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Is financial development shaping or shaking economic sophistication in African countries?

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Abstract

This paper aims to investigate the effect of financial development on economic complexity using a panel dataset of 24 African countries over the period 1983-2017. The empirical evidence is based on two different approaches. First, we adopt the [Hoechle \(2007\)](#) procedure which produces Driscoll-Kraay standard errors to account for heteroscedasticity and cross-sectional dependence. Second, we implement the system Generalized Method of Moments to account for endogeneity. The results show that financial development increases economic complexity in Africa. Looking at the regional difference, the results show that this effect is less beneficial for SSA countries.

Keywords: Financial development, Economic complexity, Panel data analysis, Africa

JEL Classification: G20; G24; E02; P14; O55

1. Introduction

Since the influential work of [Hidalgo and Hausmann \(2009\)](#), economic complexity² is increasingly seen as a key driver of the economic development process. Literature shows that economic complexity contributes to economic development by increasing productivity ([Sweet and Eterovic, 2019](#)), mitigating income inequality ([Hartmann et al., 2017](#)), reducing the dependence on natural resources ([Canh et al., 2020](#)), improving health outcomes ([Vu, 2020](#)), enhancing environmental quality ([Mealy and Teytelboym, 2020](#)), and more importantly, increasing economic growth ([Zhu and Li, 2017](#)). Despite these virtues of economic sophistication, the facts suggest that in most African countries, the level of economic complexity is low compared to other developing regions like South Asia and Latin America. For instance, in 2018, of 142 nations ranked by the Observatory of Economic Complexity (OEC), the last twenty include fifteen African countries. Out of the 34 African countries included in this ranking, 9 are in the top 100 with Egypt ranked first in Africa and 69th in the world.

Several factors have been recently advanced in the literature to explain the differences in economic complexity between countries, among which is financial development ([Nguyen et al., 2020](#); [Chu, 2020](#)). The sophistication of the economy involves high-tech or knowledge-intensive industries, which requires huge upstream investments in the promotion and extension of innovation. Theoretically, a well-developed and well-functioning financial market, by reducing financing cost, allocating scarce resources, evaluating innovative projects and managing risks ([Hsu et al., 2014](#)) is supposed to favour the development of new and innovative projects, all of which will contribute to the sophistication of the economic system. Do we have any empirical evidence to corroborate this hypothesis in African countries?

The only studies which investigate the direct link between financial development and economic complexity are those of [Nguyen et al. \(2020\)](#) and [Chu \(2020\)](#). These authors show that financial development increases economic complexity. However, none of these studies focus on the specific case of African countries. The choice of the African context is doubly motivated. On the one hand, it is one of the regions with the lowest level of economic complexity compared to other developing regions. On the other hand, Africa represents a potentially promising, though still developing, financial market. It is therefore more than important for policy makers and academics alike to examine the role of financial development on the sophistication of African

²In general sense, economic complexity refers to the productive capacity in a country. More formally, economic complexity refers to the country's productive structure by combining information on the diversity of a country (the number of products it exports), and the ubiquity of its products (the number of countries that export the underlying product) ([Hidalgo and Hausmann, 2009](#)).

economies. Moreover, this paper uses the new financial development indicators developed by the International Monetary Fund (IMF) namely: financial institutions, financial markets and financial development which is a composite financial indicator capturing both financial institutions and markets. Using the [Driscoll and Kraay \(1998\)](#) standard error and the Generalized Method of Moments (GMM) estimators, this paper provides strong evidence that economic complexity is positively correlated to financial development in Africa.

The rest of this paper is structured as follows. Section 2 presents the data and methodology. The empirical results are displayed in Section 3 and Section 4 concludes.

