Capital Flight, Foreign Direct Investment and Natural Resources in Africa

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Abstract

This paper provides theoretical and empirical insights into the puzzling simultaneous rise in foreign direct investment inflows in Africa and capital flight from the continent over the past decades. Indeed, paradoxically, even as African countries have become more attractive to foreign private capital, they have continued to experience capital exodus in the context of improved economic performance, especially since the turn of the century. This paper explores three questions. First, does foreign direct investment fuel capital flight as has been established in the case of external borrowing? In other words, is there an FDI-fueled capital flight phenomenon akin to debt-fueled capital flight? Second, is natural resource endowment a possible channel for the capital flight-FDI link, given that resource-rich countries tend to be both preferred destinations of FDI and prominent sources of capital flight? Third, does the quality of institutions mitigate the impact of natural resources on capital flight? The paper develops a theoretical model that conceptualizes these linkages and sets the stage for an econometric investigation of these questions. The results from econometric analysis based on a sample of 30 African countries over the period 1970-2015 show that FDI flows are positively related to capital flight, suggesting a possible FDI-fueled capital flight phenomenon. However, there is no evidence for an FDI overhang effect; past stock of FDI has no impact on capital flight. High natural resource rents are associated with high capital flight and the quality of institutions does not mitigate this link. The paper offers some policy insights derived from the empirical results.

Key words: capital flight; foreign direct investment; natural resources; Africa
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1 Introduction

Since the turn of the century the African continent has experienced a historical turnaround marked with growth acceleration[4] in the context of a commodity boom in the lead up to the global financial crisis and sustained improvement in overall macroeconomic stability. The period has also witnessed a surge in private capital inflows in the form of foreign direct investment (FDI), including from emerging economies, especially China (see Sanfilipo, 2010; Cheung et al, 2012). However, like in other developing regions, the overall gains from foreign capital inflows in terms of employment and welfare have been limited, mostly due to the weak spillovers in the domestic economy as these flows are predominantly directed into capital-intensive natural resource exploitation (Morrissey, 2012; Sanfilipo 2010). Moreover, commodity dependence exposes African economies to growth volatility and other risks inherent to export instability and exchange rate appreciation, or the 'resource curse'. Indeed, growth in resource-rich countries remains erratic due to the narrow production base and exposure to the vagaries of international commodity markets. Moreover, most natural resource-rich countries exhibit high levels of poverty and lag behind in development goals including access to social services such as health, education, water and sanitation. This raises a serious concern regarding the sustainability of the resource-led growth.

Recent history of African economies exhibits a stunning paradox whereby the acceleration of foreign capital inflows and economic growth have occurred simultaneously with an equally rapid increase in unrecorded capital outflows or capital flight (Ajayi and Ndikumana, 2015; Ndikumana et al., 2015).[5] The phenomenon of capital flight from a capital-starved continent – an illustration of the Lucas paradox (Lucas, 1990) – constitutes a theoretical and empirical puzzle as well as a major concern from a development policy standpoint. It is therefore worth investigating the

[4] Franklin Obeng-Oddom (2015, 2017) offers a critical analysis of the recent growth acceleration in Africa, especially stressing the limited gains in terms of employment, distribution, and the environment.
[5] For updated data, see Ndikumana and Boyce (2018) "Capital Flight From Africa: Updated Methodology and New Estimates" PERI Research Report, June 1, 2018. Available on line: https://www.peri.umass.edu/publication/item/1083-capital-flight-from-africa-updated-methodology-and-new-estimates.

linkages between the two phenomena.

The economics literature has devoted a fair amount of attention to the linkages between FDI and natural resources, and to a lesser extent on the relationship between natural resources and capital flight. But there has been relatively little attention to the role that natural resources may play in linking capital flight and FDI. Yet, from both conceptual and empirical perspectives, natural resources may help explain the co-movements between FDI and capital flight in several ways. In the case of African economies, the limited spillover effects of FDI in the domestic economy may be due to the fact that most FDI is directed to extractive industries which typically have weak links with the local economy, are capital intensive, and therefore create little employment. Natural resources may also provide a vehicle for rent-seeking foreign capital inflows that are driven by illicit motives (see Perez, Brada and Drabek, 2011).

This paper aims to address three empirical questions. First, is there a relationship between FDI into Africa and capital flight from the continent? On the one hand, it may be hypothesized that FDI may provide resources that fuel capital flight, which would imply a positive relationship between the two phenomena; in other words, countries with high FDI would also have high capital flight. This question is worth investigating given the fact that private capital flows have increased faster than external borrowing as a source of foreign resource inflows. While the literature has established that external borrowing fuels capital flight (Boyce, 1992; Ndikumana and Boyce, 2003, 2011a; Ndikumana, Boyce, and Ndiaye 2015), relatively little attention has been paid to the possibility that foreign private capital flows may also finance capital flight. On the other hand, high FDI would signal an environment that is conducive to investment in the destination country, in which case the two phenomena would be negatively related: high FDI would be associated with low capital flight. For the sake of clarity of the terminology used in this paper, it is important to mention that capital flight represents net capital outflows that are not recorded in the Balance of Payments. A description of the algorithm used to calculate capital flight is provided in the appendix. FDI represents net foreign direct inflows; that is inflows minus outflows, as reported in the Balance of Payments and UNCTAD database.

The second question is: does natural resource endowment increase exposure to capital fight? A positive correlation between capital flight and natural resources may reflect, *ex-post*, the fact that

revenues from natural resource exploitation finance capital flight,[6] or because the *ex-ante* motive of capital inflows is to use natural resource-rich African countries solely as a transit of capital towards offshore financial centers and secrecy jurisdictions. It is reasonable to expect that the positive relationship between natural resources and capital flight would be stronger in the context of bad institutions that enable rent-seeking and lack effective mechanisms of control of embezzlement of national resources. Therefore, the third question is whether good quality institutions may mitigate the FDI-capital flight linkages. This paper develops a conceptual motivation of these relationships through a formal theoretical model and provides empirical evidence through econometric analysis on African countries.

The empirical analysis is based on a sample of 30 African countries for which we have adequate data on capital flight from 1970 to 2015. The econometric results are generated from a fixed-effects estimation strategy that enables us to take into account country-specific effects that are not captured by the variables included in the model. The evidence from the econometric analysis indicates that FDI flows are positively related to capital flight, suggesting a possible FDI-fueled capital flight phenomenon akin to the debt-fueled capital flight. However, there is no evidence for an FDI overhang effect; past stock of FDI has no impact on capital flight. We also find that high natural resource rents are associated with high capital flight and that the quality of institutions does not mitigate this link. These results hold up to a variety of robustness tests, including using various measures of governance and political stability, controlling for possible simultaneity between capital flight and FDI, accounting for periods of resource booms before and after the global economic crisis, and periods of hyperinflation in some countries (Angola, Democratic Republic of Congo, and Zimbabwe).

The remainder of the paper proceeds as follows. The next section provides a review of the literature, summarizing the evidence on the links between natural resources and capital flight, between natural resources and FDI, and between FDI and capital flight, especially highlighting the role that natural resources play in this latter relationship. Section 3 presents a theoretical model that links capital flight, FDI and natural resource booms. Section 4 describes the specification of the empirical model and the estimation methodology. The data and stylized facts are provided in

[6] See Ndikumana and Boyce (1998) for an illustration with the case of the Congo under President Mobutu.

Section 5. Section 6 presents and discusses the econometric results. Section 7 concludes.

2 Literature review

This paper draws from three strands of the literature. The first two strands relate to the linkages between natural resources and FDI on the one hand, and the relationship between natural resources and capital flight, on the other hand. The third strand relates to the linkages between FDI and capital flight. While the first two strands of literature are relatively extensive, the third is comparatively thin.

Natural resources and FDI

The empirical literature has explored the role of natural resources as a driver of FDI especially in developing countries. The question is: do natural resources attract FDI? Conceptually, the relationship between natural resources and FDI could be either positive or negative. Two factors may explain or motivate a positive relationship between the two phenomena. First, in many developing countries, natural resource exploitation is dominated by multinational corporations (MNCs). This is especially the case in Africa where foreign ownership of resource exploitation companies is much higher than in other developing regions (UNCTAD, 2007; Asiedu, 2013). The dominance of MNCs in resource exploitation is due to the high capital costs required for investment in the sector, the high technological intensity and high investment risk, which discourage the less capitalized domestic investors. Under these circumstances we would expect a positive relationship between natural resource endowment and FDI. Secondly, in countries where the natural resource sector accounts for a large share of the national economy, extractive industries would also account for a large share of private capital inflows, yielding a positive correlation between FDI and natural resources.

Empirical evidence bears out this hypothesized positive relationship between natural resource endowment and FDI. The relationship has been documented at the aggregate level in the context of multi-country panel data studies (Asiedu, 2006, 2013; Ezeoha and Cattaneo, 2012) and country case studies as in the case of Ghana (Acheampong and Osei, 2014), as well as at the disaggregated company and sector levels (Aleksynska and Havrylchyk, 2013). The evidence suggests that countries with a high endowment in natural resources also attract high FDI inflows. Furthermore,

this result persists even when the analysis controls for the quality of institutions. In fact, it appears that natural resource endowment diminishes the deterrent effect of bad institutions on FDI in resource-rich recipient countries (Aleksynska and Havrylchyk, 2013).

