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This paper investigates the relationship between remittances and the size of the informal economy for 30 Sub-Saharan African (SSA) countries over the period 1991-2015. Based on Ordinary Least Squared (OLS) and System Generalized Method of Moments (GMM), empirical findings show that remittances increase significantly the size of the informal economy.

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1 Introduction

In the recent times, economists and policymakers considered international remittances as an important contributor to economic growth such as capital. For many developing countries, remittances flows exceed foreign direct investment and official development assistance (Chami et al., 2008). According to the World Bank, remittances to developing countries is estimated to US$ 429 billion in 2015. Figure 1 (see appendix) presents the evolution of the average level of the external financial flows for 140 developing countries from 1980 to 2016. However, despite their increased importance and volume, remittances sent to developing countries are often transferred through informal channels such as friends and family members travelling abroad, or informal money-transfer networks such as the "hawala" system. Accordingly, more than 50 percent of the remittances to Sub-Saharan Africa is through the informal channels (World Bank, 2011), meaning that remittances may be highly correlated to the informal economy.

A large amount of empirical studies have investigated the effects of remittances on economic growth both at macro and micro levels, using cross section, time series and panel data analysis (Catrinescu et al., 2009; Kumar, 2013; Lim and Simmons, 2015; Batu, 2017; Imad, 2017; Bahadir et al., 2018). However, even though theoretical and empirical studies do not provide a conclusive answer regarding the impacts of remittances on economic growth, there is a generally accepted belief that remittances can play a primary position for developing countries to achieve economic growth and development (Adams Jr, and Page, 2005; Adams Jr, 2009; Combes and Ebeke, 2011; Driffield and Jones, 2013; Zghidi et al., 2016; Meyer and Shera, 2017). Despite the large and growing literature on the relationship between remittances and economic growth, the macroeconomic literature has devoted little attention on the relationship between remittances and the size of the informal economy, particularly in Africa. Our goal is to bridge this gap by investigating the effect of remittances on the size of the informal economy. Remittances can affect the size of the informal economy in three different ways. First, empirical studies have proved that remittances to developing countries finance mainly household consumption (Durand et al.,1996; Brown and Ahlburg,1999; Combes and Ebeke, 2011). By providing more financial resources for household consumption, they can allocate remittances to the consumption of informal sector goods. Second, remittances can be used as a minimum capital to start a small business or facilitate the accumulation of capital in the informal economy, thus increasing the size of the informal economy (Woodruff and Zenteno, 2007; Yang, 2008; Posso, 2012). Third, the possibility of Dutch Disease phenomenon. Remittances can appreciate the real exchange rate in the host economies, which in return leads to a contraction in GDP and therefore generate an expansion of the share of informal production.

To the best of our knowledge, the only serious empirical study that focusses particularly on the effect of remittances on the informal economy is that of Chatterjee and Turnovsky (2018). These authors analyse the relationship between remittances and the informal economy at micro-level in 56 developing countries for the period 1990-2014. By using a general equilibrium framework, authors found that under certain conditions, such as Dutch Disease effect, remittances are associated with an expansion of the informal sector. Other studies were more interested in analysing the impact of remittances on self-employment and the informal work (Shapiro and Mandelman, 2016; Posso, 2012), without however, directly measuring the impact of remittances on the informal economy. This paper is related to Chatterjee and Turnovsky (2018) and analyses, at the macro level, the effects of remittances on the size of the informal economy in 30 Sub-Saharan African countries for the period 1991-2015. The results show that remittances increase the size of the informal economy.

The rest of this paper is organized as follows. Section 2 describes the data and methodology. Section 3 presents and analyses the results. Section 4 concludes.

2 Data and methodology

2.1 Data

This paper employs panel data for 30 Sub-Saharan African countries over the period 1991−2015 to investigate the effect of remittances on the size of the informal economy. This provides us with a number of observation equal to N*T=750 where N is the number of countries (30) and T is the number of years (25). The full description of the data is as follows:

Table 1: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Remittances*	750	-.056812	1.759595	-8.534034	3.450097
Informal economy*	750	3.679343	.2348088	2.956471	4.235265
GDP per capita growth	750	1.548275	6.399954	-33.88099	91.64805
Inflation*	723	3.862318	.8009428	-12.52353	10.10426
Population growth*	750	2.686601	.8120413	-1.8388	7.849706
Government stability	750	7.905556	2.052323	1	11.0833
Financial development*	750	2.410591	.8109008	-.8907295	4.431439
Human capital*	749	4.481013	.3166808	3.314329	5.025534
Corruption Control	750	2.301611	.9398077	0	5
Socio economic conditions	750	3.675833	1.498526	.5	8

Note: * Variable expressed in logarithms.

