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Financial Access and Productivity Dynamics in Sub-Saharan Africa

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Abstract

The purpose of this study is to investigate whether enhancing financial access influences productivity in Sub-Saharan Africa. The research focuses on 25 countries in the region with data for the period 1980-2014. The adopted empirical strategy is the Generalised Method of Moments. The credit channel of financial access is considered and proxied by private domestic credit while four main total factor productivity (TFP) dynamics are adopted for the study, namely: TFP, real TFP, welfare TFP and real welfare TFP. It is apparent from the findings that enhancing financial access positively affects welfare TFP whereas the effect is not significant on TFP, real TFP and welfare TFP. Policy implications are discussed. The study complements the extant literature by engaging hitherto unemployed dynamics of TFP in Sub-Saharan Africa.

1. Introduction

Does enhancing financial access affect productivity in Sub-Saharan Africa (SSA)? Assessing the importance of improving financial access in total factor productivity (TFP) is worthwhile on the premise of three fundamental motivations, notably: the growing debate on the paramount role of productivity compared to other parameters of economic development in the prosperity of developing countries; (ii) the essence of financial access in driving economic development and (iii) shortcomings in the productivity literature. These highlighted features are substantiated chronologically in the subsequent paragraphs.

First, scholarship on the importance of aggregate productivity in economic development is still divided on a plethora of fronts, notably, in the light of the fact that consensus is lacking on the channels through which the underlying aggregate productivity can

be realised and consolidated in order to ultimately improve development outcomes (Baliamoune, 2009; Elu & Price, 2010; Baliamoune-Lutz, 2011; Ssozi & Asongu, 2016a; Cheruiyot, 2017; Tchamyou, 2017). One very recurrent part of the debate has been the relevance of factor accumulation vis-à-vis TFP in economic prosperity. Among the contending strands, Young (1995) has built on success stories in East Asia to establish that compared to TFP; factor accumultation is associated with more economic development externalities. However, another strand of scholarship promotes the stance that cross-country differences in TFP thresholds, elicit cross-country disparities in economic development levels (Abramovitz, 1986; Romer, 1986, 1993; Nelson & Pack, 1999; Klenow & Rodriguez-Clare, 1997; Easterly & Levine, 2001; Temple, 1999; Durlauf, Johnson & Temple, 2005).

Narrowing the debate to the context of Africa, it has been argued by Devarajan, Easterly and Pack (2001) that the comparatively low level of economic development in Africa is more traceable to low productivity levels than is it to unfavourable levels of investment. The authors recommend policy makers to put more emphasis on consolidating drivers of productivity than on boosting uproductive investments. An underlying assumption motivating this recommendation is the fact that relative to low investment levels, investment productivity is more worthwhile. The positioning of this research contributes to the underlying debate by assessing how enhacing financial access in SSA affects dynamics of productivity. As clarified in the following paragraph, the relevance of financial development in determining productivity is consistent with the substantially documented importance of financial access in boosting economic development in SSA.

Second, in the light of the theoretical perspective disclosed in Section 2, the extant literature on financial development has documented that enhancing financial access is important in driving investments for employment and output growth, improving household welfare and business operators, *inter alia* (Odhiambo, 2010, 2013, 2014; Bocher, Alemu, & Kelbore, 2017; Wale & Makina, 2017; Chikalipah, 2017; Daniel, 2017; Osah & Kyobe, 2017; Oben & Sakyi, 2017; Ofori-Sasu, Abor & Osei, 2017; Boadi, Dana, Mertens, & Mensah, 2017; Chapoto & Aboagye, 2017; Iyke & Odhiambo, 2017; Tchamyou, Erreygers, Cassimon, 2019; Tchamyou, 2019a, 2019a). The study contributes to the strand of literature by assessing the nexus between enhancing financial access and productivity because to the best of our knowledge, the contemporary extant literature has not focused on the problem statement.