It is conceptually possible, however, that the relationship between natural resources and FDI may be negative. There are two possible reasons. First, a natural resource export boom may cause a depreciation of the national currency, which discourages export-oriented FDI. Second, at the sectoral level, an increase in FDI in extractive industries can discourage investment in other sectors, which may result in a decline in overall FDI in the economy. Evidence from data on Netherland multinational companies supports this prediction: Poelhekke and van der Ploeg (2013) find that the net effects of FDI in natural resources on total investment is indeed negative.

To make sense of the relationship between natural resources, the literature has explored the role of institutions. The quality of institutions may help attract foreign investment, notably by mitigating negative effects of some country-specific deterrents of FDI such as macroeconomic uncertainty (see Asamoha, Adjasi and Alhassan 2016). The impact of institutions may be either positive or negative. On the one hand, bad institutions discourage investment in natural resources by profit maximizing firms. In particular, corruption is a tax on capital, which reduces the net returns to investment. Under this view, FDI would be lower in countries with bad institutions, including those that are rich in natural resources (Wei, 2000). On the other hand, bad institutions create opportunities for rent-seeking by MNCs through bribery of local rulers, resulting in high resource-seeking FDI in resource-rich countries. In the case of Angola, for example, Guidolin and La Ferrara (2007) point out that multinational diamond mining companies profited from corruption during the war. In general, bad institutions create an environment that encourages rent-seeking by the political elites and MNCs, resulting in a positive correlation between natural resources and FDI (Kolstad and Wiig, 2013; Wiig and Kolstad, 2010). However, the evidence at the micro level is inconclusive. For example, Poelhekke and van der Ploeg (2013) find evidence suggesting that foreign direct investors are not systematically attracted to badly governed countries.

The relationship between natural resources and FDI may also depend on the type of resources and the extent of resource dependence. In this respect, Teixeira et al (2017) argue that what matters is not the amount of 'proven reserves' of non-renewable resources but rather the share of these

resources in total exports. They argue that countries with high resource dependence tend to attract more FDI, and that "resource-seeking FDI targets mainly economically shaky countries" (p. 66). Okafor, Piesce and Webser (2015) in turn find that the resource-seeking nature of FDI varies across regions in Africa, suggesting variations in institutional contexts. Asiedu and Lien (2011) posit that the triangular relationship between democracy, natural resource endowment and FDI varies with the intensity of nature resource dependence measured by their share in total exports. The complexity of the role that institutions play in the relationship between natural resources and FDI partly explains the lack of consensus in the empirical evidence. This may be attributed to measurement issues as well as econometric estimation problems. See, for example, the debate between Farla et al (2016) and Morrissey and Udomkerdol (2012, 2016) on the role of governance for domestic and foreign investment.

On the basis of the existing evidence, it is clear that the question of the nature of the relationship between natural resources and FDI remains a highly debated empirical question that is worth investigating further. This is more so for the case of African countries given the rising global demand for natural resources from the continent.

Natural resources and capital flight

The evidence from studies that provide estimates of capital flight from developing countries show that resource-rich countries feature prominently at the top of the list of countries with high capital flight. In the case of African countries, oil-rich countries especially appear to be more prone to high capital flight than resource-scarce countries (Ndikumana et al., 2015). The empirical question is: what are the factors behind the positive association between capital flight and natural resources? Several factors can be considered. First, the management of the natural resource sector is characterized by high discretionary control by the central government, which yields substantial economic and political power to policy makers. This weakens the mechanisms of control and it undermines accountability of the government vis-à-vis the public. The fact that natural resources generate high revenues also weakens accountability of the government vis-à-vis taxpayers and donors. This implies a high risk of embezzlement of government revenue due to corruption and rent-seeking in the management of natural resources. As Kolstad and Søreide (2009: 214) put it, "corruption is the development problem in resource-rich countries, rather than just one of a number

of problems."

Second, limited competition in the natural resource sector creates high economic and political power and leverage for the key players, enabling them to manipulate the system to circumvent regulations and siphon capital out of the country, notably to avoid taxation. Third, the complexity of technological and financial processes involved in natural resource exploitation creates an imbalance of expertise and technical capacity between governments of resource-rich developing countries and multinational corporations. This creates opportunities for export underinvoicing, export smuggling, and other forms of unrecorded outflows of resources from resource-rich countries. Finally, the complexity of multinational corporations with regard to ownership structure and residence facilitates capital flight especially through trade misinvoicing.[7]

The analysis of the linkages between capital flight and natural resources suggests that, from an empirical perspective, it is important to distinguish among various types of natural resources because each resource may face different types of exposure to capital flight. The key risks of capital flight associated with resource exploitation pertain to corruption, illegal exploitation, and tax evasion (Le Billon, 2011). For example, oil-rich countries face a high risk of corruption due to high concentration of discretionary decision making in the management of the sector. In turn, industrial mining faces further risk of trade mispricing due to variations in unit prices, which is less of an issue for the oil sector where prices are more standardized internationally. Artisanal mining faces a high risk of capital flight through illegal exploitation and export smuggling due to the large number of small players operating informally.

It is also important to distinguish between natural resource endowment as measured by underground stock of wealth and natural resource dependence as illustrated in the predominance of natural resources in total exports and government revenue (Brunnschweiler and Bulte, 2008; Teixeira et al, 2016). High natural resource endowment along with high resource dependence make a country prone to high risk of capital flight due to corruption associated with high concentration of power. This scenario is also a symptom of poor institutions in general and weak governance of the natural resource sector in particular. In contrast, a country with high natural resource

[7] See Lewis, McNeill and Shabalala (2019) for an analysis of discrepancies in statistics of gold exports from Africa to the United Arab Emirates.

endowment but low resource dependence (with a diversified economy) faces a relatively lower risk of capital flight. The empirical analysis in this study will take these important distinctions into account by considering a variety of types of natural resources, specifically oil and mineral resources.

Econometric evidence on the link between capital flight and natural resources remains mixed. While studies that estimate capital flight from developing countries find that resource-rich countries feature prominently on the top of the list of countries with high capital flight, robust econometric evidence of a direct impact of natural resources on capital flight is relatively scarce. In Ljungberg and Friedl (2014), natural resources are associated with high capital flight, which the authors attribute to rent-seeking. The effect persists even when they control for the quality of institutions. In the case of African countries, existing studies find a positive effect of natural resources on capital flight, but it is only robustly significant when natural resources are interacted with the quality of institutions. The evidence tends to suggest that natural resources are a conduit of capital flight in the context of bad institutions (Ndikumana and Boyce, 2003; Ndikumana et al., 2015). In a study of 21 resource-rich countries, Demachi (2014) finds that while there is a positive relationship between capital flight and natural resource revenues, a stronger link is found between capital flight and external debt inflows as documented in other studies.

An important channel of the relationship between capital flight and natural resources is the misinvoicing of exports of oil, gas and minerals. Kwaramba, Mahonye and Mandishara (2016) find substantial underinvoicing of exports of diamonds, gold and nickel from Zimbabwe. Gankou, Bedoma and Sow (2016) as well as Mpenya, Matseyem and Epo (2016) find similar patterns of underinvoicing of exports of oil and timber from Cameroon. In these and other countries in Africa, exports of minerals are typically dominated by multinational corporations. The foregoing discussion suggests that the relationship between capital flight and natural resources deserves further empirical investigation.

FDI and capital flight

The literature has provided substantial evidence that capital flight is partly fueled by inflows of external capital in the form of sovereign debt. This issue gathered attention especially in the wake

of the debt crisis of the 1980s. In the case of Mexico, Cuddington (1987) found that about 31 cents of each dollar of new long-term external loans to the government flew out as capital flight in the same year. This phenomenon was also observed in a sample of Latin American countries by Pastor (1990), and in the case of the Philippines, a phenomenon referred to as 'revolving door' by Boyce (1992). Studies on African countries also find similar evidence pointing to a tight link between debt inflows and capital flight (Ndikumana and Boyce, 2003, 2011b; Ndikumana et al., 2015). The question is whether private capital flows such as FDI may also potentially fuel capital flight. This question was first posed directly by Kant (1996: 1): "Do FDI flows facilitate capital flight, by increasing the availability of foreign exchange, or do they instead, mark a reduction of capital flight or a gradual return of capital flight". This question is relevant for developing countries in general and for African countries in particular, given the recent increase in FDI and the decline in the relative importance of external debt in total capital inflows. The statement by Kant (1996) suggests that the relationship between capital flight and FDI cannot be established a priori. Two conceptual frameworks can be drawn upon to motivate the relationship between FDI and capital flight: the investment climate as a determinant of investment decisions; and discriminatory treatment of capital as a determinant of investment decisions.

Under the investment climate perspective, capital flight is driven by the risk-adjusted return differential between domestic and foreign assets. Under this view, capital flight would be a signal of higher returns to investment abroad relative to the home country. But as Lessard and Williamson (1987) point out, the investment climate cannot explain simultaneous capital flight and FDI. If domestic assets are dominated by external assets in rate of return, this should be so for both domestic and foreign investors. In fact, the investment climate perspective would suggest a negative relationship between FDI and capital flight: a good investment climate would attract FDI while discouraging capital flight; in other words, it would encourage both domestic investment and FDI.