Table 2: Correlation matrix

	IS	Remit	GDPPg	Inflation	PopG	Govstab	Credit	HK	Corruption	Socioecoc
IS	1.0000									
Remit	0.0967	1.0000								
GDPPg	-0.1137	0.0558	1.0000							
Inflation	0.1603	-0.1028	-0.0946	1.0000						
PopG	0.0008	0.0735	0.1133	-0.0560	1.0000					
Govstab	-0.1446	0.0150	0.1461	-0.1698	0.0713	1.0000				
Credit	-0.1474	0.0535	0.0075	-0.0708	-0.2134	0.0207	1.0000			
HK	-0.1654	-0.2193	0.0202	-0.0054	-0.1433	0.1992	0.2116	1.0000		
Corruption	0.0840	-0.1918	-0.0614	0.0070	0.0744	-0.1030	0.1165	0.0261	1.0000	
Socioecoc	-0.0103	-0.1650	-0.0884	-0.0438	-0.0679	-0.0914	0.2004	-0.0757	0.5085	1.0000

Note: IS: The informal economy. Remit: remittances. GDPPg: GDP per capita growthPopG: population growth rate. Govstab: government stability. HK: human capital. Corruption: corruption control. Socioecoc: socio economic conditions. Credit: financial development.

The dependent variable is the size of the informal economy. This variable is obtained directly from Medina and Schneider (2017). These authors applied the Multiple Indicators Multiple Causes (MIMIC) modelling approach to estimate the size of the informal economy as a percentage of GDP. Our main independent variable is remittances received as a percentage of GDP. This variable is gathered from the World Bank: African Development indicators. Next to

remittances variable, we include eight control variables, generally considered in the literature as determinants of the informal economy: (i) GDP per capita growth; (ii) Inflation rate; (iii) population growth rate; (iv) Government stability; (v) Financial development measured by the credit to private sector; (vi) Human Capital; (vii) Corruption and (viii) Socio-economic conditions. A detailed description of all the variables is presented in the Appendix. Table 1 and 2 present respectively the descriptive statistics and correlation matrix of the variable used in the analysis.

2.2Methodology

To investigate the relationship between remittances and the size of the informal economy in a panel of 30 Sub-Saharan African countries, we estimate the following model:

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

Where $Informal_{it}$ is the size of the informal economy for country i in period t, $Remittances_{it}$ is remittances received, X_{it} is a vector which includes all control variables, μ_i is an unobserved country-specific effect, v_t is time specific effect and ε_{it} is the error term.

We use different specifications and two estimation techniques to analyse the effect of remittances on the informal economy. We first use the Ordinary Least Square (OLS) estimator to estimation Equation (1). However, when the OLS technique is used to estimate this model, the estimated coefficients are inconsistent and likely to be biased since the lagged value of the informal economy is positively correlated with the omitted fixed effects. The presence of the lagged value of the informal economy in the Eq (1) puts our model inside the context of dynamic panel model. We then apply the System Generalized method of moment (GMM) proposed by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998). GMM is useful for several advantages. First, GMM estimator has been widely used to address the endogeneity problem that appears in panel data estimation (Arellano and Bover, 1995 and Blundell and Bond, 1998). Second, GMM estimator also consider the biases that appear due to country-specific effects. Third, GMM also avoids simultaneity or reverse causality problems. The consistency of the GMM estimator depends on two things: the validity of the assumption that the error term does not exhibit serial correlation (AR(2)) and the validity of the instruments (Hansen test).

3 Results

As a first step of our empirical analysis, we investigate the relationship between remittances and economic growth. The Results presented in Table 3 show that remittances have a positive and significant effect on economic growth in Sub-Saharan African countries. This result corroborates several studies in the literature (Kumar, 2013; Meyer and Shera, 2017).

In the second step we examine the impact of remittances on the size of the informal economy. The results from the estimations are presented in Table 4. We start with the standard OLS regressions reports in columns (1-3). columns (4-5) present system GMM regressions on annual data, while columns (6-7) present system GMM regressions for five years data average. All variables have been converted into a logarithmic form for the empirical estimation except for GDP per capita growth rate, corruption and socio-economic conditions.