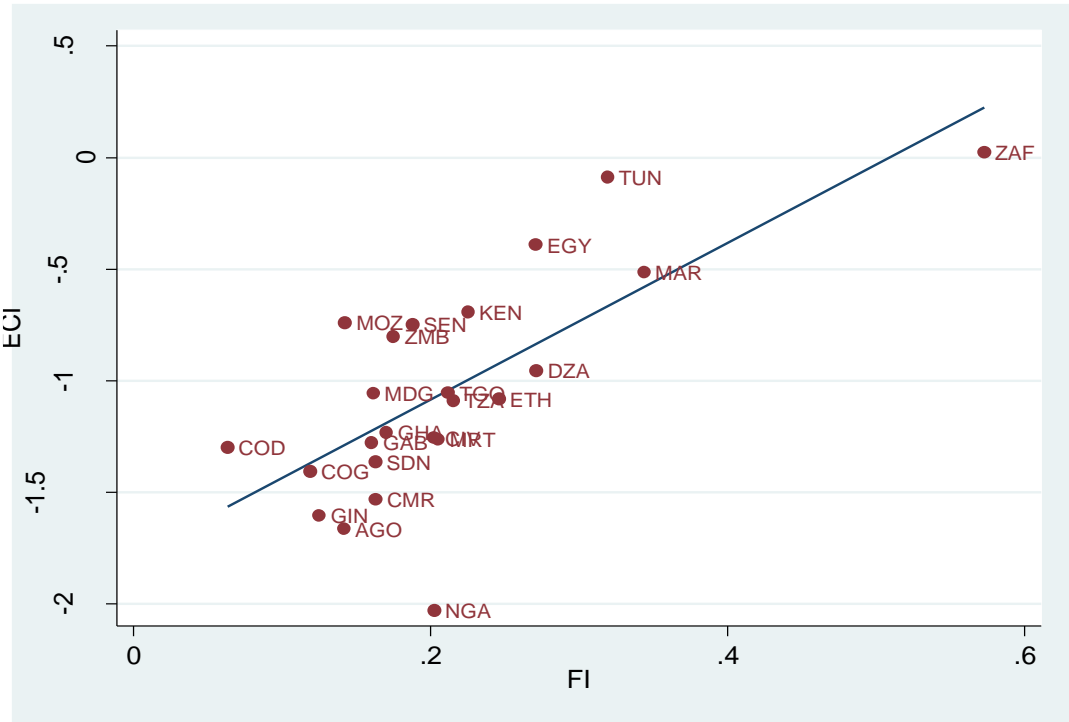
2. Data and methodology

2.1. Data

This paper uses a cross-country data of 24 African countries over the period 1983-2017. This year span is divided into seven five-year non-overlapping intervals: 1983-1987; 1988-1992; 1993-1997; 1998-2002; 2003-2007; 2008-2012, and 2013-2017. The interest of using a five-year data averages is to limit instrument proliferation and mitigate short run disturbances that may loom substantially ([Asongu and Nwachukwu, 2017](#)). A five year average data allow us to avoid the influence of idiosyncratic economic dynamics at business cycle frequency, as well as to control for cyclical output movements. The dependent variable in this paper is the economic complexity index (ECI), obtained from the Massachusetts Institute of Technology (MIT) Observatory of Economic complexity. This indicator, which measures the level of complexity of a country's economic structure, was constructed by applying the method of reflection on international trade data from the United Nations Comtrade database (see, e.g., [Hidalgo and Hausmann, 2009](#)). Consistent with the new financial development literature in Africa ([Sahay et al., 2015](#)), this paper uses three indicators of financial development namely: financial institutions (FI), financial markets (FM) and financial development (FD) which is a composite financial indicator capturing both financial institutions and markets. Figure (1) - (3) plot a positive relationship between financial development indicators and ECI. However, as correlation does not mean causality, these relationships will be tested empirically in the next section.

