The FDI-Growth Nexus: A Comparative Analysis of Resource-Rich and Resource-Scarce African Economies

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The FDI-Growth Nexus: A Comparative Analysis of Resource-Rich and Resource-Scarce African Economies

By

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List of abbreviations and acronyms

FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GMM	Generalized Method of Moments
UNCTAD	United Nations Conference on Trade and Development
WGI	World Governance Indicators

Abstract

In an attempt to capture the impact that cross-country resource endowment differences may have on the FDI–growth relationship, this study investigates the FDI–growth nexus in Africa by categorizing the countries as resource-rich and resource-scarce, for the period 2000–2017. Thus, the study is a modest attempt to answer the following main questions: a) Do FDI inflows contribute to economic growth in the host country after controlling for endogeneity? b) Does being a natural resource-abundant/scarce country alter the FDI–growth nexus? Using a System GMM, both the direct and interaction effects of FDI on growth are investigated in a comparative framework across resource-rich and resource-scarce African countries. The results show that the effects of FDI on economic growth vary depending on resource richness of countries. While FDI is found to affect growth positively and significantly in resource-scarce African economies, no significant effect of FDI on growth is identified for the resource-rich category.

Key words: Africa; Economic growth; FDI; Resource-rich; Resource-scarce; System GMM.
JEL classification codes: C23; F21; F43; O55.

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1. Introduction

Foreign direct investment (FDI) inflows are important for growth in developing countries mainly for two reasons. First, as they represent one form of capital inflow to host countries, they increase the domestic capital stock, which is scarce in these economies (De Mello, 1997; Jude and Levieuge, 2015; Akadiri et al., 2019). Second, they are believed to have positive spillover effects on productivity improvements and economic growth through the introduction of new technologies, human capital development, and export promotion through access to foreign markets (Jude and Levieuge, 2015; Iamsiraroj, 2016; Akadiri and Ajmi, 2020; Nguyen et al., 2021).

Several theoretical arguments have been forwarded in the literature on the positive contributions of FDI to economic growth in host countries. The empirical evidence so far on the growth impacts of FDI, however, has not provided a conclusive result. Some studies have reported a positive effect of FDI on economic growth (see, e.g., De Gregorio, 1992; Balasubramanyam et al., 1996; Blomström et al., 1996; Basu et al., 2003; Hansen and Rand, 2006). Others argued that, although FDI is found to have a positive growth impact, the degree to which it positively affects growth depends on the availability of a number of factors in the recipient country. Such factors include host country's level of human capital development (De Mello, 1997; Borensztein et al., 1998), initial level of per capita income (Borensztein et al., 1998), the complementarity between FDI and domestic investment (De Mello, 1997), financial system development (Hermes and Lensink, 2003; Alfaro et al., 2004; Durham, 2004), openness and policies towards FDI (Balasubramanyam et al., 1996), the sectoral target of the incoming FDI which in turn is influenced by natural resource abundance in FDI host country (Dutt, 1997; Akinlo, 2004; Ayanwale, 2007), and the quality of institutions (Durham, 2004; Jude and Levieuge, 2015). On the other hand, some other studies have reported either a negative effect or the lack of robust positive effect of FDI on growth (see, e.g., Akinlo, 2004; Carkovic and Levine, 2005; Herzer et al., 2008; Belloumi, 2014).

The FDI–growth relationship has been explored from many aspects. As noted above, several studies have shown that the FDI–growth nexus is conditional upon many other relevant factors; and variations in these factors substantially alter the FDI–growth relationship. This study considers one such factor, i.e., the influence of host countries' natural resource endowment differences on the FDI–growth relationship, which is largely overlooked by most cross-country studies on the FDI–growth nexus in Africa.

The impact of natural resource abundance on economic growth is widely investigated; and studies show that countries that are natural resource-rich tend to grow slower than countries that are natural resource-poor (Sachs and Warner, 2001). In the literature, this phenomenon is known as 'natural resource curse'. Several studies have also explored the role of natural resource abundance in attracting FDI (see, e.g., Aseidu and Lien, 2011; Anyanwu, 2012). However, the question of the impact of being resource-rich or not on the FDI–growth nexus is largely ignored, as most previous cross-country studies pooled all different countries in one sample and overlooked the need to control for such differences in empirical analysis.

There are a number of arguments explaining the channels through which natural resource abundance may alter the FDI–growth relationship. First, while resource richness is considered to be a factor in attracting FDI (Aseidu, 2006), it is expected to result in lower levels of FDI inflow in the non-resource tradeable sectors of the economy. The aggregate level of FDI inflow is expected to fall because of increased resource sector (Aseidu and Lien, 2011). This will result in lowering the levels of capital accumulation in the economy and, ultimately, will result in lower economic growth. Thus, FDI is not expected to have the positive spillovers of job creation and technology transfers because countries that are resource-rich generally channel FDI to the natural resource industries (Aseidu, 2006).

The second channel of natural resource abundance impact on the FDI-growth relationship is through the capital accumulation in the natural resource sector. Natural resource abundance alters the FDI inflow position of a country in favour of the natural resource sector at the cost of non-resource tradeable sector (Poelhekke and van der Ploeg, 2013). This will result in greater capital accumulation in the natural resource sector and will increase natural resource exports further. Natural resource exports are associated with slower growth rate (Sachs and Warner, 2001), therefore such accumulation of FDI in the resource sector is expected to fuel the natural resource curse further and deny any potential growth-inducing effect of FDI. An increased activity in the resource sector due to accumulation of FDI in this sector will make firms operating in the non-resource tradeable sector less competitive. This, in turn, is expected to deny any potential positive impact of FDI on growth.

Natural resource curse also takes shape by lowering institutional and governance quality of the country which, ultimately, adversely affects economic growth (Sala-i-Martin and Subramanian, 2008; Busse and Gröning, 2013). This also reduces the potential growth-inducing effect of FDI because studies have shown that countries with better institutional quality tend to receive higher FDI-induced economic growth (Jude and Levieuge, 2015; Hayat, 2016). Donato and Mariana (2012) found that the high degree of resource exports is associated with worse government effectiveness and reduced level of competitiveness.

Thus, in an attempt to capture the impact that resource richness may have on the FDI–growth relationship and modestly close the gap in literature noted previously, this study uses an analytical classification of African countries, with each being characterized as natural resource abundant (resource-rich) or natural resource-scarce,

and explore whether the FDI–growth relationship differs across such groupings. Hence, this study attempts to answer the following main research questions: does FDI inflow contribute to per capita gross domestic product (GDP) growth in the host country after controlling for endogeneity? And more importantly, does being resource-rich/ resource-scarce alter the FDI–-growth nexus in Africa?

This study uses the World Bank's (2019) classification of countries as resource-rich and resource-scarce. Resource-rich countries are those where fuel and mineral exports contribute over 20% to their GDP during the period 2000–2017 (see Table B1 (Annex B) for the list of countries). However, resource richness of countries has changed over the sample period in a number of cases. This has been taken into account in the analysis by carrying out various robustness checks using alternative sample of countries.

The remainder of this study is organized as follows. Section 2 provides the background of the study in which the general pattern of FDI inflows in Africa is discussed. Section 3 presents a review of the related literature, and Section 4 describes the methodology and the data used in the study. Section 5 discusses the findings, while Section 6 concludes the study.

2. The general pattern of FDI inflows in Africa

Over the past three and a half decades, FDI inflows to the various regions of the world have grown substantially, as shown in Table 1 (United Nations Conference on Trade and Development [UNCTAD], 2020).

Table 1: Annual inward FDI flows (US$ billion)

Economy	Year			
	2000	2010	2017	2019
World	1,359	1,372	1,868	1,430
Developed economies	1,121	680	1,133	712
Transition economies	6	64	64	47
Developing economies	232	629	670	671
Africa	10	47	53	42
America	80	167	140	151
Asia	142	413	475	476

Source: UNCTAD (2020).

The total world FDI inflows grew significantly from US$13 billion in 1970 to reach an all-time peak of nearly US$2 trillion in 2015 (UNCTAD, 2020). Global FDI inflows fell by 23% in 2019 compared to the amount registered in 2017, but with considerable variation between the various regions and country groups, and stood at US$1.43 trillion in 2019 (UNCTAD, 2020 in Table 1). Similar to the patterns in the global FDI inflows, FDI flows to developing countries reached their all-time high of US$744 billion in 2015, which represents 39% of the global FDI inflows for the same year (UNCTAD, 2020). In 2019, the inflows of FDI to the developing world stood at US$671 billion. However, the overall increase in the developing economies' FDI inflows is predominantly a developing Asia story. Developing Asia constitutes the lion's share (nearly 67%) of the total FDI flows into developing economies in 2019 (UNCTAD, 2020 in Table 1). In Africa, FDI inflows amounted to an all-time high of US$58.1 billion in 2008. Following some ups and downs, FDI stood at US$42 billion in 2019, which is a 28% and 21% decline from the historic high recorded in 2008 and the amount of FDI inflow registered in 2017, respectively, (UNCTAD, 2020 in Table 1). Such a decline is associated with the weak oil prices and harmful lingering effects from the commodity bust, especially in the larger commodity-exporting African economies (UNCTAD, 2018).

The overall surge in the FDI flows to the continent in the last four decades is, to a large extent, related to investments in extractive industries, although these flows have risen in various service sectors of the economy too (UNCTAD, 2020).

The main conclusions that can be made about the recent trends of FDI in Africa are the following. First, although the volume of FDI to Africa has increased significantly over the years, Africa's financial globalization with the rest of the world remains very marginal. For example, by 2019, Africa's total FDI stock stood at US$867 billion, which is not that significant when compared to the US$951 billion FDI that developing Asia received for just two years (2017 and 2019) (UNCTAD, 2020). Second, the distribution of FDI in Africa is extremely skewed. Africa's top five FDI destination countries take more than 50% of the FDI inflows to the continent. Third, the sectoral[1] distribution of FDI to Africa is concentrated in the primary sector—mainly in oil and gas extraction. Fourth, rising intra-African FDI (mainly from South Africa), expansion by emerging-market firms (largely from East Asia) and non-traditional actors (private equity), and growing consumer markets in Africa (particularly the food and beverages industry) are among the most important drivers that shape FDI trends to Africa (UNCTAD, 2016).

