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Shadow economy and educational systems in Africa

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Abstract

Using data from a sample of 30 countries over the period 2000-15, we find evidence that shadow economy is higher in countries where educational system is focused on general programs. This finding highlights the mismatch between the needs of the private sector in skilled workers and what the educational system offers in some countries. In addition, we show that vocational education negatively affects the size of the shadow economy, suggesting that it enhances students' opportunities of finding gainful employment in formal sector. We also find that shadow economy in Africa is related to financial development, public investment as well as demographic dividend. In terms of public implications, our findings call for the need for a balanced educational system between general and vocational education programmes in order to reduce the size of the shadow economy in Africa

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1. Introduction

According to a UN estimate, a quarter of the world's population will be African by 2050 (United Nations, 2015). This demographic growth already presents a real social and economic challenge for many countries and, therefore, calls for the implementation of several structural transformations. These reforms are all the more essential, since informal economy[1] is particularly high throughout Africa. The extent of informality represents an unweighted average of 38% on a continent-wide scale over the period 2000-15, as compared to 32% in emerging and developing countries outside Africa. A wide spread shadow economy is a major constraint to the social and economic outcomes, especially in Sub-Saharan African (SSA) countries, where it is particularly extensive and where the challenges for development are stronger than ever before with respect to the population projection in 2050 mentioned above. The informal sector has been regarded as a constraint to development mainly because it reduces the ability of governments to collect revenues which are indispensable in providing public goods and services. It also aggravates the already inefficient use of scarce financial resources, distorts investment and increases income inequality (Kodila-Tedika and Mutascu, 2014; Elbahnasawy et al., 2016).

The large size of informal economy in Africa can be interpreted as reflecting a weakness in private sector. It can also be analysed under the prism of a mismatch between the needs of the private sector in skilled workers and what the educational system offers in some countries. If this is the case, then it follows that is more relevant to assess the relationship between educational system and shadow economy.

The purpose of this study consists in establishing an empirical relationship between shadow economy and educational system. In particular, we investigate the impact of the general education versus vocational education on the size of shadow economy in 30 African over the period 2000-15. Our findings indicate that shadow economy has been higher in countries where educational system is focused on general programs. In addition, we find that vocational education negatively affects the size of the shadow economy, suggesting that vocational education enhances students' opportunities of finding gainful employment in the formal sector. We also find that shadow economy in Africa is related to financial development, public investment as well as demographic dividend, which is a reflection of growth potential generated by the youth bulge. In terms of public implications, our findings draw attention to the need for a more balanced educational system between general and vocational education in order to reduce the size of the shadow economy in Africa.

The remainder of the paper proceeds as follows. Section 2 provides a review of related literature. Section 3 describes data and empirical approach. The results are reported in Section 4, and Section 6 discusses the robustness checks. The final section concludes.

2. Literature review

The literature identifies several factors explaining informality. Their relative weights vary according to the features of each country. Referring to several studies, tax and social security contribution burdens are one of the main factors of the underground economy (e.g. Schneider and Enste, 2000; Djankov et al., 2010; Schneider et al., 2010; Goel and Nelson, 2016; Mitra,

[1] Buehn and Schneider (2012a) define the informal sector as all market-based legal production of good and services that escape inclusion in official account. As discussed in Dell'anno (2016), based on this definition, the informal, shadow, hidden, unofficial are often used synonymously with terms such as economy, market or GDP.