Third, the attendant contemporary literature on productivity has fundamentally focused on *inter alia*: productivity externalities that are driven by foreign investment (Fanta &

Makina, 2017; Dunne & Masiyandima, 2017); variations in the distribution of labour and concerns about gender (Elu & Price, 2017); the relationship between exports and manufacturing (Cisse, 2017); education characteristics and intensity of children engagement in the labour market (Ahouakan & Diene, 2017); investigation of gaps in output in relation to potential economic productivity (Fedderke & Mengisteab, 2017); the engagement of women to improve productivity in the argricultural sector (Uduji, Okolo-Obasi, 2018a, 2018b); the moderating importance of value chains on the impact of foregn investment on economic growth and productivity (Meniago & Asongu, 2019); investigation of nexuses underpinning TFP and the manufacturing sectors with relevance to cross-sector differences in the growth of productivity (Kreuser & Newman, 2018); the importance of information technology in convergence in TFP (Maryan & Jehan, 2018) and financial access and TFP in SSA (Bokpin, Ackah & Kunawotor, 2018).

The study in the literature closest to the positioning of this research is Bokpin et al. (2018) which has investigated the impact of financial access on the productivity of manufacturing corporations in SSA. Employing Ordinary Least Squares and Random Effects regressions, the study establishes that access to a cost-effective credit line improves the productivity of firms. This research departs from Bokping et al. (2018) from three main strandpoints: (i) the empirical strategy adopted is the generalised method of moments (GMM) that controls for the unobserved heterogeneity and simultaneity in order to account for endogeneity; (ii) the concept of enhancing financial access is adopted in place of financial access because quadratic interactive regressions are engaged and (iii) four productivity dynamics are considered in place of the mainstream productivity indicator used by the underlying study. This third point merits more emphasis. Accordingly, this study engages both productivity and welfare productivity dynamics in the light of challenges to sustainable development goals (SDG). These include: TFP, real TFP, welfare TFP and real welfare TFP. In essence, the study is not only concerned with productivity but also about how the productivity is distributed across the population (i.e. welfare-related TFP) because the equitable distribution of friuts of output and productivity are at the centre of most SDGs (Asongu, Biekpe & le Roux, 2017).

The remainder of the research proceeds as follows. This introduction is followed by theoretical underpinnings in Section 2. Section 3 provides insights into the data and methodology while the empirical results and corresponding discussion are covered in Section 4. The concluding implications and future research directions are engaged in Section 5.

2. Theoretical underpinnings

Two fundamental theoretical perspectives can be acknowleged to underpin the linkage between financial acess and output or productivity. In essence, in order to boost output, coporates require the much needed finance to fund their production processes. As recently motivated by Tchamyou *et al.* (2019), a theoretical school on the relevance of financial development on output posits that more financial access is important for consolidating output and economic prosperity. This theoretical view is consistent with an important body of literature on the connection between financial development and efficiency in the implementation of investment projects (Galor & Zeira, 1993; Galor & Moav, 2004; Aghion & Bolton, 2005). Intuitively such investment projects ultimately engender productivity externalities, which are captured as the outcome variables in this research.

On the other hand, another position in the theoretical literature is the view that very demanding conditions for access to finance can limit the underlying access to finance. Some requirements for financial access that can constraint the availability of credit include: collateral requirements; transaction costs and information asymmetry, which *inter alia*, have led to documented concerns of surplus liquidity in financial institutions in SSA (Asongu & Odhiambo, 2018a, 2018b). According to this strand of theoretical debate, for the most part, owing to the underlying constraints, financial access is skewed in favour of wealthier fractions of society to the detriment of poorer corporations and households (Asongu, Nwachukwu & Tchamyou, 2016). One outcome of such constraints is that businesses and households are constrained to rely on less formal external sources of finance (i.e. remittances) and the domestic informal financial sector for funding opportunities (Beck, Demirgüç-Kunt & Levine, 2007; Tchamyou, 2019a). There is another reconciling strand of literature which merges the contending strands by advocating that the nexus between financial development and economic output can be non-monotic or non-linear in the perspective that the relationship can be negative or positive from one stage of the economic development process to another (Greenwood & Jovanovic, 1990; Asongu & Tchamyou, 2014). This non-linear element is taken on board in this study because the estimation exercise involves interactive regressions. With such interactive estimations, the estimated coefficients corresponding to the unconditional and marginal effects are associated with different signs in estimated coefficients that reflect this discussed non-linear pattern.