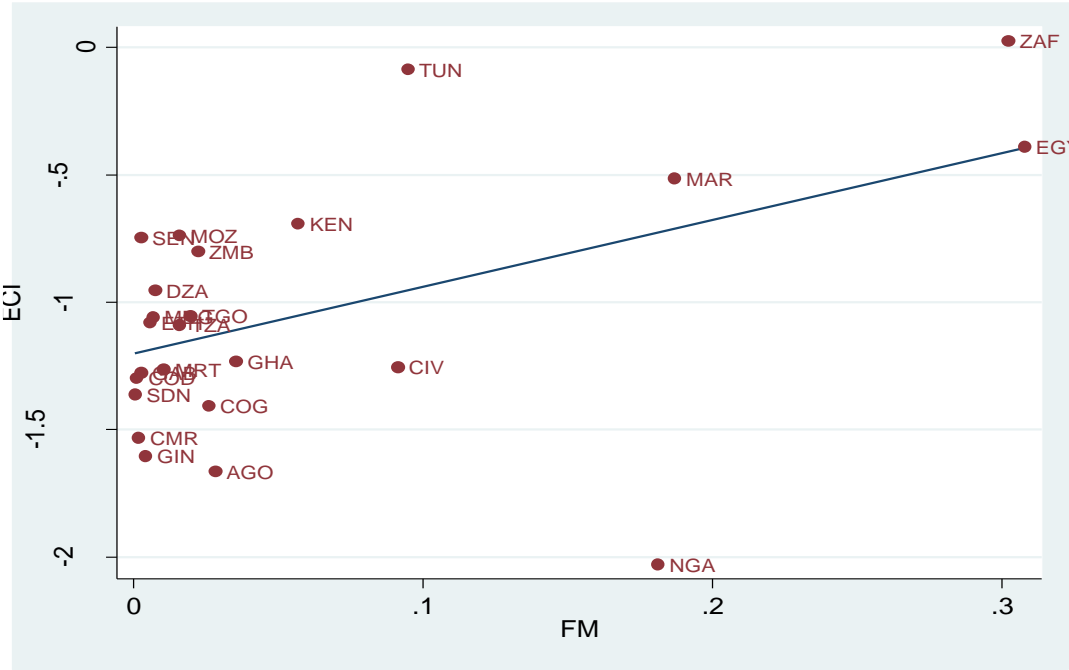
To substantiate on this relationship and avoid omission variable bias, we include six control variables in our model. The control variables are selected according to the literature on the determinants of economic complexity ([Vu, 2019](#); [Nguyen et al., 2020](#); [Kannen, 2020](#); [Saadi, 2020](#)). They comprise GDP per capita; foreign direct investment; remittances; democracy; urbanization; and natural resources. The summary statistics is apparent in Table 1.

Figure 1: Financial institutions and ECI



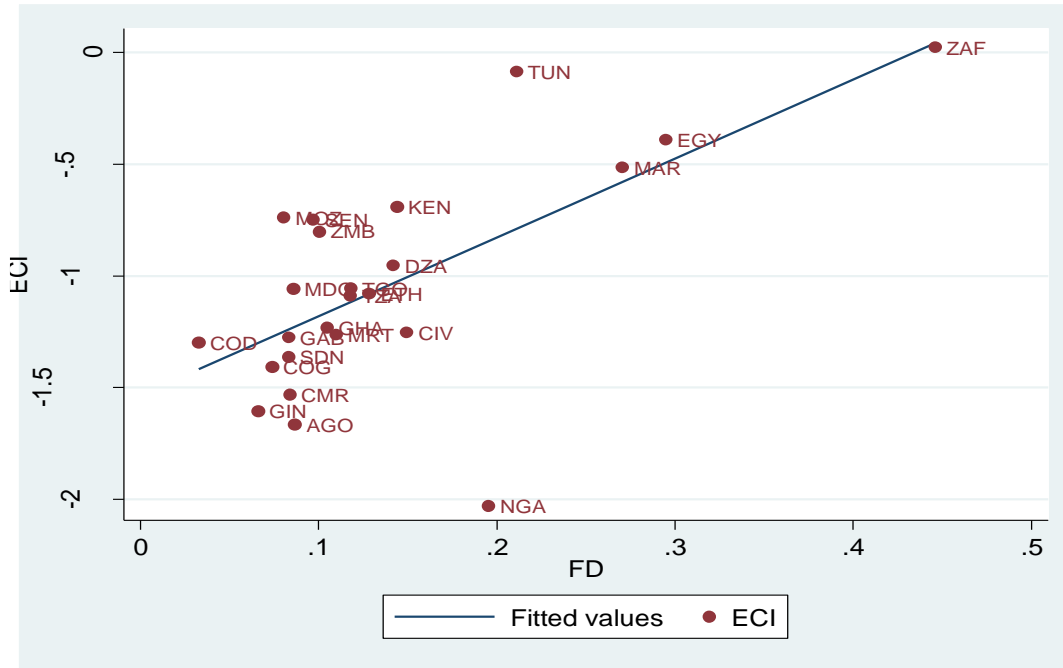
Source: Authors

Figure 2: Financial markets and ECI



Source: Authors

Figure 3: Financial development index and ECI



Source: Authors

Table 1: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Economic complexity	166	-1.043	0.528	-2.373	0.286
Financial Institutions	168	0.217	0.109	0.000	0.732
Financial Markets	168	0.062	0.102	0.000	0.524
Financial development	168	0.142	0.099	0.000	0.627
Foreign direct investment	167	2.961	4.423	-2.080	33.108
Urbanization	168	42.349	15.610	11.913	88.551
Remittances	152	2.104	2.585	0.005	10.926
GDP per capita (log)	168	7.189	0.924	5.209	9.345
Natural resources	167	13.396	10.883	0.004	51.852
Democracy	167	-0.857	5.084	-9.000	9.000

Note: For definitions of variables, sources of data, and List of countries, see Appendix 1.

