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Linkages between Financial Deepening, Trade Openness and Economic Development: Causality Evidence from Sub-Saharan Africa

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Linkages between Financial Deepening, Trade Openness and Economic Development: Causality Evidence from Sub-Saharan Africa

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Summary. — This contribution tests for causality between financial deepening, trade openness and economic development for 16 Sub-Saharan African countries. An advanced econometric methodology is used to add to existing empirical evidence. Only limited support is found for finance promoting regional development. In particular, support for the popular hypothesis of finance-led growth is not substantial. In general, it is found that financial deepening and trade openness have swayed regional development only marginally. Thus, development strategies prioritizing financial sector or trade liberalization cannot be supported. Instead, a holistic policy approach taking into account other fundamental development factors is advocated.

Keywords. — Financial Markets, Economic Growth, Openness, Hsiao's Granger Causality, Sub-Saharan Africa,

JEL Classification: C32, O16, O55

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1 Introduction

In the last decades, many developing economies have adopted development strategies that prioritize the modernization and liberalization of their financial systems. The countries of Sub-Saharan Africa (henceforth *SSA*) are no exception. Since the end of the 1980s, these countries have been interested in lowering the levels of financial repression by generally reducing the extent of governmental intervention in national financial sectors, e.g. via the privatization of banks. These policies were expected to promote growth through financial development, e.g. through a higher mobilization of savings, a rise in domestic and foreign investments or a general improvement in the efficiency of resource allocation (e.g. Gelbard and Leite, 1999; Reinhart and Tokatlidis, 2003). However, the effectiveness of such development strategies requires a strong and convenient causal relationship between regional financial and real sectors.

The intention of this contribution is to assess whether financial deepening has actually swayed economic development in SSA and whether liberalization strategies are appropriate policy tools for fostering regional development. Previous empirical evidence in these fields is ambiguous, further motivating our analysis. We test for causality between financial development and economic growth, capturing indirect linkages between finance and growth by also scrutinizing the relationship between finance and trade openness. We add to the existing literature by (i) using econometric methods that are less prone to common methodological misspecifications that occur when testing for causality, (ii) employing a composite indicator of financial deepening in order to proxy financial depth in a broad sense, (iii) carefully distinguishing between short-run and long-run effects between finance, openness and growth, and (iv) taking into account the linkages of finance and openness that allow for further influences on economic development.

This contribution is structured as follows: Section 2 introduces the theory and empirical evidence on the linkages between finance, openness and growth which form the basis of our analysis. It also

provides an overview of the economic performance of SSA and of the state of its financial systems. Section 3 introduces the applied data and results for principal component and cointegration analyses. Section 4 presents and discusses the findings of the causality analyses, consequently deducing implications for economic theory and policy. Section 5 concludes with a summary.

2 Finance, Openness, Growth and Development

Theory and Evidence. Financial markets provide an economy with certain vital services which comprise e.g. the management of risk and information, or the pooling and mobilization of savings. More ample and efficient, i.e. *deeper* financial systems are associated with a more effective supply of these financial services to the real sector. From a theoretical point of view, linkages between financial and economic development may take different forms. On the one hand, it is argued that the financial sector may influence growth through the *accumulative channel* and the *allocative channel.* The accumulation channel emphasizes the finance-induced positive effects of physical and human capital accumulation on economic growth (e.g. Pagano, 1993; De Gregorio and Kim, 2000). The allocation channel focuses on the rising efficiency of resource allocation which is caused by financial deepening and which subsequently enhances growth (e.g. King and Levine, 1993).

On the other hand, the development of the financial system may also be initiated by economic growth. For instance, in an expanding economy the private sector may demand new financial instruments and better access to external finance. Hence, financial sector activities may then simply amplify in step with general economic development (e.g. Robinson, 1952; Patrick, 1966). In this connection, the real sector may also provide financial institutions with the funds necessary to enable financial deepening, eventually allowing for a capitalization on financial economies of scale (Berthelemy and Varoudakis, 1996; Blackburn and Hung, 1998).

Empirical evidence regarding finance-growth interactions suggests that certain economies have indeed benefited from well-developed financial systems.[1] Several studies also highlight the role of

strong financial systems in attracting foreign or domestic investment, and in allocating investment in efficient and productive ways (e.g. Hermes and Lensink, 2003; Kumbhakar and Mavrotas, 2005). In general, causality evidence is less conclusive. For some successful emerging economies, finance appears to have been a leading economic success factor, e.g. in Singapore (Murinde and Eng, 1994), Korea (Choe and Moosa, 1999) or Taiwan (Chang and Caudill, 2005). Still, such a strong connection cannot be identified in mature OECD countries (e.g. Shan *et al.*, 2001; Shan and Morris, 2002). For developing economies, the results are similarly diverse. Some studies find a generally strong impact of finance on growth (e.g. Christopoulos and Tsionas, 2004), while others find the finance-growth relationship to be more complex (e.g. Demetriades and Hussein, 1996; Luintel and Khan, 1999). Generally, empirical findings strongly indicate that there is a country-specific dimension to finance-growth dynamics that accounts for frequently ambiguous results across countries.[2]

Possible linkages between financial institutions and a country's openness to trade open up further channels through which financial systems and real sectors may interact. On the one hand, mature financial institutions may constitute a comparative advantage for industrial sectors that rely heavily on external financing (e.g. Kletzer and Bardhan, 1987; Beck, 2003). Thus, economies that exhibit developed financial systems are expected to feature industrial and trade structures that are linked to finance-dependent industry sectors.

On the other hand, increased trade openness may trigger demand for new financial products. As argued by Svaleryd and Vlachos (2002), trade carries risks linked to external shocks and foreign competition. Therefore, an increase in trade openness may lead to a supply of more ample financial instruments. In such an environment, financial institutions are expected to evolve in order to provide insurance and risk diversification more adequately. Rajan and Zingales (2003) argue that openness may also influence financial development with respect to effects from political economy. Here, domestic interest groups have a natural interest in obstructing financial development to prevent competitors from entering the market. As international competition increases, such groups shift their interests towards positive financial sector development.

Empirically, findings generally indicate the existence of a nexus between finance and openness, although the subject has not been studied exhaustively. For instance, Beck (2003) shows that countries with more developed financial systems exhibit higher trade shares in industries that depend on external finance, concluding that finance is an important determinant of trade structures. Similarly, Svaleryd and Vlachos (2005) find that financial sectors significantly determine industrial specialization patterns across OECD countries. Conversely, the findings of Huang and Temple (2005) indicate that increases in trade openness are followed by increases in financial depth.