Another stream of theories that can be employed to elucidate the nexuses being investigated in this study consists of the intensive and extensive margin theories (Tchamyou *et al.*, 2019). First, the intensive margin theory maintains that output is promoted by financial

access through both direct and indirect mechanisms in order to reward businesses that are already engaged with formal banking services (Chipote, Mgxekwa & Godza, 2014). Second, from the framework of the extensive margin theory, enhancing financial access goes beyond benefiting existing users of formal financial services to equally rewarding previously excluded fractions of the population (Holtz-Eakin, Joulfaian & Rosen, 1994; Batabyal & Chowdhury, 2015; Evans & Jovanovic, 1989; Black & Lynch, 1996; Bae, Han & Sohn, 2012; Odhiambo, 2014; Chiwira, Bakwena, Mupimpila & Tlhalefang, 2016; Orji, Aguegboh & Anthony-Orji, 2015). Put in other terms, the framework of the extensive margin theory maintains that access to finance could also be benefitical to households and business segments that were not previously involved in formal banking operations.

This research accords with both the extensive and intensive margin theories in the perspective that, improving access to finance can be rewarding both to the existing and future users of formal banking establishments. To these, the tailoring of the estimation approach conforms to both theories in the estimation framework. It is worthwhile to put these posited nexuses into more perspective. First, the study is consistent with the intensive margin theory in the light of the fact that financial access can affect economic output both indirectly and directly. Access to finance directly influences productivity and output because corporations naturally depend on financial services to fund their productive operations. Access to finance also indirectly influences economic output in the light of the interactive framework of the empirical analysis underpinning the study. Hence, the possibility of inflexion points associated with interactive regressions mirror the indirect linkage.

Second, the positioning of this reseafch accords with the extensive margin theory in view of the fact that as argued by Tchamyou et al. (2019), when interactive regressions are involved in a specification exercise within the context of the finance-development nexus, both intensive and extensive margin theories are relevant underpinnings motivating the corresponding nexus being investigated. Moreover, a policy measure of enhancing access to finance is by intuition, not exclusively meant for existing users of formal banks accounts, but also targets previously excluded corporations from formal banking services. Hence, these previously excluded businesses can leverage on the new avenues of financial access in order to improve their production capacities.

3. Data and Methodology

3.1 Data

The study involves twenty-five countries in the region (i.e. SSA) and the data used is for the period 1980 to 2014[1]. The geographical and temporal restrictions are motivated by constraints in the availability of data at the time the study was carried out. Another constraint that determines the structure of the dataset is the estimation strategy to be adopted in the study. Accordingly, the choice of the GMM estimation approach motivates the restructuring of the dataset in terms of non-overlapping data averages. Such transformation is relevant in order to enable the datastructure to conform to the N>T condition that is imperative for the adoption of the estimation approach (Tchamyou, Asongu & Nwachukwu, 2018). The advantages of the GMM in the light of the closest study in the literature motivating this research have been clarified in the introduction.

The engaged restructuring process which is designed to reduce instrument proliferation that could bias estimated coefficients generates two main datasets: seven five-year and five seven-year averages. An exploratory analysis informs the study that the latter set of non-overlapping intervals results in less constraints of instrument proliferation and hence, produces estimated models that are not biased. Hence, the retained data averages used for the empirical exercise are: 1980-1986; 1987-1993; 1994-2000; 2001-2007 and 2008-2014.

In the light of the motivation of the study, four TFP dynamics from the Penn World Table database are employed as outcome variables, namely: TFP, real TFP, welfare TFP and real welfare TFP. Accordingly, beyond the employed standard TFP measurement, TFP proxies that are associated with welfare are also taken on board in the light of challenges to SDGs in the post-2015 sustainable development era. In essence, the outcome variables articulate both productivity as well as welfare dynamics that are associated with such productivity in order to incorporate the dimension of whether output is beneficial to the masses. These TFP dynamics have been used in recent TFP literature on SSA (Meniago & Asongu, 2019).

Consistent with contemporary financial development literature (Tchamyou, 2019a, 2019b), private domestic credit from the Financial Development and Structure Database (FDSD) of the World Bank is used as a credit channel. The research prefers the credit channel

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[1]The countries selected on data availability are: Benin; Botswana; Burkina Faso; Burundi; Cameroon; Central African Republic; Cote d'Ivoire; Gabon; Kenya; Lesotho; Mauritania; Mauritius; Mozambique; Namibia; Niger; Nigeria; Rwanda; Senegal; Sierra Leone; South Africa; Sudan; Swaziland; Tanzania; Togo and Zimbabwe.

to the deposit mechanism because financial access is intuitively more associated with the credit channel than with the deposit channel.