Under the discriminatory treatment of capital perspective, capital flight is explained by government laws and regulations that are biased in favor of foreign investment. These may include preferential taxation such as tax holidays, investment or exchange rate guarantees, and priority given to foreign claims over resident claims in the event of a financial crisis (Kant, 1996). Such preferential treatments would result in differential perceived or actual risk for domestic investment

relative to FDI, which would induce capital flight (Dooley, 1988; Eaton, 1987; Khan and Haque, 1985). Under those circumstances, high capital flight would coexist with high FDI.

The literature has ignored a third possibility. Under the above two perspectives, capital flight and FDI may move either in the same direction or in the opposite direction due to a third factor that affects both. The relationship may not necessarily be direct. But there is a possibility that FDI can actually fuel capital flight directly, in a similar fashion as the debt-fueled capital flight. First, FDI may provide resources that can be siphoned out of the country outside of official channels, thus remaining unrecorded in the country's Balance of Payments. This would be a case of FDI-fueled capital flight. Second, *ex ante*, capital flight could be the true motive of FDI, in which case the host country serves as mere transit for unrecorded financial outflows, especially those destined towards secrecy jurisdictions. This would be the case for capital flight-bound FDI. Perez, Brada and Drabek (2012) find empirical evidence in a sample of transition countries suggesting that FDI is partly motivated by illicit transfer of asset abroad. Specifically, they argue that "establishing businesses in foreign countries through FDI is a way of facilitating more traditional ways of moving illicit money overseas." (p. 109)

The question then is, could natural resources be one of the possible factors that facilitate the FDI-capital flight link? There are two possible ways in which this could be the case. First, natural resources attract FDI, which can then be used to finance capital flight. Second, as the natural resource sector is subject to corruption and rent seeking, FDI directed to natural resources is more susceptible to contribute to capital flight. This would suggest a positive relationship between capital flight and FDI that would be especially strong in countries that have both high natural resource endowment and bad institutions.

3 A theoretical model of FDI and capital flight in resource-rich countries

The objective of this section is to provide a theoretical motivation for the linkages between natural resources, FDI and capital flight. The model considers that the world economy comprises two countries, a host nation that is heavily endowed with natural resources (subsoil assets such oil, gas, coal and minerals) and a capital source nation that is endowed with physical and human capital, as well as the capacity to extract the resources located in the host country. The model features two

players: an incumbent ruler of the host nation and a multinational corporation originating from the capital source nation. The timing in the model is as follows:

- The multinational corporation chooses the level of FDI F in the resource sector of the host nation.
- Upon observing F, the ruler chooses the amount of consumption c for the population and the amount of funds e to embezzle for his own benefit.
- Given these choices, the ruler faces an endogenous probability $q(c)$ of being overthrown.

Multinational corporation's choices

The goal of the multinational company is to maximize the flow of profits by solving the following problem:

$$\Pi = \max_{F}(p-\tau)Q(F) - rF \qquad (1)$$

where the production function $Q(.)$ exhibits decreasing marginal product, so that $Q' > 0$ and $Q'' < 0$; p and r denote the commodity prices and the world interest rate (which is the rental rate for international capital F) respectively; τ represents the severance tax on extracted resources.

Optimality requires the multinational corporation to provide the level of FDI F^* such that the net value of the marginal product of foreign capital equals its rental rate:

$$(p-\tau)Q'(F^*) = r \qquad (2)$$

By the implicit function theorem, it follows from first order condition (2) that:

$$\frac{\partial F^*}{\partial p} = -\frac{Q'(F^*)}{(p-\tau)Q''(F^*)} > 0 \qquad (3)$$

Expression (3) suggests that a rise in commodity prices provides the multinational company the incentive to increase its capital investment in the resource-rich country.

Ruler's choices

Now, consider the ruler of a small open economy who has the authority to enter into resource extraction contracts with the multinational corporation on behalf of the host nation. The host nation generates total output *y* from local production (z)[8] and from the taxation of the resource according to:[9]

$$y = z + \tau Q(F^*) \tag{4}$$

The ruler allocates total output between the population's consumption c and a flow of expected misappropriated funds πe to be placed in a foreign account (as capital flight), where e represents the amount to be embezzled and $0 < \pi < 1$ is the probability of successful embezzlement. The latter is a reflection of the quality of institutions in the host country. High values of π indicate weak institutions while low values suggest strong institutions. The resource constraint in the host nation is:

$$c + \pi e = z + \tau Q(F^*) \tag{5}$$

While in office, the ruler derives a flow of utility $u(\overline{w} + \pi e)$ from his legitimate remuneration $\overline{w}$ and expected misappropriated funds πe. The utility function is strictly increasing and concave in e: ($u' > 0$ and $u'' < 0$). Misappropriation of public funds may, on the other hand, exacerbate discontent among segments of the society and eventually trigger the toppling of the ruler.[10] In this model, the ruler may be deposed with some probability $q(c)$. We assume that increased population's consumption reduces the ruler's probability of being toppled at a decreasing rate, i.e., $q' < 0$ and $q'' > 0$. Should he lose power, he will derive utility $u(\underline{w})$ where $\underline{w} < \overline{w}$ denotes the ousted ruler's entitlement. The ruler's expected utility function is therefore expressed as follows:

[8] In an earlier version of the paper, we endogenized *z* by introducing a stock of physical capital. Doing so simply adds complexity to the model without changing the core results.

[9] We assume that the severance unit tax τ is exogenous since it is not the focus of this paper. Rather, we focus on the allocation decision of the total income between *c* and *e*. In any event, it would be fairly straightforward to endogenize the ruler's tax decision, for example by setting a constraint such as $0 < \tau \leq \overline{\tau}$.

[10] Such examples in recent history include rulers such as Ferdinand Marcos of the Philippines, Mobutu Sese Seko of Zaire, Alberto Fujimori of Peru, Zine al-Abidine Ben Ali of Tunisia, or Hosni Mubarak of Egypt.

$$\big(1-q(c)\big)u(\bar{w}+\pi e)+q(c)u(\underline{w}) \tag{6}$$

Upon observing $F^*=F(p)$, the ruler's optimization problem is to maximize his net benefit subject to the host country's resource constraint (5). This optimization problem can be written as:

$$V=\max_{e,c}\big(1-q(c)\big)u(\bar{w}+\pi e)+q(c)u\big(\underline{w}\big) \tag{7}$$

$$\text{s.t.}\quad c+\pi e=z+\tau Q(F(p)) \tag{8}$$

The first order condition for an interior solution yields[11]:

$$q'(c)\big[u(\bar{w}+\pi e)-u\big(\underline{w}\big)\big]+(1-q(c))u'(\bar{w}+\pi e)=0 \tag{9}$$

Applying the implicit function theorem to equation (9) yields:

$$\frac{\partial e}{\partial p}=-\frac{\{q''(c)\big[u(\bar{w}+\pi e)-u\big(\underline{w}\big)\big]-q'(c)u'(\bar{w}+\pi e)\}\tau Q'(F^*)\frac{\partial F^*}{\partial p}}{-q''(c)\big[u(\bar{w}+\pi e)-u\big(\underline{w}\big)\big]+2q'(c)u'(\bar{w}+\pi e)+(1-q(c))u''(\bar{w}+\pi e)} \tag{10}$$

Given the assumptions that $Q'>0, q'<0, q''>0, u'>0$ and $u''<0$, it is clear that the denominator in equation 10 is negative while the numerator is positive. This implies that misappropriation of funds (capital flight) will increase with commodity price boom; that is, $\frac{\partial e}{\partial p}>0$. The mechanism through which the increase in capital flight occurs runs through higher foreign investment. Higher commodity prices provide incentives for increased foreign investment in the resource sector, which in turn leads to increased resource extraction and therefore increased tax on the multinational corporation. This enhanced revenue provides further potential source of financing for capital flight.

[11] A corner solution that yields $e^*=0$ would obtain if the marginal rate of substitution between c and e is always greater than the ratio $1/\pi$; that is, if $\frac{q'(c)\big[u\big(\underline{w}\big)-u(\bar{w}+\pi e)\big]}{(1-q(c))\pi u'(\bar{w}+\pi e)}>\frac{1}{\pi}$, or equivalently if $\frac{u'(\bar{w}+\pi e)}{u\big(\underline{w}\big)-u(\bar{w}+\pi e)}>\frac{q'(c)}{(1-q(c))}$.