The interaction between finance and openness also allows for more complex paths to economic development. First, if increasing trade openness leads to an increase in financial development, it may promote economic growth where financial deepening is found to enhance growth via the allocative and accumulative channels, as discussed above. Second, if finance induces openness, it may subsequently foster growth when openness is found to be a growth-driving factor. Openness may induce economic growth in several ways, including by increasing a country's level of specialization and positively affecting innovation and technological diffusion (Harrison, 1996). Conversely, economic development may also trigger a country's level of trade openness, e.g. with shifts in production and demand patterns as well as increased levels of international integration that accompany national industrialization experiences. Empirically, Edwards (1998) provides some empirical evidence for the hypothesis that trade openness leads economic growth, finding that more open economies experience greater productivity growth. In contrast, Rodriguez and Rodrik (2001) find only limited support for a strong and positive link between openness and economic development.

Finance and Development in SSA. During the last decades, the economic performance of SSA has been distinctly worse than that of other developing world regions. Between 1960 and 1980, average annual per capita income growth in the region was 1.3%, compared to 2.5% worldwide. Between 1980 and 2000, SSA countries even experienced a decline in annual growth rates of about -0.6% on average, where the world grew at an annual rate of 2.7%.

Sachs and Warner (1997) attribute the region's poor economic performance to geographical factors such as climate or access to seas as well as to inappropriate economic policies. In particular, they argue that the region's lack of openness to international trade has been a major obstacle to better performance, a factor that almost naturally coincides with low levels of trade liberalization in SSA. Collier and Gunning (1999) similarly suggest that geographical disadvantages have negatively affected economic growth. Still, they also argue that poor economic policies have impaired growth more markedly. For instance, they suggest that the lack of trade openness, poor infrastructure and public services, and the underdevelopment and closeness of both financial and product markets are among the factors that have had growth-reducing effects.

Financial systems in SSA can generally be described as underdeveloped. As summarized by Gelbard and Leite (1999) and Ncube (2007), regional financial sectors suffer from various unfavorable characteristics. These characteristics include limited financial products and financial innovation, wide interest rate spreads, weak legal systems, poor institutional environments and pronounced market fragmentation. The level of financial depth and financial efficiency in the region is rather low, also in comparison to other developing world regions. Financial systems in SSA are strongly bank-based, whereas stock markets are generally not well-developed.

From the discussion so far, one would expect a distortionary rather than a promoting effect of financial markets on regional economic development. Empirical studies on this issue for SSA have yielded mixed results which are summarized in Table (1). Evidently, some studies suggest that financial factors have enhanced economic growth in the past, e.g. by positively influencing the levels of investment or capital accumulation. Other findings indicate that the impact of financial development on growth has been rather negligible. The issue of finance-growth causality is by far settled: While Ghirmay (2004) finds strong evidence of a virtuous circle of finance and growth, the results of Atindehou *et al.* (2005) indicate the opposite, with finance and growth exhibiting only a weak causal relationship.

Table (1) here

The review of existing literature on linkages between finance, openness and growth in SSA reveals that financial depth and trade openness may be generally expected to play only minor roles in swaying economic development. Nevertheless, theory and some empirical evidence suggest that financial and trade factors may interact favorably with economic growth. The ambiguity of related empirical literature, especially with respect to finance-growth causality, motivates our analysis in particular.

3 Principal Component and Cointegration Analysis

In the following sections, we will test for the direct and indirect causal interactions of finance, openness and growth. From the previously discussed literature we deduce our hypotheses. When we first investigate the causal linkages between finance and growth, this relationship may therefore take different forms. Causality may either run from finance to growth *(supply-leading hypothesis)* or from growth to finance *(demand-following hypothesis)*. In these two cases the respective reverse causation pattern is not emphasized. Finance and growth may also influence each other simultaneously *(bidirectional causality)*. In addition, the relationship between finance and growth may also change over time as a country passes through different stages of development *(temporary bidirectional causation)*. This means that in the early stages, either finance leads growth but its impact on growth diminishes as an economy develops (e.g. Patrick, 1966), or finance follows growth but eventually becomes a factor that contributes to growth after a threshold of financial development is reached (e.g. Berthelemy and Varoudakis, 1996). Following views that are more skeptical towards finance-growth linkages (e.g. Chandavarkar, 1992), the financial and real sector may also be independent of each other, thereby naturally putting emphasis on factors that may determine economic development instead *(insignificant causation)*.[3]

When we later test for causality between finance and openness, and growth and openness, we hypothesize by analogy. Thus, causality again may run in only one or both directions, or may be regarded as insignificant.

Our methodological framework to appropriately test for the various causality interrelations is carefully composed. First, we create a composite indicator of financial deepening via *principal component analysis*. We should thereby be able to capture developments in the region's financial systems in a broader sense while avoiding problems associated with multicollinearity and over-parameterization. Second, we employ *unit root* and *cointegration tests* to identify the stationary properties and possible cointegration relationships of the investigated time series. By building on integration and cointegration results accordingly, we evade spurious regression results in the following causality analyses. Third, we test for *Granger causality* in a modified framework following Hsiao (1979, 1982), using *bivariate* and *trivariate vector autoregressive (VAR)* or *vector error correction models (VECM)*.[4] Misspecifications within such models may lead to spurious and inconsistent results as shown by Braun and Mittnik (1993). In particular, standard Granger causality analyses may suffer from problems of arbitrary lag length selection because the considered variables are constrained to all enter at the same lag length. Our procedure avoids such problems as all variables may enter at different lag lengths. We are also able to differentiate between short-run and long-run causality. Here, we take any error correction *(ECM)* term estimate as evidence of a long-run causal relationship between the considered variables. However, such an interpretation is only feasible if the ECM term is negative and statistically significant (Wickens, 1996).

Data. Two standard data sources are utilized for our analysis.[5] We use annual time series observations for they are absolutely suffcient to ensure the quality of the analyses, as argued by Hakkio and Rush (1991).

First, level data for the individual finance indicators used in the following principal component analysis is taken from the *Financial Development and Structure Database* of Beck *et al.* (2000) that mainly builds on World Bank and IMF data. It is referred to the latest database version of 2005. Specifically, we extract the finance proxies *commercial bank assets to commercial bank plus central bank assets (DBMA)*, *liquid liabilities to GDP (LL)* and *private credit by deposit money banks to GDP*.[6]

Second, level data for economic growth and trade openness is taken from the *PENN World Table*, version 6.2, compiled by Heston *et al.* (2006). As for economic growth, the standard proxy of real GDP per capita is utilized, labeled *GROWTH (G)*. As for trade openness, the sum of exports plus imports to real GDP is employed, labeled *TRADE (T)*. As Harrison (1996) suggests, this measure is a simple and common indicator of trade openness.[7] In the case of both real GDP per capita and trade openness, GDP is measured in international US dollars, with the year 2000 as the reference base year for its calculation. *GROWTH* and *TRADE* are taken as the differences of logarithms because of the usual analytical considerations.