2017). For instance, Schneider et al. (2010) point out that the incentive to work in the informal sector depends on the difference between the cost of labour in the official sector and the after-tax income from work. The wider the gap is, the more economic agents will prefer to shift to the informal sector and avoid the formal one. Some studies also single out the institutional framework (bureaucracy, rule of law, corruption, political environment and legal system) as a key factor of the shadow economy (e.g. Dabla-Norris et al., 2008; Dreher et al., 2009; Buehn and Schneider, 2012b; Buehn et al., 2013; Goel and Saunoris, 2014a,b; Elbahnasawy et al., 2016). Dreher et al. (2009) investigated the relationship between unofficial economy and institutional framework. More precisely, they have shown that an improvement in the institutional quality reduces the shadow economy and impacts the corruption market.[2] In addition, Globalization[3] is also considered as a mitigating factor of the volume of the informal sector. In this respect, Schneider and Enste (2000) argue that policies aimed to promote greater economic integration, such as eliminating trade restrictions may generate incentives for economic agents to migrate from the informal to the formal sector. More recently, Berdiev and Saunoris (2018) found out that globalization has a significant influence in reducing shadow economy. In particular, they demonstrated that political globalization (such as the dissemination of sound government policies, policies to fight corruption, etc.) has a much greater weight than economic and social aspects of globalization.[4] Moreover, economic conditions play a crucial role in giving incentives to economic agents to work, or disincentives not to, in the underground economy. For instance, in periods of economic boom individuals and firms can easily migrate from the informal to the formal sector to seize the opportunities offered by the formal sector. In periods of recession, many economic agents try to compensate their income losses from the formal sector through informal activities (Schneider, 2005). La porta and Shleifer (2014) also highlight that the more a country develops the smaller of the informal sector size. Other studies have also shown that an improvement in the development of the financial sector is associated with a smaller informal sector (e.g. Blackburn et al., 2012; Bose et al., 2012; Capasso and Jappelli, 2013 and, Berdiev and Saunoris, 2016).

The studies focusing on the relationship between shadow economy and the human capital are scarce. Buehn and Farzanegan (2013) examined the effect of education on the informal sector for more than 80 countries from 1999 to 2007. The authors found that higher levels of participation in education tend to lower informality activities only in an environment characterized by institutional framework of high quality. On this part, Berrittella (2015) looked at the impact of public education spending on shadow economy using a cross-country analysis. The results show that public policies which increase expenditure on education reduce the size of the shadow economy. To the best of our knowledge, there are no studies on the relationship between informality and education in Africa. This paper aims to contribute to this issue by analysing the impact of secondary education - especially educational systems, on shadow economy in Africa.

[2] See also Choi and Thum (2005), Dreher and Schneider (2010), Cooray et al. (2017).
[3] Globalization is a generic term used to describe social, economic (trade and financial), cultural, environmental and political globalization aspects.
[4] See also Elgin (2013) and Pham (2017).

3. Methodology

3.1. Data

The purpose of our study is to examine the relationship between education and informal economy in Africa over the period 2000-15. The study covers 30 African countries.[5] To this end, we use three educational variables: secondary education, vocational education and general education. Data on education are drawn from the UNESCO-education database. Secondary education refers to the number of individuals enrolled in secondary education programs, regardless of age, divided by the population of the age group that officially corresponds to the same level. General education is measured as a percentage of students in secondary education enrolled in general programmes. This is an educational system designed to develop learners' general knowledge, without necessarily preparing them for a particular job or profession. Vocational education is measured as a percentage of students in secondary education enrolled in vocational programmes, which refers to an education designed for learners to acquire the knowledge, abilities and competencies specific to a particular profession or class of occupations or trade. Based on Glewwe and Kremer (2006) as well as Buehn and Farzanegan (2013), we prefer to focus our analysis on secondary education because it is more appropriate than tertiary education in developing countries. In particular, the population covered by secondary education is larger than that covered by tertiary education.[6] These two variables can therefore be interpreted as a decomposition of secondary education. Table A1 (in appendices) provides information for the sample countries. The average secondary school enrolment represents 45% over the period 2000-2015. The best-performing countries in this field are South Africa with an average enrolment rate of 91%, Mauritius (88%) and Cape Verde (86%). The worst performing are Mozambique (20%), Chad (19%) and Niger (12%). The data also show that education systems in Africa are mainly oriented towards general education. The average share of general programmes in the secondary education is 93% as opposed to 7% for vocational programmes.

