

Analysis of the Gap in Economic Informality between Africa and the Advanced and Emerging Countries

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Abstract This paper analyzes the factors that account for economic informality disparities between African countries and advanced and emerging economies. The study encompasses a survey of 84 nations, comprising 44 African countries, during the span of 1995-2015. The econometric outcomes, acquired from Kröger and Hartmann's (2021) decomposition model, indicate that, on average, the level of informality in African country's economy is greater than that of advanced and emerging countries (OECD+). An increase in the standard of living of the population, an improvement in the control of corruption and the strengthening of financial development could enable African countries to reduce the explained gap. However, fiscal freedom, technological infrastructure, trade liberalization and political stability increase the explained gap. Furthermore, human capital and technological infrastructure reduce the total gap.

Keywords: gap, informal economy, decomposition method, Africa, emerging and advanced countries

JEL Classifications: E26, E20, F60, H55, O57

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I. Introduction

This paper identifies the socio-economic and institutional factors that could help African countries decrease the level of informality in their economies, in comparison to advanced and emerging economies. To achieve this goal, we utilized an econometric model based on the Kröger and Hartmann (2021) decomposition approach. This study is warranted due to the significance of decreasing the size of the informal economy for economic growth, heightened tax revenues, safety, environmental preservation, and better work conditions.

The African continent's economic crisis in the mid-1980s compelled several of its nations to implement structural adjustment programs (SAPs) under the guidance of the IMF and World

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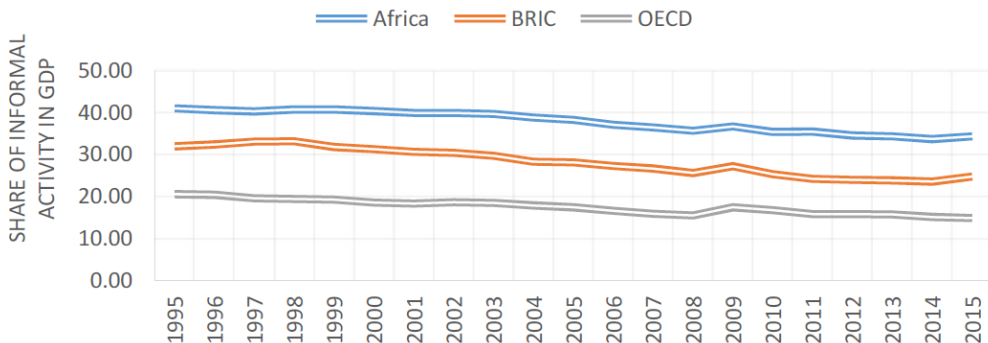
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Bank. These programs, rooted in neoclassical thought, contend that economic liberalism can foster economic growth, diminish unemployment, decrease the domestic deficit, and augment external balance (Potts, 2008). Contrary to expectations, implementing SAPs to reduce the cost of living for the state has actually caused a rise in unemployment and underemployment (Coussy, 2006), especially among recent college graduates who have sought shelter in the informal job market (Fortin, 2002; Holt and Littlewood, 2014; Wu et al, 2019; Gnangnon, 2019).

Medina and Scheifer (2018) define the shadow economy as comprising all economic activities hidden from official authorities due to monetary, regulatory, and institutional reasons. This includes avoiding taxes and social security contributions for monetary reasons and circumventing governmental bureaucracy or regulatory frameworks for regulatory reasons. Institutional reasons include corruption, weak rule of law, and low-quality political institutions. For these authors, the shadow economy goes by various names, including "the underground economy, gray market, black market, or parallel economy, cash-based economy, or informal economy". In Africa, the informal economy employs an average of 72% of the working population (AfDB¹, 2019) and accounts for an average of 38% of gross domestic product (GDP) between 2000 and 2015. This is in contrast with OECD countries where the number is only 13.5% (IMF, 2017; Keneck-Massil and Noah, 2019). Figure 1 below indicates a persisting gap in informality between African and emerging or advanced countries. However, there has been a worldwide reduction in informality levels.

Figure 1. Trends in informality in Africa and in emerging and advanced countries



(Source) Authors based on data from Medina and Schneider (2018)

In African countries, discussions around informal activities have always been relevant and are even more so today, as some of these nations have initiated economic recovery programs with goals such as decreasing unemployment, increasing tax revenue, and fighting against poverty. As a result, managing informal activities has been recognized as a crucial solution. Reducing or controlling the size of the informal economy can optimize tax revenue collection, which is

1) AfDB: African Development Bank

crucial for supporting the financing of African economies (WTO-ILO, 2009). OECD (2011) asserts that the underground economy reduces productivity and restricts economic development. In addition, it is a major source of tax leakage and encourages underemployment and job insecurity (Dessy and Pellage, 2003; WTO-ILO, 2009).

However, the measures taken by African states to reduce the size of the informal economy have struggled to bear fruit (Balepa and Roubeaud, 2009; WTO-ILO, 2009; UNECA, 2017; AfDB, 2019). Some studies that have examined the determinants of the expansion of the informal sector in Africa have adopted a qualitative approach (Verick, 2006; Potts, 2008; Meagher, 2015; Fourie, 2018; Etim and Daramola, 2020). Others, on the other hand, have opted for a quantitative approach, most often using the multiple indicator cluster model (MIMIC). This is the case in Nigeria (Ogbuabor and Malaolu, 2013; Igudia et al., 2016) and Côte d'Ivoire (Koffi, 2022). The idea behind this technique is to represent the output of the informal economy as a latent (unobservable) variable whose causes and effects are observable. The MIMIC approach therefore includes three (03) types of variables. Causal" variables and "indicator" variables linked to a latent variable. The size of the informal economy (latent variable) is inferred from the causal and indicator variables. The MIMIC model has been criticized in the economic literature (Smith, 2002; Hill, 2002; Breush, 2005). Most critics of the MIMIC method believe that the results obtained are highly sensitive to the time period studied (time series) and the individuals studied (panel data). They also claim that the lists of causal and indicator variables cannot be exhaustive. Finally, another weakness of this approach is that it is not supported by economic theory and that the estimation strategy is complex.

Therefore, it is very difficult to use MIMIC to draw statistically confirmed conclusions about causal relationships in the real world and not just in the model estimated from these estimates (Medina and Schneider, 2018). Moreover, according to these two authors: "A major problem with macro approaches such as MIMIC or CDA is that they use causal factors such as tax burden, unemployment, self-employment, and regulation that are also responsible for people doing do-it-yourself activities or asking friends and neighbors to do things. Thus, do-it-yourself activities, help from neighbors or friends, and legally purchased materials for informal economy activities are included in these macro approaches. This means that these macro approaches (including the electricity approach) estimate a "total" shadow economy that includes do-it-yourself activities, neighbor's help, legally purchased materials, and smuggling". Aware of these limitations, Medina and Schneider (2018) combine the MIMIC model with the Predictive Mean Matching (PMM) model, which "treats the empirical challenge in estimating the size of the shadow economy as a missing data problem: for a number of countries, we have survey-based estimates of the size of the shadow economy, but for other countries this is missing".