Principal Component Analysis. In related literature, several proxies for financial deepening have been employed, e.g. monetary aggregates such as *M2 to GDP* or financial intermediation indices such as the *ratio of domestic credit to the private sector to GDP*. To date there is no consensus on the superiority of any of these indicators. Following the recent examples by Kumbhakar and Mavrotas (2005) and Ang and McKibbin (2007), we thereby construct a composite indicator of financial deepening to obtain a finance indicator that is as broad as possible. Specifically, we use the finance proxies *DBMA*, *LL* and *PC* to construct this index which is labeled *DEPTH (D)* via principal component analysis. As emphasized before, SSA financial systems are strongly bank-based. This justifies our use of finance indicators that are primarily associated with bank development.

Principal component analysis is commonly employed to reduce data sets to lower dimensions while retaining as much information of the original sets as possible. In our case, after having transformed the finance indicators into natural logarithms, only the first unrotated principal component is extracted and utilized as *DEPTH*.[8]

Table (2) gives an overview of the results of the principal component analysis as well as a descriptive overview of the investigated countries. Our index *DEPTH* is usually the only component to show fitting characteristics. It generally exhibits either at least 60% of the initial variance of the considered series or an eigenvalue that is significantly larger than one. Thus, the index provides a

suffcient amount of information on financial deepening. In reference to the respective component matrices, it is evident that *DEPTH* does not measure exactly the same aspects of financial deepening, i.e. of financial effciency and of the size of the financial sector, across all countries. Still, we regard the composite indicator as a functional measure, particularly when taking into account the discussion about the lack of a truly consistent measure of financial development.

Table (2) here

Unit Root Test. As a next step, a unit root test is employed to check if the considered time series are stationary, i.e. *I(0)*, or first difference-stationary, i.e. *I(1)*. The existence of unit roots in the considered series may contaminate the findings of our causality analyses because of the properties of nonstationary time series. We use the unit root test following Phillips and Perron (1988), the *PP test*. Our choice for the PP test is based on Choi and Chung (1995) who argue that this test is more powerful when low sampling frequency data, i.e. annual data is used, compared to the standard unit root tests developed by Dickey and Fuller (1979, 1981) on which the PP test builds. As reported in Table (3), in almost all cases the PP test does not reject the null hypothesis of the existence of a unit root for the data at levels, whereas in all but two cases the null hypothesis is rejected strongly when the first difference is taken. The examined time series are thus *I(1)* at levels and *I(0)* when taking the first difference. Therefore, we use a difference filter to obtain stationarity.

Table (3) here

Cointegration Analysis. As a further step of our analysis, we test for the rank of cointegration in bivariate and trivariate VAR models, following Johansen (1988) and Johansen and Juselius (1990). Generally, this complex procedure involves testing how many eigenvalues of a cointegrating matrix significantly depart from zero in order to obtain its cointegrating rank. Two tests are available, namely the trace statistic and the maximum eigenvalue test. In the following, only the trace statistic is utilized to estimate the rank of the respective models so as to obtain more robust results (Cheung and Lai, 1993). The test for cointegration is always conducted within a VAR framework, where the

optimal lag length of the considered time series is chosen by the more conservative Bayesian Information Criterion *(BIC)* due to its superior accuracy (Koehler and Murphree, 1988).

Table (4) shows the cointegration results for the trivariate VAR models.[9] For Ghana, Nigeria, Rwanda, Senegal and Sierra Leone, at most one cointegration relationship between the three series is found at either the 5% or 10% significance level. When a cointegration relationship is present, finance, growth and trade openness share a common trend and long-run equilibrium as suggested theoretically. Due to such a cointegration relationship, we include an ECM and hence any VAR passes into a VECM (Engle and Granger, 1987). As for Burundi, Cameroon, Cote d'Ivoire, Ethiopia, Gabon, Kenya, Madagascar, Mauritius, South Africa, The Gambia and Togo, we find no evidence of cointegration between the three series. Thus, we do not include any ECM term in the subsequent analyses for these countries, but instead test for causality in a standard VAR framework.

Table (4) here

4 Causality Analysis

Hsiao's Causality Test. Granger's (1969) definition of non-causality states that if one is able to better predict a series x_t when including information from a series y_t instead of only employing lagged values of x_t, then y_t Granger-causes x_t, denoted $y_t \rightarrow x_t$. Bidirectional causality, or feedback, is present when x_t also Granger-causes y_t, where such feedback is denoted $x_t \leftrightarrow y_t$. By combining this definition of causality with Akaike's (1969) *Final Prediction Error (FPE)*, Hsiao's approach towards testing for causality between time series can be conducted.

In its basic form, the causality testing procedure requires us to first consider this autoregressive process:

$$y_t = \alpha + \sum_{i=1}^{m}(L)\beta y_t + u_t \qquad (1)$$

In Equation (1), the sigma sign in front of L indicates the lag order of the series, L is the lag operator, $L_{yt} = y_{t-1}$, u_t is a white noise term with the usual statistical properties, α is a constant term and β is the coeffcient of the exogenous variables.

We choose the lag order that yields the smallest FPE, denoted $FPE_y(m, 0)$, where the individual FPE are calculated in accordance with the following equation with lags varying from 1 to m:

$$FPE_y(m,0) = \frac{(T+m+1)}{(T-m-1)} \times \frac{SSE}{T} \tag{2}$$

Here, T is the number of observations and SSE is the residual sum of squares. Then, we allow another variable x_t to enter our model, so that we receive the subsequent VAR:

$$y_t = \alpha + \sum_{i=1}^{m}(L)\beta y_t + \sum_{j=1}^{n}(L)\gamma x_t + u_t \tag{3}$$

$$x_t = \alpha + \sum_{j=1}^{n}(L)\gamma x_t + \sum_{i=1}^{m}(L)\beta y_t + v_t \tag{4}$$

Again, the sigma sign in front of L indicates the lag order of the respective series, L is the lag operator, e.g. $L_{yt} = y_{t-1}$, u_t and v_t are white noise terms with the usual statistical properties, α is a constant term and β, γ are the coeffcients of the exogenous variables. While y_t steadily enters Equation (3) with the lag order from Equation (2) that yields the smallest FPE, m^*, x_t enters with a sequence of lags varying from 1 to n. Analogously, the FPE of Equation (3) are computed, with the specific lag order being chosen that generates the smallest FPE, denoted as $FPE_y(m^*,n^*)$, from:

$$FPE_y(m^*, n) = \frac{(T + m + n + 1)}{(T - m - n - 1)} \times \frac{SSE}{T} \qquad (5)$$

By comparing the two minimal FPE, we can draw conclusions on causality. If $FPE_y(m,0) > FPE_y(m^*,n^*)$, then $x_t \rightarrow y_t$, thus Granger causality is established. If $FPE_y(m,0) < FPE_y(m^*,n^*)$, then $x_t \rightarrow y_t$ and no Granger causality is detected. Testing for causality from y_t to x_t requires us to repeat the previously described steps, this time with x_t as the dependent variable.

