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DOES GOVERNMENT SIZE MODERATE FINANCE-GROWTH NEXUS IN SUB-SAHARAN AFRICA?

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Abstract

We ask how government size impacts the relationship between financial development and economic growth for Sub-Saharan African countries during 1980-2014 period. The empirical strategy relies on panel data techniques of panel smooth transition regression (PSTR) and dynamic GMM approaches to test for non-linearities in finance-growth nexus and endogenously model the non-linearity to depend on government size. Preliminary results from the dynamic panel model show that finance-growth nexus is non-linear. Upon delving further into the non-linearities, our results show that financial development impacts economic growth positively only beyond a necessary threshold level of government expenditure share of 12 percent of GDP. Given the large informal sector and the pervasive market failures in Sub-Saharan African economies, governments need a minimum threshold level of expenditure to "correct" the credit markets and "formalize" the large informal financial sector. Therefore, Sub-Saharan African countries should not shy away from government expenditures that are meant to "correct" market failures in the financial sector or "formalize" the large informal financial sector to make finance work for economic growth.

Keywords: Financial development, growth, non-linearity, government size, PSTR, System GMM, Sub-Saharan Africa

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SAHRA - ALTI AFRİKADA KAMU SEKTÖRÜNÜN BÜYÜKLÜĞÜ FİNANS - BÜYÜME İLİŞKİNDE ETKİLİ Mİ?

Özet

Bu çalışmada, Sahra-altı Afrika ülkelerinde kamu sektörünün büyüklüğünün finansal gelişmişlik ve ekonomik büyüme ilişkisini nasıl etkilediği analiz edilmektedir. Finansal gelişmişlik-ekonomik büyüme ilişkisinin doğrusallığı ve kamu sektörü büyüklüğünün bu ilişkideki rolü PSTR yöntemi ve dinamik panel GMM yöntemleri kullanılarak 1980-2014 dönemini için incelenmiştir. Sonuçlar finansal gelişmişlik-ekonomik büyüme ilişkisinin doğrusal olmadığını ve kamu sektörünün büyüklüğünün GSYH'ye oranının yüzde 12 eşik değerinden yüksek olduğu durumlarda finansal gelişmişliğin ekonomik büyüme üzerinde pozitif bir etkiye sahip olduğunu göstermektedir. Sahra-altı Afrika ülkelerinde yüksek kayıtdışılık ve yaygın piyasa aksaklıkları bulunmaktadır. Kredi piyasasındaki aksaklıkların giderilmesi ve kayıtdışılık oranın yüksek olduğu finansal sektörün kayıt altına alınabilmesi için asgari bir düzeyde kamu harcamasına ihtiyaç vardır. Dolayısıyla, finansal sektörün ekonomik büyümeyi destekler bir mahiyete kavuşabilmesi için Sahra-altı Afrika ülkelerinde kamu, piyasa aksaklıklarını düzeltici ve kayıtdışılığı azaltıcı harcama yapmaktan çekinmemelidir.

Anahtar kelimeler: Finansal gelişmişlik, doğrusal olmayan, kamu sektörünün büyüklüğü, PSTR, Sistem GMM, Sahra-altı Afrika

Introduction

The role of the financial sector in the economic growth process has been the subject of much academic research. While some trivializes the role of finance in economic growth (Lucas, 1988), others hold the view that it is economic growth that triggers financial sector development (Robinson, 1952). However, today the dominant view is that financial sector development exerts a first order positive impact on the economic growth (King and Levine, 1993; Miller, 1998; Levine 1997, 2005). Miller (1998) argued that "that financial markets contribute to economic growth is a proposition too obvious for serious discussion". Financial institutions, markets and instruments that ameliorate market frictions increase savings rates, technological innovation and capital accumulation through investment, and hence long run economic growth.