In light of the above, it is clear that, to our knowledge, no study has analyzed the differences in the size of the informal economy between advanced and emerging economies and developing

countries. Our study aims to go further by examining the differences in the size of the informal economy between advanced and emerging economies (OECD+) and African countries. To achieve this goal, we first review the economic literature on the determinants of the informal economy in Section 2. We then present our methodology based on an econometric analysis of data comparing the size of the informal economy in African countries with that in advanced and emerging economies in Section 3. In Section 4, we present our econometric results. In Section 5, we discuss the various factors that may explain the differences in the informality of the economy between OECD+ countries and those in Africa.

II. Literature Review

A considerable amount of literature has been devoted to explaining informality. In fact, the difficulty of properly grasping the concept of informality has given rise over time to several approaches to the notion of informality, notably the dualist approach, the structuralist approach and the legalist approach.

The dualist approach, based on a model of a dual labor market, in which the informal sector is seen as a residual component of this market, with no links to the formal economy. In fact, this approach sees the emergence of informality as a manifestation of the heterogeneity of economic structures. The structuralist approach, which considers that there is a relationship of subordination and interdependence between the formal and informal sectors. Structuralists argue that the informal sector consists of small enterprises and unregistered workers that are subordinate to large enterprises; a relationship in which small enterprises provide cheap labor and inputs to large enterprises, thereby improving the competitiveness of large enterprises and, by extension, the economy as a whole. The legalist approach assumes that the informal sector is made up of very small enterprises that prefer to operate underground to avoid the costs associated with registration and government regulations that are perceived as stifling. Unlike the previous two approaches, this approach postulates that the choice to operate in the informal economy is voluntary. Economic agents are rational and make a trade-off at each moment based on a "cost-benefit" analysis between the costs and benefits associated with the informal economy (Medina and Schneider, 2018). Informal enterprises face two types of costs (Loayza, 1997): on the one hand, the bribes and penalties paid in case of detection, and on the other hand, the inability to benefit from public services, such as judicial services in case of abuse, and other services, such as obtaining financing from the formal financial system.

The advantages of informality are mainly the avoidance of taxes and other public regulations. On the other hand, the disadvantages of formal enterprises are the costs associated with bureaucracy, taxation and other regulations (Loayza, 1997), while the advantages are mainly the freedom

to operate and the full use of public services. Thus, according to this approach, a firm would prefer to operate informally as long as the costs of informal activity remain lower than those of formal activity. In this case, the informal economy is seen as an escape route for economic agents from the legal constraints imposed by the state.

We will use the dualist approach of the informal economy to conduct our analysis. It seems to be more in line with the reality of African economies, which face numerous obstacles in the business environment that are likely to increase the costs of doing business. In the empirical literature, several factors have been identified to analyze the cause of the expansion of the informal economy. They can be grouped into 2 categories: socio-economic factors and institutional factors.

A. Socio-economic factors

Economic growth has an impact on the size of the informal economy. However, the nature of this effect is debated. Some authors argue that GDP growth significantly reduces the size of the informal sector (Medina and Schneider, 2018). For Côte d'Ivoire, Koffi (2022) finds a similar result.

Hypothesis 1: The increase in GDP per capita in African countries allows them to reduce the informality of their economies relative to advanced and emerging economies.

Human capital is considered by several authors in the economic literature (OECD, 2011; Holt and Littlewood, 2014; Keneck-Massil and Noah, 2019) as a determinant of the size of the informal economy. For these authors, human capital is the main driver of productivity. In the absence of human capital, the result is low productivity, which is a source of informality.

Hypothesis 2: The increase in human capital in African countries allows them to reduce the informality of their economies relative to advanced and emerging economies.

Tax incidence is a potential source of growth of the informal economy (Loayza, 1997; Fortin, 2002; Medina and Schneider, 2018; Huynh, 2020). In this sense, informality seems to be a natural response of firms to the constraints or costs that the state tries to impose on trade. Several studies conducted in sub-Saharan Africa (Ogbuabor and Malaolu, 2013; Igudia et al., 2016; Koffi, 2022) show that tax pressure has contributed significantly to the expansion of the informal sector.

Hypothesis 3: Increased tax relief measures in African countries will enable them to reduce informality in their economies relative to advanced and emerging economies.

In addition, Capasso and Jappelli (2011) argue that financial development can improve the reduction of the size of the informal economy. Koffi (2022) finds a similar result for Côte d'Ivoire. In fact, the more developed the financial system (due to a high bank penetration rate or the digitization of the payment system), the easier it is for the government to identify informal

activities. On the other hand, Ogbuabor and Malaolu (2013) find that higher interest rates did not have a significant impact on the expansion of the informal sector in Nigeria.

Hypothesis 4: The acceleration of financial development in African countries will enable them to reduce the informality of their economies relative to advanced and emerging economies.

Moreover, technological infrastructures promote the digitization of the economy, which facilitates government control and the detection of informal activities. Furthermore, in the case of the Internet, Elgin (2012) shows that technological infrastructures increase productivity and thus the reputation of the firm, which makes concealment and informality more difficult.

Hypothesis 5: The development of technological infrastructures in African countries will enable them to significantly reduce the informality of their economies compared to advanced and emerging countries.

B. Institutional factors

Governance is one of the relevant factors for informality. Indeed, the use of good practices in administration (low corruption) or the awareness of economic agents to comply with regulations contribute to a significant reduction in informality (Medina and Schneider, 2018; Berdiev et al, 2018; Ulyssea, 2020). Nguyen et al. (2020) show that the government can reduce the size of the informal economy through the quality of its institutions. Porta and Shleifer (2014) and Ulyssea (2020) go further to suggest that managing informality requires a great deal of ingenuity on the part of public authorities: there is a trade-off between formalization policies and policies of taxing informal activity. In Nigeria, Ogbuabor and Malaolu (2013) argue that the size of the public sector does not significantly affect the expansion of the informal economy. On the other hand, in a later study in the same country, Igudia et al. (2016) find that corruption favors the growth of the informal sector.

Hypothesis 6: Respect for the rule of law in African countries allows them to significantly reduce informality in their economies compared to advanced and emerging economies.

Hypothesis 7: The control of corruption in African countries enables them to significantly reduce the informality of their economies compared to advanced and emerging countries.