Model Specification. With respect to the specific surroundings of our analysis, Hsiao's original approach needs to be adjusted. First, we use our results on unit roots and cointegration. Thus, we employ a first difference filter to achieve stationarity and an ECM whenever unit root or cointegration evidence requires this to be applied. Again, it has to be noted that if the time series are found to be *I(0)* but not cointegrated, then the model is estimated as a VAR in differences. Second, in order to obviate the possibility of spurious causality detection, the causality procedure is conducted in a trivariate model. That is, we test for causality between two series, conditional upon the presence of a third one. Our earlier discussion of possible interactions between finance, growth and trade openness provides the ground for such trivariate model specifications. As theory suggests interactions between all three considered series, a subsequent exchange of control variables is implemented, possibly rendering a richer picture of causal interdependencies between finance, openness and growth.

Besides, causal interactions are established and interpreted according to the previous introduction. In the short run, by analogy causality inferences are made by comparing the minimal FPE of the bivariate and trivariate case. If we include an ECM term to account for cointegration relationships, we take the ECM term as an indicator of long-run causality

as described before. If no cointegration relationship is present, then we conduct the analyses in simple bivariate and trivariate VAR models in differences. In these cases, we refer to the results of respective F-tests that indicate if the regression coeffcients of the trivariate VAR are statistically significant. If the F-test statistics indicate no suffcient significance, then any possible causality inference may be spurious, with only limited explanatory and analytical power.

Finance-Growth Causality. We now analyze causal linkages between financial deepening and economic growth. Theory suggests that finance may be either an important or a negligible factor of economic development. As for the former, we may expect evidence for the supply-leading or bidirectional hypothesis. As for the latter, we may expect support for demand-following or insignificant finance-growth causation.

Table (5) gives the results of the interaction between *DEPTH* and *GROWTH*, conditional on *TRADE*. The results generally show no sign of autocorrelation or multicollinearity and appear to be statistically significant and stable, in particular with respect to the lag orders chosen in accordance with the causality testing procedure.

Table (5) here

In general, the analysis reveals only weak causal linkages between financial depth and economic growth for the investigated countries. In particular, we find evidence of finance-led growth only in the cases of Rwanda, Sierra Leone and South Africa. For Nigeria and Senegal, our findings suggest a feedback relationship between finance and growth, i.e. bidirectional finance-growth causality. For Cameroon, Ghana and Madagascar, the results indicate support for the demand-following hypothesis, so financial depth is caused by economic development. With respect to the other eight countries in the data sample, our analysis does not show any significant causal linkages between *DEPTH* and *GROWTH*.

Our findings offer support for rather skeptical theoretical and empirical considerations of finance-growth linkages. With respect to the previously discussed deficiencies of regional financial systems,

our results fit reasonably well. Because of generally low levels of financial depth and related institutional shortcomings, it appears reasonable to expect financial sectors in SSA to interact only marginally with real sectors.

Thus, we argue that policies of financial liberalization should be considered carefully and should not be prioritized, particularly as past liberalization efforts have generally failed to enhance economic performance in SSA (Reinhart and Tokatlidis, 2003). In line with Collier and Gunning (1999), our results indicate that the poor economic performance in the region is at least partially a consequence of deficient interaction, i.e. match of financial and real sector development. Sound economic policies should aim to sway the development of regional financial sectors towards increasing financial depth and efficiency. Through such policies, financial sectors may be able to interact measurably with real sectors in the future, e.g. by enhancing the accumulative capabilities and allocative efficiency of SSA countries. Promising development strategies in this connection may include greater macroeconomic stability, more appropriate macroeconomic policies or improved institutional quality, all of which may influence financial development favorably (e.g. Rousseau and Wachtel, 2002; Montiel, 2003; Demetriades and Law, 2006). Thanks to such policies, over time the development of regional financial systems may correspond more effectively and adequately to real sector activities, in consequence facilitating economic development.

Finance-Openness Causality. Theoretical considerations suggests that finance may unilaterally lead openness as a comparative advantage for outward-oriented industries, or that openness may induce financial development as a consequence of trade-associated internal and external influences. A nexus between finance and openness may additionally allow for bidirectional causality. Following more skeptical views, we may also find no evidence of significant causality between finance and openness.

Table (6) shows the results for the causal inferences of *DEPTH* and *TRADE*, controlling for *GROWTH*. Our results again show no sign of autocorrelation or multicollinearity and appear to be statistically significant and stable, particularly with respect to the chosen lag orders.

Table (6) here

Our findings confirm the existence of a nexus between financial depth and trade openness. Nevertheless, neither we are able to identify a predominant causation pattern nor do causal relationships appear to be stable in the long run for many investigated countries. Specifically, we find evidence of the hypothesis that finance causes openness for Gabon, Kenya, Nigeria, and Sierra Leone, where in the case of Sierra Leone results do not indicate stable long-run causality. Our findings suggest that openness has unilaterally influenced financial depth in the cases of Ghana, Madagascar and Rwanda, where for Rwanda long-run causation inferences are not robust. For Burundi, Mauritius, Senegal and South Africa, the causality analysis results point at a feedback relationship between the two series, where F-test statistics or ECM estimates may at times hint at the possibility of spurious correlations. In the cases of Cameroon, Cote d'Ivoire, Ethiopia, The Gambia and Togo, we do not find evidence of any significant causal linkages between *DEPTH* and *TRADE*.

From our findings, we conclude that there are indeed interactions between financial development and trade openness in SSA, as theories on the finance-openness nexus imply. Still, such linkages do not appear to be of particular importance and strength for SSA, as indicated by the many cases where finance and openness are unrelated or where the relationship lacks long-run stability, respectively. Policies that aim at enhancing a country's financial depth are thus rather unlikely to significantly shape trade structures and policies as a by-product. Along the lines of this argument, trade policies that are targeted at increasing national levels of openness cannot be expected to have substantial finance-promoting effects.

Further, the effect of finance-openness linkages in SSA on general economic development is only marginal. On the one hand, the influence of trade openness on financial depth has not translated into economic growth, as our previous results have already shown. Only in the cases of Rwanda, Senegal and South Africa does it seem that openness has interacted with financial depth, which in turn contributed to economic growth. Moreover, here the results suffer from problems that are either associated with insignificant F-test statistics or undetectable long-run causality. In other words, evidence of an indirect effect of openness on growth via the channel of financial development is

generally limited.

On the other hand, we also do not find evidence for the hypothesis that finance-induced advances in trade openness have translated into enhanced economic performance. This becomes apparent from the results of the causality analysis of *GROWTH* and *TRADE*, conditional upon *DEPTH*, which is presented in Table (7).[10] Here, in most cases *GROWTH* either causes *TRADE* or both series share a feedback relationship.[11] When we now combine our findings from Tables (6) and (7), we see that only in the case of Nigeria has financial depth actually had a significant effect on openness, while openness has simultaneously influenced economic growth. In all other related cases, no indirect effect of financial deepening on economic growth through the channel of trade openness can be demonstrated.