Recently, direct first order linear finance-growth nexus has been call to question with the introduction of models exhibiting multiple equilibria (Berthélemy and Varoudakis, 1996; Aghion et al, 2004; Deidda and Fattouh, 2002) while the role of possible mediating variables is a subject of active research. Deidda and Fattouh (2002), using a simple overlapping generation model with risk averse agents and costly financial transaction, show that financial development impacts growth ambiguously at low levels of development, but as development continues finance impacts growth positively. In line with multiple equilibria finance-growth models, empirical studies seek to uncover such non-linearities and mediating variable upon which they rely.

One such mechanism via which finance impact on economic growth is the size of government. A very large government may crowd out the private sector and hamper productive investment. However small government may not be enough to make the necessary public investment to spur private sector growth, especially in regions such as Sub-Saharan Africa (SSA) where market failures and the share of informal sector are significant. Consistently, Demetriades and Rousseau (2010) finds that government expenditure has positive impact on financial development of countries in middle-position of economic development, negative impact on the wealthiest countries, and little effect on poor countries. Yilmazkuday (2011), using a rolling regression approach finds that in the context of finance-growth nexus, optimal government size is between 11 and 19 % of GDP.

The evidence on the impact of financial sector development on economic growth in Sub-African Africa is mixed. Rousseau and D'onofrio (2013) studies 22 sub-Saharan African countries from 1960-2009 and finds that financial development, as measured by liquid liability, positively impacts growth and capital accumulation in two-third of the countries. In Xu (2000) about two-third of countries showing negative finance-growth elasticity are found in Africa, which comprise 60% of African countries in his sample. This observation is echoed in a survey article on the African and global evidence (Murinde, 2011). Since SSA countries are characterized by large informal sector and relatively high information asymmetries, this study seeks to examine the role of government expenditure in mediating the impact of financial development on economic growth in SSA. It contributes to the literature by (i) providing the SSA evidence on government expenditure role in finance-growth nexus and (ii) introducing the panel smooth transition regression (PSTR) modelling in uncovering government expenditure impact on finance-growth nexus.

The rest of the paper is organized as follows: Second section introduces data and methodology and the third section provides the estimations results. The fourth section discuss the results and last section concludes.

Data and Methodology

To examine the mediating role of government size on finance-growth nexus we specify the following two-regime PSTR model.

$$Growth_{it} = \mu_i + \beta_0 FD_{it-1}(q_{it-1} < \gamma, c) + \beta_1 FD_{it-1}\Gamma(q_{it-1} > \gamma, c) + \varphi_0 X_{it-1}(q_{it-1} < \gamma, c) + \varphi_1 X_{it-1}\Gamma(q_{it-1} > \gamma, c) + \varepsilon_{it}$$

where $\Gamma(q_{it};\gamma,c)$ is the transition function, continuous and bounded between 0 and 1 depending on government size q_{it}, with a threshold value c and γ as the slope of the transition function. The transition function is a logistic function (Fok, Van Dijk, and Franses 2005; Gonzalez, Teräsvirta, and Van Dijk 2005) specified as follows:

$$\Gamma(q_{it}; c) = \frac{1}{1+\exp[-\gamma(q_{it},-c)]}$$

The PSTR modelling involves the following steps (Fouquau, Hurlin, and Rabaud 2008): (i) linearity test, (ii) test of no remaining linearity, (iii) PSTR parameter estimation and (iv) misspecification test. The linearity test tells whether there is any non-linear relationship; in our specific case non-linearity in finance growth nexus for SSA countries. The null hypothesis is a PSTR model with no threshold (linear model) and the alternative is a PSTR model with at least one threshold. Test statistics based on LM, Wald and the likelihood ratio tests are specified below:

$$LM_F = \frac{(SSR_0 - SSR_1)/K}{SSR_0/(TN - N - K)} \sim F(K, TN - N - K)$$

$$LM_w = \frac{NT(SSR_0 - SSR_1)}{SSR_0}$$

$$LR = -2[\log(SSR_1) - \log(SSR_0)]$$

Where SSR_0 denotes the sum ot squares residual under H_0 of linear panel model and SSR_1 is the sum of squares residual under (H_1) PSTR with atleast one threshold. The LM_F follows an F (K,TN-N-K) distribution, and LM_W and LR statistics follow a $\chi^2(K)$. The K degrees of freedom refers to the number of explanatory variables, while T and N are the number of periods and number of countries respectively. Once the veracity of a non-linear PSTR model is affirmed from above, the appropriate number of regimes is tested using the test of no remaining nonlinearity. This test is done sequentially until the appropriate number of thresholds is established. The estimation of the PSTR model which is done via non-linear least squares approach, while the misspecification tests involves the tests of no remaining heterogeneity and parameter constancy.

Data is sourced from World Bank's World Development Indicators (WDI) and the Global Financial Development Database (GFDD). Financial development is measured as deposit banks asset to deposit banks asset plus central bank's asset as in Levine et al (2000) and Jeude (2010). This measure of financial development is based on the premise that deposit money banks are better at mobilizing savings, identifying profitable investment opportunities and allocating resources to them, managing risk and monitoring managers than central

banks. The second indicator for financial development is private credit to GDP ratio, which has been widely used in the literature (Levine 2005). Human capital is measured by gross secondary school enrolment ratio, while trade openness is taken as the ratio of imports and exports (trade) to GDP. Inflation is percentage change in the consumer price index for the countries during the sample period, government size is given by the general government consumption expenditure as percentage of GDP.

Table 1: Data

Variable	Measure	Source
Financial Development	Banks' Asset to Central bank and deposit banks asset	GFD, World Bank
Financial Development	Private Credit to GDP ratio	GFD, World Bank
Economic Growth	GDP per capita growth	WDI
Human Capital	Secondary School enrollment	WDI
Investment	Gross fixed capital formation /GDP	WDI
Inflation	CPI	WDI
Trade Openness	Export+ Import / GDP	WDI
Government expenditure	Government Consumption Share of GDP	WDI

Results and Findings

The set of countries in the sample comprise of sixteen low income (16), twelve (12) lower middle income, five (5) upper middle income, and two (2) high income countries in sub-Saharan Africa (SSA) given in table A1 in the appendix. The summary statistics for the sample shows that the average real per capita income is less than two thousand dollars ($2000). Financial development measured by asset of deposit money banks as percentage of the sum of assets of deposit money banks and central bank (ASSET) is high (70%) in the region. The range of financial development in the range is wide, from a minimum of 29 % of GDP to almost 100% of GDP. Output per capita growth range from negative growth of 1.5% to as high as 12.3%, showing the wide heterogeneity in the sample. In addition, the level of economic development ranges from as low as a per capita income level of $262 to $10525 in the sample.

Table 2: Summary Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Per Capita GDP	36	1991.838	2584.457	262.2957	10525.22
Per Capita GDP Growth	36	1.52	2.39	-1.54	12.3
Human Capital	36	32.50272	20.50787	8.521499	87.89686
Openness	36	74.28356	41.97054	26.17647	247.7647
ASSET	36	70.20844	18.05684	29.8605	99.04439
PRIVATE	36	15.69021	12.19657	3.705884	58.87147

Following Doumbia (2015), we first present the result of dynamic panel model based on Arellano and Bover (1995) and Blundell and Bond (1997). In the estimation of the dynamic panel model, the sample dataset comprises twenty-six sub-Saharan African countries, taking non-overlapping five-year averages of GDP per capita growth, investment, human capital, financial development metrics, openness, general government consumption expenditure as percentage of GDP, and inflation. Due to lack of full data for a sizeable number of countries from 1960, we reduced our sample to 1980-2014.