The estimation of the size of the informal sector remains a source of controversies within the academic literature. This is mainly due to the difficulty in providing a clear definition of the informal sector as well as the lack of a proper approach to measure it. However, several studies have attempted to estimate its size, including Medina and Schneider (2018), Buehn and Schneider (2012b), Elgin and Öztunali (2012) and Alm and Embaye (2013). In this paper, we adopt the approach suggested by Medina and Schneider (2018), and Buehn and Schneider (2012b), which define the informal sector as an all market-based legal production of good and services that escapes inclusion in the official account. This definition is also adopted by Elgin and Öztunali (2012) but differs from one by Alm and Embaye (2013) who include illegal production in their definition of the informal sector. The estimates of the size of the informal economy as a percentage of GDP are collected from Medina and Schneider (2018). These estimates are derived from a Multiple Indicators, Multiple Causes (MIMIC) approach. The MIMIC model, which is a particular type of strucutural equation model (SEM), consists in using associations between different observable causes and impacts of an observed variable (shadow economy in the present case), to estimate the variable itself. Based on these estimates, within our sample of 30 African countries, covering the period 2000-15, the average size of the informal economy as a percentage of the GDP is 35%, with slight disparities between regions (39% in West Africa, 35% in East Africa, 34% in Central Africa, 33% in Southern Africa and 31% in North Africa).

[5] Our initial sample covers 47 countries. 17 countries were excluded from our sample mainly due to the poor quality of education data

[6] There is also data challenges for tertiary education.

3.2. Empirical approach

In order to examine the impact of education (and education systems) on the shadow economy, we estimate the following model:

$$\boldsymbol{shadow_{it} = \alpha_0 + \alpha_1 Educ_{it} + \beta X_{it} + \alpha_i + \alpha_t + \varepsilon_{it}} \quad (1)$$

where the subscripts denote the country i and the time period t. α_i denotes country fixed effects and α_t time fixed effects. The dependent variable ($shadow_{it}$) is the shadow economy expressed as a percentage of GDP. $Educ_{it}$ denotes our three interest variables, namely secondary education, vocational education and general education. X_{it} is a vector of control variables including financial development, public investment, GDP per capita, institutional framework, social globalization index, demographic dividend, total tax rate.[7] Summary statistics are reported in Table 1.

Table 1: Summary statistics for the regression variables

Variable	Unit	Obs.	Mean	Std. Dev.	min	max
Shadow economy	Percentage	357	34	6.67	19.2	55.5
Secondary education	Percentage	357	44.75	26.17	6.11	102.75
Vocational education	Percentage	357	7.28	7.38	0.00	45.23
General education	Percentage	357	92.72	7.38	54.77	100.00
Financial development	Percentage	357	24.74	21.96	1.97	106.26
Public investment	Percentage	357	22.59	7.88	3.95	59.72
GDP per capita	Logarithm	357	7.04	1.02	5.39	9.16
Institution	Index	357	0.61	0.29	0.05	1.00
Social globalization	index	357	40.58	14.01	15.86	73.30
Demographic dividend	Percentage	357	55.96	6.20	47.24	70.78
Total tax rate	Percentage	245	47.56	18.15	13.6	94.7

Notes: The sample period runs from 2000 to 2015. "Unit" denotes the measurement units of the regression variable. "Obs." denotes the number of observations for the respective variable. The last four columns show the mean, standard deviation, minimum and maximum.

As mentioned above, the choice to operate in the informal sector is driven by a wide of economic, financial and institutional motives. Low financial development (credit to private sector) and in particular poor access to credit may favour remaining in the informal sector (Blackburn et al., 2012; Bose et al., 2012). The attractiveness of the shadow economy may also influence by economic prosperity (GDP per capita) and the opportunities it creates in the formal sector (Schneider and Enste, 2000; La Porta and Shleifer, 2014; Goel and Nelson, 2016). Openness to social globalization (Pham, 2017; Berdiev and Saunoris, 2018), as well as institutional framework (Dabla-Norris et al., 2008; Dreher et al., 2009; Goel and Saunoris, 2014) may also drive the appetite for formal activities over informal one. Moreover, tax burden (total tax rate in percentage of profit) is also considered as one of the main motives for firms move to the underground sector (Goel and Nelson, 2016).

First, we estimate this model using the Ordinary Least Squares (OLS). However, this approach raises an important issue – that of endogeneity. This endogeneity problem may arise because education depends upon some macroeconomic factors, which if not included in the

[7] Data come from three databases including World Bank database (WDI), Polity4 and KOF Swiss Economic Institute.

model, would induce a correlation between education and the error term. In addition, a wide informal sector can also be interpreted as a reflection of a failing education system. This is a case of reverse causality. To deal with such an issue, we use a Two-Stage Least Squares (2SLS) estimation strategy. The lagged values (1 to 3 year) of education indicators are used as instruments (Buehn and Farzanegan. 2013).