To take on board concerns related to omitted-variable bias, four elements are adopted in the conditioning information set, namely: foreign direct investment (FDI), education quality, population and government expenditure. FDI is from the United Nations Conference on Trade and Development database while the remaining three variables are from the World Development Indicators (WDI) of the World Bank. The choice of these indicators in the conditioning information set is motivated by contemporary economic output scholarship, notably: Becker, Laeser and Murphy (1999), Barro (2003), Heady and Hodge (2009), Sahoo, Dash and Nataraj (2010), Elu and Price (2010, 2017), Ssozi and Asongu (2016a, 2016b), Tchamyou, (2017), Dunne and Masiyandima (2017) and Efobi, Tanankem and Asongu (2018)[2]. In accordance with the attendant literature, all four variables are expected to positively influence productivity and corresponding dynamics. Appendix 1, Appendix 2 and Appendix 3 respectively, disclose the definitions and sources of variables, the summary statistics and the correlation matrix.

3.2 Methodology

3.2.1 Specification

The narrative in the data section pertaining to the restructuring of the dataset in the light of the estimation strategy to be adopted obviously justify the selection of the GMM as empirical approach. The *two-step* approach is preferred to the *one-step* strategy in the light of contemporary GMM-centric literature (Akinyemi, Efobi, Asongu & Osabuohien, 2019; Tchamyou, 2019a). The GMM option used is the forward orthogonal deviations approach based on the extension of Arellano and Bover (1995) by Roodman (2009). In addition to the motivation outlined in the introduction, two more complementary motivations justify the choice of the estimation strategy, notably: (i) the dependent variable reflects persistence because correlation coefficients corresponding to the level and first lag values are higher than 0.800 which is the established threshold for assessing persistence in an outcome indicator (Tchamyou, 2019b) and (ii) endogeneity is accounted for in the light of the fact that

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[2] Other economic output and productivity research supporting the relevance of adopted control variables include: Nyasha and Odhiambo (2015a, 2015b); Okafor, Piesse and Webster (2017); Kumi, Muazu and Yeboah (2017); Maryam and Jehan (2018); Kreuser and Newman (2018); Muazu and Alagidede (2017); and Yaya and Cabral (2017).

simultaneity is controlled with the employment of internal instruments and the unobserved heterogeneity is taken on board with the control for time-invariant omitted variables.

Eq. (1) and Eq. (2) below illustrate the standard GMM equations that can be employed to investigate the importance of enhancing financial access for productivity.

$$TFP_{i,t} = \sigma_0 + \sigma_1 TFP_{i,t-\tau} + \sigma_2 Pc_{i,t} + \sigma_3 PcPc_{i,t} + \sum_{h=1}^{4} \delta_h W_{h,i,t-\tau} + \eta_i + \xi_t + \varepsilon_{i,t} \tag{1}$$

$$TFP_{i,t} - TFP_{i,t-\tau} = \sigma_1(TFP_{i,t-\tau} - TFP_{i,t-2\tau}) + \sigma_2(Pc_{i,t} - Pc_{i,t-\tau}) + \sigma_3(PcPc_{i,t} - PcPc_{i,t-\tau})$$
$$+ \sum_{h=1}^{4} \delta_h(W_{h,i,t-\tau} - W_{h,i,t-2\tau}) + (\xi_t - \xi_{t-\tau}) + (\varepsilon_{i,t} + \varepsilon_{i,t-\tau}) \tag{2}$$

where $TFP_{i,t}$ denotes a TFP dynamic (i.e. TFP, real TFP, welfare TFP and real welfare TFP) of country i in period t; Pc represents private domestic credit; $PcPc$ denotes a quadratic interaction of private domestic credit ("private domestic credit" × "private domestic credit"); σ_0 is a constant; τ is the degree of auto-regression which corresponds to one and represents a seven year lag because such a time lag appropriately captures past information; W reflects the set of control variables used in the research (*FDI, education, population and government expenditure*), η_i is the country-specific effect, ξ_t is the time-specific constant and $\varepsilon_{i,t}$ the error term.

The GMM option adopted in the study is the technique by Roodman (2009) which builds on the Arellano and Bover (1995) *difference* GMM approach. Such a technique has been established in contemporary GMM related scholarship to produce more efficient estimated coefficients, because, *inter alia*, it mitigates instrument proliferation (Boateng, Asongu, Akamavi & Tchamyou, 2018; Tchamyou et al., 2019; Asongu & Odhiambo, 2019a, 2019b).