3. Review of literature

Theoretical literature

In the literature, a number of theoretical mechanisms through which FDI can affect economic growth are identified. These include increased capital stock in the host economy (Solow, 1957; Buckley and Casson, 1976; Hymer, 1976; De Mello, 1997; Akinlo, 2004), technological improvement and know-how transfers (De Mello, 1997), improved productivity through labour trainings and managerial capability spillovers (Vernon, 1966; Kindleberger, 1969; Dunning, 1973; Hymer, 1976), increased competitiveness due to intense competition (Akinlo, 2004), and increased market access through export promotions (Dunning, 1973; Balasubramanyam et al., 1996; Akinlo, 2004).

In general, the theoretical literature on the growth impacts of FDI draws alternative views from the neoclassical and the endogenous models of economic growth. According to the neoclassical growth models, long-term economic growth is assumed to be attained only through technological innovation and growth in the labour force of the economy (see, e.g., Solow, 1957; De Mello, 1997; Iamsiraroj and Ulubaşoğlu, 2015; Iamsiraroj, 2016). Given the assumption of diminishing marginal returns to capital in these models, the growth impact of FDI is limited to the short run only (Herzer et al., 2008; Iamsiraroj and Ulubaşoğlu, 2015; Iamsiraroj, 2016). In response to the weaknesses noted in the neoclassical growth models, the endogenous growth theories have attempted to establish a connection between increased FDI and economic growth by emphasizing the role of technological change, technology transfer, diffusion, and spillover effects on growth (Herzer et al., 2008; Iamsiraroj, 2016).

In contrast to their neoclassical counterparts, in the endogenous growth models, FDI into a country is assumed to be an important source of additional productive input and means of knowledge and technology transfer that will help to promote long-run economic growth (De Mello, 1997; Borensztein et al., 1998; Akinlo, 2004; Li and Liu, 2005; Herzer et al., 2008; Iamsiraroj, 2016). Thus, through its direct impact on capital accumulation and indirect effect through knowledge spillovers, FDI may contribute positively to the economic growth of host countries (Iamsiraroj, 2016).

However, FDI could also negatively affect economic growth in the FDI host countries. For example, if new entries of foreign-affiliated firms crowd out domestic firms, growth in the FDI recipient country may be constrained (Misun and Tomsik, 2002; Herzer et al., 2008). In addition, the dependency-school theorists claim that

dependence on FDI could have an adverse effect on host country's economic growth and income distribution (Adams, 2009). FDI may also have a negative effect on host country's economic growth if it results to a significant amount of capital outflows in the form of returns on investment (Ramirez, 2000; Akinlo, 2004). Moreover, the "adverse incentive effect" hypothesis, which is pointed out by Easterly (1993), is also a case to consider in relation to the negative effects of FDI in host economies. Favourable tax treatments and other incentives given to foreign investors might significantly distort incentives for domestic firms and thus adversely affect host country's economic growth (Iwasaki and Tokunaga, 2014).

In broadly similar terms, several other authors have argued that FDI might have no effect on growth on its own. Rather, they have emphasized its effect on growth as conditional upon the quality of other socioeconomic and political factors prevailing in the recipient countries (Borensztein et al., 1998; Akinlo, 2004; Durham, 2004; Iwasaki and Tokunaga, 2014).

Despite the theoretical controversies that surround the FDI–growth nexus, there is a broad consensus on the view which suggests that FDI's positive impact on economic growth in developing countries is dependent upon the economic and political conditions in the host country. Such factors include the level of per capita income, the initial level of human capital development, the degree of openness in the economy, the degree of domestic financial markets development, and the political conditions and institutional qualities that prevail in the host country. Nevertheless, the effect of FDI inflows on growth still remains as an empirical issue, which is discussed next.

Empirical literature[2]

In general, the empirical FDI–growth relationship literature has been based on both cross-country and panel data analyses (see, e.g., Saltz, 1992; Blomström et al., 1996; Borenztein et al., 1998; Basu et al., 2003; Lumbila, 2005; Herzer et al., 2008; Adams, 2009; Iamsiraroj, 2016; Zghidi et al., 2016) as well as country case studies (see, e.g., Kokko, 1994; Blomström et al., 1996; Akinlo, 2004; Ayanwale, 2007; Omri and Sassi-Tmar, 2015). However, mixed results from these studies have been reported.

Some studies from the developing world have found that FDI could positively affect economic growth through capital accumulation, spillover effects, increased export, and human capital development (Balasubramanyam, et al., 1996; Borensztein et al., 1998; Nair-Reichert and Weinhold 2001; Liu et al., 2002; Akinlo, 2004; Table A1 in Annex A). However, such positive impact is also found to be a function of the availability of several contributing factors, such as the level of development (Blomström et al., 1996), human capital (Borensztein et al., 1998), open trade and investment regime (Balasubramanyam et al., 1996; Basu et al., 2003), the sectoral target of FDI (Akinlo, 2004; Ayanwale, 2007), and financial market development (Hermes and Lensink, 2003; Durham, 2004; Alfaro et al., 2004), among other things.

On the other hand, some other studies have found that FDI inflows have had a negative effect on growth in some countries by crowding out domestic firms that results in adverse effects on economic growth (see, e.g., Bende-Nabende et al., 2002, 2003; Adams; 2009), while others (see, e.g., Carkovic and Levine, 2005) do not confirm a robust, positive impact of FDI on economic growth.

The existing few African studies on the effect of FDI on growth (which are mostly country case studies) have also reported mixed findings. For example, from studies using panel data technique, Lumbila (2005) for 47 SSA countries and Brambila-Macias and Massa (2010) for 27 SSA countries reported a significant positive impact of FDI on economic growth. On the other hand, Adams (2009) reported a mixed result that depends on the estimation technique used. Adams (2009) found that the effect of FDI is positive and significant only when the OLS estimation technique is used, but in the fixed effects estimation, he found the effect of FDI on growth to be insignificant. Similarly, mixed results are reported in country case studies in Africa. For example, Fedderke and Romm (2006) have found that the growth impact of FDI is indeed positive for South Africa and that long-run causality runs from FDI to growth. Similarly, Ayanwale (2007) reported that FDI in Nigeria contributed positively to economic growth. Akinlo (2004), on the other hand, did not confirm the positive result found in Fedderke and Romm (2006) and Ayanwale (2007), and instead reported a statistically insignificant effect of FDI on economic growth in Nigeria.

One possible explanation for these mixed findings may be the failure to model interaction effects in the relationship between FDI and growth on one hand and methodological and host-country differences on the other. However, the conclusion that can be drawn from the existing empirical literature is that positive growth effects from FDI are conditional on initial conditions of the host country, including the absorptive capacity, level of development, trade openness, human capital, financial development, and the business environment at large, among other things.

There are several shortcomings with the existing empirical literature on the FDI–growth relationship reviewed here. One major problem that may apply to most of these studies is that they consider the FDI–growth relationship to be determined only by macroeconomic fundamentals, largely overlooking the issues of governance, institutions, and political conditions in FDI host countries. However, poor quality institutions, bad governances, and political instability are oftentimes associated with poor overall economic performances (Acemoglu et al., 2001; Rodrik et al., 2004; Jude and Levieuge, 2015).

In addition, most of the existing studies have some methodological-related problems. For example, cross-country studies pool all different countries in one sample without due consideration for structural differences between countries (see, e.g., Blomström et al., 1996; Balasubramanyam et al., 1996; Borenztein et al., 1998; Lumbila, 2005; Hansen and Rand, 2006; Adams, 2009). One such instance is that most of these studies overlook to control for the impact that differences in natural resource abundance between countries may have on the FDI–growth relationship. Countries vary in the type of FDI inflows they receive based on their natural resource endowment

differences (Aseidu, 2006). As a result, the growth effects of FDI are also likely to differ across countries (Dutt, 1997), which most of the existing studies have not considered. Thus, unaccounted-for cross-country parameter heterogeneity is a major problem for most of these studies. In addition, as noted by Herzer et al. (2008), the problem of endogeneity bias is a concern for the cross-country studies (see, e.g., Blomström et al., 1996; Balasubramanyam et al., 1996; Borensztein et al., 1998).

Given some of the limitations in previous studies noted above, this study is a modest attempt to address some of them by revisiting the FDI–growth nexus over the period 2000–2017 for 46 African countries classified as resource-rich and resource-scarce economies.

4. Methodology

The theoretical growth model

The study follows a variant of an endogenous growth model to investigate the effects of FDI on economic growth in Africa, including both the direct effects (by increasing the domestic physical capital stock) and the interaction effects. As such, it closely follows the formulation given in Iamsiraroj (2016) and Romer (1986),[3] and augments the explanatory variables in this variant of models by including the following variables: two policy variables (measures of trade openness and government consumption); measure of exogenous growth influencing factor (commodity-specific commodity export price index); an aggregate institutional and political conditions indicator; and two interaction terms (between human capital and FDI, and between an aggregate measure of political and institutional indicator and FDI). These augmentations distinguish the generalized model used in this study from the traditional endogenous growth model.

A variant of the production function in an endogenous-growth-model context in which FDI is explicitly incorporated as a factor input can be specified as:

$$Y = A(\lambda L)^{\alpha} K_d^{\beta} \mu^{1-\alpha-\beta} \text{ and } \lambda = H^z \quad (1)$$

in which A denotes exogenous economic, political, and institutional factors which influence productivity in the economy. Y denotes real GDP, and K_d is real domestic capital. L and λ are labour input and the level of human capital, respectively. H and z are measures of educational level and the return to education relative to labour input, respectively. μ is the externality generated by FDI inflows and α and β are the shares of labour and domestic capital, respectively. It is assumed that there are diminishing returns to labour and capital in production, i.e., α and β are less than one.