4. Empirical results

As mentioned above, we first estimated our model using OLS. The regression results are reported in Table 2. These results show that secondary education enrollment in Africa positively affects the size of the informal sector (column 1 in Table 2). We then proceed to assessment effect of the educational system (column 2 and 3 in Table 2). The results highlight the opposite effect of education system on the size of informal economy. In particular, vocational education is associated with a lower size of informal sector, while general education is coupled with higher informal activities. The significant control variables have the signs expected in the literature.

In views of the limitations of the OLS estimation strategy (omitted variable bias, reverse causality and measurement error), we prefer to lean on the results from the instrumental variables estimation approach (2SLS). Table 3 presents the results obtained by using 2SLS estimation. We proceed through the same steps as before and reached to the similar findings.

Secondary education in Africa is significantly (at 1% level) associated with a larger size of informal activities. The 2SLS method also confirms the opposite effect of secondary education on shadow economy depending on the educational system preferred by the country. Vocational (general) oriented education system negatively (positively) affects the size of the informal sector. The positive effect of secondary education on the informal sector therefore could be explained by the pre-eminence of general education over vocational education. This finding highlights the mismatch between the needs of the private sector in skilled workers and what the educational system offers in some countries. African economies would do well to balance their education systems through the promotion of vocational education, which, as our results show (columns 9 and 10, Table 3), helps reduce the size of the informal sector.

All our significant control variables have the signs expected in literature. Financial development negatively impacts the spread of informal activities. This result confirms the role played by financial institutions in the process of business formalization. Informal activities are, by definition, associated with the lack of transparency. However, in order to qualify for a loan, firms or individuals must necessarily disclose information about their assets or income (Bose et al, 2012; Capasso and Jappelli, 2013).

Table 2: Results for baseline model

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS					
Secondary education	0.057**	0.103***				
	(0.025)	(0.032)				
Vocational program			-0.080**	-0.105**		
			(0.034)	(0.044)		
General program					0.080**	0.105**
					(0.034)	(0.044)
Financial development	-0.071***	-0.078***	-0.063***	-0.078***	-0.063***	-0.078***
	(0.017)	(0.024)	(0.018)	(0.024)	(0.018)	(0.024)
Public investment	-0.072***	-0.133***	-0.097***	-0.175***	-0.097***	-0.175***

	(0.027)	(0.033)	(0.028)	(0.035)	(0.028)	(0.035)
GDP per capita	-2.435***	-3.619***	-1.517***	-2.104***	-1.517***	-2.104***
	(0.595)	(0.647)	(0.484)	(0.539)	(0.484)	(0.539)
Institutions	-1.640	-3.028**	-1.175	-1.495	-1.175	-1.495
	(0.996)	(1.240)	(0.933)	(1.119)	(0.933)	(1.119)
Social globalization	0.007	0.118**	-0.029	0.077	-0.029	0.077
	(0.042)	(0.059)	(0.043)	(0.061)	(0.043)	(0.061)
Demographic dividend	-0.342***	-0.443***	-0.200**	-0.197*	-0.200**	-0.197*
	(0.103)	(0.133)	(0.086)	(0.106)	(0.086)	(0.106)
Total tax rate		0.019***		0.024***		0.024***
		(0.005)		(0.007)		(0.007)
Constant	76.00***	81.97***	65.86***	63.69***	57.85***	53.15***
	(5.948)	(7.298)	(3.947)	(4.534)	(5.320)	(6.689)
Time fixed effects	YES	YES	YES	YES	YES	YES
Obs.	357	245	357	245	357	245
Number of Countries	30	30	30	30	30	30
R^2	0.529	0.545	0.529	0.537	0.529	0.537
Adj. R^2	0.498	0.509	0.497	0.500	0.497	0.500

Notes: The sample goes from 2000 to 2015. Robust standard errors are reported in brackets. (***, **, *) indicate statistical significance at the 1 %, 5 % and 10 % level.

Both public investment and institutional framework[8] also play a role in reducing the informal sector in Africa. Both variables are significant at 1% level. In particular, the results indicate that improvement in the quality of political institutions is accompanied by a decrease in the size of the informal sector. Corruption market is weak in this context. Policy makers also seem more willing to implement reforms or regulations in favour of private sector development. Tax rate is significant and positively impacts informality at 1 % level. This suggests higher taxes promote the spread of the shadow economy.