3.2.2 Identification, simultaneity and exclusion restrictions

In order to ensure that the specification discussed in the previous section is robust, it is necessary to discuss the identification strategy, articulate how simultaneity is addressed and clarify the information criterion pertaining to the identification strategy. First, the identification process requires that the research should clarify three sets of variables, namely: the outcome indicators, predetermined or endogenous explaining variables and the strictly exogenous variables. In the light of the motivation in the introduction and clarification in the data section, the dependent variables are obviously TFP dynamics. Consistent with the attendant GMM-centric literature (Tchamyou & Asongu, 2017; Meniago & Asongu, 2018), the endogenous explaining variables constitute the independent variable of interest and

control variables while the adopted strictly exogenous variables are years. The choice of the strictly exogenous indicators accords with Roodman (2009) who has argued that years are worthwhile strictly exogenous variables because it is not feasible for the years to be endogenous upon a first difference. Building on this identification strategy, the exclusion restrictions assumption is examined by assessing if the adopted strictly exogenous indicators can influence the outcome variable through the adopted endogenous explaining channels.

Second, with regard to the concern about simultaneity, instrumental indicators that are forward differenced are employed and such a process also encompasses the employment of Helmet transformations in order to eliminate fixed effects which are probable of biasing estimated models given the underlying correlation between the lagged outcome variables and fixed impacts. Consistent with Arellano and Bover (1995), Love and Zicchino (2006) and Roodman (2009), this process of doing away with fixed effects enables orthogonal or parallel conditions pertaining to lagged and forward-differenced observations.

Third, in the light of the narrative on identification elucidated in the first paragraph of this section, the exclusion restriction underpinning is investigated by means of the Difference in Hansen Test (DHT) for the exogeneity of instruments which has a null hypothesis that supports the position that the elucidated strictly exogenous variables affect the outcome variables exclusively via the proposed predetermined variables. It follows from this clarification that the hypothesis corresponding to the exclusion restriction is valid if in the results reported in the next section, the null hypothesis corresponding to the DHT is not rejected. This criterion is not dissimilar to the process underpinning the validation of instruments in the standard Sargan/Hansen test in which a rejection of the corresponding null hypothesis is indicative of the fact that the instruments are valid (Beck, Demirgüç-Kunt & Levine, 2003; Amavilah, Asongu & Andrés, 2017).

4. Empirical results

The section presents the empirical results in Tables 1-2. Each table shows findings on two TFP dynamics, notably: (i) TFP and real TFP growth in Table 1 and (ii) welfare TFP and real welfare TFP in Table 2. For each given TFP dynamic, five main specifications are considered: one without a variable in the conditioning information set and four with one indicator from the adopted elements in the conditioning information set. Accordingly, it is essentially because of issues pertaining to instrument proliferation that one variable is adopted for every specification. It is relevant to recall that the engagement of limited variables in the conditioning information set is not uncommon because the attendant GMM-centric literature

has documented scholarship in which limited control variables are considered in order to enable valid instruments. For instance, examples of studies in the literature that have involved no control variables in order to achieve robust estimated coefficients include: Osabuohien and Efobi (2013) and Asongu and Nwachukwu (2017).

In the light of the attendant GMM-oriented literature, the research employs four criteria of information to assess if the estimated models are valid or not[3]. Based on these criteria, some estimated models are invalid because the null hypothesis of the Hansen is rejected. It is important to clarify that the Hansen test is robust, though can be weakened by instrument proliferation while the Sargen test is not robust, although cannot be weakened by the proliferation of instruments. A mode of clarifying this conflict of interest consists of adopting the Hansen test and then avoiding the issue pertaining to the proliferation of instruments by making sure that in each specification, the number of instruments is less than the corresponding number of countries.

To investigate the problem statement motivating this research which is to assess how enhancing financial access affects dynamics of TFP, as documented by contemporary interactive regressions scholarship, net impacts are computed (Agoba, Abor, Osei & Sa-Aadu, 2019; Asongu & Odhiambo, 2019c). These net effects embody both the unconditional effect of financial access as well as the conditional effect underpinned by the interactive regression. The consideration of these net impacts can be articulated in the fourth column of Table 2 in which the net effect from enhancing financial access on welfare TFP is 0.002 (2×[-0.00002 × 21.009] + [0.003]). In this calculation, 0.003 is the unconditional effect of financial access on welfare TFP, 21.009 is the average value of financial access, -0.00002 is the conditional or marginal effect of financial access while the leading 2 corresponds to the quadractic derivation.