Trade liberalization can also slow the growth of the informal economy (Berdiev and Saunoris, 2017; Medina and Schneider, 2018; Wu et al., 2019). Trade liberalization stimulates economic growth, which is likely to reduce the size of the informal economy. In the case of Nigeria, Ogbuabor and Malaolu (2013) show that trade openness does not significantly affect the size of the informal economy.

Hypothesis 8: Trade liberalization in African countries has allowed them to significantly reduce informality in their economies relative to advanced and emerging economies.

III. Methodology

The decomposition method seems the most appropriate to estimate the gap in the size of the informal economy between Africa and OECD+ countries (Coudin et al., 2019). In fact, unlike the other methods used (in particular the LSDV regression²) on differences between groups used by Mpabe and Keneck (2017)), it allows us to recognize the part of the gap explained by the selected variables and, by extension, the part that is not explained.

In our study, we opt for the decomposition method developed by Kröger and Hartmann (2020), which has the advantage over other Blinder-Oaxaca-type decomposition methods of being adapted to panel data. In fact, this method brings greater flexibility to the analysis in that, in addition to providing the overall gap in the size of the informal economy in terms of levels between the two groups of countries, it allows us to observe changes in the gap over time.

Broadly speaking, the model is described as follows: consider a continuous variable Y , the dependent variable, and k explanatory variables $X_1, X_2, X_3, \dots, X_k$. We wish to study the difference between the means of Y for two groups A (African countries) and B (OECD+ countries), assuming that they have different observable characteristics. A linear regression model is then specified separately for the 2 groups, with:

$$Y_i = \beta_{A0} + \sum_{k=1}^K X_{ik} \beta_{Ak} + \mu_{iA}, \forall i \in A \quad (1)$$

$$Y_i = \beta_{B0} + \sum_{k=1}^K X_{ik} \beta_{Bk} + \mu_{iB}, \forall i \in B \quad (2)$$

Once the parameters of each of the models have been estimated, we can obtain the mean of the variable to be explained in the two groups:

$$\bar{Y}_A = \hat{\beta}_{A0} + \sum_{k=1}^K \bar{X}_{Ak} \hat{\beta}_{Ak} \quad (3)$$

$$\bar{Y}_B = \hat{\beta}_{B0} + \sum_{k=1}^K \bar{X}_{Bk} \hat{\beta}_{Bk} \quad (4)$$

The average difference between the two groups is then calculated as :

$$\bar{Y}_B - \bar{Y}_A = \hat{\beta}_{B0} + \sum_{k=1}^K \bar{X}_{Bk} \hat{\beta}_{Bk} - \hat{\beta}_{A0} - \sum_{k=1}^K \bar{X}_{Ak} \hat{\beta}_{Ak} \quad (5)$$

2) LSDV = Least Squares Dummy Variables

In general, 2 reasons are given to justify the average difference in relation to Y between the two groups: (i) the average characteristics (the \overline{X}_{ik}) are different in the two groups and (ii) the returns to these characteristics (as indicated by the estimated coefficients) are different in the two models. It therefore follows that the average difference between the two groups with respect to Y can be broken down into two :

$$\overline{Y}_B - \overline{Y}_A = \underbrace{\sum_{k=1}^K (\overline{X}_{Bk} - \overline{X}_{Ak}) \hat{\beta}_{Bk}}_{\text{Explained gap}} + \underbrace{(\hat{\beta}_{B0} - \hat{\beta}_{A0}) + \sum_{k=1}^K \overline{X}_{Ak} (\hat{\beta}_{Bk} - \hat{\beta}_{Ak})}_{\text{Unexplained gap}} \quad (6)$$

The left-hand side of this equation represents the observed average difference in the size of the informal economy between African countries and emerging and advanced countries. The first term in the right-hand side of the equation above expresses the share of the difference in the size of the informal economy that is explained by differences in economic and institutional characteristics, rather than how these characteristics affect the size of the informal economy. The second term in this part of the equation represents the share of the difference in the size of the informal economy relative to the performance of the same characteristics for the two groups of countries. It is referred to as the "unexplained component" of the gap in the size of the informal economy because it does not arise from the difference in observable characteristics between the two groups of countries. In fact, it expresses the differences due to a different performance of an identical characteristic from one group to the other. Thus, this part of the difference can be explained by the intrinsic characteristics of each group or by the basic structure of each group.

The data for this study come from 5 sources: Heritage Foundation, Medina and Schneider (2018), World Development Indicators (WDI), World Governance Indicators (WGI), and UN data. The study covers 84 countries³⁾ (including 44 African countries and 40 advanced and emerging economies) over the period 1995-2015. This selection was based primarily on data availability. In addition, the low level of informality in OECD+ countries is used as a benchmark. The variables used in this study are described below.

A. Size of informal economy (SHADO)

This is a quantitative variable that measures the size of the informal economy as a proportion of GDP. This variable makes it possible to capture the share of economic activity that escapes national accounting. These data are the result of the work of Medina and Schneider (2018),

3) See Table A8 in the Appendix

who have the merit of having produced the most up-to-date database on the size of the informal economy. These authors use several methods to ensure the robustness of the results, but insist on the "multiple indicators, multiple causes" (MIMIC) method, which is an econometric method for qualitative variables.

B. Gross domestic product per capita (PIBH)

Gross Domestic Product (GDP) per capita is the ratio of GDP to population size. It is used to assess the standard of living of the population of a given country. This indicator is provided by the World Bank's World Development Indicators (2020) database.

C. Human capital stock (ICH)

The human capital stock is measured by the share of individuals enrolled in secondary education in a given year, regardless of age, in the population of individuals in the age group standardized for secondary education. This indicator is provided by the World Bank's WDI database (2020).

D. Tax burden reduction (FISC)

The tax burden reduction index measures government efforts to reduce the tax burden on business. The tax burden is a composite measure that reflects marginal tax rates on personal and corporate income and the overall level of taxation (including direct and indirect taxes levied by all levels of government) as a percentage of GDP. The component score is derived from three quantitative sub-factors: (i) the top marginal tax rate on personal income, (ii) the top marginal tax rate on corporate income, and (iii) the total tax burden as a percentage of GDP. Each of these numerical variables is equally weighted and accounts for one-third of the component score. The tax burden scores are calculated using a quadratic cost function to reflect the diminishing returns in terms of revenue from very high tax rates. The data for each subfactor are converted to a 100-point scale to capture the reduction in the tax burden. This indicator is provided by the Heritage Foundation (2020).

E. Financial development (FIN)

Financial development refers to the level of dynamism of the financial sector. It is an index calculated by the Heritage Foundation (2020) based on factors such as the openness of the financial system to international competition, the extent of government intervention in the financial system, and the level of development of the capital market.