Finally, we examine the effect of demographic dividend on shadow economy. We measure demographic dividend by the proportion of adults aged 15 to 64 as a percentage of the total of population. It corresponds on average to 56%, ranging from 47 to 71% over the period 2000-15. This variable allows us to capture the growth potential generated by changing the age structure of a country. This growth potential is due to the strong representativeness of the young population. It can also be interpreted as the availability of workforce. According to our results, demographic dividend negatively impacts informal economy in Africa. Young and dynamic, the African population, in addition to being an available labour force, represents an opportunity to be seized in view of the economic potential that characterizes it.

Table 3: Instrumental variables

	(7)	(8)	(9)	(10)	(11)	(12)
	2SLS					
Secondary education	0.082***	0.147***				
	(0.027)	(0.031)				
Vocational program			-0.111**	-0.137**		
			(0.056)	(0.070)		
General program					0.111**	0.137**
					(0.056)	(0.070)
Financial development	-0.040**	-0.045**	-0.038**	-0.048**	-0.038**	-0.048**
	(0.016)	(0.020)	(0.017)	(0.020)	(0.017)	(0.020)

[8] We use Polity2 index as an indicator of institutional framework. This index measures the quality of political institutions and runs from -10 (full dictatorship) to 10 (full democracy). This index is used in a re-scaled form from 0 to 1.

Public investment	-0.074***	-0.102***	-0.094***	-0.133***	-0.094***	-0.133***
	(0.026)	(0.028)	(0.026)	(0.032)	(0.026)	(0.032)
GDP per capita	-3.002***	-4.082***	-1.902***	-2.518***	-1.902***	-2.518***
	(0.705)	(0.685)	(0.550)	(0.558)	(0.550)	(0.558)
Institution	-3.860***	-5.729***	-3.877***	-4.623***	-3.877***	-4.623***
	(1.057)	(1.203)	(0.878)	(1.030)	(0.878)	(1.030)
Social globalization	0.010	0.100*	0.014	0.104*	0.014	0.104*
	(0.043)	(0.055)	(0.042)	(0.058)	(0.042)	(0.058)
Demographic dividend	-0.458***	-0.594***	-0.291***	-0.247**	-0.291***	-0.247**
	(0.089)	(0.102)	(0.085)	(0.101)	(0.085)	(0.101)
Total tax rate		0.017***		0.018**		0.018**
		(0.007)		(0.009)		(0.009)
Constant	86.41***	92.39***	72.81***	69.18***	61.66***	55.49***
	(5.862)	(6.006)	(3.504)	(3.565)	(7.026)	(8.421)
Time fixed effects	YES	YES	YES	YES	YES	YES
Obs.	266	190	246	181	246	181
Number of countries	30	30	30	30	30	30
(Centered) R^2	0.616	0.655	0.650	0.653	0.650	0.653
Over id. test: Hansen J test	0.764	3.088	0.336	1.411	0.336	1.411
Hansen J test (p-value)	0.683	0.214	0.845	0.494	0.845	0.494
Under id. test (p-value)	0.000	0.000	0.000	0.000	0.000	0.000

Notes: The sample goes from 2000 to 2015. Robust standard errors are reported in brackets. (***, **, *) indicate statistical significance at the 1 %, 5 % and 10 % level. The Hansen test evaluates the joint validity of instruments used. The under-identification test by Kleibergen and Paap (2006) indicates whether the equation is identified (i.e., that the instruments are correlated with the endogenous variable).

5. Robustness checks

In this section, we discuss the tests applied to assess further robustness of our regression results. To test whether the results are sensitive to the choice of control variables, we use alternative control variable including financial constraint indicator and government size. We use lending rate as a measure of financial access in order to capture the effect of firm's external financing constraint.[9] This is another aspect of financial development. A well-developed financial sector is usually associated with low external financing constraints (Beck and Demirguc-Kunt, 2006). We therefore expect a positive relationship between shadow economy and financial access. Government size index[10] captures changes in government spending and taxation. It used in the literature as a tax burden indicator (Schneider et al., 2010). In addition, it measures the crowding out effect of government decision-making on individual choices and economic freedom.