Considering the information criteria for the validity of models, the clarified net effects are not engaged in certain models for two main reasons: (i) "not specifically applicable" or "nsa" is employed to illustrate scenarios where the suggested information criteria does not enable the study to validate estimated models and (ii) "not applicable" or "na" illustrates models in which, at least one estimated coefficient needed for the calculation of the

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[3] *"First, the null hypothesis of the second-order Arellano and Bond autocorrelation test (AR (2)) in difference for the absence of autocorrelation in the residuals should not be rejected. Second the Sargan and Hansen over-identification restrictions (OIR) tests should not be significant because their null hypotheses are the positions that instruments are valid or not correlated with the error terms. In essence, while the Sargan OIR test is not robust but not weakened by instruments, the Hansen OIR is robust but weakened by instruments. In order to restrict identification or limit the proliferation of instruments, we have ensured that instruments are lower than the number of cross-sections in most specifications. Third, the Difference in Hansen Test (DHT) for exogeneity of instruments is also employed to assess the validity of results from the Hansen OIR test. Fourth, a Fischer test for the joint validity of estimated coefficients is also provided"* (Asongu & De Moor, 2017, p.200).

corresponding net effect is not significant. The following findings can be established from Tables 1-2. Enhancing financial access positively affects welfare TFP whereas the effect is not significant on TFP, real TFP and welfare TFP. The significant control variables reflect the anticipated signs.

Table 1: TFP and Enhancing Credit

| | Dependent variable: Total Factor Productivity (TFP) dynamics | | | | | | | | | |
	Total Factor Productivity (TFP)					Real Total Factor Productivity Growth (Real TFP growth)				
TFP (-1)	**0.879*** (0.000)**	**0.796*** (0.000)**	**0.595*** (0.000)**	**0.766*** (0.000)**	**0.811*** (0.000)**	---	---	---	---	---
Real TFP growth (-1)	---	---	---	---	---	**0.721*** (0.000)**	**0.805*** (0.000)**	**0.579*** (0.000)**	**0.661*** (0.001)**	**0.687*** (0.000)**
DCredit	0.002 (0.182)	0.002 (0.251)	**0.004* (0.057)**	0.002 (0.313)	-0.0007 (0.783)	0.0008 (0.764)	-0.001 (0.595)	-0.0008 (0.748)	-0.0007 (0.807)	0.002 (0.394)
DCredit× DCredit	**-0.00002* (0.085)**	-0.00001 (0.412)	-0.00003 (0.106)	-0.00001 (0.558)	0.00001 (0.634)	-5.54e-06 (0.848)	0.00001 (0.513)	0 .00001 (0.592)	0.00001 (0.550)	-0.00002 (0.470)
FDI	---	0.001 (0.424)	---	---	---	---	**0.003** (0.026)**	---	---	---
Education	---	---	0.203 (0.104)	---	---	---	---	-0.162 (0.122)	---	---
Population	---	---	---	0.013 (0.204)	---	---	---	---	0.024 (0.118)	---
Gov't Expenditure	---	---	---	---	0.001 (0.529)	---	---	---	---	-0.005 (0.145)
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Net Effects	nsa	na	na	nsa	na	nsa	na	na	na	nsa
AR(1)	**(0.791)**	**(0.843)**	**(0.251)**	**(0.854)**	**(0.788)**	**(0.204)**	**(0.179)**	**(0.937)**	**(0.122)**	**(0.224)**
AR(2)	**(0.573)**	**(0.418)**	**(0.397)**	**(0.540)**	**(0.392)**	**(0.178)**	**(0.159)**	**(0.801)**	**(0.187)**	**(0.190)**
Sargan OIR	**(0.412)**	**(0.407)**	**(0.920)**	**(0.108)**	(0.083)	(0.072)	(0.038)	(0.074)	(0.003)	(0.021)
Hansen OIR	(0.084)	**(0.182)**	**(0.620)**	(0.062)	**(0.221)**	(0.052)	**(0.129)**	**(0.116)**	**(0.122)**	(0.045)
DHT for instruments (a)Instruments in levels										
H excluding group	---	(0.079)	**(0.518)**	(0.047)	(0.008)	---	**(0.109)**	(0.047)	(0.006)	(0.002)
Dif(null, H=exogenous)	**(0.195)**	**(0.309)**	**(0.560)**	**(0.141)**	**(0.832)**	**(0.140)**	**(0.190)**	**(0.257)**	**(0.637)**	**(0.464)**
(b) IV (years, eq(diff))										
H excluding group	(0.054)	**(0.142)**	**(0.644)**	(0.013)	(0.087)	(0.013)	(0.038)	(0.076)	(0.088)	(0.026)
Dif(null, H=exogenous)	**(0.277)**	**(0.378)**	**(0.410)**	**(0.920)**	**(0.783)**	**(0.522)**	**(0.851)**	**(0.403)**	**(0.370)**	**(0.384)**
Fisher	**7296.39 *****	**7645.80 *****	**21700.66 *****	**455.32 *****	**292.02 *****	**4.84*** **	**16044.20 *****	**8710.17 *****	**33.64*** **	**7.95*** **
Instruments	14	18	18	18	18	14	18	18	18	18
Countries	24	24	24	24	24	24	24	24	24	24
Observations	92	92	78	92	90	92	92	78	92	90