Table (7) here

Our analysis reveals that only few countries in SSA have actually benefited directly or indirectly from financial or trade factors.[12] Thereby, development strategies that unilaterally emphasize either financial sector or trade liberalization do not appear to be feasible for SSA. Rather, a holistic policy approach that takes into account various fundamental determinants of development is more appropriate for SSA. For instance, one may expect improvements in infrastructure, human capital, institutional quality or regional legal systems to effectively help to overcome deficiencies in regional financial systems, thereby affecting finance-growth dynamics favorably.

5 Summary

Drawing on conflicting theoretical considerations about the linkages between financial deepening, economic development and trade openness, we have tested for causality for 16 Sub-Saharan African countries. We used principal component analysis to obtain a broad indicator of financial deepening. We employed unit root and cointegration tests to analyze the properties of the investigated time

series and to identify possible long-run relationships between them. Subsequently employing Hsiao's version of Granger causality testing within a VAR/VECM framework has several advantages which were discussed.

Our empirical results can be summarized as follows. First, cointegration evidence shows that finance, growth and openness do not share significant long-run relationships for most of the sample. Second, we detect only limited support for causal interactions of financial depth and economic development. In particular, there is evidence of finance-led growth only in three out of 16 cases. Third, for most countries we detect either a demand-following or insignificant relationship between finance and growth. We thus provide support for more skeptical views on direct finance-growth linkages. Fourth, while we find ample support for theories that suggest a nexus between finance and openness, we are not able to identify any predominant causal relationship for SSA. Additionally, there is only limited evidence that suggests that either financial deepening has promoted economic development indirectly via influencing trade openness or that openness has enhanced growth as a by-product of its impact on financial development. In the light of our results, we question policies that unilaterally prioritize financial sector or trade liberalization. Financial deepening and trade openness do not appear to have been crucial preconditions of economic development in SSA. Instead, we advocate a more balanced policy approach that also takes into account other fundamental development factors, such as regional macroeconomic surroundings or national institutional environments. An holistic approach towards a strengthening of these factors may, amongst others, help to reduce deficiencies in regional financial systems, so countries in SSA may benefit from more effcient financial institutions in the future.

Notes

[1]For long-term studies with a historic focus that stress the importance of financial development for economic take-off, see e.g. Rousseau and Wachtel (1998) and Sylla (2002).

[2]For far more extensive discussions of the potential linkages between finance and growth, we refer to the excellent surveys of Pagano (1993) and Levine (2005).

[3]In this connection, Lucas (1988, p.6) famously states: ”In general, I believe that the importance of financial matters is very badly over-stressed in popular and even much professional discussion and so am not inclined to be apologetic for going to the other extreme.”

[4]This causality testing procedure has been used in a number of previous studies, e.g. in Cheng (1999) or Bajo-Rubio and Montavez-Garces (2002), beyond the applications given in Hsiao (1979, 1982).

[5]The use of data from several sources may prove inappropriate. Hanousek *et al.* (2007) show that results of econometric analyses may be sensitive to the choice of data sources. Hence, data sensitivity problems may contaminate the results. However, in our case the considered series that originate from different data sources in general exhibit a high level of correlation, therefore reducing problems associated with data choice.

[6]In general, the *Financial Development and Structure Database* provides complete information across series and countries. In the few cases where variables are missing, we impute these ones by average.

[7]As suggested by, inter alia, Harrison (1996) and Edwards (1998), a number of potentially more sophisticated measures for trade openness exist. Still, these measures raise the question of availability. While we consider *TRADE* to be a rather rough openness indicator, it does however constitutes a convenient trade off between accessibility and accuracy.

[8]The Principal Component Analysis was conducted using SPSS, version 13. Other software packages used during this analysis include EViews, version 5.0, Stata, version 9.2, and Gretl, version 1.6.4.

[9]Cointegration analyses have also been conducted in all bivariate cases but are not reported in order to save space.

[10]Again, the findings show no sign of autocorrelation or multicollinearity. Estimations are also generally statistically significant and stable, in particular with respect to the chosen lag orders.

[11]This finding is also consistent with former findings of Berthelemy and Varoudakis (1996) who detect no sizeable effect of openness on growth in the presence of weak financial systems.

[12]Nigeria and Senegal seem to have benefited most from a virtuous circle of finance, openness and growth. Mauritius, Rwanda, Sierra Leone and South Africa also appear to have gained substantially from various interactions of these factors, compared to the rest of our sample.

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Table 1: Financial Factors and Development in SSA

Author	Subject	Method	Main Findings
Ndikumana (2000)	Effect of finance on investment	Panel data analysis	There is evidence of a positive long-run effect of financial development on investment.
Allen and Ndikumana (2000)	Relationship of finance and growth	Panel data analysis	Finance and growth are generally positively correlated, although some results are mixed.
Anorou and Ahmad (2001)	Relationship between savings and finance	Granger causality test	Economic growth causes growth in domestic savings for most investigated countries.
Ghirmay (2004)	Causality between finance and growth	VECM approach	Evidence indicates finance-led growth or bidirectional between finance and growth for most of the sample.
Atindehou et al. (2005)	Causality between finance and growth	Granger causality test	Findings point at a weak causal relationship between financial development and economic growth.
Adjasi and Biekpe (2006)	Effect of stock market development on growth	Panel data analysis	Stock market development influences growth positively and significantly only in more developed countries.

Table 2: Summary Statistics and Results of Principal Component Analysis

Country (Data Availability)	DEPTH (Principal Component)	Component Matrix		
		DBMA	LL	PC
Burundi (1966-2003)	75.53%	0.738	0.863	0.973
Cameroon (1969-2003)	83.82%	0.838	0.916	0.986
Cote d'Ivoire (1971-2003)	68.89%	0.681	0.882	0.909
Ethiopia (1967-2003)	58.00%	0.951	-0.715	0.570
Gabon (1964-2004)	57.96%	0.457	0.764	0.973
Ghana (1964-2003)	74.05%	0.817	0.888	0.909
Kenya (1967-2003)	72.46%	-0.770	0.974	0.795
Madagascar (1965-2004)	50.66%	0.864	0.866	0.158
Mauritius (1967-2004)	79.69%	0.756	0.964	0.943
Nigeria (1961-2004)	72.36%	-0.636	0.937	0.943
Rwanda (1966-2003)	84.71%	0.828	0.959	0.968
Senegal (1972-2003)	51.78%	0.322	0.781	0.916
Sierra Leone (1970-2003)	64.59%	0.810	0.676	0.907
South Africa (1966-2004)	65.78%	0.896	-0.674	0.846
The Gambia (1965-2003)	43.27%	0.462	-0.832	0.626
Togo (1974-2004)	65.13%	-0.507	0.956	0.885

Notes: The column *DEPT*H contains the value of the initial eigenvalues as a percentage of the total variance the first principal component contains (percentage of variance criterion) that represents the composite indicator of financial deepening. Following the standard income measurement of the World Bank as taken from Beck *e*t *al*. (2000), South Africa, Mauritius and Gabon can be classified as Upper Middle Income countries, and Cameroon as a Lower Middle Income country, while all the others are Low Income countries.