The results of robustness test are reported in Table 4. Our results remain valid in each specification used (columns 13 to 18, Table 4). The financial constraint indicator and government size positively affect shadow economy, confirming the above-mentioned adverse effects.

We also test whether our results are sensitive to the measure of the informal sector. For this purpose, we use the shadow economy estimates stem from the currency demand approach of Alm and Embaye (2013). In addition, since GDP is potentially correlated with the informal sector measure and school attainment, we run a set of regressions without GDP as a control variable. The results are reported in Table A2 (in appendices). We reach to the same findings as before.

[9] Data are collected from a World Bank database (WDI).
[10] Data come from Fraser Institute.

Table 4: Robustness checks

	(13)	(14)	(15)	(16)	(17)	(18)
	2SLS					
Secondary education	0.056**	0.086***				
	(0.025)	(0.023)				
Vocational program			-0.089*	-0.064*		
			(0.053)	(0.034)		
General program					0.089*	0.064*
					(0.053)	(0.034)
Financial development	-0.058***		-0.052***		-0.052***	
	(0.016)		(0.020)		(0.020)	
Public investment	-0.045	0.013	-0.100***	-0.004	-0.100***	-0.004
	(0.029)	(0.032)	(0.036)	(0.033)	(0.036)	(0.033)
GDP per capita	-1.760**	-1.275***	-0.405	0.005	-0.405	0.005
	(0.792)	(0.394)	(0.665)	(0.348)	(0.665)	(0.348)
Institution	-1.060	-6.632***	-1.167	-5.743***	-1.167	-5.743***
	(1.630)	(1.017)	(1.619)	(0.976)	(1.619)	(0.976)
Social globalization	-0.122**	-0.090**	-0.174***	-0.060	-0.174***	-0.060
	(0.053)	(0.045)	(0.061)	(0.051)	(0.061)	(0.051)
Demographic dividend	-0.289**	-0.676***	-0.130	-0.562***	-0.130	-0.562***
	(0.124)	(0.074)	(0.142)	(0.087)	(0.142)	(0.087)
Government size	0.807***		0.877***		0.877***	
	(0.212)		(0.232)		(0.232)	
Financial constraint		0.084***		0.097***		0.097***
		(0.016)		(0.019)		(0.019)
Constant	62.00***	80.54***	46.38***	67.93***	37.52***	61.53***
	(6.823)	(4.115)	(5.643)	(3.993)	(7.731)	(5.936)
Time Fixed Effects	Yes	Yes	No	Yes	No	Yes
Regional Fixed Effects	Yes	Yes	Yes	Yes	Yes	No
Obs.	273	218	221	202	221	202
Number of countries	30	30	30	30	30	30
(Centered) R^2	0.681	0.780	0.672	0.784	0.672	0.784
Over id. test: Hansen J-test	0.237	0.098	1.695	1.164	1.695	1.164
Hansen J-test (p-value)	0.626	0.754	0.429	0.281	0.429	0.281
Under id. test (p-value)	0.000	0.000	0.000	0.000	0.000	0.000

Notes: The sample goes from 2000 to 2015. Robust standard errors are reported in brackets. (***, **, *) indicate significance at the 1%, 5% and 10% level. The Hansen test evaluates the joint validity of instruments used. The under-identification test by Kleibergen and Paap (2006) indicates whether is identified (i.e., that the instruments are correlated with the endogenous variable).

6. Conclusion and policy implications

This paper has empirically examined the impacts of secondary education – disaggregated into vocational and general education, on the size of the informal sector in African countries. This question is more relevant in view of the demographic challenges facing African economies in the future. Furthermore, studies focusing on the relationship between education and shadow economy are scarce.

Using data from a sample of 30 countries over the period 2000-15, we find evidence that shadow economy has been higher in countries where the educational system is focused on general educational programs. This finding highlights the mismatch between the needs of the private sector in skilled workers and what educational systems offer in some countries. In addition, we find that vocational education negatively affects the size of shadow economy, suggesting that vocational education enhances students' opportunities of finding gainful and

qualified employment in formal sector. We also find that shadow economy in Africa is also related to financial development, public investment as well as demographic dividend.