F. Development of technological infrastructure (INFT)

We will use a proxy variable to capture the development of technological infrastructure, we will use a proxy variable that is the rate of access to electricity. The World Development Indicator provides information on this indicator (World Bank, 2021). Electricity is essential for industrialization, innovation and technological development.

G. Respect for the rule of law (JUR)

The legal system quality index measures the efficiency, impartiality and independence of the judicial system. In other words, it measures the level of trust and respect that agents in a given economy have for the judicial system. It is also derived from the WGI and scored on a scale ranging from -2.5 (no rule of law) to 2.5 (effective rule of law). Its scores are also reported on a scale of 0 to 100.

H. Control of corruption (COR)

The Corruption Perceptions Index is based on the Heritage Foundation's Government Integrity Index (2020), which in turn is based on Transparency International's Corruption Perceptions Index. In addition, this index takes values on a scale of 0 to 100, with 0 representing the maximum level of corruption and 100 reflecting a situation where there is no corruption in the economy.

I. Trade liberalization (EXT)

Trade liberalization, commonly referred to as "trade openness" in the literature, is measured in this study by the Index of Trade Freedom calculated by the Heritage Foundation (2020). This index is constructed from scores on tariff and non-tariff barriers erected by countries. Because it is based on tariff and non-tariff barriers, this index allows us to truly assess the ease of doing business with the "rest of the world" (the fluidity of international trade). In fact, it allows us to move away from the criticism of trade openness as a measure of foreign trade liberalization.

J. Political stability (STAP)

The Political Stability Index is a measure based on the perceived absence of violence and/or terrorism in a country. It is extracted from the WGI and scored on a scale ranging from -2.5 (notoriously politically unstable) to 2.5 (notoriously politically stable). Its values are then reported on a scale of 0-100 to harmonize with the other variables.

IV. Results

Table 1 shows that the average of the shadow economy index is 29.04. The interquartile range shows that there is considerable variability in the data. In fact, the variability in the data leads us to suspect a large disparity between the 2 groups of countries (Africa, OECD+) and therefore a large gap between these countries.

Table 1. *Descriptive Statistics*

	Number of observations	mean	Std. Dev.	p25	p50	p75	IQR	min	max
SHADO	1,764	29.041	13.284	16.695	29.625	38.725	22.030	6.160	69.080
PIBH	1,764	8.526	1.730	6.880	8.665	10.209	3.329	5.212	11.626
ICH	1,764	70.627	37.872	34.768	79.964	99.969	65.201	3.478	163.935
FISC	1,764	66.352	13.082	58.350	68.100	76.000	17.650	29.800	95.000
FIN	1,764	53.540	20.068	40.000	50.000	70.000	30	10.000	90.000
INFT	1,764	67.046	37.472	27.479	95.436	100	72.52	0.010	100.000
JUR	1,764	54.741	26.154	34.412	49.525	78.170	43.758	1.000	100.000
COR	1,764	45.208	25.441	27.000	37.000	65.000	38	7.000	100.000
EXT	1,764	67.811	16.373	59.000	70.709	80.400	21.40	0.000	90.000
STAP	1,764	49.215	25.976	28.340	44.605	71.750	43.410	0.000	100.000
INSTR	1,764	8.522	1.422	7.170	7.370	10.010	2.840	6.940	10.200

To get a clearer picture, a comparison of means test is appropriate to see if the two groups of countries really differ on the different variables. This shows that at the 1% threshold, the difference in means is significant for each variable. Table 2 shows that Africa has a much larger informal economy than the advanced countries. It also lags far behind the advanced countries on all other variables.

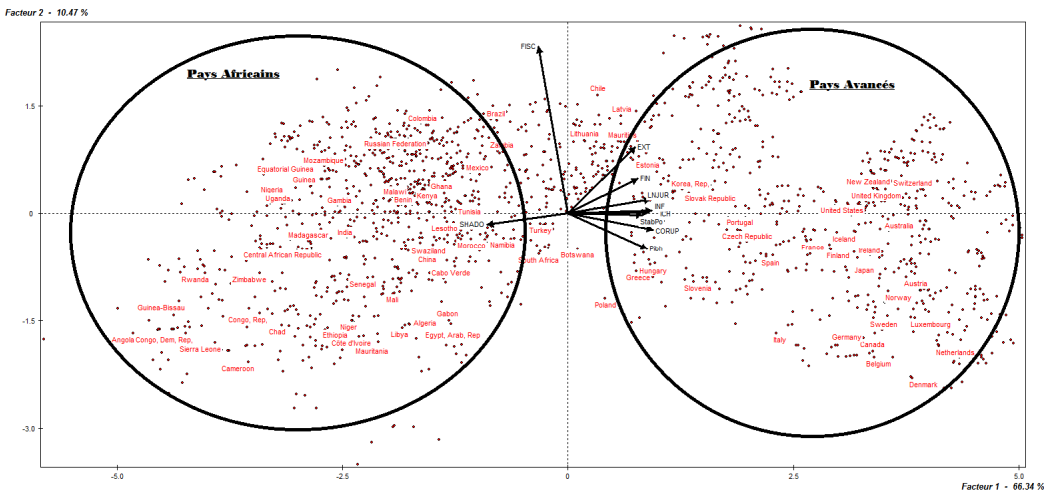
PCA can also be used to examine the correlation between variables. Looking at Figure 2, we see (along the first factorial axis, which contains 66% of the information in the data) that the size of the informal economy is positively correlated with the tax burden, but negatively correlated with the other variables. In addition, the index of technological infrastructure (INF), the stock of human capital (ICH), and the index of political stability (STAP) are highly correlated. However, there is no need to worry about possible multicollinearity because the Variance Inflation Factor (VIF) is less than 10 for all variables (see Table A1). In addition, the PCA analysis shows that emerging countries are clustered with African countries. In other words, emerging countries are similar to African countries in terms of informality.

Table 2. Mean-Comparison Test

	OCDE+		AFRICA		Difference	
	Mean	std.err.	Mean	std.err.	Mean	std.err.
SHADO	18.57	0.292	38.55	0.297	-19.97***	0.48
PIBH	10	0.032	7.17	0.034	2.831***	0.047
ICH	102.5	0.655	41.649	0.836	60.853***	1.076
FISC	63.209	0.487	69.208	0.372	-5.999***	0.607
FIN	65.761	0.585	42.429	0.518	23.332***	0.778
INFT	98.756	0.189	38.218	0.99	60.537***	1.055
JUR	75.716	0.651	35.673	0.485	40.043***	0.803
COR	63.698	0.785	28.397	0.43	35.301***	0.874
EXT	77.888	0.404	58.65	0.477	19.237***	0.632
STAP	71.16	0.588	29.265	0.45	41.894***	0.733

NB: *** $p<0.01$

Figure 2. Overview of the data using principal component analysis (PCA)



A. Validation tests

In addition to the multicollinearity test carried out with the VIF analysis, the main tests to be carried out are the unit root test and the homogeneity test between the two groups of countries. In particular, it should be noted that the unit root test is crucial in this study, given the number of years covered by the study period (Hurlin and Mignon, 2006).