The results of OLS regressions show a positive and strongly significant effect of remittances on the size of the informal economy. The estimate coefficients associated with remittances have a positive sign in all the three columns. For example, remittances in column

(1) suggest that a 1 percent increase in the remittances increases the size of the informal economy by 0.0174%. However, because results obtained by OLS regressions may be biased, this result cannot be generalised.

Tableau 3 : Remittances and economic growth

	Dependent variable : GDP per capita growth				
	(1)	(2)	(3)	(4)	(5)
Remittances	0.217**	0.212***	0.201**	0.185***	0.179***
	(0.0911)	(0.0747)	(0.0730)	(0.0659)	(0.0205)
Population		0.731*	0.735**	0.936***	1.286***
		(0.371)	(0.349)	(0.316)	(0.306)
Inflation rate		-0.252***	-0.245***	-0.197***	-0.0515
		(0.0735)	(0.0693)	(0.0430)	(0.0530)
Financial dev			0.205**	0.116**	0.210*
			(0.0781)	(0.0494)	(0.107)
Human capital				1.673***	1.919***
				(0.347)	(0.519)
Government stability					0.503***
					(0.0594)
Socio conditions					1.921***
					(0.206)
Corruption				-0.526***	
				(0.175)	
Lag of GDP per capita growth	-0.111***	-0.121***	-0.121***	-0.149***	-0.163***
	(0.0324)	(0.0353)	(0.0333)	(0.0166)	(0.0139)
Constant	2.005***	-4.783	-21.11***	-6.497***	-7.638**
	(0.311)	(3.479)	(6.985)	(1.468)	(3.220)
Fisher	10.67***	16.34***	22.21***	126.5***	60.05***
AR(1) test	0.01373	0.00518	0.00237	0.00549	0.00019
AR(2) test	0.114	0.127	0.140	0.168	0.134
Hansen test (p-value)	0.151	0.164	0.101	0.188	0.138
Countries	30	30	30	30	30
Instruments	9	17	21	29	29
Observations	720	695	695	695	695

Note: The standard errors are reported in parenthesis. The dependent variable is GDP per capita growth. Financial dev : Financial development. Socio conditions: socio-economic conditions.. ***,**,* indicate significance levels at 1%, 5% and 10% respectively.

Table 4 : Remittances and the informal economy

	Annual data					Five years average data	
	OLS			System GMM		System GMM	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Remittances	0.0174***	0.0150***	0.0145***	0.00458***	0.00453***	0.0227***	0.0250***
	(0.00499)	(0.00520)	(0.00523)	(0.00132)	(0.000946)	(0.00327)	(0.00341)
GDP per cap growth	-0.00422**	-0.00404**	-0.00423**	-0.00227***	-0.00256***	-0.00282*	-0.00214**
	(0.00172)	(0.00173)	(0.00172)	(0.000302)	(0.000318)	(0.00149)	(0.000983)
Inflation rate	0.0403***	0.0442***	0.0413***	0.00195***	0.00203***	0.0158***	0.0304***
	(0.0109)	(0.0109)	(0.0109)	(0.000410)	(0.000268)	(0.00344)	(0.00471)
Governement stability	-0.0126***	-0.00862*	-0.0103**	-0.00212**	-0.00156**	-0.00217	-0.00215
	(0.00437)	(0.00451)	(0.00447)	(0.000943)	(0.000608)	(0.00473)	(0.00361)
Population	0.00518	0.00345		0.000202		0.0126*	
	(0.0135)	(0.0133)		(0.00318)		(0.00666)	
Human capital		0.0981***	0.0727**	0.00371	0.00909	0.0749***	0.0412***
		(0.0290)	(0.0297)	(0.00411)	(0.00778)	(0.0146)	(0.0119)
Corruption		0.0246**		0.00238		0.0152**	
		(0.00955)		(0.00178)		(0.00571)	
Financial dev	-0.0441***		-0.0375***	-0.00425*	-0.00530***	-0.0160***	-0.0154**
	(0.0112)		(0.0115)	(0.00234)	(0.00188)	(0.00509)	(0.00608)
Socio conditions			0.00239		0.00161		0.000435
			(0.00606)		(0.00107)		(0.00461)
L.(informal economy)				0.939***	0.926***	0.919***	0.905***
				(0.0149)	(0.0110)	(0.0230)	(0.0162)
Constant	3.753***	3.978***	4.019***	0.252***	0.321***	-0.0662	0.0186
	(0.0781)	(0.146)	(0.141)	(0.0585)	(0.0709)	(0.0963)	(0.0832)
R-squared	0.081	0.084	0.089				
Fisher	10.51***	9.333***	9.970***	802.2***	2169***	1680***	2455***
AR(1) test				0.0142	0.0143	0.0401	0.0506
AR(2) test				0.560	0.579	0.102	0.158
Hansen test (p-value)				0.325	0.580	0.258	0.443
Countries				30	30	30	30
Instruments				28	29	28	29
Observations	723	722	722	695	695	119	119

Note: The standard errors are reported in parenthesis. The dependent variable is the size of the informal economy. Financial dev : Financial development. Socio conditions: socio-economic conditions.. ***,**,* indicate significance levels at 1%, 5% and 10% respectively.