We now analyze how the institutional quality, represented by π, affects misappropriation of funds in periods of rising commodity prices. The mitigating or aggravating effect of institutions is captured by the following expression:

$$\frac{\partial^2 e}{\partial p \partial \pi} = -\frac{e}{D}\Big\{[q''(c)u'(\bar{w}+\pi e) - q'(c)u''(\bar{w}+\pi e)]\tau Q'(F^*)\frac{\partial F^*}{\partial p} - \big[-q''(c)u'(\bar{w}+\pi e) + 2q'(c)u''(\bar{w}+\pi e) + \big(1-q(c)\big)u''(\bar{w}+\pi e)\big]\frac{N}{D}\Big\},$$

where $N \equiv \{q''(c)\big[u(\bar{w}+\pi e) - u\big(\underline{w}\big)\big] - q'(c)u'(\bar{w}+\pi e)\}\tau Q'(F^*)\frac{\partial F^*}{\partial p}$ and

$D \equiv -q''(c)\big[u(\bar{w}+\pi e) - u\big(\underline{w}\big)\big] + 2q'(c)u'(\bar{w}+\pi e) + (1-q(c))u''(\bar{w}+\pi e)$ denote the numerator and denominator in expression (10), respectively. It then follows that:

$$\frac{\partial^2 e}{\partial p \partial \pi} = -\frac{eq'(c)u''(\bar{w}+\pi e)}{D}\left\{\left[\frac{q''(c)u'(\bar{w}+\pi e)}{q'(c)u''(\bar{w}+\pi e)} - 1\right]\left(\tau Q'(F^*)\frac{\partial F^*}{\partial p} - \frac{\partial e}{\partial p}\right) + \left[1 + \frac{\big(1-q(c)\big)u'''(\bar{w}+\pi e)}{q'(c)u''(\bar{w}+\pi e)}\right]\frac{\partial e}{\partial p}\right\} \quad (11)$$

Expression (11) cannot be unambiguously signed. It is however sufficient for the product $\left(\frac{q''(c)u'(\bar{w}+\pi e)}{q'(c)u''(\bar{w}+\pi e)} - 1\right)\left(\tau Q'(F^*)\frac{\partial F^*}{\partial p} - \frac{\partial e}{\partial p}\right)$ to be positive for institutions to have a mitigating effect on the misappropriation of resources rents. That is, settings with stronger institutions will command lower marginal benefit of misappropriating resource rents as commodity prices increase and therefore $\frac{\partial^2 e}{\partial p \partial \pi} > 0$.[12] The product is positive in one of two cases:

[12] Note that since lower π signals stronger institutions, $\frac{\partial^2 e}{\partial p \partial \pi} > 0$ does capture the mitigating effect of institutions in this model.

(i) $$-\frac{u''(\bar{w}+\pi e)}{u'(\bar{w}+\pi e)} < -\frac{q''(c)}{q'(c)} \text{ and } \frac{\partial e}{\partial p} < \tau Q'(F^*)\frac{\partial F^*}{\partial p},$$

(ii) $$-\frac{u''(\bar{w}+\pi e)}{u'(\bar{w}+\pi e)} > -\frac{q''(c)}{q'(c)} \text{ and } \frac{\partial e}{\partial p} > \tau Q'(F^*)\frac{\partial F^*}{\partial p}$$

In the former case, although the ruler is only moderately averse to risk (the coefficient of absolute risk aversion is small enough), the marginal benefit of misappropriation is small enough so that he has less incentive to engage in embezzlement when institutions are strong. In the latter case, although the ruler exhibits a relatively high degree of risk aversion (the coefficient of absolute risk aversion is large enough), the marginal benefit of misappropriation is sufficiently large to make it worthwhile to engage in more embezzlement in a context with weak institutions. In either case, strong institutions deter misappropriation while weak institutions encourage misappropriation.

These predictions on the linkages between capital flight, foreign investment and natural resources are investigated empirically in the remainder of the paper.

4 Empirical specification and estimation methodology

Main specification

According to portfolio choice theory, capital flight would be driven by the difference between the rate of return to investment abroad and in the domestic market. The empirical literature has explored this relationship by using proxies for relative returns to investment such as the interest rate differential and the rate of economic growth (see Fofack and Ndikumana, 2015). In our empirical model, the interest rate differential is measured as the difference between the African country's deposit interest rate and the world interest rate proxied by the 3-month US Treasury Bill rate. We also consider that the investor faces a cost for transferring capital abroad, which depends, among other things, on the quality of institutions, especially the legal and regulatory environment as it determines the ability to track, prosecute and punish capital smuggling. In the base empirical model, the quality of institutions is measured by the Polity 2 index obtained from the Polity IV database, which has the advantage of being reported on the entire sample period over 1970-2015.[13]

[13] The Polity2 indicator has the advantage that it is reported over our full sample period. Other measures of institutions, such as the Worldwide Governance Indicators (available online at the World Bank) cover a shorter period (from 1996, with missing values for 1997, 1999 and 2001).

In the robustness analysis, we use various measures of quality of institutions obtained from the World Bank's Worldwide Governance Indicators[14], which cover a shorter period starting in 1996. These robustness tests are discussed further below.

The focus of the analysis is to explore the impact of FDI and natural resources on capital flight. We examine both the effects of annual flows as well as past stock of FDI. We also explore the impact of natural resources measured by total natural rents and by distinguishing between major resources, notably oil and minerals.

The empirical capital flight equation is therefore specified as follows:

$$KF_{it} = \alpha_0 + \alpha_1 rd_{it} + \alpha_2 Polity2_{it} + \alpha_3 FDI_{it} + \alpha_4 NR_{it} + \boldsymbol{X}_{it}\Gamma + \varepsilon_{it} \qquad (12)$$

where *KF* is capital flight, *rd* is the interest rate differential, *FDI* is foreign direct investment flows and stock, Polity2 is a measure of the quality of institutions, *NR* is alternatively total natural resource rents and oil rents and mineral rents, **X** is a vector of other determinants of capital flight, and ε is a random error term.

The vector **X** includes the following indicators:

- The annual flow of external debt capturing the possibility of debt-fueled capital flight; it is expected to be positively related to capital flight.
- The stock of external debt, which captures the debt overhang effect; it is expected to be positively related to capital flight.
- GDP growth rate, representing the expected return on domestic investment associated with overall economic performance; it is expected to be negatively correlated with capital flight.

To test whether the quality of institutions may mitigate the impact of natural resource rents on capital flight, the Polity2 index is interacted with resource rents and incorporated in the regressions in addition to resource rents – total rents or oil rents and mineral rents.

[14] The Worldwide Governance Indicators are available at https://datacatalog.worldbank.org/dataset/worldwide-governance-indicators

We use a fixed-effects estimation method to account for omitted time invariant country-specific factors that influence capital flight. Given that the stock of debt and the stock of FDI are related to the annual flows, we include the third lags of the stocks to minimize problems of multicollinearity. In the next section we present the data used in the econometric analysis and some stylized facts from the data.

Robustness tests

It is impossible to account for all the factors that may influence capital flight and its relationship with FDI and natural resources. To explore the robustness of the results obtained from the base empirical model, we extend the analysis in three ways. First, we consider other indicators of the quality of institutions to test the robustness of the results obtained from the regressions incorporating the Polity2 indicator. We use six indictors of governance and political stability obtained from the World Bank's Worldwide Governance Indicators: control of corruption, government effectiveness, political stability, regulatory quality, rule of law, and voice and accountability. These variables are available only from 1996.[15] Therefore the regression sample is reduced to 1996-2015. As expected, these indicators are positively correlated with Polity2, although not strongly. The correlation coefficient in the sample ranges from 0.19 with government effectiveness to 0.68 with for voice and accountability.

These governance indicators measure various dimensions of the quality of the institutional environment that matter for saving and investment, and therefore they are potential determinants of capital flight. They also may be considered as proxies for the capacity of the government to establish a framework that enables efficient management of natural resources, thus limiting the potential for natural resources to fuel capital flight.

As a second extension, we include year/period dummies to account for the substantial increase in commodity prices in the resource boom before and after the global crisis that may influence capital flight and its relations with natural resources. We include dummies for years with oil price hikes (2007-08 and 2011) as well as the fall in oil prices in 2014.

[15] The data are not reported for 1997, 1999, and 2001. These missing observations are filled in by interpolation with the average of the values from the adjacent years.

Third, in addition to accounting for the role of the rate of return to investment for capital flight as measured by the interest rate differential, we also need to ensure that the results are not driven by excessively high inflation rates that may distort relative returns to investment. This is the case for Angola, the Democratic Republic of Congo and Zimbabwe which experienced hyperinflation in some years during the sample period. We include dummies for these countries.

Because of the inclusion of dummies in the model, we use the random-effects estimation method in the regression of the extended model. In addition, rather than the contemporaneous value of FDI inflows, we include the lagged value to examine whether the results obtained in the estimation of the main empirical model may have been affected by potential simultaneity bias. The extended model used for the robustness tests includes total natural resource rents.

5 Data and stylized facts

The data used in the analysis covers the period from 1970-2015 and contains 30 countries that have adequate data on capital flight. The capital flight series are obtained from the Political Economy Research Institute (PERI) at the University of Massachusetts Amherst,[16] which were constructed by James Boyce and Léonce Ndikumana using the following algorithm: for a country *i* in year *t*, capital flight is measured as follows:[17]

$$KF_{it} = \Delta DEBTADJ_{it} + FDI_{it} + PI_{it} - (CA_{it} + CRES_{it}) + MISINV_{it} \qquad (11)$$

where $\Delta DEBTADJ$ is the change in the stock of external debt outstanding adjusted for exchange rate fluctuations, *FDI* is net foreign direct investment inflows, *PI* is net portfolio investment, *CA* is the current account deficit, and *CRES* is net additions to the stock of foreign reserves, and *MISINV* is trade misinvoicing.

Data on FDI flows, FDI stock and GDP growth are obtained from the UNCTAD online database. Data on indicators of natural resource endowment – oil rents, mineral rents, and total resource rents, as well as the interest rate and the exchange rate, which are used to calculate the rate of

[16] The capital flight series are available at PERI's website at: https://www.peri.umass.edu/capital-flight-from-africa.
[17] A summary of the algorithm used to calculate capital fight is provided in the Appendix. A detailed exposition of the methodology can be found in Ndikumana and Boyce (2010) and Ndikumana, Boyce and Ndiaye (2015).

return differential between African countries and the world (proxied by the US Treasury bill rate) are obtained from the World Development Indicators. Debt indicators (change in debt and total debt stock) are from the World Bank's International Debt Statistics. The data for Polity2 are obtained from the Polity IV Project database (available online), while the various governance indicators are from the World Bank's Worldwide Governance Indicators (available online). A detailed description of the variable definitions and data sources is provided in Table A1 in the appendix.