Table 3: Phillips-Perron Unit Root Test Statistic

County		Level		First Difference	
		Z (t_a)	Z(t_{at})	Z(t_a)	Z(t_{at})
Burundi	G	-2.310	-1.946	-6.760***	-7.236***
	T	1.090	-0.433	-5.047***	-5.814***
	D	-0.839	-2.443	-5.452***	-5.372***
Cameroon	G	-1.599	-1.584	-2.798*	- 2.767
	T	-0.856	-1.544	-3.763***	-3.701**
	D	-0.999	-1.654	-2.661*	-2.642
Cote d'Ivoire	G	-2.429	-2.298	-5.779***	-5.794***
	T	-1.488	-1.931	-4.635***	-4.562***
	D	-0.937	-2.121	-4.555***	-4.583***
Ethiopia	G	-0.912	-1.804	-8.409***	-8.470***
	T	-1.426	-1.581	-6.894***	-6.892***
	D	-1.490	-1.213	-4.757***	-4.848***
Gabon	G	-1.424	-2.276	-5.751***	-5.990***
	T	-1.824	-2.024	-5.504***	-5.584***
	D	-1.917	-2.199	-6.410***	-7.589***
Ghana	G	-2.283	-3.035	-11.012***	-11.733***
	T	-2.034	-1.531	-9.209***	-13.057***
	D	-0.920	-0.169	-7.644***	-8.394***
Kenya	G	-3.062**	-3.548**	-7.293***	-7.164***
	T	-1,456	-1.372	-6.423***	-6.436***
	D	-2.445	-1.513	-6.805***	-7.687***
Madagascar	G	0.064	-3.404*	-6.816***	-6.866***
	T	-1.021	-2.039	-7.313***	-10.764***
	D	-1.392	-1.064	-4.197***	-4.240***
Mauritius	G	0.337	-3.470*	-5.959***	-5.764***
	T	-2.094	-2.018	5.632***	-5.534***
	D	-0.748	-1.621	-6.039***	-5.983***
Nigeria	G	-1.931	-2.004	-4.791***	-4.735***
	T	-1.015	-2.606	-9.226***	-9.146***
	D	-1.804	-2.182	-5.900***	-5.826***
Rwanda	G	-2.471	-2.434	-7.264***	-7.154***
	T	-1.705	-2.059	-9.235***	-10.186***
	D	-1.806	-1.599	-4.383***	-4.472***
Senegal	G	-3.676***	-3.653**	-6.502***	-6.417***
	T	-2.269	-2.628	-8.021***	-8.603***
	D	-2.391	-3.046	-3.721***	-3.454*
Sierra Leone	G	0.123	-1.684	-4.132***	-4.051**
	T	-3.943***	-4.520***	24.687***	24.984***
	D	1.256	1.805	-5.875***	-5.805***
South Africa	G	-0.608	-1.591	-4.232***	-4.165***
	T	-1.332	-0.867	-5.054***	-5.337***
	D	-0.451	-3.003	-5.654***	-5.708***
The Gambia	G	-2.444	-2.530	-5.151***	-5.041***
	T	-2.183	-2.162	-5.511***	-5.465***
	D	-0.584	-2.803	-6.373***	-6.283***
Togo	G	-1.179	-1.811	-5.100***	-5.237***
	T	-1.916	-1.827	-3.451**	-3.478*
	D	-2.845*	-4.440***	-4.922***	-5.068***

Notes: Z (t_a) and Z (t_{at}) denote the PP test statistics with a constant, and a constant with a linear trend, respectively. (***), (**) and (*) denote significance at1%, 5% and 10% levels, respectively. The critical values were taken from MacKinnon (1996). G, T, D indicate the series for growth, trade openness and financial depth, respectively.

Table 4: Johansen Trace Statistics for Trivariate VAR

Country	Hypothesized Trace No. of CE (H_0)	0.05 Critical Value	0.10 Critical Value	Statistic
Burundi	None	16.959	29.797	27.067
	At most 1	7.990	15.495	13.429
	At most 2	0.880	3.842	2.706
Cameroon	None	24.020	29.797	27.067
	At most 1	10.638	15.495	13.429
	At most 2	1.298	3.842	2.706
Cote d'Ivoire	None	21.417	29.797	27.067
	At most 1	5.142	15.495	13.429
	At most 2	0.554	3.842	2.706
Ethiopia	None	24.695	29.797	27.067
	At most 1	8.420	15.495	13.429
	At most 2	1.381	3.842	2.706
Gabon	None	16.031	29.797	27.067
	At most 1	5.763	15.495	13.429
	At most 2	0.957	3.842	2.706
Ghana	None	53.468	29. 797**	27. 067*
	At most 1	12.271	15.495	13.429
	At most 2	0.210	3.842	2.706
Kenya	None	24.254	29.797	27.067
	At most 1	10.748	15.495	13.429
	At most 2	3.882	3. 842**	2. 706*
Madagascar	None	22.537	29.797	27.067
	At most 1	5.122	15.495	13.429
	At most 2	0.012	3.842	2.706
Mauritius	None	13.327	29.797	27.067
	At most 1	4.635	15.495	13.429
	At most 2	0.182	3.842	2.706
Nigeria	None	27.250	29.797	27. 067*
	At most 1	7.742	15.495	13.429
	At most 2	0.335	3.842	2.706
Rwanda	None	36.636	29. 797**	27. 067*
	At most 1	16.450	15. 495**	13. 429*
	At most 2	3.997	3. 842**	2. 706*
Senegal	None	31.298	29. 797**	27. 067*
	At most 1	12.824	15.495	13.429
	At most 2	2.217	3.842	2.706
Sierra Leone	None	34.064	29. 797**	27. 067*
	At most 1	11.845	15.495	13.429
	At most 2	1.139	3.842	2.706
South Africa	None	25.375	29.797	27.067
	At most 1	10.056	15.495	13.429
	At most 2	1.260	3.842	2.706
The Gambia	None	18.275	29.797	27.067
	At most 1	6.610	15.495	13.429
	At most 2	0.935	3.842	2.706
Togo	None	24.949	29.797	27.067
	At most 1	9.768	15.495	13.429
	At most 2	1.157	3.842	2.706

Notes: (**) and (*) denote rejection of the H0 hypothesis that is related to the number of cointegration equations (CE) at 5% or 10% significance levels. The critical values were taken from MacKinnon et al. (1999). The test was conducted under the assumption of a linear deterministic trend. The lag orders of the underlying VAR were chosen via the BIC, where the maximum lag length was 4, with the exception of Nigeria (maximum of 5 lags) and Togo (maximum of 3 lags) due to considerably different time horizons.