The results presented in columns (4-5) confirm the previous findings. The coefficients associated with remittances remained positive and statistically significant. Meaning that remittances continue to affect the size of the informal economy positively and significantly at 1% level. This result is explained by the fact that migrant remittances provide sufficient liquidity for household consumption. In Sub-Saharan African countries, mostly, goods are 75% produced by the informal sector. The consequence is that, the production of the informal sector is increasing. These results are similar to those found by Posso (2012), which shows that migrant remittances lead to an increase in self-employment, which is a characteristic of the informal sector in African countries. However, the effect of remittances is low compared to that of GDP per capita on the size of the informal economy. For example, in column (4), if GDP per

capita growth increases by 1-unit, the informal economy decreases by 0.227% (0.00227 * 100), compared to the 0.00458% drop in the informal sector due to the 1% increase in remittances.

The results of the diagnostic tests suggest that all models are relatively well specified. The Hansen test does not reject the validity of instruments, and the absence of second order serial correlation is also not rejected. The number of instruments is less than the number of countries and, therefore, there is no instrument proliferation.

In columns (6) and (7), we use data over five years average instead of annual data as a robustness check. We divide the sample period 1991–2015 into 5 non-overlapping 5-year periods to avoid the influence of idiosyncratic economic dynamics at business cycle frequency, as well as to control for cyclical output movements. Results are quantitatively similar to those reported in columns (4-5). More specifically, all the coefficients associated with remittances are positive and statistically significant at 1% level. For example, the coefficient of remittances in column (6) is 0.0227; this implies that if remittances increase by 1%, the size of the informal economy will increase by 0.0227%. On the other hand, the coefficient of remittances, as shown in column (7) is still significant at the conventional levels. Therefore, the empirical results are robust to the alternative sample period.

In terms of post estimation for the robustness check, the diagnostic tests suggest that all models are well specified. The Hansen test and the serial correlation test (AR(2)) confirm that the moment's conditions cannot be rejected.

The control variables have the expected sign. Inflation and corruption have the expected positive correlation with the informal. Additionally, the growth rate and access to credit are negatively associated with the informal economy. This finding confirms that the lack of growth (Chen, 2012) and the higher cost of credit (Capasso and jappelli, 2013) increase the size of the informal economy. Moreover, education, corruption, socio-economic conditions and government expenditure are positively correlated to the informal economy.

4 Conclusion

Does remittances increase the size of the informal economy in Sub-Saharan African countries? To answer this important economic question, this paper investigates the relationship between remittances and the size of the informal economy using the annual data of 30 Sub-Saharan African countries over the period 1991–2015. Empirical evidence is based on Ordinary Least Squared (OLS) and system Generalized Method of Moments (GMM). The empirical findings suggest that remittances have a positive and statistically significant effect on the size of the informal economy. Our findings remain quantitatively important and robust when the dataset is divided into a five years average. This clearly suggests that higher level of remittances leads to a large informal sector.

Appendix

Table 5: The informal economy and economic growth

	Dependent variable : GDP per capita growth			
	(1)	(2)	(3)	(4)
Informal economy	-8.334***	-6.206**	-5.606***	-1.167
	(2.770)	(2.602)	(1.163)	(6.028)
Population growth	0.828**	0.993***	0.834***	1.494***
	(0.325)	(0.329)	(0.268)	(0.332)
Inflation rate	-0.235***	-0.240***	-0.219***	-0.167**
	(0.0536)	(0.0538)	(0.0353)	(0.0798)
Financial development		0.159		1.887***
		(0.135)		(0.302)
Human capital			1.242***	2.445***
			(0.344)	(0.0155)
Governement stability				0.438***
				(0.0580)
Socio conditions	1.335***			
	(0.237)			
Corruption			-0.587***	
			(0.142)	
Lag of GDP per capita growth	-0.122***	-0.108***	-0.140***	-0.132***
	(0.0365)	(0.0351)	(0.0131)	(0.0188)
Constant	11.78***	8.109*	3.394**	-68.51***
	(3.882)	(4.096)	(1.627)	(15.54)
Fisher	21.83***	23.62***	90.24***	401.4***
AR(1) test	1.33e-05	7.52e-06	5.75e-05	8.87e-05
AR(2) test	0.107	0.161	0.165	0.129
Hansen test (p-value)	0.236	0.254	0.258	0.227
Countries	30	30	30	30
Instruments	20	21	29	29
Observations	695	695	695	695