The externality generated by additional inflows FDI, μ, can be represented by a Cobb–Douglas functional form (see Akinlo, 2004) as:

$$\mu = \{(\lambda L) K_d K_f^{\sigma}\}^{\gamma} \quad (2)$$

Where, Kf is FDI. σ is the marginal elasticity of substitution between private and foreign capital, and γ is the intertemporal elasticity of substitution between domestic and foreign capital, respectively.

Following Akinlo (2004), let $\sigma > 0$, such that a higher FDI inflows yields a positive externality to the host country's economy. If γ>0, intertemporal complimentarity prevails and, if γ<0, additions to the FDI stock crowd out domestic capital over time and diminish the growth potential of the host country.

By substituting (2) into (1) for μ, Equation 1 can be rewritten as:

$$Y = A(\lambda L)^{\alpha} K_d^{\beta} \left[\{(\lambda L) K_d K_f^{\sigma}\}^{\gamma} \right]^{1-\alpha-\beta} \tag{3}$$

$$= A(\lambda L)^{\alpha} K_d^{\beta} \left[(\lambda L)^{\gamma(1-\alpha-\beta)} K_d^{\gamma(1-\alpha-\beta)} K_f^{\sigma\gamma(1-\alpha-\beta)} \right] \tag{4}$$

$$= A\left((\lambda L)^{\alpha} (\lambda L)^{\gamma(1-\alpha-\beta)}\right) \left(K_d^{\beta} K_d^{\gamma(1-\alpha-\beta)}\right) \left(K_f^{\sigma\gamma(1-\alpha-\beta)}\right) \tag{5}$$

After factorization for like terms, Equation 5 becomes:

$$Y = A(\lambda L)^{\alpha+\gamma(1-\alpha-\beta)} K_d^{\beta+\gamma(1-\alpha-\beta)} K_f^{\sigma\gamma(1-\alpha-\beta)} \tag{6}$$

Substituting λ=H^z, Equation 6 becomes:

$$Y = A(H^z L)^{\alpha+\gamma(1-\alpha-\beta)} K_d^{\beta+\gamma(1-\alpha-\beta)} K_f^{\sigma\gamma(1-\alpha-\beta)} \tag{7}$$

Equation 8 presents a variant of the growth model (Equation 7) estimated in this study in an endogenous-growth-model context in which FDI is explicitly incorporated as a factor input.

$$y_{i,t} = \alpha y_{i,t-1} + \beta_1 FDI_{i,t} + \beta_2 FDI_{i,t} * H_{i,t} + \beta_3 FDI_{i,t} * INST_{i,t} + \beta_4 Z_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t} \tag{8}$$

Where, $y_{i,t}$ is the logarithm of real GDP per capita; $FDI_{i,t}$ is FDI inflows as a percentage of GDP; $FDI_{i,t}*H_{i,t}$ is the multiplicative interaction term between $FDI_{i,t}$ and the stock

human capital indicator $(H_{i,t})$; $FDI_{i,t} * INST_{i,t}$ is the multiplicative interaction term between $FDI_{i,t}$ and an aggregate measure of host country's institutional conditions $(INST_{i,t})$; and $Z_{i,t}$ is a vector of control variables described below. The subscripts *i* identifies FDI host countries, the *t* subscript is for time; μ_t is a time specific effect; η_i is an unobserved country-specific fixed effect; and $\varepsilon_{i,t}$ is an error term.

Equation 8 can also be alternatively written with the growth rate of real GDP per capita $g_{i,t}$ as a dependent variable as:

$$g_{i,t} = (1-\alpha)y_{i,t-1} + \beta_1 FDI_{i,t} + \beta_2 FDI_{i,t} * H_{i,t} + \beta_3 FDI_{i,t} * INST_{i,t} + \beta_4 Z_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t} \quad (9)$$

The selection of variables of the control vector ($Z_{i,t}$) is driven by theoretical and previous empirical literature on cross-country growth analysis in general and the FDI–growth nexus in particular. $Z_{i,t}$ contains: three variables relating to domestic endowments (labour growth measured by population growth rate, human capital, and domestic investment), two policy variables (measures of trade openness and size of the government), exogenous growth influencing factor (commodity export price index), and an aggregate measure of institutional and political condition in FDI host economies. The reasons for including these augmenting variables, along with how they are calculated (measured), are provided in the next subsection.

Data source and description

Annual data, covering 46 African countries classified as resource-rich and resource-scarce from 2000 to 2017, is used. The selection of countries and the time period is solely based on the availability of data. Overall, the numbers of African countries classified as resource-rich and resource-scarce are 23 and 30, respectively. However, due to lack of a complete data for some countries and some variables, the numbers of countries used in the empirical model as resource-rich and resource-scarce are reduced to 20 and 26, respectively (see Table B1 in Annex B).

Altogether, most of the data is taken from UNCTAD (2020) and the World Bank (2020a, 2020b) online databases, except for the human capital and commodity-specific commodity export price index variables which are extracted from the Penn World Table of version 9.1 by Feenstra et al. (2015) and Gruss and Kebhaj (2019), respectively.[4] The aim here is to restrict the data retrieval to only a few sources to avoid any problems emerging from different variable definitions and data adjustments and revisions over time. The definition of the variables, how they are measured and their source are given in Table C1 (in Annex C). In addition, the summary statistics for each of the country groupings is provided in tables D1 and D2 (in Annex D).

The dependent variable

The dependent variable is economic growth, measured as the growth rate of real GDP per capita at 2015 US$ constant prices.

Measure of FDI

The existing empirical studies use different measures of FDI to investigate the FDI–growth nexus. While 'flow' measures are based on current account inflows or outflows of foreign capital for certain period of time, 'stock' measures estimate the total cumulated value of foreign-owned capital in a country. FDI inflows measure the value of new foreign capital flows into the host country in a particular year (Alfaro et al., 2004). Hence, this provides a measure of additional capital available to the production process of host economies for certain period of time. This study examines whether FDI inflows (new foreign capital inflows) would influence host country's economic growth rather than the stock of FDI (existing foreign capital). For this variable, FDI inflows, as a percentage of GDP, is used in this study.

Measure of host country's endowments

In Equation 9, three host country control variables are included. These are labour force growth (measured by population growth rates), human capital, and domestic investment. Labour force growth measures the contributions of labour to income growth rate, holding other factors constant. It can be argued that high labour force growth results in lower steady-state income as each worker has less capital to work with (Iamsiraroj, 2016). Given this argument holds, labour force growth is expected to have a negative relationship with income growth as it is part of the investment requirement.

The level of human capital development might be a minimum requirement of absorptive capability in the host country for FDI to perform better (Iamsiraroj, 2016). Evidence from empirical studies suggests that the degree to which the population is educated and skilled is a key determinant of economic growth (see, e.g., Barro, 1991, 1998; Mankiw et al., 1992; Barro and Sala-i-Martin, 1997; Barro and Lee, 2013). This study uses a widely used measure of human capital based on the average years of schooling as given in Feenstra et al. (2015). In Equation 9, the coefficients attached to human capital variables reflect the direct effects of human capital, while the coefficients attached to the interacted variables reflect the effects of human capital interacted with FDI; and the two together measures the total effect of human capital on economic growth. The effect of human capital on growth is hypothesized as a positively stimulating one.

Domestic investment is one of the robust determinants of economic growth in many empirical studies (Barro, 1999; Iamsiraroj, 2016). The domestic investment to GDP ratio

is used in this study as a measure of the additional fixed capital formation available in a local economy for a given time period. The domestic investment is generated taking the difference between gross capital formation and FDI inflows. This is motivated by the need to find a way to net-out the foreign investment component of the overall investment in the economy (see Neuhaus (2006) for a similar application). Domestic investment is expected to have a positive effect on economic growth.

Measure of host country's policies

There are two policy variables in the empirical model given in Equation 9. These are measures of openness to international trade and government consumption. These variables are the outcomes of government policies. For trade openness (OP), the trade share (calculated as the ratio of exports and imports of goods and services divided by 2 divided by GDP) adjusted for population size is used in this study.[5] This is done by running a regression on the log of the trade share (TS) on the log of the population size (POP), either on a panel of countries or for each cross-section in the panel. The resulting residuals are then taken as a trade share adjusted for population size. Trade openness can positively contribute to economic growth through its efficiency effect in the allocation of scarce economic resources and productivity improvements through technological and skill transfer (Barro and Sala-i-Martin, 1997). Given this argument, higher degree of openness is expected to be positively correlated with the growth of real per capita income.

Government consumption is an important variable in growth regressions. An increase in government expenditure would stimulate aggregate expenditure or income growth (Barro, 1990; King and Rebelo, 1990); while others have argued that an increase in government consumption may affect growth negatively if it crowds out the private sector (Akinlo, 2004).

Measure of exogenous growth influencing factor

Several earlier studies use commodity export prices to capture exogenous commodity price fluctuations for macroeconomic outcomes (Gruss and Kebhaj, 2019). Given the fact that international commodity price movements are closely related to economic growth in Africa (Anyanwu, 2014; UNCTAD, 2017), commodity-specific commodity export price index is incorporated in the estimated growth equation in this study (see Deaton and Miller, 1996; Collier and Goderis, 2012; Gruss & Kebhaj, 2019, for a similar application). Commodity price is expected to have a positive effect on growth in this study.