The results of the test of inter-individual independence (Table A2) show that, at the 1% threshold, the hypothesis of inter-individual independence should be rejected for all variables except COR, for which the null hypothesis cannot be rejected. Therefore, a second generation test should be used for all variables except COR, which should be subjected to a first generation

test. The results (Tables A3 and A4) show that 6 of the 10 variables are stationary at the 1% level. Therefore, we also test for cointegration, since non-stationarity is a characteristic of cointegrated variables. In this context, the Kao test (which is appropriate given the large number of variables) confirms the presence of a cointegrating relationship between the series at the 1% threshold (see Table A5).

The test of homogeneity between groups of countries (Table A6) confirms that the coefficients of the regression vector are systematically different between the OECD+ countries and the African countries. Indeed, given the chi-squared statistic and the associated p-value, it is appropriate to reject the null hypothesis that the coefficients of the variables are the same in the two groups of countries. Thus, our data set is suitable for applying an Oaxaca-Blinder type decomposition.

B. Econometric results

As mentioned above, the appropriate statistical method is the Kröger and Hartmann decomposition method. However, since Blinder-Oaxaca-type decomposition models do not provide information on the econometric relationship between the upstream variables, it is advisable to first examine the econometric relationship between the different variables in order to ensure the consistency of the decomposition model at a later stage. Since random shocks that affect the size of the informal economy in a state are also likely to affect the value of GDP per capita, we consider GDP per capita as an endogenous variable. To do so, we use the instrumental variables method (LIML⁴) estimator, as recommended by theory (Greene, 2018; Wooldridge, 2020). We assume that the correlation between PIBH and the error term is not zero. On the other hand, we have no reason to believe that the correlations between the other explanatory variables and the error term are non-zero; therefore, we assume that these other explanatory variables are exogenous.

Since we consider PIBH to be an endogenous variable, we need to have one or more additional variables that are correlated with PIBH but not with the error term: these are instrumental variables. Several studies have highlighted the impact of the informal economy on GDP (Giles, 1999; Tanzi, 1999; Schneider and Enste, 2000). For Latin American countries, Loayza (1996) finds that, *ceteris paribus*, an increase in the shadow economy by one percentage point of GDP reduces the growth rate of official real GDP per capita by 1.2 percentage points. However, Schneider (2008) shows that (i) income earned in the shadow economy raises the standard of living of at least 1/3 of the working population and (ii) between 40 and 50% of shadow economy activities are complementary in nature, i.e. additional value added is created, which increases official GDP.

In reality, this instrumental variable method is not so easy to apply because the instrumental variables must simultaneously satisfy two conditions. The first is the relevance condition, which

4) LIML: Limited Information Maximum Likelihood

implies that the instrumental variable must be sufficiently correlated with the endogenous variable that it is instrumenting. This means that the instrumental variable must be relevant to explain the variation in the endogenous variable. The second condition is that the instrument must satisfy the validity property. To be valid, the instrumental variable must have no partial effect (direct or indirect) on the variable to be explained except through the endogenous variable. Thus, the instrumental variable must not be correlated with the error term. Inspired by the suggestions of Angrist and Krueger (2001), we chose as PIBH instrument the annual average PIBH by block (Africa and outside Africa). To test its validity, we used Montiel and Pflueger's (2013) robust test for weak instruments. The results of this test confirm the validity of this instrument (Table A10).

The results of the LIML model (Table A7) show that improving the standard of living of the population and controlling the tax burden significantly increase the size of the informal economy. On the other hand, improvements in human capital, trade openness, provision of technological infrastructure, political stability, control of the legal system, and control of corruption significantly reduce informality. Financial development also significantly favors the decline in the weight of the informal sector in Africa. Moreover, most of these factors contribute to improving the business climate. Thus, by improving the quality of the business climate, countries can better combat informality.

Table 3 presents the results of the Kröger and Hartmann decomposition of the size differential of the informal economy. The average size of the informal economy is larger in Africa than in OECD+ countries. To illustrate, looking at Model 9, the average size of the informal economy in Africa is 38.525, while it is 18.556 in OECD+ countries. This is a difference of 19.969 points.

The gap associated with the explained share equation⁵⁾ reflects the reduction in the size of the informal economy in African countries if they had the same characteristics as OECD+ countries. This is the gap that would remain if there were no differences between African and OECD+ countries, i.e. if the characteristics of the countries in these two blocks were identical. Our results show that in the case of Model 9, the explained part of the gap related to differences in individual characteristics accounts for 67,71% of the total gap. The explained part of the gap in the size of the informal economy between African and non-African countries, looking at model 9, is negatively and significantly influenced by GDP per capita (PIBH), financial development (FIN) and control of corruption (COR). On the other hand, it is positively and significantly influenced by the reduction of the tax burden (FISC), trade liberalization (EXT), technological infrastructure endowment (INFT) and political stability (STAP). We also find that respect for the rule of law (JUR) and human capital (ICH) have no significant effect on the explained gap. On the other hand, all these variables are significant in the explained share equation when we run a simple regression (models 1 to 8).

5) See equation 3

Table 3. *Kroeger and Hartmann Decomposition Result (AFRICA vs OCDE+)*

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7		Model 8		Model 9	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
AFRICA	38.492***	0.306	26.413	0.854	37.317***	0.425	33.348***	0.622	22.388***	0.826	31.615***	0.739	30.807***	0.762	35.671***	0.518	38.525***	0.301
OCDE+	18.548***	0.294	17.447	0.340	18.220***	0.325	16.491***	0.369	18.423***	0.298	15.928***	0.345	14.449***	0.365	17.605***	0.316	18.556***	0.294
Difference	19.944***	0.424	8.967	0.919	19.088***	0.535	16.857***	0.723	3.965***	0.879	15.687***	0.816	16.358***	0.845	18.066***	0.607	19.969***	0.421
Explained gap	-8.845***	0.131	-15.838	0.407	2.578***	0.265	-9.949***	0.381	-16.374***	0.378	-14.165***	0.414	-13.775***	0.482	-7.237***	0.259	13.522***	0.542
Unexplained gap	28.790***	0.437	24.805	0.824	16.510***	0.478	26.806***	0.613	20.339***	0.754	29.852***	0.746	30.131***	0.753	25.303***	0.550	6.446***	0.371
Explained share equation																		
INSTRUM	-8.845***	0.131															-15.266***	0.641
ICH			-15.838***	0.407													-0.264	0.990
FISC					2.578***	0.265											1.574***	0.187
FIN							-9.949***	0.381									-0.884**	0.386
INFT									-16.374***	0.378							9.623***	0.914
JUR											-14.165***	0.414					0.001	1.806
COR													-13.775***	0.482			-2.870***	0.907
EXT															-7.237***	0.259	2.063***	0.458
STAP																	19.545***	2.043
Unexplained share equation																		
INSTRUM	28.790***	0.437															48.495***	3.902
ICH			24.805***	0.824													-14.753***	1.805
FISC					16.510***	0.478											0.596	1.960
FIN							26.806***	0.613									2.714*	1.402
INFT									20.339***	0.754							-40.737***	4.998
JUR											29.852***	0.746					0.197	4.104
COR													30.131***	0.753			9.256***	1.963
EXT															25.303***	0.550	0.616	2.973
STAP																	0.062	3.900