Table 3: GMM Result (Basic Model)

VARIABLES	**Linear**		**Non-linear**	
	PRIVATE	ASSET	PRIVATE	ASSET
L_INCOME	0.139***	0.126***	0.153***	0.123***
	(-0.0134)	(-0.00516)	(-0.0175)	(-0.00527)
INVESTMENT	0.0266***	-0.0308***	0.0388***	-0.0342***
	(-0.00333)	(-0.00137)	(-0.00807)	(-0.00241)
HUMAN CAP.	0.117***	0.0174***	0.0875***	0.0283***
	(-0.0046)	(-0.00372)	(-0.015)	(-0.00408)
PRIVATE	0.0257***		-0.172***	
	(-0.00903)		(-0.0597)	
PRIVATE_SQ			0.0441***	
			(-0.0118)	
ASSET		0.290***		-2.724***
		-0.00401		(-0.264)
ASSET2				0.360***
				(-0.0313)
Constant	0.497***	-0.282***	0.847***	5.933***
	(-0.0871)	(-0.0306)	(-0.0533)	(-0.537)
Observations	92	90	92	90
Number of ID	25	25	25	25
Sargan	0.186	0.137	0.162	0.139
Hansen	0.428	0.495	0.354	0.64
D-Hansen	0.263	0.27	0.27	0.683

Robust standard errors in parenthesis.
*, **, *** indicate significance at 5%, 1% and 0.1% respectively.

Table 3 shows the results of a systems GMM estimation of models based on the two financial development indicators- ASSET and PRIVATE. The basic model comprise of investment (INVESTMENT), human capital (HUMAN CAP.) and financial development

(ASSET and PRIVATE), while the extended model further includes other growth covariates such as inflation, (INFLATION) government expenditure (GOVERNMENT) and openness (OPENESS) . The result indicates a consistent positive and significant association between financial development and growth measured by private credit ratio and banks' asset ratio in the basic and extended model. The same table shows that the relationship between financial development and economic growth is non-linear (albeit without testing for non-linearity). For all financial development metrics at low levels of financial development, the finance-growth association is negative, and the threshold level of financial development becomes positively related to economic growth. This result is consistent in the basic model and the extended model, though the first regime coefficients are insignificant in the extended model in Table 4.

Table 4: GMM Result (Extended Model)

VARIABLES	**Linear**		**Non-linear**	
	PRIVATE	ASSET	PRIVATE	ASSET
L_INCOME	-0.121*** (-0.0466)	-0.12*** (-0.00642)	-0.179*** (-0.0565)	-0.108*** (-0.00546)
INVESTMENT	0.0701 (-0.044)	-0.0612*** (-0.00952)	0.0338 (-0.0228)	-0.0614* (-0.0302)
HUMAN CAP.	0.139*** (-0.0155)	0.0396*** (-0.00857)	0.134*** (-0.0244)	0.0309 (-0.0203)
PRIVATE	0.00287 (-0.0263)		-0.119 (-0.173)	
PRIVATE2			0.0326 (-0.0397)	
ASSET		0.333*** (-0.0291)		-3.166*** (-1.105)
ASSET2				0.415*** (-0.129)
GOVERNMENT	-0.201*** (-0.0448)	-0.0688 (-0.0458)	-0.153*** (-0.0448)	-0.00221 (-0.0432)
INFLATION	-0.00028 (-0.0178)	-0.0316*** (-0.00902)	-0.0358** (-0.0145)	-0.0129 (-0.0228)
OPENESS	0.104** (-0.0462)	0.127*** (-0.0153)	0.148*** (-0.045)	0.0781 (-0.0467)
CONSTANT	0.367 (-0.33)	-0.693*** (-0.114)	0.792 (-0.58)	6.554** (-2.49)
Observations	90	87	90	87
Number of ID	25	25	25	25
Sargan	0.136	0.135	0.105	0.076
Hansen	0.754	0.655	0.64	0.946
D-Hansen	0.484	0.385	0.13	0.743

Robust standard errors in parenthesis.
*, **, *** indicate significance at 5%, 1% and 0.1% respectively.