Measure of host country's institutions

An aggregate measure of political and institutional indicators ($INST_{i,t}$) is incorporated given the fact that countries with good institutions and political stability tend to grow faster than others with weaker institutions and poor political stability (Easterly and Levine, 1997; Acemoglu et al., 2001). In addition, good governance and institutions and political stability enhance the overall benefits of FDI on economic growth (Asiedu, 2002; Alfaro et al., 2004; Carkovic and Levine, 2005; Jude and Levieuge, 2015). These factors can promote better linkages between FDI and domestic firms and stimulate knowledge transfer to domestic firms and improve productivity gains (Jude and Levieuge, 2015). It can thus be argued that better political stability and good governance, as well as better developed institutions, stimulate economic growth in FDI host economies, making FDI into these countries more effective, which is why the interaction of $INST_{i,t}$ with $FDI_{i,t}$ is included as an explanatory variable in Equation 9, in addition to the variable $INST_{i,t}$.

The study uses the world governance indicators (WGI) data set of the World Bank (2020b)—due to its comprehensiveness – to capture the effects of governance, quality of institutions, and political instability on the FDI–growth nexus in Africa. The WGI data set constructs six aggregate indicators of broad dimensions of governance. These are voice and accountability, political stability, government effectiveness, regulatory quality, the rule of law, and control of corruption. As there is high correlation among the variables (not reported here) and the possibility of high degree multicollinearity among them, this study uses three of them by taking their aggregate sum (after normalization). These three variables are discussed below.

The Political Stability (*POL*) indicator reflects "perceptions of the likelihood that the government will be overthrown or destabilized by unconstitutional or violent means" (Kaufmann et al., 2010). The Regulatory Quality (*RQ*) indicator reflects "perceptions of the ability of the government to formulate and implement sound policies and regulations that promote private sector development" (Kaufmann et al., 2010). The Rule of Law (*RL*) indicator reflects "perceptions of the extent to which agents have confidence in and abide by the rules of society, and the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence" (Kaufmann et al., 2010). Values for each of these *INST* variables are assigned such that higher values represent lower risk for the country characteristic under consideration (see Kaufmann et al., 2010).

The econometric technique

This study uses the Generalized Method of Moments (GMM) panel estimator developed by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998) to estimate the empirical model given in Equation 8. The selection of this estimator is founded on two major reasons. The first is to control for country-specific effects,

which cannot be done with country-specific dummies as the empirical model in Equation 8 is dynamic in nature. The second is to control for simultaneity problem as a result of the possibility that some of the explanatory variables may be endogenous with the dependent variable (growth). The possibility of endogeneity problem is very likely when estimating the relationship between FDI and growth. By definition, an explanatory variable is said to be endogenous if it correlates with the error term. In such a case, the inconsistency of estimation methods such as OLS cannot be overemphasized (Iamsiraroj, 2016).

To eliminate country-specific effects, Equation 8 can be transformed into first-difference equation, following Arellano and Bond (1991), as follows:

$$y_{i,t} - y_{i,t-1} = \alpha(y_{i,t-1} - y_{i,t-2}) + \beta_1\left(FDI_{i,t} - FDI_{i,t-1}\right) + \beta_2\left(FDI_{i,t} * H_{i,t} - FDI_{i,t-1} * H_{i,t-1}\right) + \beta_3\left(FDI_{i,t} * INST_{i,t} - FDI_{i,t-1} * INST_{i,t-1}\right) + \beta_4\left(Z_{i,t} - Z_{i,t-1}\right) + (\varepsilon_{i,t} - \varepsilon_{i,t}) \quad (10)$$

Equivalently, letting Δ represent the first-difference of a given variable, (10) can be written as:

$$\Delta y_{i,t} = \alpha\Delta y_{i,t-1} + \beta_1\Delta FDI_{i,t} + \beta_2\Delta(FDI_{it} * H_{it}) + \beta_3\Delta\left(FDI_{i,t} * INST_{i,t}\right) + \beta_4\Delta Z_{i,t} + \Delta\varepsilon_{i,t} \quad (11)$$

To deal with the possible simultaneity bias of the explanatory variables and the correlation between $\Delta y_{i,t-1}$ and $\Delta\varepsilon_{i,t}$, Arellano and Bond (1991) proposes the lagged levels of the regressors to be used as instruments. This is, however, only valid in assuming that the error term is not serially correlated, and also that the lags of the explanatory variables are weakly exogenous (Alonso-Borrego and Arellano, 1999; Blundell and Bond, 1998). In panel data econometrics literature, this strategy is known as Difference GMM estimation. The moment conditions for this estimator can be given as:

$$E\left[y_{i,t-s} * \Delta\varepsilon_{i,t-1}\right] = 0 \quad \text{for } s \geq 2; t = 3,4, \ldots . T \quad (12)$$

$$E\left[FDI_{i,t-s} * \Delta\varepsilon_{i,t-1}\right] = 0 \quad \text{for } s \geq 2; t = 3,4, \ldots . T \quad (13)$$

$$E\left[FDI_{i,t-s} * H_{it-s} * \Delta\varepsilon_{i,t-1}\right] = 0 \quad \text{for } s \geq 2; t = 3,4, \ldots . T \quad (14)$$

$$E\left[FDI_{i,t-s} * INST_{i,t-s} * \Delta\varepsilon_{i,t-1}\right] = 0 \quad \text{for } s \geq 2; t = 3,4, \ldots . T \quad (15)$$

$$E\left[Z_{i,t-s} * \Delta\varepsilon_{i,t-1}\right] = 0 \quad \text{for } s \geq 2; t = 3,4, \ldots . T \quad (16)$$

However, Equation 11 may still suffer from possible endogeneity due to feedback between economic growth and its determinants, such as the FDI variable, or due to omitted variable bias. It has been shown that, though the Difference GMM estimator controls for country-specific effects and simultaneity bias, it has some problems. Blundell and Bond (1998) and Alonso-Borrego and Arellano (1999) showed that, when the explanatory variables are persistent, their past values convey little information about their future changes, making the lagged value of the variables weak instruments for their differenced series (Iamsiraroj, 2016). This gives misleading results. Arellano and Bover (1995) suggested a combination of the differenced Equation 11 and level Equation 8. Blundell and Bond (1998) showed that this estimator is able to increase the efficiency via its reduction in biases, and imprecision characterized the Difference GMM estimator, especially the aforementioned weak instrument problem. Arellano and Bover (1995) and Blundell and Bond (1998) proposed a System GMM estimator as follows. In addition to the moment conditions of (12), (13), (14), (15), and ((16), the authors proposed that the System GMM uses the following moment conditions given in equations 17–21:

$$E\left[\left(y_{i,t-s} - y_{i,t-s-1}\right) * \left(\eta_i + \varepsilon_{i,t}\right)\right] = 0 \quad \text{for } s = 1 \tag{17}$$

$$E\left[\left(FDI_{i,t-s} - FDI_{i,t-s-1}\right) * \left(\eta_i + \varepsilon_{i,t}\right)\right] = 0 \quad \text{for } s = 1 \tag{18}$$

$$E\left[\left(FDI_{i,t-s} * H_{i,t-s} - FDI_{i,t-s-1} * H_{i,t-s-1}\right) * \left(\eta_i + \varepsilon_{i,t}\right)\right] = 0 \quad \text{for } s = 1 \tag{19}$$

$$E\left[\left(FDI_{i,t-s} * INST_{i,t-s} - FDI_{i,t-s-1} * INST_{i,t-s-1}\right) * \left(\eta_i + \varepsilon_{i,t}\right)\right] = 0 \quad \text{for } s = 1 \tag{20}$$

$$E\left[\left(FDI_{i,t-s} * Z_{i,t-s} - FDI_{i,t-s-1} * Z_{i,t-s-1}\right) * \left(\eta_i + \varepsilon_{i,t}\right)\right] = 0 \quad \text{for } s = 1 \tag{21}$$

The consistency of the System GMM estimator depends on the validity of the assumption that the error term does not exhibit serial correlation, and on the validity of the instruments. By construction, the test for the null hypothesis of no first-order serial correlation should be rejected under the assumption that the error is not serially correlated; but the test for the null hypothesis of no second-order serial correlation should not be rejected. We use two diagnostic tests proposed by Arellano and Bover (1995) and Blundell and Bond (1998), the Hansen test of overidentifying restrictions, and whether the differenced residuals are second-order serially correlated. If the null hypothesis of both tests cannot be rejected, this would indicate that the model is adequately specified and the instruments are valid. The results from this estimation procedure are reported in Table 2 and Table 3.

5. Discussion of results

This section presents the results of the estimated models. In the analysis, two separate models of the empirical growth model are estimated using the System GMM approach, for each country grouping. For the first model, Model 1, the growth model is based on the macro fundamentals and the aggregate political and institutional variables. Thus, Model 1 contains the dependent variable real GDP per capita growth and the following regressors: the natural log of initial real GDP per capita, domestic investment as share of GDP, labour force growth (as measured by population growth), human capital, government consumption as share of GDP, commodity-specific commodity export price index, trade openness, institutions, and FDI as share of GDP. The other model, Model 2, incorporates two interaction terms, human capital x FDI as share of GDP, and institutions x FDI as share of GDP, as additional variables to Model 1. The estimated results from these two models are shown in Table 2 and Table 3.

The effects of FDI on growth

Table 2 shows the System GMM estimated coefficients of Model 1 of Equation 9 with the P-values presented in parenthesis. As Table 2 shows, the effect of FDI on growth is found to vary across the country groups considered. The coefficient of FDI is positive and significant only for the resource-scarce economies (Table 3). This shows that FDI inflows strongly enhance growth rate in this group of countries. The results for this group of countries can be taken to represent there being stronger effects of FDI in countries where the incoming FDI is mainly in the non-resource extractive sector.

The coefficient of our interest here is $\frac{\partial g_{i,t}}{\partial FDI_{i,t}} = \beta_1$. Therefore, the estimated coefficient of FDI ($\hat{\beta}_1$) for resource-scarce economies in Model 1 is 0.109, which means that a 1% increase in the ratio of FDI inflow to GDP leads to a 0.109 percentage points increase in the per capita growth rate of FDI host country in the resource-scarce category. Several previous studies have reported a similar result on the positive direct effect of FDI on growth (see, e.g., Blomström et al., 1996; Basu et al., 2003; Zghidi et al., 2016).