Stylized facts are presented in Table 1 and Figures 1-3. Table 1 presents the means for the regression variables for the sample and by decade. The list of countries in the sample is also presented under this table. An examination of the data on FDI, capital flight and natural resources shows noteworthy patterns and trends. The data shows that African countries have attracted an increasing volume of FDI since the start of the 1990s (Figure 1). At the turn of the century, the strong upward trend of both FDI is sustained in the context of the natural resource boom that preceded the global economic crisis. Since 2010-2011, both variables have trended downward in the context of the decline in commodity prices. These patterns reflect the fact that a substantial fraction of FDI to Africa is resource-seeking.

The data also indicated a positive correlation between annual FDI flows and capital flight on average over the sample (Figure 2). There is an even stronger correlation between the stock of FDI and accumulated capital fight. This is illustrated in Figure 3 which presents the stocks of FDI and capital fight as of 2015 in logarithmic values. The figure shows that resource-rich countries such as Algeria, Angola, Egypt and Sudan feature prominently on the top of the list of countries having both high FDI and high capital flight. The econometric analysis in this paper seeks to shed light on these relationships between capital flight, FDI and natural resource rents.

Given that FDI is one of the elements in the calculation of capital flight as indicated in the above formula, one may ask why we include it as a regressor in the capital flight model. To understand the rationale, we refer to the basic definition of capital flight as a Balance of Payment residual. High FDI inflows need not translate into high capital flight, because in a transparent environment, these additional resources are supposed to be used to cover the country's needs in foreign exchange, such as covering the current account deficit, with the excess being added to

the stock of reserves. Therefore, a positive effect of FDI on capital flight can be interpreted as a symptom of leakages in the BoP. The relationship, therefore needs to be tested empirically.

Table 1: Summary statistics (over 1970-2015, by decade): GDP-weighted means*

Variable	1970-79	1980-89	1990-99	2000-2009	2010-2015	Sample average
kf/gdp	4.16	4.19	2.02	1.86	2.97	2.74
cdebt/gdp	3.68	3.59	0.49	0.39	1.42	1.41
totdebt/gdp	8.77	27.08	34.35	21.28	21.63	23.35
fdi/gdp	0.48	0.4	0.81	2.47	1.66	1.53
gdp growth	3.61	2.34	2.38	5.06	4.09	3.85
oil rents	12.19	11.02	7.26	11.22	8.26	9.56
mineral rents	1.04	1.18	0.46	1.03	1.84	1.26
resource rents	14.81	14.99	11.27	15.2	12.65	13.61
polity2	-5.56	-5.32	-2.19	0.62	2.12	-2.26
Corruption			-0.59	-0.61	-0.63	-0.61
Govt eff.			-0.57	-0.61	-0.65	-0.61
Pol. stab			-0.68	-0.64	-0.64	-0.65
Regulation			-0.59	-0.60	-0.61	-0.60
Rule of law			-0.72	-0.68	-0.62	-0.67
Voice			-0.69	-0.68	-0.62	-0.66

Variable symbols: kf/gdp = capital flight to GDP ratio, cdebt/gdp = adjusted change in debt to GDP ratio, totdebt/gdp = total debt stock to GDP ratio, fdi/gdp = FDI to GDP ratio, corruption = control of corruption, govt eff. = government effectiveness, pol. stab = political stability, regulation = regulatory quality, voice = voice and accountability.
*Note: The means are GDP-weighted, except for Polity2 for which simple means are reported.
Sources: Capital flight data are from the Political Economy Research Institute (PERI), accessible online at https://www.peri.umass.edu/capital-flight-from-africa; Polity2 is from the Polity IV Project; other variables are from the World Development Indicators.

The countries included in the sample are: Algeria, Angola, Botswana, Burkina Faso, Burundi, Cameroon, Dem. Rep Congo, Rep. Congo, Cote d'Ivoire, Egypt, Ethiopia, Gabon, Ghana, Kenya, Madagascar, Malawi, Mauritania, Morocco, Mozambique, Nigeria, Rwanda, Seychelles, Sierra Leone, South Africa, Sudan, Tanzania, Tunisia, Uganda, Zambia, Zimbabwe

Figure 1: FDI and resource rents (% GDP, annual sample average)

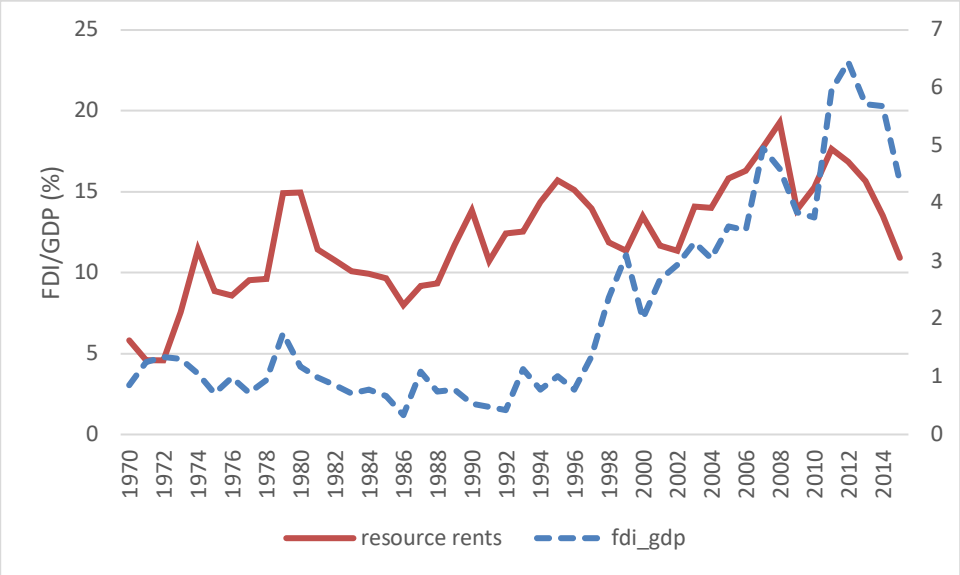
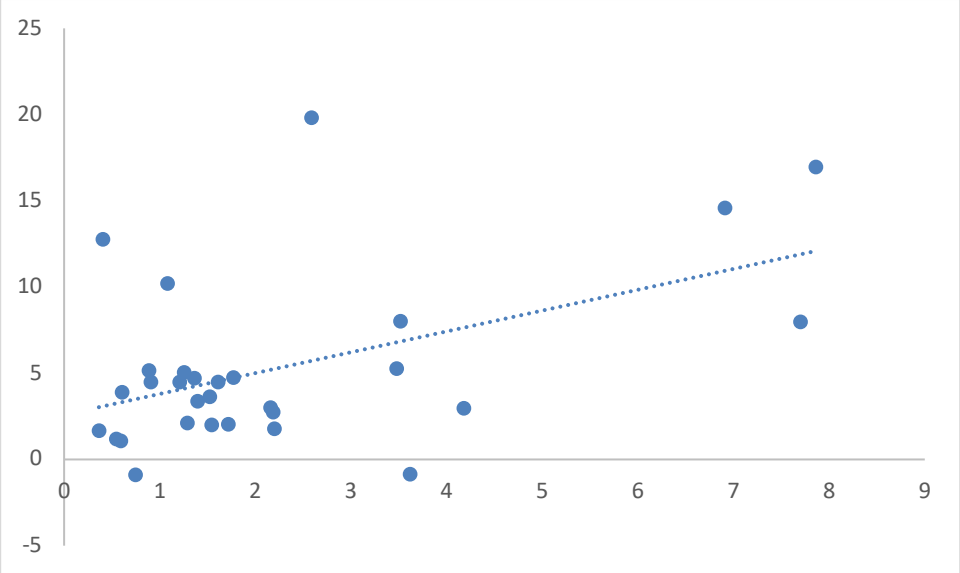
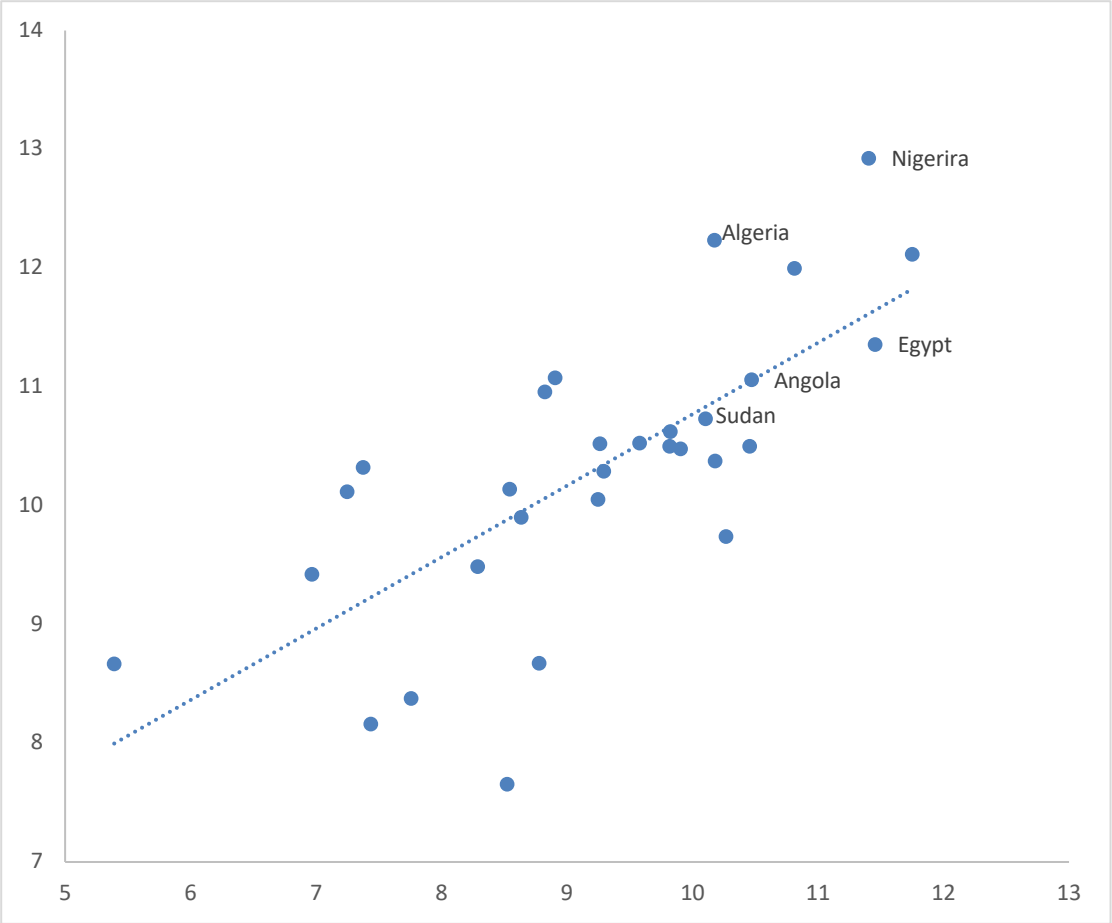