Other growth covariates are mainly significant, though with varying effects. Human capital and openness are significantly positive in all specification, while inflation and government expenditure are significantly negative. Investment is significantly positive in the basic and extended models when financial development is measured as private credit ratio and assets ratio. Model diagnostics show that we cannot reject the validity of the instrument in the differenced equation (Hansen and Sargan) and in the levels equation (Difference-Hansen) for all the panel data models.

The non-linearity evidence uncovered here is based on an assumption that there is a non-linear relationship without doing any formal testing. Even if we could formally test for a non-linear relationship, we may still want to know the source of nonlinear relationship. These are questions that the GMM model cannot explain. So to answer these we turn to recent advances in panel data econometrics of panel smooth transition regression model (PSTR).

PSTR Results

What follows in this section shows the results for the panel smooth transition model- linearity test, test of number of regimes, estimation of PSTR, the evaluation of the model and the transition function based on the financial development measures and various transition functions. We report the test statistics based on LM-Chi- Square and LM F-version, but according to Gonzalez et al (2005) LM F-version has better small sample properties than the chi-square version.

Table 5: Linearity Test Result

	LM-Chi Square		**LM-Fisher**	
M	Test	p-Value	Test	p-Value
1	4.285	0.038	3.28	0.07
2	6.501	0.038	2.44	0.09
3	9.846	0.019	2.42	0.07

Table 6: Sequence of Homogeneity Test Result

	LM-Chi Square		**LM-Fisher**	
M	Test	p-Value	Test	p-Value
1	4.285	0.038	3.28	0.07
2	2.346	0.125	1.76	0.188

We test for non-linearity in the empirical model with government size as the threshold variable. The linearity test results reported in Table 5, shows that the null of linearity is rejected and Table 6 shows the sequence of homogeneity test. The test results indicate that we can content with only one transition function which is in line with Gonzalez (2005) that one transition function is usually enough for empirical examinations. In the misspecification tests in Table 8 indicate that our desired model of one threshold captures all heterogeneity in finance-growth nexus and that our parameters based on a one threshold model are

constant. In order words, model misspecification test results show that all non-linearities have been captured by our estimated models, and that parameter constancy cannot be rejected too.

The resulting PSTR specification is a model with one transition function (m=1) where the threshold variable is government size. The estimated model is presented below in Table 7.

Table 7: PSTR Results

VARIABLE	COEFFICIENT	STANDARD ERROR
	B0j	
INVESTMENT	0.14**	0.05
HUMAN CAP.	1.7*	0.960452
ASSET	-0.41***	0.058074
GOVERNEMTN	0.11***	0.011
OPENESS	0.092**	0.046
INFLATION	-0.022**	0.009016
	B0j +B1j	
ASSET	0.18***	0.034026
Gamma	31	91.17647
C	12***	0.17002
B1j	0.59***	0.041001

*, **, *** indicate significance at 10%, 5% and 1% respectively.

The parameters estimated from PSTR model, like Logit and Probit models, are not directly interpretable, but the signs are (Gonzalez et al, 2005). In all estimated models the sign of financial development significantly changes from negative to positive. Below a threshold value of 12 percent, the effect of financial development on growth is negative and above this threshold value the effect turns out be positive.

Table 8: Misspecification Test

	LM-Chi Square		LM-Fisher	
m/h	Test	p-Value	Test	p-Value
No Remaining heterogeneity				
1	12.40	0.08	1.19	0.32
2	17.42	0.23	0.72	0.73
Parameter Constancy				
1	7.614	0.36	0.73	0.64
2	16.900	0.26	0.7	0.75

The transition function indicates the movement from one regime (lower finance-growth) to another regime (higher finance-growth) based on the threshold variable (government size). In our case, a threshold value of government size of 12 percent of GDP is the threshold value.