In terms of public implications, our findings point to the need for a balanced educational system between general and vocational education in order to reduce the size of the shadow economy in Africa. An increase in public investment as well as public awareness would be required in view of apprehensions usually expressed about the vocational education. Considering the challenges ahead (e.g. strong demographic growth, digitalization of the economy, climate shocks, etc.), African countries should rethink their educational systems. Educational systems should be focused on professions of the future and not on those of the past. Furthermore, educational systems should be able to offer appropriate vocational training opportunities that match the demand for skilled employment in the formal sector. A well-educated population will always know how to turn challenges into opportunities. It will also be able to cope with the rapid changes in the world.

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Appendices

Table A1: List of countries

Country	Shadow economy (% of GDP)	Secondary education	General education	Vocational education
Algeria	27.82	79.20	90.97	9.03
Angola	41.13	19.87	67.37	32.63
Benin	51.05	38.59	93.81	6.19
Botswana	30.23	79.51	93.93	6.07
Burkina Faso	35.48	19.68	94.06	5.94
Burundi	37.96	22.00	93.78	6.22
Cameroon	30.95	40.05	80.17	19.83
Cape Verde	29.87	86.37	97.24	2.76
Chad	36.63	18.72	98.47	1.53
Congo. Dem. Rep.	44.85	42.10	80.99	19.01
Egypt	34.05	78.93	75.17	24.83
Eritrea	40.91	30.80	99.15	0.85
Ghana	41.32	46.46	97.67	2.33
Guinea	38.51	22.82	98.68	1.32
Kenya	34.01	47.56	99.28	0.72
Lesotho	28.55	49.79	96.87	3.13
Madagascar	42.94	31.59	97.05	2.95
Malawi	37.62	31.55	100.00	0.00
Mali	35.73	32.70	88.23	11.77
Mauritania	28.64	21.85	97.92	2.08
Mauritius	21.14	88.43	88.98	11.02
Morocco	32.47	53.20	93.99	6.01
Mozambique	33.89	19.64	92.28	7.72
Niger	38.94	11.82	96.05	3.95
Rwanda	33.71	24.98	82.60	17.40
Senegal	39.02	31.76	96.44	3.56
South Africa	24.11	91.44	94.47	5.53
Swaziland	38.41	52.89	99.71	0.29
Togo	37.24	42.25	93.86	6.14
Tunisia	32.92	85.51	91.46	8.54
Average	**35.00**	**44.75**	**92.72**	**7.28**

Notes: This table provides information for the sample countries. Data are expressed as average over the period 2000-15.
Sources: Medina and Schneider (2018), UNESCO-education database and authors' calculations.

Table A2: Robustness check

	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)
	2SLS			2SLS					
	Medina and Schneider (2018) database			Alm and Embaye (2013) database					
Secondary education	0.038*			0.158**			0.147**		
	(0.021)			(0.077)			(0.073)		
Vocational education		-0.090***			-0.237**				-0.242**
		(0.034)			(0.115)				(0.094)
General education			0.090***			0.237**		0.242**	
			(0.034)			(0.115)		(0.094)	
Control variables	YES	YES	YES	YES	YES	YES	YES	YES	YES
Without GDP	YES	YES	YES	YES	YES	YES	NO	NO	NO
Obs.	300	285	285	80	73	73	80	73	73
Number of countries.	30	30	30	16	16	16	16	16	16
(Centered) R^2	0.680	0.660	0.660	0.477	0.531	0.531	0.217	0.418	0.418
Over id test: Hansen J-test	0.009	0.339	0.339	0.604	0.597	0.597	0.118	0.414	0.414
Hansen J-test (p-value)	0.922	0.560	0.560	0.437	0.440	0.440	0.731	0.520	0.520
Under id test (p-value)	0.000	0.000	0.000	0.000	0.005	0.005	0.000	0.002	0.002

Notes: The sample goes from 2000 to 2015 for the Medina and Schneider (2018) database, and from 2000 to 2006 for the Alm and Embaye (2013) databases. Robust standard errors are reported in brackets. Unreported constant included. Time and regional fixed effects are included. (***, **, *) indicate significance at the 1%, 5% and 10% level. The Hansen test evaluates the joint validity of instruments used. The under-identification test by Kleibergen and Paap (2006) indicates whether the equation is identified (i.e., that the instruments are correlated with the endogenous variable).