2.2. Model and estimation strategy

The purpose of this paper is to investigate the effect of financial development on economic complexity in Africa. We hypothesize that financial development increases economic sophistication. Therefore, we investigate the following linear model in Equation (1).

$$ECI_{i,t} = \alpha + \beta_1 FinDev_{i,t} + \beta_2 X_{i,t} + v_{i,t} \tag{1}$$

Where ECI is economic complexity index for country i in period t . $FinDev_{i,t}$ stands for financial development, X_{it} is a vector which includes control variables, and $v_{i,t}$ is the error term.

We begin this exercise by estimating Equation (1) using Driscoll and Kraay (1998) (DK) standard errors technique. This method has the advantage of providing the best robust estimates in the presence of heteroscedasticity, cross-sectional and serial dependence. We then subsequently use the System GMM proposed by Arellano and Bover (1995) and Blundell and Bond (1998) to deal with the possible endogeneity issue. We therefore estimate the following dynamic panel model:

$$ECI_{it} = \alpha + \beta_1 ECI_{it-1} + \beta_2 FinDev_{it} + \beta_3 X_{it} + \mu_i + v_t + \varepsilon_{it} \quad (2)$$

Where ECI_{it-1} is the lag level of economic complexity, μ_i is an unobserved country-specific effect, v_t is time specific effect, and ε_{it} is the error term. GMM is useful for several reasons. First, the GMM estimator has been widely used to address the endogeneity problem that appears in panel data estimation. Second, the GMM estimator also takes into account the biases that appear due to country-specific effects. Third, GMM also avoids simultaneity or reverse causality problems.

3. Findings

3.1. Baseline results

Table 2 reports the baseline Driscoll-Kraay (DK) standard error estimation results. In Columns (1) – (2), financial development is measured by financial institutions; in Columns (3) – (4), financial development is measured by financial markets and in Columns (5) – (6), financial development is measured by the financial development composite index. Columns (1), (3) and (5) present a parsimonious specification which excludes others controls; in Columns (2), (4), and (6), the controls variables are included in the regression. Consistent with Figures (1) - (3), the results in Columns (1), (3) and (5) provide evidence of a positive impact of financial development on economic complexity, regardless of the proxy of financial development and this impact is significant at the 1% level. Specifically, in Column (3), the coefficient associated with the composite indicator of financial development is positive with magnitude suggesting that a 1-unit increase in financial development leads to an increase in economic complexity by 3.151. Additionally, the results show that the effect of financial institutions is quantitatively more beneficial for economic complexity than financial markets. There are several possible explanations for this result. The problem of asymmetric information and incentives that make it difficult to finance innovative projects because of their gestation periods and profitability can be

solved by a well-developed financial system. Indeed, one of the main functions of the financial system is the collection of information to facilitate the ex-ante evaluation and ex-post monitoring of investment opportunities, which helps to ease information asymmetry problems and facilitates the allocation of resources to innovative projects (Levine, 2005) and therefore to produce more complex products. These results are consistent with those of Nguyen et al. (2020) and Chu (2020).

Table 2: Baseline results

	Dependent variable : Economic complexity					
	(1)	(2)	(3)	(4)	(5)	(6)
Financial Institutions	3.067*** (0.252)	3.021*** (0.243)				
Financial Markets			2.269*** (0.180)	1.534*** (0.056)		
Financial development					3.074*** (0.257)	2.721*** (0.242)
Foreign direct investment		0.004 (0.006)		0.006 (0.004)		0.004 (0.005)
Urbanization		0.014** (0.004)		0.016** (0.004)		0.017*** (0.004)
Remittances		0.045** (0.015)		0.031 (0.017)		0.031* (0.014)
GDP per capita (log)		-0.218*** (0.058)		-0.141 (0.074)		-0.237** (0.068)
Natural resources		-0.009*** (0.001)		-0.017*** (0.001)		-0.012*** (0.001)
Democracy		0.017* (0.007)		0.025** (0.010)		0.020** (0.008)
Period fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-1.592*** (0.048)	-0.528* (0.257)	-1.123*** (0.009)	-0.431 (0.408)	-1.385*** (0.031)	-0.160 (0.322)
Observations	166	149	166	149	166	149
R-squared	0.380	0.545	0.201	0.400	0.331	0.488
Number of groups	24	24	24	24	24	24

Note: *, **, *** denote statistical significance at the 10%, 5% and 1% levels respectively. Standard errors reported in parenthesis.