Discussion

Theoretically, a moderate government size is needed to promote growth by providing essential services such as property rights, legal system, national defense and civil protection, for example through policing. However, large government size can encumber growth by crowding out productive investment from the private sector, but also small government size is not desirable in the sense that it hinders the provision of public goods such as property rights, infrastructure and efficient legal system. The empirical counterpart upholds this mixed government size-growth nexus. Moreover, in the context of finance literature Demetriades and Rousseau (2010) finds that government expenditure impact positively on financial development of countries in middle-position of economic development, negatively on the wealthiest countries, and little effect on poor countries. Yilmazkuday (2011), also in the context of finance-growth nexus shows that the optimal government size is on average between 11 percent and 19 percent of GDP. Our result mirrors Yilmazkuday (2011) that "optimal government size (% GDP) for the finance-growth nexus is between 11 and 19 percent; government sizes below 11 percent hurt the low-income countries, and those above 19 percent hurt the high-income countries" (p-15).

This paper focuses on Sub-Saharan African countries majority of which are low income countries with a sample average per capita income of $1991, and finds that government size moderates finance-growth nexus such that government expenditure share of GDP of 12 percent is necessary to make finance work for growth. Given that SSA largely comprise low income ($1991) countries, pervasive market failures abound and governments need to spend on "correcting" markets so that potential investor and capital owners are able to leverage the financial sector, while the essential expenditure on legal and institutional development is needed to assure potential investors that their property rights will be protected if they take credit and invest in the economy.

Conclusion and Recommendations

This paper examines non-linearity in finance-growth nexus for a sample of Sub-Saharan African countries. However, unlike the discrete approach of sample splitting as found in, for example, Doumbia (2015) and Samargandi et al (2015), or the continuous rolling regression approach of type in Rousseau and Watchel (2002), Rousseau and Yilmazkuday (2009), and Yilmazkuday (2011), this paper follows a panel smooth transition regression (PSTR) approach as in Jeude (2010) that has the ability to test for non-linearity and also model it to depend on economic policy and structural variables. The paper investigates the role of government size in finance-growth nexus using a sample of SSA countries and shows that finance-growth relations is (i) non-linear, (ii) such non-linearity depends on size of the government, and (iii) the threshold level of government size that promotes a positive finance-growth nexus is 12% of GDP.

The results are in line with previous findings for developing countries in Jeude (2010) and for low income countries for Yilmazkuday (2011). Our findings shows that sub-Saharan African countries should not follow financial deepening policies in absence of an efficient public sector. The public sector, through its spending, should lay down the needed infrastructure to allow financial sector reforms and deepening to enhance impact growth. Such expenditures as spending on efficient legal systems to protect investors and creditors rights, the needed road and transportation infrastructure that spurs private sector investment, and spending on security to allow for a peaceful investment climate will all enhance the role of finance in promoting growth. Going by these results, typical linear cross country regression results may be misleading given the presence of non-linearity (Durlauf, 2001).

This analysis can be extended to other policy and structural variables like inflation, institutional quality and openness in the place of government size as used in this paper. Findings from such studies will help policy makers working on growth –enhancing financial development policies to endogenous thresholds in such variables in their policy making process. For example, inflation threshold in finance growth will help central banks working on achieving low inflation (perhaps through inflation targeting) and deepening of the financial sector to carefully set inflation target so as achieve both objectives.

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Appendix

Table A1: Sample SSA countries by Income Group

Low Income	**Lower Middle Income**	**Upper Middle Income**	**High Income: Non-OECD**
Togo	Zambia	South Africa	Equatorial
Tanzania	Swaziland	Namibia	Guinea
Sierreleone	Sudan	Mauritius	Seychelles
Rwanda	Senegal	Gabon	
Niger	Nigeria		
Mozambique	Kenya	Botswana	
Mali	Lesotho		
Madagascar	Congo, Rep.		
Malawi	Cabo Verde		
Guinea	Cameroon		
Guinea-Bissau	Burkina Faso		
Gambia, The	Burundi		
Central African			
Republic			
Chad			
Comoros			
Benin			