In contrast, the positive and significant direct effect of FDI on growth noted above becomes insignificant in the case of resource-rich economies (Table 2). Some earlier studies have also reported a similar insignificant effect of FDI on growth for some resource-rich African countries (see, e.g., Akinlo, 2004).

Table 2: Estimation results for Model 1[a]

Dependent Variable : Real GDP Per Capita Growth	Model 1	
	Resource-Rich	Resource-Scarce
Real GDP per capita lagged	-0.021**	-0.015**
	(0.025)	(0.030)
Domestic investment as share of GDP	0.240**	0.214**
	(0.022)	(0.030)
Labour force growth	-0.011**	-0.020**
	(0.025)	(0.020)
Human capital	0.001	0.009*
	(0.129)	(0.081)
Government consumption as share of GDP	0.210***	0.240***
	(0.000)	(0.000)
Commodity export price index	0.615***	0.591***
	(0.000)	(0.000)
Trade openness	0.211**	0.203**
	(0.020)	(0.018)
Institutions	0.001	0.210**
	(0.134)	(0.019)
FDI as share of GDP	0.001	0.109**
	(0.190)	(0.012)
Human capital × FDI as share of GDP	-	-
Institutions × FDI as share of GDP	-	-
Constant	1.238***	1.201***
	(0.000)	(0.000)
F-statistic: P-value	0.000	0.000
R-squared	0.720	0.729
Number of observations	340	442
Number of countries	20	26
AR(2) test: P-value	0.625	0.652
Hansen test: P-value	0.696	0.711

Notes: ***, **, and * represent significance at 1%, 5%, and 10% level, respectively. a Model 1 includes all the macro fundamentals and institutions variables. Estimation is run using System GMM with robust standard errors, consistent with panel-specific autocorrelation and heteroscedasticity. The Hansen test is the Sargan over-identification test (J-test) and has the null hypothesis of joint exogeneity of the instrument set. AR(2) is a test of second-order residual serial correlation and has the null of no second-order serial correlation in the residuals. Failure to reject the null of both tests provides support for the consistency of the estimated models.

However, in addition to its direct effect, FDI might interact with other determinants of growth to affect growth in FDI host countries. Table 3 presents the System GMM estimated coefficients of Model 2 with the P-values in parenthesis.

Table 3: Estimation results for Model 2[a]

Dependent Variable : Real GDP Per Capita Growth	Model 2	
	Resource-Rich	Resource-Scarce
Real GDP per capita lagged	-0.023**	-0.018**
	(0.021)	(0.046)
Domestic investment as share of GDP	0.239**	0.227**
	(0.020)	(0.048)
Labour force growth	-0.012*	-0.018**
	(0.071)	(0.069)
Human capital	0.002	0.011*
	(0.121)	(0.074)
Government consumption as share of GDP	0.219***	0.233***
	(0.000)	(0.000)
Commodity export price index	0.621***	0.600***
	(0.000)	(0.000)
Trade openness	0.205**	0.201**
	(0.029)	(0.020)
Institutions	0.003	0.223**
	(0.121)	(0.014)
FDI as share of GDP	0.002	0.142***
	(0.190)	(0.001)
Human capital × FDI as share of GDP	0.005	0.021**
	(0.214)	(0.011)
Institutions × FDI as share of GDP	0.011	0.071**
	(0.128)	(0.012)
Constant	1.006***	1.004***
	(0.000)	(0.000)
F-statistic: P-value	0.000	0.000
R-squared	0.788	0.796
Number of observations	340	442
Number of countries	20	26
AR(2) test: P-value	0.601	0.587
Hansen test: P-value	0.489	0.479

Notes: ***, **, and * represent significance at 1%, 5%, and 10% level, respectively. a Model 2 includes two interaction terms (the interaction terms between human capital and FDI, and institutions and FDI) as additional variables on Model 1. Estimation is run using System GMM with robust standard errors, consistent with panel-specific autocorrelation and heteroscedasticity.

Note here that, $\frac{\partial g_{i,t}}{\partial FDI_{i,t}} = \beta_1$ β1 in Equation 9, therefore the coefficient of our interest for finding the estimated direct impact of FDI on economic growth is $\hat{\beta}_1$. While

such an effect is found to be positive and strongly significant for the resource-scarce category of African countries, it is insignificant in the resource-rich group, however (Table 3). As shown in Table 3, the estimated coefficient for the direct effect of FDI ($\hat{\beta}_1$) on growth for the resource-scarce economies is $\hat{\beta}_1$=0.142. Ignoring the interaction effects of FDI, this tell us that a 1% increase in FDI inflow into a country in resource-scarce group of countries leads to a 0.142 percentage points increase in real GDP per capita of that country. However, this was without taking into account the growth impact of the two interaction terms of FDI.

With regard to the interaction terms, the effect of the interaction term between human capital and FDI on growth is significant and positive only for resource-scarce economies. This result is similar with the one reported, for example, in Borensztein et al. (1998), Li and Liu (2005), and Balasubramanyam et al. (1996). The insignificance of this interactive effect in resource-rich economies is similar to results reported, for example, in Carkovic and Levine (2005). This lack of a significant positive interactive effect of FDI on growth may be due to the low absorptive capability (below the threshold level) of most resource-rich African countries to make use of the technology, knowledge, and other skills associated with inflows of FDI. Also, it may be related to the nature of most of the FDI flows to this category of countries, which are mainly concentrated in the extractive sector (UNCTAD, 2020), where the issue of skill development of workers and knowledge transfer is given less importance. Similarly, the effect of the interaction term between FDI and the aggregate political and institutional quality indicator (INST) on economic growth is found to be positive and significant only for resource-scarce country group. This finding is in line with the view that good quality of political and institutional factors prevailing in FDI recipient countries have a positive influence on the growth effects of FDI (Borensztein et al., 1998; Akinlo, 2004; Durham, 2004). The effect of such interaction term is insignificant in resource-rich economies, however. This may be related to the relatively weak institutions that usually characterize most resource-rich countries in Africa (see Annex D).

Therefore, in Equation 9, the total economic growth effect of an increase in FDI (the total effect that comes from the non-interactive term of FDI and the interactive terms) would be:

$$\frac{\partial g_{i,t}}{\partial FDI_{i,t}} = \beta_1 + \beta_2 H_{i,t} + \beta_3 INST_{i,t}$$

The total effect of FDI, when the coefficient of the interaction terms are statistically significant, can be calculated by plugging the average value for $H_{i,t}$ and $INST_{i,t}$ in $\frac{\partial Y_{it}}{\partial FDI_{it}}$. In cases where β_2 and β_3 are statistically insignificant, the total marginal effect equals β_1 (which is also the marginal effect due to the non-interactive term). Thus, the estimated total effect of FDI on economic growth in resource-scarce African countries would be:

$$\frac{\partial g_{i,t}}{\partial FDI_{i,t}} = 0.142 + 0.021 H_{i,t} + 0.071 INST_{i,t}$$

Considering the average values for human capital ($\overline{H}$) and political and institutional variable ($\overline{INST}$) for this group of countries (see Table D1 in Annex D for the mean values of H), the total effect of FDI inflow on economic growth in resource-scarce African economies would be 0.142+0.021*(1.84)+0.071*(1.31))=0.273. This means that a 1% increase in FDI inflow into resource-scare African countries with an average level of human capital and political and institutional variable leads to a 0.273 percentage point increase in economic growth. This is significantly higher than β_1 which estimated the effect of FDI inflow on economic growth without taking into account the effects of the FDI interaction terms. On the other hand, the total effect of FDI in the resource-rich economies is zero as β_1, β_2, and β_3 are all insignificant (zero) in Model 2 of Equation 9 for this group of countries. This means that, for a resource-rich country, FDI inflow has no contribution to its economic growth.

Effects of the other variables of the model

The results on the rest of the variables in the empirical model are very much as expected and in line with the conventional growth regression results. For example, the effect of domestic investment on growth is found to be significant and positive in all the models for each of the country groupings. However, the magnitude of the effect is found to be stronger in resource-rich economies. Openness to trade is found to have a significant positive effect on growth in all the models of each of the country groups. Greater trade openness arguably promotes economic growth in Africa through increasing competitiveness and providing access to international markets, as well as by enabling importation of raw materials and capital goods. However, the potency of the results is stronger in resource-scarce economies. Similarly, government consumption is found to affect growth positively in all the models of each of the country groups. However, the magnitude of the effect is stronger in resource-scarce economies.

The aggregate measure of the institutional and political quality indicator is found to have a significant positive effect on growth only in resource-scarce countries group. These results are consistent with the hypothesis that the quality of institutions plays a crucial role in enhancing economic growth. Similarly, the effect of human capital on economic growth is found to be positive and significant only for resource-scarce economies. Finally, labour force growth (proxied by population growth) has the expected statistically significant negative coefficient in all the models of each country groups. However, the size of the effect is stronger in resource-scarce economies.

Robustness check: Data averaging, control variables, sub-sample stability, and outliers

The baseline models (see Table 2 and Table 3) were checked for robustness of the results using data averaging techniques, sub-samples, different sets of control

variables, and by dropping some outlying observations. The results from such exercises are discussed hereunder.

In the baseline regressions, annual data from 2000 to 2017 is used to estimate the models using the System GMM approach. To check the robustness of the estimated results, however, System GMM estimation is applied on non-overlapping three-year period averaged values of all variables in Model 1 and Model 2 for each of the country groupings. Averaging is justified as it will eliminate the influence of short-term shocks and business cycles fluctuations and allows us to focus on long-term relationship between FDI and economic growth. In the GMM empirical literature, three-, five-, and ten-year averages are commonly used. In this study, the three-year averages are considered as this will give us more observations on each variable and preserve the time-series dimension of the data. As shown in Table 4, the regression results in Table 2 and Table 3 are found to be robust to this alternative three-year averaged estimation.