NB: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

In addition, we show that the second gap associated with the unexplained share equation⁶⁾ accounts for 32,29% of the total gap in the case of Model 9. This result shows that the discrimination suffered by African countries in terms of formalization and modernization of the economy does not predominate when we try to explain the gaps between African countries and OECD+ countries. The unexplained share is negatively and significantly influenced by human capital (*ICH*) and technological infrastructure endowment (*INFT*). On the other hand, it is positively and significantly influenced by GDP per capita (*PIBH*), financial development (*FIN*) and control of corruption (*COR*). In addition, tax burden reduction (*FISC*), rule of law (*JUR*), political stability (*STAP*) and trade liberalization (*EXT*) have no significant effect on the unexplained gap. On the other hand, all these variables are significant in the unexplained gap equation when a simple regression is run (models 1 to 8).

V. Discussions

PIBH is the second variable with the most negative and significant contribution to the explained gap, with a contribution of -15.266 in Model 9, corresponding to 29,306% of the total explained gap. Thus, if African countries had the same level of GDP per capita as OECD+ countries, the size of the informal economy would be significantly reduced. We can therefore see that an increase in GDP per capita can help to reduce the informality gap between Africa and the OECD+. Some studies have shown that the increase in living standards captured by GDP per capita favors the migration of firms from the informal to the formal sector (Goel and Nelson, 2016; Medina and Schneider, 2018; Canh et al, 2020). Lyulyov et al (2021) find that a 10% increase in GDP per capita in a selected group of transition economies reduces the size of the shadow economy by 1.2%. However, the *PIBH* variable has a positive effect on the total gap (Figure A1).

Human capital (*ICH*) has a negative and non-significantly effect to the explained gap in the case of model 9. Furthermore, the *ICH* variable has a negative effect on the total gap (Figure A1). Some studies conducted in sub-Saharan Africa have shown that the size of the informal sector increases with the unemployment rate (Igudia et al., 2016). Other empirical work has shown that underemployment significantly reduces the expansion of the informal economy (Ogbuabor and Malaolu, 2013; Koffi, 2022). The less educated are more likely to find jobs in the informal sector.

On the other hand, fiscal freedom (*FISC*) contributes positively and significantly to the gap explained in model 9. Thus, if African countries had the same level of fiscal freedom as OECD+

6) See equation 3

countries, the informality of their economies would increase more. The improvement in fiscal freedom in Africa may further widen the gap in the informality of the economy between African and OECD+ countries. Furthermore, the *FISC* variable has a positive effect on the total gap (Figure A1). However, some studies (Ogbuabor and Malaolu, 2013; Goel and Nelson, 2016; Igudia et al, 2016; Mara, 2021; Koffi, 2022; Gokmenoglu and Amir, 2023) have shown that tax pressure favors the growth of the informal sector. The tax burden influences the choice between work and leisure and stimulates the supply of labor in the informal economy (Loayza, 1996). Schneider and Enste (2000) recognize that "the greater the difference between the total cost of work in the formal economy and the after-tax return to work, the greater the incentive to avoid this difference and to work in the informal economy". However, Johnson et al (1998a) and Zoido-Lobaton et al (2013) conclude that it is not higher tax rates per se that increase the size of the shadow economy, but inefficient and discretionary application of the tax system and regulations by the government. These authors show that there is a negative correlation between the size of the informal sector and top (marginal) tax rates, which may be unexpected, but since other factors (such as tax deductibility, tax rebates, tax exemptions, the choice between different tax systems, and various other opportunities for legal tax avoidance) were not taken into account, it is not too surprising. In the same vein, Friedman et al (2000) also found that higher tax rates are associated with less informal activity. They argue that entrepreneurs go underground not to avoid official taxes, but to reduce the burden of bureaucracy and corruption. Some other studies (Canh et al, 2020; Canh and Dinh Thanh, 2020) show that fiscal freedom reduces the size of the shadow economy.

Financial development (*FIN*) contributes negatively and significantly to the explained gap in the case of model 9. Thus, if African countries had the same level of financial development as OECD+ countries, the weight of the informal economy would decrease significantly. Thus, an increase in financial development can help reduce the informality gap between Africa and the OECD+. However, the *FIN* variable has a positive effect on the total gap (Figure A1). Gokmenoglu and Amir (2023) find that financial development increases the size of the informal economy in the Baltic region.

The technological infrastructure endowment (*INFT*) contributes positively and significantly to the explained gap in model 9. Thus, if African countries had the same level of technological infrastructure endowment as OECD+ countries, the size of the informal economy would increase. However, the *INFT* variable has a negative effect on the total gap (Figure A1). Boitan and Stefoni (2022) have shown that the digital transformation, proxied by the large-scale adoption and use of digital technologies, as well as the continuous improvements in the quality of ICT technologies, leads to a reduction in the size of the informal economy in the European Union. Compared with other regions of the world, Africa lags behind in terms of installed power generation capacity, per capita electricity consumption and household access to electricity. Total

power generation capacity in the region, which has a total population of close to one billion, is less than 100 gigawatts (i.e. less than the total generation capacity of Spain, which has just 46 million inhabitants), and half that without South Africa. Fifteen of the countries ranked in the bottom 20 worldwide for electricity consumption per capita are in Africa (IEA⁷, 2016; Banque Mondiale, 2016).

Respect for the rule of law (*JUR*) have a non-significantly effect to the explained gap and unexplained gap in model 9. However, the *INFT* variable has a positive effect on the total gap (Figure A1). Some authors (Medina and Schneider, 2018; Canh and Dinh Thanh, 2020; Gokmenoglu and Amir, 2023) have shown that establishing the rule of law reduces the size of the informal economy in both developed and developing countries.