Table 5: Causality Analysis for DEPTH and GROWTH

Country	FPE (m,0,p)	FPE (m,n,p)	ECM	F-Stats	D → G i) short-run ii) long-run	FPE (m,0,p)	FPE (m,n,p)	ECM	F-Stats	G → D i) short-run ii) long-run
Burundi	0.0057	0.0059	---	0.392	i) No	0.1025	0.1072	---	2.150	i) No
	(1,0,4)	(1,1,4)			ii) ---	(1,0,1)	(1,1,1)			ii) ---
Cameroon	0.0025	0.0027	---	3.942***	i) No	0.0529	0.0527	---	4.856***	i) Yes
	(4,0,1)	(4,1,1)			ii) ---	(2,0,1)	(2,1,1)			ii) ---
Cote d'Ivoire	0.0026	0.0036	---	1.432	i) No	0.1704	0.1754	---	0.570	i) No
	(4,0,3)	(4,1,3)			ii) ---	(1,0,1)	(1,1,1)			ii) ---
Ethiopia	0.0066	0.0070	---	1.823	i) No	0.1617	0.1633	---	1.381	i) No
	(2,0,1)	(2,1,1)			ii) ---	(1,0,1)	(1,2,1)			ii) ---
Gabon	0.0139	0.0143	---	0.419	i) No	0.4872	0.4876	---	1.345	i) No
	(1,0,1)	(1,1,1)			ii) ---	(2,0,1)	(2,1,1)			ii) ---
Ghana	0.0052	0.0058	-0.628***	---	i) No	0.2323	0.2056	0.031***	---	i) Yes
	(3,0,4)	(3,1,4)			ii) No	(2,0,1)	(2,1,1)			ii) Yes
Kenya	0.0010	0.0011	---	0.811	i) No	0.1611	0.1670	---	2.242*	i) No
	(1,0,3)	(1,1,3)			ii) ---	(1,0,4)	(1,1,4)			ii) ---
Madagascar	0.0017	0.0018	---	0.982	i) No	0.1293	0.1212	---	3.570***	i) Yes
	(1,0,3)	(1,1,3)			ii) ---	(4,0,1)	(4,1,1)			ii) ---
Mauritius	0.0012	0.0013	---	1.267	i) No	0.0547	0.0580	---	2.593**	i) No
	(1,0,1)	(1,1,1)			ii) ---	(4,0,1)	(4,1,1)			ii) ---
Nigeria	0.0045	0.0042	-0.195*	---	i) Yes	0.2325	0.1943	-0.027***	---	i) Yes
	(2,0,2)	(2,1,2)			ii) Yes	(1,0,1)	(1,1,1)			ii) Yes
Rwanda	0.0209	0.0136	-0.788***	---	i) Yes	0.0617	0.0625	-0.007	---	i) No
	(1,0,4)	(1,1,4)			ii) Yes	(4,0,1)	(4,1,1)			ii) No
Senegal	0.0029	0.0024	-0.705***	---	i) Yes	0.2121	0.0982	-0.013***	---	i) Yes
	(1,0,1)	(1,1,1)			ii) Yes	(2,0,3)	(2,1,3)			ii) Yes
Sierra Leone	0.0027	0.0013	-0.381***	---	i) Yes	0.2110	0.2184	-0.014	---	i) No
	(1,0,1)	(1,3,1)			ii) Yes	(1,0,1)	(1,1,1)			ii) No
South Africa	0.0004	0.0003	---	2.449*	i) Yes	0.0935	0.0986	---	1.473	i) No
	(2,0,1)	(2,2,1)			ii) ---	(1,0,3)	(1,1,3)			ii) ---
The Gambia	0.0017	0.0024	---	1.177	i) No	0.2020	0.2113	---	0.190	i) No
	(3,0,4)	(3,2,4)			ii) ---	(1,0,1)	(1,1,1)			ii) ---
Togo	0.0034	0.0036	---	0.658	i) No	0.1256	0.1327	---	-3.236**	i) No
	(1,0,1)	(1,1,1)			ii) ---	(1,0,2)	(1,1,2)			ii) ---

Notes: m, n and p denote the lags leading to the smallest FPE in each case, where the maximum lag length was 4, with the expection of Nigeria (maximum of 5 lags) and Togo (maximum of 3 lages) due to considerably different time horizons. (*), (**) and (***) denote significance of the ECM or F- test statistic at 10%, 5% and 1% levels, respectively. (a) indicates an insignifcant F-statistic, while (b) indicates an ECM term that is insignifcant or has a wrong sign.

Table 6: Causality Analysis for DEPTH and TRADE

Country	FPE (m,0,p)	FPE (m,n,p)	ECM	F-Stats	D → T i) short-run ii) long-run	FPE (m,0,p)	FPE (m,n,p)	ECM	F-Stats	T→D i) short-run ii) long-run
Burundi	0.0247	0.0246	---	1.411	i) Yes[a]	0.1082	0.1072	---	2,15	i) Yes[a]
	(3,0,1)	(3,2,1)			ii) ---	(1,0,1)	(1,1,1)			ii) ---
Cameroon	0.0032	0.0034	---	2.992**	i) No	0.0501	0.0527	---	4.856***	i) No
	(2,0,2)	(2,1,2)			ii) ---	(2,0,1)	(2,1,1)			ii) ---
Cote d'Ivoire	0.0055	0.0065	---	2.291*	i) No	0.1691	0.1704	---	0.570	i) No
	(1,0,4)	(1,1,4)			ii) ---	(1,0,1)	(1,1,1)			ii) ---
Ethiopia	0.0268	0.0272	---	2.955**	i) No	0.1577	0.1633	---	1.381	i) No
	(3,0,1)	(3,1,1)			ii) --	(1,0,2)	(1,1,2)			ii) ---
Gabon	0.0092	0.0089	---	3.014**	i) Yes	0.4635	0.4876	---	1.345	i) No
	(1,0,1)	(1,1,1)			ii) ---	(2,0,1)	(2,1,1)			ii) ---
Ghana	0.0209	0.0213	-0.147***	---	i) No	0.2109	0.2056	-0.031**	---	i) Yes
	(1,0,1)	(1,1,1)			ii) No	(2,0,1)	(2,1,1)			ii) Yes
Kenya	0.0101	0.0081	---	3.111**	i) Yes	0.1472	0.1759	---	1.921	i) No
	(1,0,3)	(1,4,3)			ii) ---	(1,0,2)	(1,4,2)			ii) ---
Madagascar	0.0211	0.0214	---	1.776	i) No	0.1275	0.1212	---	3.570***	i) Yes
	(4,0,1)	(4,1,1)			ii) ---	(4,0,1)	(4,1,1)			ii) ---
Mauritius	0.0037	0.0033	---	3.926***	i) Yes	0.0623	0.0580	---	2.593**	i) Yes
	(3,0,1)	(3,2,1)			ii) ---	(4,0,1)	(4,1,1)			ii) ---
Nigeria	0.1105	0.0898	-0.043*	---	i) Yes	0.1888	0.1943	-0.027***	---	i) No
	(2,0,1)	(2,1,1)			ii) Yes	(1,0,1)	(1,1,1)			ii) No
Rwanda	0.0546	0.0626	0.156***	---	i) No	0.0668	0.0625	-0.007	---	i) Yes
	(2,0,1)	(2,4,1)			ii) No	(4,0,1)	(4,1,1)			ii) No[b]
Senegal	0.0141	0.0133	0.118*	---	i) Yes	0.1622	0.0796	0.108***	---	i) Yes
	(1,0,1)	(1,1,1)			ii) No[b]	(2,0,3)	(2,4,3)			ii) No[b]
Sierra Leone	0.0405	0.0367	0.027	---	i) Yes	0.2094	0.2184	-0.014	---	i) No
	(1,0,1)	(1,1,1)			ii) No[b]	(1,0,1)	(1,1,1)			ii) No
South Africa	0.0046	0.0045	---	1.666	i) Yes[a]	0.0991	0.0986	---	1.473	i) Yes[a]
	(1,0,2)	(1,1,2)			ii) ---	(1,0,1)	(1,3,1)			ii) ---
The Gambia	0.0625	0.0802	---	0.500	i) No	0.2028	0.2113	---	0.190	i) No
	(3,0,1)	(3,1,1)			ii) ---	(1,0,1)	(1,1,1)			ii) ---
Togo	0.0124	0.0129	---	2.493*	i) No	0.1119	0.1327	---	3.236**	i) No
	(2,0,1)	(2,1,1)			ii) ---	(1,0,1)	(1,2,1)			ii) ---

