0.1544)	-0.045 (0.8314)	-0.245 (1.1806)	-0.096 (0.6236)	-0.449 (0.4477)	0.534** (0.2457)	12.975 (9.1386)	-0.101 (1.7689)
South Africa	Total	-1.5182*** (0.1417)	0.431** (0.1746)	-0.797*** (0.1672)	0.370 (0.2988)	0.843*** (0.2495)	-0.190 (0.1510)	-25.484*** (5.3096)	39.038*** (4.9871)
	Oil	-0.2013 (0.1266)	2.326 (9.7757)	0.063 (0.3645)	-0.318 (0.3365)	0.040 (0.2278)	0.858*** (0.2330)	-17.747* (9.2900)	12.587 (7.9595)
	Gas	-1.4064*** (0.0972)	-113.301*** (16.3190)	-0.677*** (0.1211)	1.060*** (0.1726)	1.791*** (0.1464)	-0.175 (0.1220)	-26.821*** (4.4331)	54.362*** (4.331)
	Other	-1.5908*** (0.1445)	0.461** (0.1849)	-0.808*** (0.1681)	0.202 (0.3130)	0.689*** (0.2595)	-0.286* (0.1533)	-24.595*** (5.7994)	33.574*** (4.9347)

***, ** and * indicate the statistical significance at the 99%, 95% and 90% confidence levels, respectively. Standard-errors are in parentheses.

5. Conclusions

The abundant natural resources wealth stands as a core pillar of the strong growth potential of the BRICS countries. Over years, the five countries have reached high economic growth rates that sometimes exceed the rates reached out by most individual G7 countries. This catching-up process has been also coupled with an increase of capital flight phenomenon. This paper sought to investigate the relationship between the natural resource wealth and capital flight for the BRICS countries, a question that has not yet been addressed for this group. To this end, a dynamic heterogeneous panel regression as panel-ARDL model was specified and estimated with the PMG procedure. Many specifications were estimated according to the aggregated as well as disaggregated types of natural resource rents and according to incorporated institutional variable.

The following findings were reached out. First, natural resources rents exert a negative effect on capital flight in BRICS countries during the period 2001-2017. Therefore, natural resources seem to bless this grouping by reducing the capital flight waves. In fact, the natural resources sector is strictly controlled for by BRICS governments. The latter have pursued policies that have been deemed resource nationalism. They control the resources exports and encourage state-owned companies to manage the sector rather than being market-oriented. These measures lead to reduce resources export misinvoicing, bribery by international companies and tax evasion, which were indicated as main channels of stimulating capital flight. Second, most of the significant control variables display expected signs. Inflation rate and change in debt stock positively affect capital flight in the long-run as well as in the short-run, while real GDP growth rate and export to GDP ratio display mixed effects according to the natural resource type. The institutional factor, which was assessed via two separately incorporated indexes in the regression model, shows also a negative impact on capital flight. Indeed, establishing an adequate institutional environment that enforces the transparency and accountability, and the effectiveness of mechanisms and institutions help curbing the capital flight waves.

The BRICS countries are building up strong economic bases thanks mainly to their mining and energy wealth. They are fast closing the gap with the developed economies. Furthermore, they are influential on both their own regions and on global scale by their large population, economic reforms and nationalistic resource-led development strategies. Nevertheless, the key challenge faced by BRICS countries is their ability to maintain the catching-up process and sustain an inclusive growth that, while focuses on ensuring sustainability at a high growth rate, puts greater emphasis on societal wellbeing, technological innovation, and environmental protection. Capital flight stands as a big issue for these countries and further efforts and measures should be undertaken in order to prevent and curb the capital flight waves and to ensure that natural resources rents and other profits are maximized for the good of the countries.

Appendix. Computation of capital flight series.

Following Boyce and Ndikumana (2001) and Ndikumana et al. (2015), this appendix provides the detailed algorithm for computing capital flight series based on the residual method of the World Bank. Accordingly, capital flight is defined as the difference between total capital inflows and recorded foreign exchange outflows. In a given year *t* the capital flight for a country is given by:

$$Flight_t = (\Delta DEBT_t + FDI_t) - (CA_t + \Delta RES_t) \qquad (A1)$$

where CF is the computed capital flight; $\Delta DEBT$ is the change in total external debt outstanding; *FDI* is the net foreign direct investment, *CA* is the current account deficit, and ΔRES is net additions to the stock of foreign reserves.

However, to correct for potential discrepancies due to exchange rate fluctuations, Boyce and Ndikumana (2001) suggested adjusting the change in the long-term debt stock for fluctuations in the exchange rate of the dollar against other currencies. For a country i, the U.S. dollar value of the beginning-of-year stock of debt at the new exchange rates is obtained as follows:

$$\begin{aligned} NEWDEBT_{i,t-1} &= \sum_{j=1}^{7} (\alpha_{ij,t-1} * LTDEBT_{i,t-1})/(EX_{jt}/EX_{j,t-1}) \\ &+ IMFCR_{i,t-1}/(EX_{SDR,t}/EX_{SDR,t-1}) + LTOTHER_{i,t-1} + LTMULT_{i,t-1} \\ &+ LTUSD_{i,t-1} + STDEBT_{i,t-1} \qquad (A2) \end{aligned}$$

where *LTDEBT* is the total long-term debt; α_{ij} is the proportion of long-term debt held in currency j, for each of the seven non-US currencies (i.e., the euro (from 2000); French franc and the Deutsche mark (up to 2000); Swiss franc, Yen, SDR, and British pound) ; *EX* is the end-of-year exchange rate of the currency of denomination against the dollar (expressed as units of currency per U.S. dollar); *IMFCR* is the use of IMF credit; *LTOTHER* is long-term debt denominated in other unspecified currencies; *LTMULT* is long-term debt denominated in multiple currencies; *LTUSD* is long-term debt denominated in U.S. dollars; and *STDEBT* is short-term debt.

The exchange rate adjustment is therefore calculated as:

$$EXRADJ_t = NEWDEBT_{t-1} - DEBT_{t-1} \qquad (A3)$$

Which gives the adjusted change in debt as follows:

$$\begin{aligned}\Delta DEBTADJ_t &= \Delta DEBT_t - EXRADJ_t = DEBT_t - DEBT_{t-1} - EXRADJ_t \\ &= DEBT_t - DEBT_{t-1} - NEWDEBT_{t-1} + DEBT_{t-1} \\ &= DEBT_t - NEWDEBT_{t-1} \qquad (A4)\end{aligned}$$

Consequently, we get the residual measure of capital flight adjusted for exchange rate fluctuations from modifying equation (A1) as follows:

$$Flight_t = (\Delta DEBTADJ_t + FDI_t) - (CA_t + \Delta RES_t) \qquad (A5)$$

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