Control of corruption (*COR*) contributes negatively and significantly to the explained gap in model 9. Thus, if African countries had the same level of control over corruption as OCDE+ countries, the size of the informal economy would be significantly decreased. However, the *COR* variable has a positive effect on the total gap (Figure A1). Some authors have shown that an improved business climate combined with good control of corruption promotes the efficiency of entrepreneurial activity in the formal sector (Rose-Ackerman, 2004; Schneider and Buehn, 2007; Mara, 2021; Canh et al, 2020). Moreover, controlling corruption reduces transaction costs and improves economic performance, thereby increasing business profits and entrepreneurial motivation in the formal sector (Anokhin and Schulze, 2009). In their empirical study of forty-nine countries (in Latin America, the OECD, and the post-communist countries of Eastern Europe and the former Soviet Union), Johnson et al. (1998a) find a statistically significant relationship between various measures of bribery or corruption and the shadow economy. For example, these authors show that, *ceteris paribus*, a one-point improvement in the corruption index ICRG⁸) is associated with an 8 to 11 percentage point reduction in the shadow economy. Zoido-Lobaton et al(2013) find that, *ceteris paribus*, a one-point increase in the International Corruption Transparency Index reduces the shadow economy by 5.1 percentage points.

Trade liberalization (*EXT*) contributes positively and significantly to the explained gap in model 9. Thus, if African countries had the same level of trade openness as OECD+ countries, the size of the informal economy would increase. The removal or reduction of barriers to external trade in Africa cannot reduce the economic informality gap between African and OECD+ countries. Also, the *EXT* variable has a positive effect on the total gap (Figure A1). Using a global sample of 116 countries over the period 2003-2014, Canh and Dinh Thanh (2020) show that trade liberalization in the direction of export diversification and export quality is an important factor in reducing the shadow economy. Other authors (Gokmenoglu and Amir, 2023; Canh et al., 2020) find a similar result.

7) EIA: Energy Information Administration of USA

8) ICRG: The International Country Risk Guide

Political stability (*STAP*) positively and significantly influences the explained gap in model 9. Thus, if African countries had the same level of political stability as OECD+ countries, the size of the informal economy would increase. Furthermore, the *INFT* variable has a positive effect on the total gap (Figure A1). Gokmenoglu and Amir (2023) confirm that political stability reduces the size of the informal sector.

A. Robustness

To check the robustness of our results, we excluded emerging markets other than South Africa from our sample. Looking at Table A9, we see that the difference in size between Africa and the rest of the world increases from 19.96 (Model 9) to 21.02 (Model 21). Moreover, the explained gap remains well below the unexplained gap.

Furthermore, the sign and significance of the explanatory variables in the estimates are stable in the case of univariate regressions (Models 13 to 21). On the other hand, there are small differences in the multivariate regressions. For example, the effect of the variable *FIN*, which was negative and significant in model 9, is not significant in model 21. In addition, the effect of the variable *ICH* is positive and significant in model 21, while it is not significant in model 9. In addition, looking at Model 21, we see that the variable *PIBH* continues to make the largest contribution to the explained gap.

B. Evolution of the gap over time

When broken down over time, the gap in the size of the informal economy between OECD+ countries and Africa widened in 2000 and 2005 compared to 1995, and narrowed in 2010 and 2015 (Table 4). This trend coincides with the Heavily Indebted Poor Countries (HIPC) initiative, a program designed to help the world's poorest countries by making their international debts "sustainable". This program was launched in 1996 by the International Monetary Fund (IMF) and the World Bank to keep debt at manageable and sustainable levels. It was revised and reformed in 1999. Debt reduction is usually linked to the countries' efforts to reduce poverty. The HIPC program covered 42 countries in September 2006, three-quarters of which are in sub-Saharan Africa (40 countries at the end of August 2006).

For a country to be eligible for the HIPC and enhanced HIPC initiatives, it must meet four criteria: (i) it must be eligible only for concessional assistance from the IMF and the World Bank; (ii) it must have an unsustainable level of debt; (iii) it must have fully implemented reforms and sound economic policies under programs supported by the IMF and the World Bank; and (iv) it must have formulated a Poverty Reduction Strategy Paper (PRSP). These economic reforms focus in particular on fighting corruption, improving the business environment and liberalizing trade. Between 2010 and 2011, twenty-six (26) countries in sub-Saharan Africa

reached completion point under the HIPC Initiative. To accelerate progress toward the Millennium Development Goals, the HIPC Initiative has been complemented since 2006 by the Multilateral Debt Relief Initiative (MDRI). MDRI provides relief for all eligible debts owed to the African Development Fund (ADF), the Inter-American Development Bank, the International Development Association of the World Bank, and the International Monetary Fund by countries that have completed the HIPC process.

Table 4. *Breakdown Over Time of the Difference in the Size of the Informal Economy*

Years	1995	2000	2005	2010	2015
Gross change in absolute value	20.21	21.21	20.55	18.32	19.21
Net change compared with 1995	0.000	1.002	0.343	-1.893	-1.001

VI. Conclusion

The reduction of the size of the informal economy and the migration of firms from the informal to the formal sector are crucial for the economic development of African countries. This study identifies the factors that explain the gap in the size of the informal economy between African countries and advanced and emerging economies. Methodologically, we used descriptive statistical techniques and the Kröger and Hartmann (2021) decomposition model.

The results of the descriptive and econometric statistics show that the size of the informal economy is larger in African countries than in advanced and emerging countries. This shows that African countries are lagging behind advanced and emerging economies in terms of the dominance of the formal economy. An increase in the standard of living of the population, an improvement in the control of corruption and the strengthening of financial development could enable African countries to reduce the explained gap. However, fiscal freedom, technological infrastructure, trade liberalization and political stability increase the explained gap. Furthermore, human capital and technological infrastructure reduce the total gap.

Therefore, in order to reduce the informality of African economies relative to OECD+ countries, it would be prudent to implement institutional reforms that focus on controlling corruption. Public authorities must also take steps improve financial development, technological infrastructure, people's living standards and human capital.