Notes: m, n and p denote the lags leading to the smallest FPE in each case, where the maximum lag length was 4, with the expection of Nigeria (maximum of 5 lags) and Togo (maximum of 3 lages) due to considerably different time horizons. (*), (**) and (***) denote significance of the ECM or F- test statistic at 10%, 5% and 1% levels, respectively. (a) indicates an insignifcant F-statistic, while (b) indicates an ECM term that is insignifcant or has a wrong sign.

Table 7: Causality Analysis for GROWTH and TRADE

Country	FPE (m,0,p)	FPE (m,n,p)	ECM	F-Stats	G → T i) short-run ii) long-run	FPE (m,0,p)	FPE (m,n,p)	ECM	F-Stats	T → G i) short-run ii) long-run
Burundi	0.0238	0.0246	---	1.411	i) No	0.0056	0.0059	---	0.365	i) No
	(3,0,2)	(3,1,2)			ii) ---	(1,0,4)	(1,1,4)			ii) ---
Cameroon	0.0038	0.0034	---	2.992**	i) Yes	0.0028	0.0027	---	3.942**	i) Yes
	(2,0,1)	(2,2,1)			ii) ---	(4,0,1)	(4,1,1)			ii) ---
Cote d'Ivoire	0.0091	0.0065	---	2.291*	i) Yes	0.0034	0.0032	---	1.975	i) Yes[a]
	(1,0,1)	(1,4,1)			ii) ---	(4,0,1)	(4,1,1)			ii) ---
Ethiopia	0.0342	0.0272	---	2.955**	i) Yes	0.0067	0.0070	---	1.823	i) No
	(3,0,1)	(3,1,1)			ii) ---	(2,0,1)	(2,1,1)			ii) ---
Gabon	0.0089	0.0088	---	3.014**	i) Yes	0.0137	0.0145	---	1.185	i) No
	(3,0,1)	(3,1,1)			ii) ---	(1,0,4)	(1,1,4)			ii) ---
Ghana	0.0230	0.0246	-0.028***	---	i) No	0.0052	0.0061	-0.748***	---	i) No
	(1,0,2)	(1,1,2)			ii) No	(3,0,4)	(3,2,4)			ii) No
Kenya	0.0100	0.0081	---	3.111*	i) Yes	0.0009	0.0011	---	0.827	i) No
	(1,0,4)	(1,3,4)			ii) ---	(1,0,3)	(1,1,3)			ii) ---
Madagascar	0.0202	0.0214	---	1.776	i) No	0.0017	0.0018	---	0.982	i) No
	(4,0,1)	(4,1,1)			ii) ---	(1,0,1)	(1,3,1)			ii) ---
Mauritius	0.0040	0.0033	---	3.926***	i) Yes	0.0012	0.0013	---	1.361	i) No
	(3,0,2)	(3,1,2)			ii) ---	(1,0,2)	(1,1,2)			ii) ---
Nigeria	0.1090	0.1060	-0.027***	---	i) Yes	0.0045	0.0041	-0.219**	---	i) Yes
	(2,0,1)	(2,1,1)			ii) Yes	(2,0,1)	(2,1,1)			ii) Yes
Rwanda	0.0754	0.0751	0.091	---	i) Yes	0.0217	0.0136	-0.788***	---	i) Yes
	(2,0,1)	(2,2,1)			ii) No[b]	(1,0,1)	(1,4,1)			ii) Yes
Senegal	0.0149	0.0133	0.118*	---	i) Yes	0.0019	0.0024	-0.819***	---	i) No
	(1,0,1)	(1,1,1)			ii) No[b]	(1,0,1)	(1,2,1)			ii) No
Sierra Leone	0.0381	0.0378	-0.089	---	i) Yes	0.0015	0.0016	-0.182***	---	i) No
	(1,0,2)	(1,1,2)			ii) No[b]	(1,0,1)	(1,1,1)			ii) No
South Africa	0.0043	0.0045	---	1.761	i) No	0.0003	0.0004	---	2.449*	i) No
	(1,0,2)	(1,1,2)			ii) ---	(2,0,2)	(2,1,2)			ii) ---
The Gambia	0.0791	0.0802	---	0.500	i) No	0.0021	0.0022	---	1.256	i) No
	(3,0,1)	(3,1,1)			ii) ---	(3,0,1)	(3,1,1)			ii) ---
Togo	0.0125	0.0109	---	3.457**	i) Yes	0.0035	0.0036	---	0.658	i) No
	(2,0,1)	(2,3,1)			ii) ---	(1,0,1)	(1,1,1)			ii) ---

Notes: m, n and p denote the lags leading to the smallest FPE in each case, where the maximum lag length was 4, with the expection of Nigeria (maximum of 5 lags) and Togo (maximum of 3 lages) due to considerably different time horizons. (*), (**) and (***) denote significance of the ECM or F- test statistic at 10%, 5% and 1% levels, respectively. (a) indicates an insignifcant F-statistic, while (b) indicates an ECM term that is insignifcant or has a wrong sign.

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