In Columns (2), (4), and (6), we introduced the control variables. Introducing these controls into the regression leaves the sign and statistical significance of the coefficients on financial development proxies unaffected, although the magnitude of the coefficients is slightly smaller. Regarding the control variables, while urbanization, remittances and democracy increase economic complexity, economic growth and natural resources are negatively correlated to economic complexity. The effect of foreign direct investment is non-significant. The negative

sign associated with GDP per capita may seem counter-intuitive but can be explained, particularly in sub-Saharan African countries dependent on natural resources. Dependence on natural resources leads to the deterioration of human capital through the misallocation of talent (see, Ebeke et al., 2015), degrades the quality of institutions through corruption and lack of accountability, promotes the misallocation of resources to non-productive sectors, which delays the diversification of the economy and consequently the production of sophisticated products.

Table 3: System GMM estimates

	Dependent variable : Economic complexity					
	(1)	(2)	(3)	(4)	(5)	(6)
Financial Institutions	2.164*** (0.153)	2.058*** (0.393)				
Financial Markets			1.135*** (0.160)	1.418*** (0.142)		
Financial development					2.548*** (0.166)	1.650*** (0.403)
Foreign direct investment		-0.021** (0.010)		0.003 (0.012)		-0.001 (0.005)
Urbanization		0.013* (0.008)		0.016*** (0.005)		0.017*** (0.005)
Remittances		0.033 (0.033)		0.023 (0.015)		0.036*** (0.009)
GDP per capita (log)		-0.182 (0.112)		-0.207** (0.091)		-0.237*** (0.079)
Natural resources		-0.022*** (0.003)		-0.026*** (0.003)		-0.023*** (0.004)
Democracy		0.006 (0.005)		0.007 (0.005)		0.005 (0.005)
Lag.ECI	0.202*** (0.040)	0.026 (0.062)	0.402*** (0.083)	-0.077 (0.085)	0.079 (0.064)	0.052 (0.366)
Constant	-1.311*** (0.053)	-0.409 (0.504)	-0.646*** (0.110)	-0.095 (0.459)	-1.329*** (0.099)	0.137*** (0.046)
Observations	166	149	166	149	166	131
Number of countries	24	24	24	24	24	24
AR(1)	0.0254	0.0587	0.0049	0.0463	0.0348	0.016
AR(2)	0.312	0.505	0.642	0.896	0.302	0.894
Instruments	19	22	17	22	19	23
Hansen OIR	0.140	0.151	0.501	0.196	0.186	0.229

Note: *, **, *** denote statistical significance at the 10%, 5% and 1% levels respectively. Standard errors reported in parenthesis.

3.2. Accounting for endogeneity

The previous results obtained with the DK standard error estimator have established a rather robust statistically significant positive effect of financial development on economic complexity. However, the possibility of reverse causality or endogeneity may bias the results and question our findings. To deal with these potential problems, we estimate our baseline model using the system GMM estimator. The results in Table 3 show that the coefficients associated with the financial development indicators remain positive and statistically significant at the 1% level, suggesting that both financial institutions and financial markets are drivers of economic complexity in African countries, although the effect of financial institutions is more important. The results of the diagnostic tests show that all models are well specified. The Hansen test does not reject the validity of instruments, and the absence of second serial correlation is also not rejected.

3.3. Is there a regional difference

Table 4 examines whether our results vary by sub-region. In Columns (1) - (3), we introduce an interaction term between GDP per capita and SSA dummy variable, while in Columns (4) to (6), we introduce the interactions between the financial development indicators and the dummy SSA variable. Overall, all coefficients associated with financial development indicators remain positive and statistically significant, confirming the beneficial role of financial development for economic complexity in African countries. The results of Columns (1) to (3) show that the effect of GDP per capita varies across regions, and that per capita income is negatively correlated to economic complexity in SSA countries than in North African (NA) countries. Moving to Columns (4) - (6), the estimated coefficients of the interaction variables are negative and statistically significant in SSA countries, suggesting that financial development is less beneficial for economic complexity in SSA countries than in NA countries.