Table 4: Robustness check using non-overlapping three-year average data[a]

Dependent Variable: Real GDP Per Capita Growth	Model 1		Model 2	
	Resource-Rich	Resource-Scarce	Resource-Rich	Resource-Scarce
GDP per capita lag	-0.016**	-0.012*	-0.024**	-0.019**
	(0.031)	(0.080)	(0.017)	(0.014)
Domestic investment as share of GDP	0.221**	0.201**	0.242**	0.230**
	(0.041)	(0.039)	(0.022)	(0.014)
Labour force growth	-0.010**	-0.017**	-0.010**	-0.015**
	(0.031)	(0.042)	(0.021)	(0.023)
Human capital	0.001	0.009*	0.001	0.011*
	(0.146)	(0.052)	(0.178)	(0.071)
Government consumption as share of GDP	0.229***	0.232***	0.220***	0.219***
	(0.000)	(0.000)	(0.000)	(0.000)
Commodity export price index	0.626***	0.599***	0.631***	0.586***
	(0.000)	(0.000)	(0.000)	(0.000)
Trade openness	0.185**	0.183**	0.229**	0.215**
	(0.029)	(0.031)	(0.019)	(0.017)
Institutions	0.008	0.230**	0.009	0.250**
	(0.161)	(0.019)	(0.110)	(0.032)
FDI as share of GDP	0.001	0.110***	0.003	0.138***
	(0.149)	(0.002)	(0.130)	(0.004)
Human capital × FDI as share of GDP	-	-	0.004	0.021**
			(0.115)	(0.043)
Institutions × FDI as share of GDP	-	-	0.009	0.074**
			(0.106)	(0.030)

continued next page

Table 4 Continued

Dependent Variable: Real GDP Per Capita Growth	Model 1		Model 2	
	Resource-Rich	Resource-Scarce	Resource-Rich	Resource-Scarce
Constant	1.297***	1.250***	1.301***	1.168***
	(0.000)	(0.000)	(0.000)	(0.000)
F-statistic: P-value	0.000	0.000	0.000	0.000
R-squared	0.713	0.721	0.751	0.730
Number of observations	120	156	120	156
Number of countries	20	26	20	26
AR(2) test: P-value	0.610	0.639	0.690	0.669
Hansen test: P-value	0.670	0.694	0.541	0.480

Notes: ***, **, and * represent significance at 1%, 5%, and 10% level, respectively. a Model 1 includes all the macro fundamentals and institutions variables. Mode 2 includes two interaction terms (the interaction terms between human capital and FDI, and institutions and FDI) as additional variables on Model 1. Estimation is run using System GMM with robust standard errors, consistent with panel-specific autocorrelation and heteroscedasticity.

In addition, the sensitivity of the results has also been examined across sub-samples for Model 2. This additional exercise is intended to evaluate the incidence of business cycle effects on the parameter estimates. The results, reported in Table 5, do not change the overall picture, and suggest that, while the signs of the controls are consistently the same, the estimated effects of FDI on growth are stable across sub-samples.

Table 5: Robustness check using non-overlapping sub-sample periods of 2000–2008 and 2009–2017[a]

Dependent Variable: Real GDP Per Capita Growth	Model 2			
	For the period 2000–2008		For the period 2009–2017	
	Resource-Rich	Resource-Scarce	Resource-Rich	Resource-Scarce
GDP per capita lag	-0.029**	-0.014*	-0.020**	-0.032**
	(0.031)	(0.067)	(0.028)	(0.012)
Domestic investment as share of GDP	0.228**	0.192*	0.225**	0.249**
	(0.039)	(0.032)	(0.025)	(0.020)
Labour force growth	-0.089**	-0.017**	-0.012**	-0.013**
	(0.023)	(0.030)	(0.028)	(0.020)
Human capital	0.001	0.010*	0.001	0.011*
	(0.130)	(0.076)	(0.168)	(0.053)
Government consumption as share of GDP	0.239***	0.191***	0.210***	0.230***
	(0.000)	(0.000)	(0.000)	(0.000)

continued next page

Table 5 Continued

Dependent Variable: Real GDP Per Capita Growth	Model 2			
	For the period 2000–2008		For the period 2009–2017	
	Resource-Rich	Resource-Scarce	Resource-Rich	Resource-Scarce
Commodity export price index	0.659***	0.633***	0.619**	0.590**
	(0.000)	(0.000)	(0.021)	(0.029)
Trade openness	0.209**	0.235**	0.209***	0.220***
	(0.025)	(0.026)	(0.000)	(0.000)
Institutions	0.006	0.220**	0.009*	0.271**
	(0.114)	(0.014)	(0.109)	(0.029)
FDI as share of GDP	0.001	0.139**	0.004	0.143***
	(0.129)	(0.003)	(0.176)	(0.003)
Human capital × FDI as share of GDP	0.003	0.020**	0.005	0.023**
	(0.129)	(0.031)	(0.128)	(0.032)
Institutions × FDI as share of GDP	0.008	0.072**	0.009	0.077**
	(0.119)	(0.024)	(0.110)	(0.033)
Constant	1.127***	1.241***	1.290***	1.252***
	(0.000)	(0.000)	(0.000)	(0.000)
F-statistic: P-value	0.000	0.000	0.000	0.000
R-squared	0.759	0.736	0.759	0.738
Number of observations	160	208	160	208
Number of countries	20	26	20	26
AR(2) test: P-value	0.692	0.671	0.689	0.668
Hansen test: P-value	0.549	0.492	0.554	0.489

Notes: ***, **, and * represent significance at 1%, 5%, and 10% level, respectively. a Model 2 includes two interaction terms (the interaction terms between human capital and FDI, and institutions and FDI) as additional variables on Model 1. Estimation is run using System GMM with robust standard errors, consistent with panel-specific autocorrelation and heteroscedasticity.

Additional sensitivity analysis was performed to check if some outlying observations were responsible for the findings in Table 2 and Table 3. In a first attempt, South Africa from resource-rich and Egypt from resource-scarce countries are dropped as they have better host country absorptive capacity in terms of human capital, institutional quality, and initial level of development. The results were, however, found to be robust for this additional experiment (Table 6).

Table 6: Robustness check after excluding South Africa and Egypt from the sample[a]

Dependent Variable: Real GDP Per Capita Growth	Model 1		Model 2	
	Resource-Rich	Resource-Scarce	Resource-Rich	Resource-Scarce
Real GDP per capita lag	-0.015**	-0.013*	-0.021**	-0.016*
	(0.033)	(0.059)	(0.041)	(0.063)
Domestic investment as share of GDP	0.187**	0.173*	0.197**	0.188**
	(0.029)	(0.030)	(0.030)	(0.041)
Labour force growth	-0.015**	-0.027**	-0.016**	-0.024**
	(0.042)	(0.033)	(0.041)	(0.044)
Human capital	0.000	0.006*	0.000	0.008*
	(0.126)	(0.092)	(0.152)	(0.069)
Government consumption as share of GDP	0.160***	0.161***	0.165***	0.170***
	(0.000)	(0.000)	(0.000)	(0.000)
Commodity export price index	0.579***	0.517***	0.573***	0.520***
	(0.000)	(0.000)	(0.000)	(0.000)
Trade openness	0.125**	0.139**	0.161**	0.180**
	(0.029)	(0.021)	(0.036)	(0.031)
Institutions	0.000	0.171**	0.001	0.194**
	(0.198)	(0.030)	(0.191)	(0.021)
FDI as share of GDP	0.000	0.131**	0.000	0.135***
	(0.201)	(0.044)	(0.162)	(0.003)
Human capital × FDI as share of GDP	-	-	0.001	0.012**
			(0.221)	(0.003)
Institutions × FDI as share of GDP	-	-	0.004	0.057**
			(0.138)	(0.004)
Constant	1.130***	1.129***	1.090***	1.109***
	(0.000)	(0.000)	(0.000)	(0.000)
F-statistic: P-value	0.000	0.000	0.000	0.000
R-squared	0.723	0.704	0.779	0.781
Number of observations	323	425	323	425
Number of countries	19	25	19	25
AR(2) test: P-value	0.607	0.650	0.621	0.596
Hansen test: P-value	0.670	0.693	0.490	0.466

Notes: ***, **, and * represent significance at 1%, 5%, and 10% level, respectively. a Model 1 includes all the macro fundamentals and institutions variables. Model 2 includes two interaction terms (the interaction terms between human capital and FDI, and institutions and FDI) as additional variables on Model 1. Estimation is run using System GMM with robust standard errors, consistent with panel-specific autocorrelation and heteroscedasticity.

In another attempt, noting that countries' positions in the resource richness classification have changed over the sample period in a number of cases, alternative estimation is made by removing those countries whose resource abundance has changed significantly over the study period. For example, Tanzania is a lot more resource-rich later in the sample period but it falls into the resource-rich category. Ghana, on the other hand, falls into resource-scarce economies while the country has become resource abundant over time, although much in the later years of the sample period. To check the robustness of the results, Model 1 and Model 2 are estimated by leaving out Tanzania and Ghana from the sample. The results of such exercise, given in Table 7, shows that results of the baseline models are robust for such sampling modification.