Figure 2: Capital flight and FDI as average % of GDP (1970-2015)



Linear fit: Y = 2.591 + 1.208X; R2=0.243

Figure 3: Stock of capital flight and FDI, 2015 (logs)



Linear fit: Y = 5.754 + 0.601 X; R2 = 0.524

6 Empirical results

Results from the main model estimated over the 1970-2015 sample

The focus on the empirical analysis is on the impact of linkages between capital flight, FDI and natural resources, and the role that institutions might play in mitigating the resource-capital flight nexus. We present two sets of regression results in Tables 2 and 3. In Table 2, we present results for the test of the direct impact of FDI and natural resources on capital flight. The results in Table

3 are used to investigate the hypothesis that the quality of institutions may mitigate the link between natural resources and capital flight. This is captured by the coefficient on the interaction between natural resources and Polity2.

With regard to the impact of FDI on capital fight, we can draw two important conclusions. First, the annual inflows of FDI have a direct positive effect on capital flight. The coefficient on the FDI/GDP ratio is positive and statistically significant, and this holds in all regressions including various control variables and alternative measures of natural resource rents. The regression results suggest that one percent increase in FDI inflows is associated with 0.21-0.40 percent increase in capital flight in the same year. As indicated earlier in the paper, FDI may have a positive impact on capital fight if private capital inflows serve as a source of financing of capital flight. It may also have a negative effect on capital fight if the influx of private capital serves as a signal of high returns to investment in the domestic economy. These regression results suggest that the former effect dominates. In that sense, FDI inflows have similar effects as debt inflows, a phenomenon we may refer to as FDI-fueled capital flight. Moreover, besides providing the funds that are siphoned abroad, FDI may have been *ex-ante* destined towards offshore financial centers or secrecy jurisdictions, with African economies only serving as transit stations for flight capital. This result is in line with the findings in Perez, Brada and Drabek (2011).

Table 2: Capital flight, FDI and natural resources: Main model
(Fixed-effects regression results)

VARIABLES	(1) Resource rents	(2) Oil rents	(3) Mineral rents	(4) Oil & mineral rents
FDI flows (% of GDP)	0.390***	0.213**	0.401***	0.211**
	(0.000)	(0.046)	(0.000)	(0.048)
FDI stock (% of GDP) (3^{rd} lag)	-0.013	-0.028	-0.010	-0.028
	(0.663)	(0.310)	(0.727)	(0.315)
Debt flows (% of GDP)	0.575***	0.500***	0.575***	0.501***
	(0.000)	(0.000)	(0.000)	(0.000)
Debt stock (% of GDP) (3^{rd} lag)	0.046*	0.040*	0.062**	0.042*
	(0.053)	(0.098)	(0.011)	(0.086)
GDP growth (lag)	0.192**	0.129	0.180**	0.124
	(0.024)	(0.244)	(0.034)	(0.266)

Interest differential	0.000	0.000	0.000	0.000
	(0.775)	(0.888)	(0.826)	(0.860)
Polity2 score	-0.042	-0.244*	-0.063	-0.252**
	(0.724)	(0.055)	(0.597)	(0.049)
Resource rents (% of GDP)	0.141*			
	(0.055)			
Oil rents (% of GDP)		0.278***		0.279***
		(0.003)		(0.003)
Mineral rents (% of GDP)			0.322**	0.108
			(0.019)	(0.585)
Constant	-1.521	-1.522	-0.868	-1.791
	(0.345)	(0.320)	(0.555)	(0.265)
R-2 within	0.172	0.176	0.174	0.176
R-2 between	0.208	0.298	0.054	0.189
R-2 overall	0.189	0.222	0.150	0.216
Observations	770	542	770	542
Number of countries	29	21	29	21

The dependent variable is capital flight (% of GDP). P-values in parentheses; *** p<0.01, ** p<0.05, * p<0.1 stand for significance at 1%, 5%, and 10%, respectively.

The second conclusion from the regression results is that the past stock of FDI does not have an impact on capital flight. The coefficients on the ratio of past stock of FDI to GDP are statistically insignificant in all specifications presented in Tables 2 and 3. The results suggest that the accumulation of FDI does not have similar effects as the accumulation of debt – the 'debt overhang effects'; and high accumulated FDI does not serve as a deterrent of capital fight either.

Regarding natural resources, the regression results show a positive relation with capital flight when we use total natural resource rents, as well as when oil rents and mineral rents are entered in the regressions separately. We note, however, that when oil rents and mineral rents are entered in the regression simultaneously, oil rents have a significant positive effect, while the effect of mineral rents loses its significance. Interestingly, we also note that regressions including oil rents produce different results for the quality of institutions. In these regressions, better quality of institutions appears, as expected, to be associated with less capital flight. This result suggests that improving institutional quality can help to reduce capital fight in resource-rich countries.

The results in Table 3 enable us to address the question of whether the quality of institutions can

mitigate the effects of natural resource rents on capital flight. In other words, do good institutions reduce the amount of natural resource rents that is lost through capital flight? In the regressions including total natural resource rents, the coefficient on the interaction term between natural resources rents and Polity2 is insignificant with a positive sign. The result is similar in the case of oil rents. In the regressions with mineral rents, the coefficient on the interaction term is positive and significant, which is counter-intuitive. When oil rents and mineral rents are entered in the regression simultaneously with their respective interaction terms with Polity2, the coefficient on the interaction term with oil is insignificant while that on the interaction term with mineral rents is negative and significant, as expected.

Table 3: Capital flight, FDI and natural resources: with Polity2*resources interactions
(Fixed-effects regression results)

Variables	(1) resources	(2) oil	(3) minerals	(4) oil & minerals
FDI flows (% of GDP)	0.375***	0.194*	0.376***	0.208**
	(0.001)	(0.069)	(0.001)	(0.048)
FDI stock (% of GDP) (3rd lag)	-0.015	-0.033	-0.003	-0.053*
	(0.625)	(0.232)	(0.931)	(0.057)
Debt flows (% of GDP)	0.580***	0.513***	0.585***	0.498***
	(0.000)	(0.000)	(0.000)	(0.000)
Debt stock (% of GDP) (3rd lag)	0.045*	0.039	0.062***	0.030
	(0.059)	(0.106)	(0.009)	(0.214)
GDP growth (lag)	0.180**	0.108	0.150*	0.181
	(0.033)	(0.329)	(0.078)	(0.103)
Interest differential	0.000	0.000	0.000	0.000
	(0.790)	(0.877)	(0.907)	(0.702)
Resource rents	0.145**			
	(0.048)			
Resource rents * Polity2	0.005			
	(0.377)			
Oil rents		0.292***		0.310***
		(0.003)		(0.001)
Oilrents * Polity2		0.001		0.002
		(0.896)		(0.761)
Mineral rents			0.242*	0.280
			(0.085)	(0.161)
Mineral rents * polity2			0.040**	-0.085***
			(0.048)	(0.000)
Constant	-1.291	-1.200	-0.776	-0.937

	(0.410)	(0.431)	(0.584)	(0.552)
R-2 within	0.173	0.170	0.178	0.198
R-2 between	0.178	0.308	0.058	0.013
R-2 overall	0.189	0.225	0.166	0.194
Observations	770	542	770	542
Number of countries	29	21	29	21

The dependent variable is capital flight (% of GDP). P-values in parentheses; *** p<0.01, ** p<0.05, * p<0.1 stand for significance at 1%, 5%, and 10, respectively.