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Appendix

Table A1. *Multicollinearity Test*

Variable	VIF	1/VIF
STAP	24.97	0.040
JUR	20.59	0.048
ICH	7.29	0.137
COR	6.99	0.143
INFT	5.11	0.195
SHADO	3.85	0.260
FIN	2.23	0.447
EXT	2.09	0.478
FISC	1.29	0.775
Mean VIF	8,27	

Table A2. *Test of Inter-Individual Independence*

Variables	SHADO	PIBH	COR	ICH	FISC	FIN	TEL	STAP	JUR	EXT
p-value	0.000	0.000	0.507	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table A3. *First Generation Test (IPS)*

Variables	COR
p-value	0.000

Table A4. *Second-Generation Test (Pesaran 2003)*

Variables	SHADO	D.PIBH	D.ICH	FISC	D.FIN	D.TEL	STAP	JUR	EXT
p-value	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000

Table A5. *Cointegration Test (Kao)*

Ho: No cointegration	Number of panels = 84	
Ha: All panels are cointegrated	Number of periods= 19	
Cointegrating vector: same		
	Statistic	p-value
Modified Dickey-Fuller t	-2.952***	0.001
Dickey-Fuller t	-3.952***	0.000
Augmented Dickey-Fuller t	-2.422***	0.007
Unadjusted modified Dickey-Fuller t	-6.531***	0.000
Unadjusted Dickey-Fuller t	-5.825***	0.000

NB: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A6. *Homogeneity Test*

	Coef.	Std. Err.	z	P>z
INSTRUM	-15.510***	1.671	-9.28	0
INTRUM_1	3.256	3.261	1	0.318
ICH	0.132***	0.012	10.79	0
ICH_1	-0.192***	0.021	-9.28	0
FISC	-0.009	0.013	-0.73	0.466
FISC_1	0.054*	0.031	1.76	0.078
FIN	-0.024**	0.012	-1.98	0.047
FIN_1	0.026	0.024	1.06	0.288
INFT	-0.007	0.057	-0.12	0.906
INFT_1	-0.010	0.059	-0.17	0.865
STAP	-0.343***	0.044	-7.87	0
STAP_1	0.149**	0.061	2.42	0.015
JUR	-0.092**	0.039	-2.4	0.017
JUR_1	0.026	0.057	0.46	0.644
COR	-0.041**	0.019	-2.1	0.036
COR_1	0.122***	0.035	3.52	0
EXT	0.044	0.042	1.04	0.297
EXT_1	-0.135***	0.047	-2.86	0.004
afrik	-56.178	25.581	-2.2	0.028
cons	193.695***	17.855	10.85	0
Test Parm	chi2(19) =10263.250***			

NB: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A7. *LIML Model Results*

	Model 10		Model 11		Model 12	
	AFRICA+OCDE+		AFRICA		OCDE+	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
LNPIBH	8.636***	0.315	9.120***	0.356	7.371***	1.177
ICH	-0.046***	0.015	-0.191***	0.023	0.100***	0.014
FISC	0.177***	0.018	0.033	0.031	0.020	0.015
FIN	0.015	0.016	-0.066**	0.027	-0.019	0.014
INFT	-0.246***	0.014	-0.183***	0.019	0.021	0.085
JUR	-0.074**	0.036	-0.025	0.051	-0.107***	0.041
COR	-0.137***	0.023	0.031	0.038	-0.124***	0.022
EXT	-0.186***	0.020	-0.126***	0.026	-0.282***	0.026
STAP	-0.300***	0.040	-0.139**	0.057	-0.417***	0.046

NB: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table A8. *Countries in the Sample*

Emerging and advanced countries (40)				African countries (44)			
Australia	Greece	Portugal	Estonia	Lesotho	Guinea	Nigeria	Egypt
Austria	Hungary	Czech Republic	Mexico	Algeria	Equatorial Guinea	Republic democratic of Congo	Morocco
Belgium	India	United Kingdom	United States	Angola	Guinea-Bissau	Central African Republic	Côte-d'Ivoire
Brazil	Ireland	Russia	Norway	Benin	Mauritius	Congo	Ethiopia
Canada	Iceland	Slovakia	Germany	Botswana	Kenya	Rwanda	Mauritania
China	Italy	Slovenia	Poland	Uganda	South Africa	Senegal	Burkina Faso
Chile	Japan	Spain	France	Cabo Verde	Libya	Sierra Leone	Ghana
Colombia	Latvia	Sweden	Netherlands	Cameroon	Madagascar	Swaziland	Niger
South Korea	Lithuania	Switzerland		Chad	Malawi	Tanzania	Gambia
Denmark	Luxembourg	Turkey		Tunisia	Mali	Togo	Namibia
Finland	New Zealand			Gabon	Mozambique	Zambia	Zimbabwe

Table A9. *Kroeger & Hartmann Decomposition Result (AFRICA vs OCDE)*

	Model 13		Model 14		Model 15		Model 16		Model 17		Model 18		Model 19		Model 20		Model 21	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
AFRICA	38.492***	0.306	26.413***	0.854	37.317***	0.425	33.348***	0.622	22.388***	0.826	31.615***	0.739	30.807***	0.762	35.671***	0.518	38.525***	0.301
OCDE	17.478***	0.273	16.626***	0.309	16.962***	0.315	16.035***	0.343	17.461***	0.272	15.638***	0.322	14.336***	0.345	17.092***	0.288	17.497***	0.272
Difference	21.014***	0.410	9.787***	0.908	20.356***	0.529	17.312***	0.710	4.927***	0.870	15.977***	0.807	16.471***	0.837	18.579***	0.593	21.028***	0.406
Explained gap	-8.904***	0.138	-16.198***	0.415	3.199***	0.275	-10.987***	0.378	-16.457***	0.383	-15.169***	0.417	-14.879***	0.493	-8.164***	0.236	15.374***	0.545
Unexplained gap	29.919***	0.433	25.986***	0.834	17.156***	0.471	28.299***	0.617	21.384***	0.763	31.146***	0.759	31.350***	0.767	26.743***	0.550	5.654***	0.365
Explained share equation																		
INSTRUM	-8.904***	0.138															-19.026***	0.570
ICH			-16.198***	0.415													0.556	1.016
FISC					3.199***	0.275											1.984***	0.203
FIN							-10.987***	0.378									0.240	0.413
INFT									-16.457***	0.383							8.705***	0.900
JUR											-15.169***	0.417					1.232	1.845
COR													-14.879***	0.493			-2.156**	0.938
EXT															-8.164***	0.236	5.041***	0.453
STAP															18.799***	2.098		32.560
Unexplained share equation																		
INSTRUM	29.919***	0.433															63.852***	12.423
ICH			25.986***	0.834													-11.967***	1.647
FISC					17.156***	0.471											0.975	1.919
FIN							28.299***	0.617									3.994***	1.366
INFT									21.384***	0.763							-67.953***	11.447
JUR											31.146***	0.759					16.360***	3.600
COR													31.350***	0.767			5.083***	1.954
EXT															26.743***	0.550	4.406*	2.460
STAP																	-9.037**	3.681

NB: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table A10. *Montiel-Pflueger Robust Weak Instrument Test*

Effective F statistic: 18.903		
Confidence level alpha: 5%		
Critical Values	TSLS	LIML
% of Worst Case Bias		
tau=5%	37.418	37.418
tau=10%	23.109	23.109
tau=20%	15.062	15.062
tau=30%	12.039	12.039

Figure A1. Explained gap, unexplained gap and total gap of each explanatory variable