Table 7: Robustness check after excluding Tanzania and Ghana from the sample

Dependent Variable: Real GDP Per Capita Growth	**Model 1**		**Model 2**	
	Resource-Rich	**Resource-Scarce**	**Resource-Rich**	**Resource-Scarce**
Real GDP per capita lag	-0.013**	-0.011*	-0.019**	-0.015*
	(0.040)	(0.070)	(0.032)	(0.069)
Domestic investment as share of GDP	0.221**	0.201*	0.228**	0.209*
	(0.041)	(0.037)	(0.023)	(0.070)
Labour force growth	-0.014**	-0.023**	-0.014*	-0.021*
	(0.031)	(0.046)	(0.060)	(0.059)
Human capital	0.001	0.008*	0.003	0.011*
	(0.126)	(0.079)	(0.119)	(0.080)
Government consumption as share of GDP	0.144***	0.152***	0.172***	0.190***
	(0.000)	(0.000)	(0.000)	(0.000)
Commodity export price index	0.579***	0.521***	0.560***	0.539***
	(0.000)	(0.000)	(0.000)	(0.000)
Trade openness	0.159**	0.155**	0.170**	0.188**
	(0.031)	(0.029)	(0.032)	(0.028)
Institutions	0.001**	0.189**	0.003	0.219**
	(0.042)	(0.026)	(0.137)	(0.033)
FDI as share of GDP	0.001	0.099***	0.002	0.128***
	(0.165)	(0.003)	(0.159)	(0.001)
Human capital × FDI as share of GDP	-	-	0.003	0.019***
			(0.214)	(0.002)
Institutions × FDI as share of GDP	-	-	0.009	0.059**
			(0.128)	(0.004)

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Table 7 Continued

Dependent Variable: Real GDP Per Capita Growth	Model 1		Model 2	
	Resource-Rich	Resource-Scarce	Resource-Rich	Resource-Scarce
Constant	1.134***	1.104***	1.020***	1.001***
	(0.000)	(0.000)	(0.000)	(0.000)
F-statistic: P-value	0.000	0.000	0.000	0.000
R-squared	0.714	0.716	0.750	0.772
Number of observations	323	425	323	425
Number of countries	19	25	19	25
AR(2) test: P-value	0.610	0.616	0.544	0.591
Hansen test: P-value	0.662	0.693	0.490	0.458

Notes: ***, **, and * represent significance at 1%, 5%, and 10% level, respectively. a Model 1 includes all the macro fundamentals and institutions variables. Model 2 includes two interaction terms (the interaction terms between human capital and FDI, and institutions and FDI) as additional variables on Model 1. Estimation is run using System GMM with robust standard errors, consistent with panel-specific autocorrelation and heteroscedasticity.

Finally, the robustness of the results reported in Table 2 and Table 3 were checked by using different sets of controls variables. In this exercise, two of the control variables were dropped (government consumption and trade openness) simultaneously from the estimation of Model 1 and Model 2. The general finding, reported in Table 8 as Model 3 and Model 4, is that the coefficients on the FDI variable are often found to be consistently estimated and the sizes continue to be largely the same. It is worth noting that all the other control variables have their expected sign in each specification.[6]

Table 8: Robustness check using different sets of control variables

Dependent Variable: Real GDP Per Capita Growth	Model 3		Model 4	
	Resource-Rich	Resource-Scarce	Resource-Rich	Resource-Scarce
Real GDP per capita lag	-0.025*	-0.029*	-0.021**	-0.019**
	(0.061)	(0.063)	(0.021)	(0.014)
Domestic investment as share of GDP	0.160**	0.131*	0.198**	0.178**
	(0.025)	(0.033)	(0.017)	(0.011)
Labour force growth	-0.009*	-0.018**	-0.011**	-0.017*
	(0.061)	(0.030)	(0.032)	(0.051)
Human capital	0.005	0.014*	0.007	0.016*
	(0.119)	(0.092)	(0.141)	(0.062)
Government consumption as share of GDP	-	-	-	-
Commodity export price index	0.710***	0.699***	0.689***	0.658***
	(0.000)	(0.000)	(0.000)	(0.000)

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Table 8 Continued

Dependent Variable: Real GDP Per Capita Growth	Model 3		Model 4	
	Resource-Rich	Resource-Scarce	Resource-Rich	Resource-Scarce
Trade openness	-	-	-	-
Institutions	0.010	0.315**	0.007	0.251***
	(0.310)	(0.018)	(0.192)	(0.003)
FDI as share of GDP	0.001	0.101**	0.003	0.130***
	(0.193)	(0.011)	(0.187)	(0.002)
Human capital × FDI as share of GDP	-	-	0.002	0.019**
			(0.129)	(0.035)
Institutions × FDI as share of GDP	-	-	0.002	0.083**
			(0.137)	(0.021)
Constant	4.698***	5.001***	3.807***	4.021***
	(0.000)	(0.000)	(0.000)	(0.000)
F-statistic: P-value	0.000	0.000	0.000	0.000
R-squared	0.622	0.651	0.648	0.675
Number of observations	120	156	120	156
Number of countries	20	26	20	26
AR(2) test: P-value	0.511	0.542	0.5380	0.571
Hansen test: P-value	0.610	0.639	0.621	0.641

Notes: ***, **, and * represent significance at 1%, 5%, and 10% level, respectively. a Model 3 includes all the macro fundamentals and institutions variables in the original specification of Model 1 except government consumption and trade openness. Model 4 includes two interaction terms (the interaction terms between human capital and FDI, and institutions and FDI) as additional variables on Model 3. Estimation is run using System GMM with robust standard errors, consistent with panel-specific autocorrelation and heteroscedasticity.

Overall, none of the results in Table 2 and Table 3 were affected significantly by the robustness check exercises, and thus the results of the estimated baseline models are robust for all these alternative scenarios.

6. Conclusion

Whereas several studies have shown that Africa is endowed with rich natural resources that have historically been the source of attraction to foreign investors (Levine et al., 2000; Hermes and Lensink, 2003; Asiedu, 2006), little has been done to explore the impact of such resource richness on the FDI–growth relationship in the region. This study modestly attempts to contribute to the FDI literature by comparatively investigating the FDI–growth nexus using an analytical classification of African countries into two categories: resource-rich and resource-scarce. In so doing, the study sought to depart from the approach taken by most FDI–growth relationship studies which pool different countries in one sample regardless of FDI host countries natural resource endowment differences that may have an impact in the nature of the FDI–growth relationship. In addition, this study takes into account the role of institutional and political factors in the FDI–growth nexus, which oftentimes are overlooked in previous studies. Moreover, the study investigates, not only the direct effects of FDI on growth, but also explores the interaction effects of FDI on economic growth of FDI host countries. The issue of endogeneity is also accounted for in the empirical analysis.

By using a System GMM dynamic panel estimation approach, for the period 2000–2017, the study provides reasonable evidence supporting that, in Africa, the FDI–growth relationship appears to depend on whether analytical emphasis is on the resource-rich or resource-scarce countries. The results suggest that: (1) FDI does not spur economic growth for all countries, and hence FDI is not virtuous by itself for growth; (2) there is a variation in the FDI–growth relationship across the analytical country classification used in this study, and thus natural resource abundance is key in altering the FDI–growth relationship in the region; (3) if countries' heterogeneity based on resource richness are taken into account, the estimated effect of FDI on real GDP per capita growth is positive and significant only for resource-scarce economies; the effects of FDI on growth is insignificant in resource-rich economies, however; (4) the effect of FDI on economic growth is found to be strong in the group of countries where there is better absorptive capacity (in the form of human capital), better quality of institutions, and political stability (embodied in rule of law and property rights, regulatory quality, and political stability); and (5) the effects and sizes of the other determinants of growth are found to be sensitive to whether a country is resource-rich or resource-scarce, suggesting that African countries require multidimensional

policy strategies depending on their nature of resource abundance to be able to stimulate both overall growth and FDI-induced growth. Some of the policy options for promoting the positive influence of FDI on growth in Africa are given hereunder.

First, given the finding that the growth effects of FDI vary across countries depending on their natural resource endowment differences, African countries in general need to look carefully and critically at the type of FDI inflows they receive. For example, while resource-rich countries use their natural resource sector as an instrument to attract FDI into their economies, these countries face the dilemma of experiencing the resource curse in the form of watered down FDI-induced growth. Therefore, resource-rich countries need to try at the same time to attract FDI into the non-resources sector to keep the relative size of the natural resource sector low as to avoid hampering the FDI-induced economic growth. Second, in resource-rich countries, a premium emphasis on improving the quality of institutions and better political stability should be placed to stimulate both overall growth and FDI-induced growth. These should include the formulation and implementation of well-functioning legal institutions that support regulatory quality and rule of law and property rights. Third, measures to ensure political stability in the region should be intensified. For example, conflict and instability, often generated because of natural resources in resource-rich African countries, must be addressed to promote the benefits that can be gained from such resources. Finally, investment in the development of basic and productive infrastructures should be encouraged both in resource-rich and resource-scarce African economies. The findings on how increasing human capital is associated with growth point to the need for Africa in general to pursue educational policies that harness the stock of such capital.

This study has attempted to comparatively explore the FDI–growth nexus in resource-rich and resource-scarce African economies using dynamic and robust panel estimation methods, but reasonable care should be applied in drawing inferences from the results. This is so considering the inherent limitations of a dynamic estimation technique in a small-sample study like this. As more complete and comprehensive data on FDI and growth determinants become available over time, studies aimed at investigating the FDI–growth nexus in the region are encouraged.

Notes

1. The top three sectors in terms of attracting FDI flows to Africa are primary (48%), service (31%), and the manufacturing sector (21%) (UNCTAD, 2016).

2. A selection of the empirical evidence found in the developing world at large is given in Table A1 (Annex A).

3. It is also informed by the works of De Mello (1997), Borsworth et al. (1999), Ramirez (2000), Akinlo (2004), and Fedderke and Romm (2006).

4. Although the Penn World Table version 9.1 is cited as Feenstra et al. (2015), due to the authors request to cite it that way, the data set is released in September 2019 and has data coverage up to the year 2017.