Note: The standard errors are reported in parenthesis. The dependent variable is GDP per capita growth. Financial dev : Financial development. Socio conditions: socio-economic conditions.. ***,**,* indicate significance levels at 1%, 5% and 10% respectively.

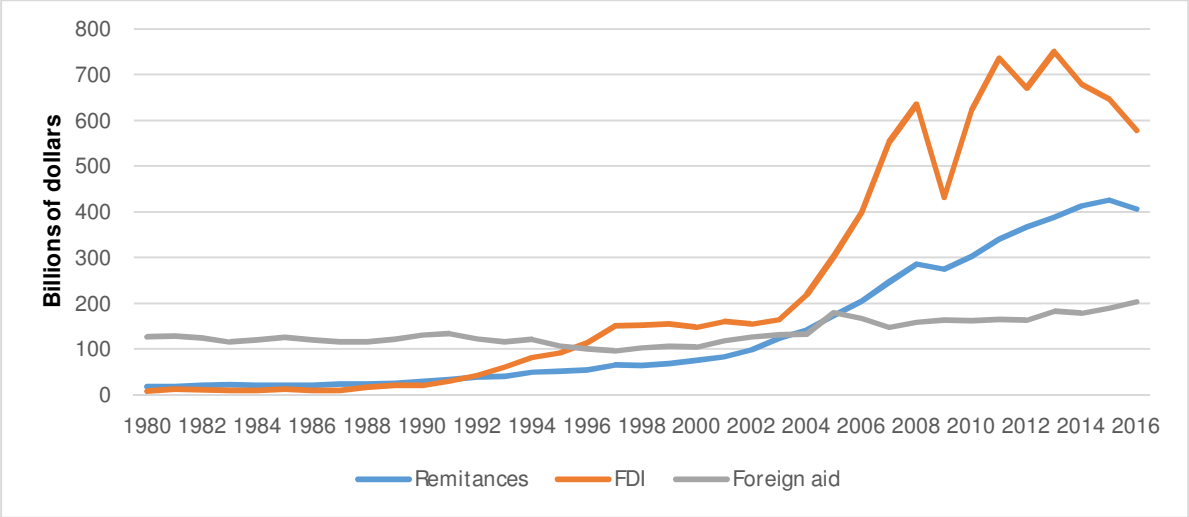
Table 6: Definitions of variables

Variables	Variables Definition (measurement)	Sources
GDP per capita growth	GDP per capita growth (annual %)	World Bank (WDI)
Remittances	Worker's remittances and compensation of employees, received (% of GDP)	World Bank (WDI)
Informal economy	Informal economy (% of GDP)	Medina and Schneider (2017
Inflation	Inflation, consumer prices (annual %)	World Bank (WDI)
Population	Population growth (annual %)	World Bank (WDI)
Financial development	Credit to private sector (% of GDP)	World Bank (WDI)
Human capital	School enrollment, primary (% gross)	World Bank (WDI)
Government stability	A measure of both of the government's ability to carry out its declared program(s), and its ability to stay in office.	ICRG
Corruption control	A measure of corruption within the political system that is a threat to foreign investment by distorting the economic and financial environment, reducing the efficiency of government and business by enabling people to assume positions of power through patronage rather than ability, and introducing inherent instability into the political process.	ICRG
Socio-economic conditions	A measure of the socioeconomic pressures at work in society that could constrain government action or fuel social dissatisfaction.	ICRG

Table 7: List of countries (30)

Angola	Guinea	Nigeria
Botswana	Guinea-Bissau	Senegal
Burkina Faso	Kenya	Sierra Leone
Cameroon	Liberia	South Africa
Congo, Rep	Madagascar	Sudan
Côte d'Ivoire	Malawi	Tanzania
Ethiopia	Mali	Togo
Gabon	Mozambique	Uganda
The Gambia	Namibia	Zambia
Ghana	Niger	Zimbabwe

Figure 1: Remittances, foreign aid and FDI, 1980-2016.



Source: World Development Indicator (2017) and authors' calculations.

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