Table 4: Is there a regional difference?

	Dependent variable : Economic complexity					
	(1)	(2)	(3)	(4)	(5)	(6)
Financial Institutions	2.629*** (0.145)			3.633*** (0.289)		
Financial Markets		1.118*** (0.143)			2.606*** (0.244)	
Financial development			2.285*** (0.100)			3.669*** (0.221)
(GDP per capita) xSSA	-0.043*** (0.006)	-0.065*** (0.008)	-0.051*** (0.004)			
(Financial Institution) xSSA				-1.000*** (0.209)		
(Financial Market) xSSA					-2.106*** (0.323)	
(Financial development) xSSA						-1.572*** (0.179)
Foreign direct investment	0.006 (0.005)	0.008** (0.003)	0.006 (0.004)	0.006 (0.005)	0.005 (0.004)	0.005 (0.004)
Urbanization	0.012** (0.004)	0.011** (0.004)	0.014*** (0.004)	0.012** (0.004)	0.015*** (0.004)	0.015*** (0.004)
Remittances	0.025** (0.010)	0.006 (0.007)	0.009 (0.007)	0.027** (0.011)	0.012 (0.011)	0.007 (0.007)
GDP per capita (log)	-0.171** (0.051)	-0.072 (0.051)	-0.172** (0.049)	-0.209*** (0.050)	-0.120* (0.062)	-0.218*** (0.051)
Natural resources	-0.009*** (0.002)	-0.016*** (0.002)	-0.012*** (0.002)	-0.009*** (0.002)	-0.018*** (0.002)	-0.012*** (0.002)
Democracy	0.022*** (0.006)	0.034*** (0.009)	0.026*** (0.006)	0.022*** (0.006)	0.036*** (0.007)	0.028*** (0.006)
Period fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.331 (0.225)	-0.185 (0.326)	0.015 (0.252)	-0.367 (0.229)	-0.341 (0.359)	0.001 (0.255)
Observations	149	149	149	149	149	149
R-squared	0.580	0.467	0.531	0.574	0.425	0.519
Number of groups	24	24	24	24	24	24

Note: *, **, *** denote statistical significance at the 10%, 5% and 1% levels respectively. Standard errors reported in parenthesis.

4. Conclusion

Using the [Hoechle \(2007\)](#) procedure which produces Driscoll-Kraay standard errors and the system GMM, this paper has investigated the effect of financial development on economic complexity using a panel dataset of 24 African countries over the period 1983-2017. Using financial institutions, financial markets, and a composite index of financial development, the results show that financial development increases economic complexity in Africa. Looking at

the regional difference, the results show that the effect of financial development on economic complexity is less beneficial in Sub-Saharan African countries than in North African countries.

Conflict of Interests

The authors declare that there are no conflict of interests.

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Appendix

Appendix 1: Definitions of variables, sources of data and list of countries

Variables	Description	Sources
Economic complexity	Economic complexity index	OECD
Financial Institutions	They include banks, insurance companies, mutual funds, pension funds, and other types of nonbank financial institutions	IMF
Financial Markets	They include mainly stock and bond markets	IMF
Financial development	It is constructed based on Financial Markets (FM) and Financial Institutions (FI)	IMF
Foreign direct investment	Foreign direct investment, net inflows (% of GDP)	WDI
Urbanization	Urban population (% of total population)	WDI
Remittances	Personal remittances, received (% of GDP)	WDI
GDP per capita	GDP per capita (constant 2010 US\$)	WDI
Natural resources	Total natural resources rents (% of GDP)	WDI
Democracy	Polity2 scores ranging from -10 (autocracy) to 10 (democracy)	Polity IV

Countries (24): Algeria, Angola, Cameroon, Congo, Dem. Rep., Congo, Rep., Cote d'Ivoire, Egypt, ArabRep., Ethiopia, Gabon, Ghana, Guinea, Kenya, Madagascar, Mauritania, Morocco, Mozambique, Nigeria, Senegal, South Africa, Sudan, Tanzania, Togo, Tunisia, Zambia.