Robustness tests: estimation results over the period 1996-2015

In Tables 4 and 5 we present the results obtained by re-estimating the empirical model over the 1996-2015 period including various measures of governance, year dummies for 2007-08, 2011 and 2014 as well as country dummies for Angola, DR Congo, and Zimbabwe. Moreover, the model includes lagged FDI instead of contemporaneous FDI to examine whether the results presented earlier in Table 2 and 3 may be influenced by some simultaneity bias. The results in Table 4 show the direct impact of FDI, natural resources, and institutional quality on capital flight, and serve as a robustness test for the results presented earlier in Table 2. Table 5 presents results with interaction terms between natural resources and the measures of institution quality, serving as a robustness test for the results presented earlier in Table 3.

The results for the impact of FDI are similar to those obtained over the 1970-2015 period with the main empirical model, and they are not affected by the specific indicator of quality of institutions and governance included in the model. We find that annual inflows of FDI are positively and significantly related to capital flight, while the past stock of FDI has no impact on capital flight. The results imply that a one percent increase in FDI inflows is associated with 0.26-0.38% increase in capital flight.

The results indicate that natural resources fuel capital flight. The coefficient on the ratio of total natural resource rents to GDP is positive and significant in all the regressions in Table 4 and in all but one regression in Table 5. The results imply that natural resource rents are unambiguously positively related to capital flight in this sample of African countries over the 1996-2015 period.

The regression results show no direct impact of the measures of the quality of institutions and governance on capital flight. The coefficients are positive but insignificant. The results in Table

5 do not show any conclusive impact of the interaction between natural resource rents and the quality of institutions. The results are counterintuitive for Polity2 and political stability: the coefficient on the interaction term is positive and significant, contrary to expectations. The coefficient on the interaction between governance effectiveness and natural resource rents is negative and significant as expected, suggesting that better governance reduces resource-fueled capital flight. The coefficients on the interaction of natural resource rents and regulatory quality, rule of law, and voice and accountability are insignificant.

Overall the results presented in Tables 4 and 5 are consistent with those reported in Tables 2 and 3 with regard to the impact of FDI, natural resources, and the interaction between the quality of institutions and natural resource rents. We can therefore confirm that the estimated relationships between capital flight, FDI, natural resources and institutions are robust to alternative specification of the model, measurement of quality of institutions and period of analysis.

Table 4: Capital flight, FDI, natural resources and various governance indicators
(Random-effects regression results)

VARIABLES	(1) Polity2	(2) Control of corruption	(3) Government effectiveness	(4) Political stability	(5) Regulatory quality	(6) Rule of law	(7) Voice & accountability
FDI flows (% of GDP) (lag)	0.379***	0.282**	0.285**	0.276**	0.278**	0.285**	0.285**
	(0.006)	(0.036)	(0.034)	(0.040)	(0.038)	(0.034)	(0.034)
FDI stock (% of GDP) (3rd lag)	-0.021	-0.032	-0.031	-0.036	-0.033	-0.031	-0.032
	(0.622)	(0.412)	(0.426)	(0.353)	(0.399)	(0.432)	(0.411)
Debt flows (% of GDP)	0.606***	0.632***	0.633***	0.647***	0.632***	0.632***	0.634***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Debt stock (% of GDP) (3rd lag)	0.007	-0.022	-0.024	-0.017	-0.019	-0.025	-0.022
	(0.860)	(0.493)	(0.453)	(0.592)	(0.547)	(0.457)	(0.489)
GDP growth (lag)	0.476**	0.427**	0.431**	0.386*	0.412**	0.433**	0.426**
	(0.021)	(0.034)	(0.033)	(0.057)	(0.040)	(0.032)	(0.035)
Interest differential	0.004	0.003	0.003	0.004	0.003	0.003	0.003
	(0.162)	(0.184)	(0.176)	(0.165)	(0.212)	(0.175)	(0.179)
Resource rents (% of GDP)	0.259**	0.308***	0.290***	0.325***	0.338***	0.287***	0.295***
	(0.014)	(0.004)	(0.009)	(0.002)	(0.002)	(0.009)	(0.005)
Institutions indicator	0.316	1.899	0.019	2.307	3.684	-0.223	0.685
	(0.279)	(0.497)	(0.995)	(0.145)	(0.196)	(0.944)	(0.795)
Country dummies:							
d_Angola	-8.774	-9.797	-10.888	-10.615	-9.350	-11.029	-10.493
	(0.442)	(0.378)	(0.324)	(0.335)	(0.395)	(0.323)	(0.344)
d_Congo, DR	-14.062	-11.763	-12.888	-9.815	-10.517	-13.075	-12.449
	(0.222)	(0.298)	(0.260)	(0.389)	(0.351)	(0.253)	(0.270)
d_Zimbabwe	-3.129	-3.880	-5.098	-3.820	-0.342	-5.319	-4.615
	(0.789)	(0.735)	(0.655)	(0.737)	(0.977)	(0.650)	(0.687)
Period dummies:							
d2007-2008	-2.698	-3.517*	-3.461*	-3.773*	-3.586*	-3.447*	-3.482*
	(0.180)	(0.081)	(0.087)	(0.062)	(0.075)	(0.088)	(0.084)
d2011	-6.397**	-6.212**	-6.170**	-6.317**	-6.262**	-6.165**	-6.192**
	(0.023)	(0.024)	(0.025)	(0.022)	(0.023)	(0.025)	(0.025)
d2014	1.865	2.007	1.918	2.111	2.047	1.929	1.857
	(0.512)	(0.485)	(0.506)	(0.462)	(0.476)	(0.503)	(0.520)
Constant	-2.580	0.491	-0.217	0.593	0.837	-0.296	0.070
	(0.432)	(0.876)	(0.945)	(0.844)	(0.785)	(0.925)	(0.982)
R2 within	0.204	0.218	0.217	0.222	0.224	0.217	0.217
R2 between	0.345	0.329	0.346	0.305	0.245	0.348	0.45
R2 overall	0.248	0.247	0.251	0.248	0.226	0.252	0.251
Observations	425	440	440	440	440	440	440
Number of countries	28	29	29	29	29	29	29

The dependent variable is capital flight (% of GDP). P-values in parentheses; *** p<0.01, ** p<0.05, * p<0.1 stand for significance at 1%, 5%, and 10, respectively.

Table 5: Capital flight, FDI and natural resources: with governance x resources interactions
(Random-effects regression results)

Variables	(1) Polity2	(2) Corruption control	(3) Government effectiveness	(4) Political stability	(5) Regulatory quality	(6) Rule of law	(7) Voice & accountability
FDI flows (% of GDP) (lag)	0.377***	0.293**	0.264**	0.294**	0.290**	0.288**	0.292**
	(0.006)	(0.030)	(0.049)	(0.028)	(0.033)	(0.033)	(0.030)
FDI stock (% of GDP) (3rd lag)	-0.011	-0.030	-0.044	-0.041	-0.031	-0.031	-0.032
	(0.796)	(0.428)	(0.237)	(0.286)	(0.411)	(0.414)	(0.412)
Debt flows (% of GDP)	0.602***	0.631***	0.644***	0.655***	0.637***	0.634***	0.633***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Debt stock (% of GDP) (3rd lag)	0.015	-0.020	-0.030	-0.011	-0.017	-0.022	-0.018
	(0.687)	(0.531)	(0.336)	(0.721)	(0.599)	(0.501)	(0.566)
GDP growth (lag)	0.389*	0.429**	0.518***	0.351*	0.448**	0.439**	0.404**
	(0.062)	(0.033)	(0.009)	(0.084)	(0.028)	(0.031)	(0.048)
Interest differential	0.003	0.003	0.005*	0.003	0.004	0.004	0.003
	(0.197)	(0.189)	(0.069)	(0.207)	(0.159)	(0.170)	(0.204)
	(0.460)						
Resource rents (% of GDP)	0.271***	0.362*	-0.278	0.450***	0.272	0.269	0.404**
	(0.008)	(0.086)	(0.233)	(0.000)	(0.104)	(0.190)	(0.022)
Resource rents x institutions	0.045**	0.066	-0.538***	0.154**	-0.044	-0.029	0.117
	(0.016)	(0.732)	(0.005)	(0.024)	(0.741)	(0.860)	(0.443)
Country dummies:							
d_Angola	-6.751	-9.864	-16.038*	-9.973	-12.271	-11.703	-9.064
	(0.520)	(0.363)	(0.080)	(0.363)	(0.178)	(0.264)	(0.407)
d_DR Congo	-19.839*	-12.077	-26.179**	-6.017	-14.473	-13.836	-10.827
	(0.067)	(0.267)	(0.011)	(0.602)	(0.125)	(0.201)	(0.334)
d_Zimbabwe	-5.318	-4.832		-5.557	-5.262	-5.198	-4.776
	(0.623)	(0.648)		(0.622)	(0.575)	(0.619)	(0.664)
Period dummies:							
d2007_2008	-2.511	-3.564*	-2.497	-4.074**	-3.487*	-3.452*	-3.593*
	(0.211)	(0.079)	(0.223)	(0.044)	(0.090)	(0.092)	(0.075)
d2011	-6.167**	-6.226**	-5.692**	-6.561**	-6.165**	-6.141**	-6.241**
	(0.028)	(0.025)	(0.039)	(0.017)	(0.027)	(0.027)	(0.024)
d2014	2.024	1.922	2.215	1.660	2.013	1.996	1.717
	(0.475)	(0.505)	(0.441)	(0.562)	(0.489)	(0.492)	(0.552)
Constant	-2.704	-0.715	1.818	-0.760	-0.751	-0.352	-0.702
	(0.386)	(0.808)	(0.517)	(0.798)	(0.782)	(0.906)	(0.812)
R2 within	0.220	0.218	0.222	0.228	0.214	0.16	0.219
R2 between	0.230	0.333	0.486	0.283	0.388	0.363	0.321
R2 overall	0.224	0.248	0.304	0.250	0.262	0.256	0.247
Observations	425	440	440	440	440	440	440
Number of	28	29	29	29	29	29	29

countries	

The dependent variable is capital flight (% of GDP). P-values in parentheses; *** p<0.01, ** p<0.05, * p<0.1 stand for significance at 1%, 5%, and 10, respectively.