5. The need for adjusting trade share for population size is motivated by the fact that "small countries (in terms of their population size) generally need to trade more with the outside world to provide all available goods for the domestic economy. On the other hand, large countries usually trade less with other nations. Thus, higher trade within the domestic economy should not be taken either as an implication for less degree of competitiveness or as an implication for the less efficiency of it than international trade" (Neuhaus, 2006). Therefore, it would be misleading to simply take the trade shares in looking at the effects of trade on economic growth. Thus, to account for this, the population effect from the trade share should be taken out (see Neuhaus, 2006).

6. An alternative robustness test is also conducted on the original specifications of Model 1 and Model 2 (not reported here) by substituting government consumption for primary deficit of the government, and population size adjusted trade openness for trade openness without adjustment for population size. The results of the exercise showed that the results of Table 2 and Table 3 are robust for this modification also.

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Annexes

Annex A: Some selected FDI-growth nexus studies

Table A1: Some selected studies on the FDI-growth nexus in developing countries

Effects on Economic Growth	Study	Coverage	Methodology	Remark
Positive	De Gregorio (1992)	12 Latin America countries (1950–1985)	Panel GLS	FDI has a positive effect on growth.
	Blomström et al. (1996)	78 developing countries (1960–1985)	Cross-country regression	FDI has a positive effect on growth.
	Balasubramanyam et al. (1996)	46 developing countries (1970–1985)	Cross-country regression	FDI has a positive effect on growth for the overall sample. The effect is stronger in more open economies.
	Borenztein et al. (1998)	69 developing countries (1970–1989)	Cross-country regression	FDI has a positive effect on growth if a certain minimum threshold level of human capital stock exists.
	Bende-Nabende et al. (2003)	Five Asia Pacific Region: Indonesia, Malaysia, the Philippines, Singapore, and Thailand (1970–1994)	Time-series analysis	FDI has positive effect on growth for Indonesia, Malaysia, and the Philippines.
	Ramírez (2000)	Mexico (1960–1995)	Time-series cointegration	FDI has a positive effect on growth both in the short and the long run.

continued next page

Table A1 Continued

Effects on Economic Growth	Study	Coverage	Methodology	Remark
Positive	Bende-Nabende et al. (2002)	Five East Asian countries: Hong Kong, Japan, the Philippines, Taiwan, and Thailand) (1965–1999)	Time-series and panel cointegration	The effect of FDI on growth is mixed. Positive effect of FDI on growth for the Philippines and Thailand.
	Basu et al. (2003)	23 developing countries (1978–1996)	Panel cointegration	FDI has a positive effect on growth but depends on trade openness.
	Hansen and Rand (2006)	31 developing countries (1970–2000)	Panel GMM	FDI has a positive effect on GDP.
Weakly Positive / Negative	De Mello (1999)	32 countries (15 OECD and 17 non-OECD) (1970–1990)	Both time-series s and panel data techniques	The effect of FDI on growth is not strong: Weakly positive for OECD and weakly negative effect for non-OECD.
	Bende-Nabende et al. (2002)	East Asian countries (Hong Kong, Japan, the Philippines, Taiwan, and Thailand) (1965–1999)	Panel VECM	Negative for Japan (insignificant).
No effect	Bende-Nabende et al. (2002)	East Asian countries (Hong Kong, Japan, the Philippines, Taiwan, and Thailand) (1965–1999)	Time-series and panel cointegration	There is no long-run relationship between FDI and GDP for Hong Kong.
	Carkovic and Levine (2005)	68 countries (1960–1995)	Panel GMM	FDI does not exert a robust, positive impact on economic growth.
	Herzer et al. (2008)	28 developing countries	Cointegration techniques on a country-by-country basis	There is not a single country where a positive unidirectional long-term effect from FDI to GDP is found.

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Table A1 Continued

Effects on Economic Growth	Study	Coverage	Methodology	Remark
Negative	Saltz (1992)	75 developing countries (1970–1980)	Cross-country regression	Negative correlation between the level of FDI and growth.
	Bende-Nabende et al. (2003)	Five Asia Pacific Region: Indonesia, Malaysia, the Philippines, Singapore, and Thailand (1970–1994)	Time-series cointegration	FDI has negative effect on growth for Singapore and Thailand.
	Bende-Nabende et al. (2002)	East Asian countries (Hong Kong, Japan, the Philippines, Taiwan, and Thailand) (1965–1999)	Panel VECM	The effect of FDI on growth is mixed. Negative in Japan (insignificant) and Taiwan.

Annex B: Country classification

Table B1: Classification of African countries based on resource richness[a]

Resource-Rich Countries	Resource-Scarce Countries
Oil-Exporting Countries	Benin
Algeria	Burkina Faso
Angola	Burundi
Cameron	Cape Verde
Chad	Comoros
Congo	Djibouti
Côte d'Ivoire	Egypt
Equatorial Guinea*	Eritrea*
Gabon	Ethiopia
Libya*	Gambia
Nigeria	Ghana
Sudan	Guinea Bissau*
South Sudan*	
Mineral Exporting Countries	Kenya
Botswana	Lesotho
Central African Republic	Liberia
Congo, Democratic Republic	Madagascar
Guinea	Malawi
Mauritania	Mali
Mozambique	Mauritius
Namibia	Morocco
Serra Leon	Niger
South Africa	Rwanda
Tanzania	Sao Tome & Principe
Zambia	Senegal
	Seychelles*
	Somalia*
	Eswatini
	Togo
	Tunisia
	Zimbabwe

Notes:
[a] Classification of countries as resource-rich and resource-scarce is based the World Bank's (2019) definition. Resource-rich countries are those where fuel and mineral exports contribute over 20% to their GDP during the period 2000–2017.
* Indicates countries excluded from the analysis as there is no complete data for these countries.

Annex C: Definition of variables

Table C1: Definition of variables and data sources

Name of Variable	Definition	Data Source
Real GDP per capita growth (g)	Economic growth, measured as the growth rate of real GDP per capita at 2015 US$ constant prices.	UNCTAD (2020) online data base.
Foreign direct investment (FDI)	FDI inflows as share of GDP.	UNCTAD (2020) online data base.
Domestic investment (DI)	Domestic investment as share of GDP. The domestic investment is generated taking the difference between gross capital formation and FDI inflows. This is motivated by the need to find a way to net-out the foreign investment component of the overall investment in the economy.	Author's calculation based on UNCTAD (2020) online data base.
Human capital (H)	Index of human capital per person, based on years of schooling and returns to education.	Penn World Table version 9.1, available at: www.ggdc.net/pwt
Labour force growth (Lfg)	Annual growth of labour force in an economy	Author's calculation based on the World Development Indicators (WDI) of the World Bank (2020a) online data base.
Government consumption (GC)	Government consumption as share of GDP	Author's calculation based on the WDI of the World Bank (2020a) online data base.
Trade openness (OP)	The trade share (calculated as the ratio of exports and imports of goods and services divided by 2 divided by GDP) adjusted for population size is considered. This is done by running a regression on the log of the trade share (TS) on the log of the population size (POP), either on a panel of countries or for each cross-section in the panel. The resulting residuals are then taken as a trade share adjusted for population size.	Author's calculation based on the UNCTAD (2020) online data base.

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Table C1 Continued

Name of Variable	Definition	Data Source
Commodity export price index (CXP)	Commodity-specific export commodity price.	Gruss and Kebhaj (2019).
Institutions (INST)	An aggregate political and institutional indicator is computed from normalized values of the three indicators (political stability, regulatory quality, and rule of law). The normalization is done using the following formula: for any x , $x_{normalized} = (x - x_{minimum}) / (x_{maximum} - x_{minimum}) = (x - (-2.5)) / (2.5 - (-2.5))$. This is done on a yearly basis for each country in the models. Then a simple sum (assigning equal weights) of the normalized values for the three variables is taken on a yearly basis for each country. Since each indicator after normalization can vary from 0 to 1, the maximum possible value for the aggregate political and institutional indicator is 3.	Author's calculation based on the World Governance Indicators (WGI) of the World Bank (2020b) online data base.
FDI as share of GDP × Human capital **(FDI*H)**	An interaction term between human capital and FDI as share of GDP.	Author's calculation based on the Penn World Table version 9.1 and UNCTAD (2020) online data base.
FDI as share of GDP × Institutions **(FDI*INST)**	An interaction term between institutions and FDI as share of GDP.	Author's calculation based on the WGI of the World Bank (2020b) and UNCTAD (2020) online data base.

Annex D: Summary statistics

Table D1: Summary statistics of the variables: Resource-scarce economies

	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
g	2.76	2.61	57.66	-31.33	5.07	468
DI	22.49	22.65	57.18	1.53	7.42	468
Lfg	2.58	2.79	5.60	0.26	1.05	468
H	1.84	1.71	2.65	1.07	0.41	468
GC	15.26	14.58	38.43	2.05	5.60	468
CXP	96.53	94.24	104.54	53.32	3.47	468
OP	33.93	28.77	145.25	14.52	17.69	468
INST	1.31	1.30	2.11	0.42	0.32	468
FDI	3.65	2.32	70.35	-2.91	6.61	468
FDI*H	8.02	7.27	114.73	-1.60	11.37	468
FDI*INST	5.06.	4.87	57.67	-1.76	6.08	468

Table D2: Summary statistics of the variables: Resource-rich economies

	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
g	2.06	2.40	21.03	-36.86	4.70	360
DI	25.79	26.02	73.70	4.04	11.64	360
Lfg	2.01	2.66	4.63	-0.62	0.70	360
H	1.21	1.23	2.89	1.13	0.43	360
GC	13.99	13.69	34.57	0.95	5.55	360
CXP	99.99	98.89	106.58	71.02	10.35	360
OP	34.55	33.56	75.17	4.27	13.85	360
INST	0.03	1.03	1.09	0.21	0.42	360
FDI	4.58	4.55	40.23	-6.06	6.22	360
FDI*H	2.01	1.98	82.08	-8.89	10.10	360
FDI*INST	1.32	1.05	47.21	-6.08	7.12	360

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