From the results presented in Tables 2-5, we conclude that the empirical evidence in this paper supports the proposition that FDI inflows and natural resource rents are positively related to capital flight. However, they do not support the proposition that the quality of institutions mitigates the risk that natural resource rents fuel capital flight. However, this conclusion needs to be interpreted with caution and should not be taken to mean that institutions are not important in mitigating the risks of capital flight fueled by natural resource rents. The lack of conclusive evidence may reflect the diversity of specific country contexts and structural factors across the countries in the sample. Detailed country level analysis is needed to pursue this empirical question.

Before closing the discussion of the regression results, it is worth highlighting the findings regarding the other variables included in the regressions. First, it is clear that the premise that capital flight is driven by rate of return differentials between African countries and the rest of the world is not supported by the empirical evidence. The coefficient on the interest rate differential is insignificant in all the regressions presented in Tables 2-5. This suggests that capital flight is not the outcome of portfolio choice by private wealth holders seeking to maximize returns by investing abroad. Other factors seem to be more pertinent in explaining the flight of capital from the African continent. The results confirm that both the annual inflows of debt and past debt stock drive capital fight. They confirm the debt-fueled and debt overhang effects of external borrowing on capital flight as established in the empirical literature. The results on GDP growth are contrary to expectations. One would expect that high growth serves as an incentive for investing domestically, which would reduce capital flight. However, when considering the 1970-2015 sample period (Tables 2-3), in the regressions containing total resource rents or mineral rents, the coefficients on growth are positive and significant. The regressions over the 1996-2015 period with the extended model show systematically positive and significant coefficients on GDP growth (Tables 4-5). These results suggest that, rather than a causal effect, the positive coefficient on GDP growth may reflect the fact that capital flight has persisted during periods of high growth, as illustrated by the increased capital flight during the growth resurgence since the turn of the century.

7 Conclusion

This paper sought to investigate the puzzling simultaneous increase in capital flight and FDI in African countries over the past decades, which seems to contradict portfolio theory of investment. The paper also explored the impact of natural resources on capital flight and examined whether the quality of institutions may mitigate the resource-capital flight link. It provided a theoretical framework that helps to motivate how capital flight emerges from an environment characterized by both high natural resource endowment and poor institutions. The formalization of these relationships constitutes an important contribution to the literature on the linkages between capital flight, FDI and natural resources.

The empirical analysis in the paper distinguished between FDI inflows and FDI stock, in the spirit of the analysis of the capital flight-external debt relationships which distinguishes between debt inflows (debt-fueled effects) and debt stock (debt overhang effects). Three conclusions emerge from the empirical analysis. First, we find that FDI inflows are robustly related to capital flight, and that higher private capital inflows are associated with higher capital flight. In that sense, there is an FDI-fueled capital flight phenomenon similar to debt-fueled capital flight. In contrast, the stock of FDI appears to have no impact on capital flight. Second, natural resource endowment is directly related to capital flight. We find a positive relationship between natural resource rents and capital flight, which holds when we use total resource rents as well as when we consider oil rents and mineral rents separately. Third, the quality of institutions does not mitigate the impact of natural resources on capital flight. These results hold when we use alternative measures of the quality of governance and political stability, although these measures are available on a shorter time period over 1996-2015.

The evidence from this study suggests that while efforts to improve the quality of the investment climate, improve institutions and raise the returns to domestic investment are worthwhile as part of the development strategy in African countries, these efforts alone will not enable governments to successfully tackle the problem of capital fight. More targeted strategies are needed to curb the exodus of capital in general, and in particular to minimize the leakages of natural resource rents through capital fight and to prevent the fueling of capital flight by private and public external capital inflows. Such strategies include increased accountability in the management of natural

resource rents by African governments as well as more transparent reporting of production, sales, profits and tax payments by foreign corporations in the resource sector on a country by country basis.

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Table A1: Variable definitions and data sources

Variables in the dataset	Definition	Data sources
kf/gdg	Capital fight as a percentage of GDP	Political Economy Research Institute, University of Massachusetts Amherst (https://www.peri.umass.edu/capital-flight-from-africa)
GDP growth	Growth rate of GDP	UNCTADStat
cdebt/gdp	Adjusted change in the stock of debt	World Bank, International Debt Statistics
totdebt/gdp	Total outstanding debt as a percentage of GDP	World Bank, International Debt Statistics
fdi/gdp	Net inward FDI flows as a percentage of GDP	UNCTADStat
fdistock/gdp	Stock of FDI as a percentage of GDP	UNCTADStat
oil rents/gdp	Oil rents (as a percentage of GDP)	World Bank, World Development Indicators
mineral rents/gdp	Mineral rents (as a percentage of GDP)	World Bank, World Development Indicators
resource rents/gdp	Total resource rents (as a percentage of GDP)	World Bank, World Development Indicators
Interest rate differential	Covered interest rate differential = domestic deposit rate – US Tbill rate – exchange rate depreciation	World Bank, World Development Indicators
Polity2	Polity 2 score = -10 (worst) to 10 (best)	Polity IV Project database (online)
Control of Corruption	Estimates of public perceptions of corruption, expressed in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.	World Bank's Worldwide Governance Indicators
Government effectiveness	Estimates of perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. Range = -2.5 to 2.5	

Political stability	Estimates of perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism. Range = -2.5 to 2.5	
Regulatory quality	Perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. Range = -2.5 to 2.5	
Rule of law	Estimates of perceptions of confidence in the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. Range = -2.5 to 2.5	
Voice and accountability	Estimates of perceptions of citizens participation in selecting their government, as well as freedom of expression, freedom of association, and a free media. Range = -2.5 to 2.5	

Appendix

Brief Presentation of the Capital Flight Computation Algorithm

Note: Detailed expositions on the computation of capital flight can be found in Ndikumana and Boyce (2010), Ndikumana, Boyce and Ndiaye (2015), and Ndikumana and Boyce (2018).

Capital flight is calculated as the difference between recorded total capital inflows and recorded foreign exchange outflows or uses; that is, discrepancies between the inflows and the use of foreign exchange as recorded in the country's Balance of Payment (BoP). Thus, the baseline formula is a BoP residual calculated as follows:

$$KF = CDEBTADJ + FDI + PI + OI - (CAD + CRES)$$

CDEBTADJ is change in total external debt outstanding adjusted for exchange rate fluctuations, net change in interest arrears, and debt forgiveness as reported in the World Bank's International Debt Statistics; FDI is net foreign direct investment; PI is portfolio investment; OI is 'other investment'; CAD is the current account deficit; CRES is the net additions to the stock of reserves.

The above BOP residual is further adjusted to take into account discrepancies between values of exports and imports recorded by the country vs. the values reported by trading partners, or trade misinvoicing. Trade misinvoicing is the sum of export misinvoicing and import misinvoicing.

For country *i* and partner *j* at time *t,* export misinvoicing (*DX*) is calculated as follows:

$$DX_{ij,t} = M_{ji,t} - c\text{if} * X_{ij,t}$$

$M_{ji,t}$ represents imports by partner *j* from country *i* as recorded by partner *j*, cif is the cost of insurance and freight, and $X_{ij,t}$ represents exports by country *i* to partner *j* as recorded by country *i*. Import misinvoicing is calculated as follows:

$$DM_{ij,t} = M_{ij,t} - \text{cif} * X_{ji,t}$$

$M_{ij,t}$ represents imports by country *i* from partner *j* as reported in country *i's* data, $X_{ji,t}$ stands for exports by partner *j* to country *i* as reported in partner *j's* data, and cif is the cost of insurance and freight. Net trade misinvoicing for country *i* with respect to partner *j* is obtained as the sum of export misinvoicing and import misinvoicing:

$$MISINV_{ij,t} = DX_{ij,t} + DM_{ij,t}$$

Total export misinvoicing and import misinvoicing vis-à-vis the world can be calculated in three ways:

- Replacing partner country *j* with the rest of the world in the above equations.
- Summing up the results over individual partners.

- Summing up the results over a subset of partners, such as the industrialized countries (termed 'advanced countries' in the DoTS database), whose trade statistics are considered relatively accurate, and then scaling up the result by the inverse of this group's share in the country's recorded exports and imports. total net trade misinvoicing is computed as follows:

$$MISINV = \frac{DXIC}{ICXS} + \frac{DMIC}{ICMS}$$

Where *DXIC* and *DMIC* are export and import misinvoicing with respect to industrialized countries as a group; and *ICXS* and *ICMS* are the shares of industrialized countries in the country's exports and imports.

Adjusted capital flight is then obtained as:

$$ADJKF = CDEBTADJ + FDI + PI + OI - (CAD + CRES) + MISINV$$