***,**,*: significance levels at 1%, 5% and 10% respectively. DHT: Difference in Hansen Test for Exogeneity of Instruments Subsets. Dif: Difference. OIR: Over-identifying Restrictions Test. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Wald statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR(1) & AR(2) tests and; b) the validity of the instruments in the Sargan and Hansen OIR tests. Gov't: Government. nsa: not specifically applicable because the estimated model is not valid. na: not applicable because at least one estimated coefficient required for the computation of net effects is not significant. The mean value of credit access is 21.009. Constants are included in all regressions.

Table 2: Real TFP growth and Enhancing Credit

	Welfare Total Factor Productivity (Welfare TFP)					Welfare real Total Factor Productivity (Welfare real TFP)				
Welfare TFP (-1)	**0.837*** (0.000)**	**0.808*** (0.000)**	**0.701** (0.000)**	**0.716*** (0.000)**	**0.945*** (0.000)**	---	---	---	---	---
Welfare real TFP (-1)	---	---	---	---	---	**0.678*** (0.000)**	**0.699*** (0.000)**	**0.647*** (0.000)**	**0.575*** (0.000)**	**0.666*** (0.000)**
DCredit	0.001 (0.238)	**0.002* (0.074)**	**0.003*** (0.006)**	0.001 (0.390)	-0.003 (0.190)	-0.0007 (0.766)	-0.001 (0.309)	-0.0007 (0.815)	-0.001 (0.562)	0.0003 (0.910)
DCredit× DCredit	-0.00001 (0.315)	-0.00001 (0.277)	**-0.00002** (0.019)**	-3.63e-06 (0.861)	0.00003 (0.141)	5.24e-06 (0.852)	0.00001 (0.389)	3.54e-06 (0.916)	0.00001 (0.626)	-6.28e-06 (0.836)
FDI	---	**0.001* (0.067)**	---	---	---	---	**0.003*** (0.034)**	---	---	---
Education	---	---	0.091 (0.358)	---	---	---	---	-0.061 (0.496)	---	---
Population	---	---	---	-0.0004 (0.968)	---	---	---	---	0.007 (0.638)	---
Gov't Expenditure	---	---	---	---	**0.012*** (0.001)**	---	---	---	---	0.0002 (0.953)
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Net Effects	nsa	na	0.002	nsa	na	na	na	na	nsa	na
AR(1)	(0.561)	(0.615)	(0.249)	(0.525)	(0.670)	(0.055)	(0.038)	(0.254)	(0.037)	(0.091)
AR(2)	(0.543)	(0.636)	(0.332)	(0.961)	(0.566)	(0.886)	(0.977)	(0.602)	(0.752)	(0.741)
Sargan OIR	(0.416)	(0.583)	(0.621)	(0.129)	(0.419)	(0.108)	(0.145)	(0.039)	(0.004)	(0.113)
Hansen OIR	(0.036)	(0.043)	(0.171)	(0.090)	(0.131)	(0.202)	(0.479)	(0.197)	(0.097)	(0.462)
DHT for instruments (a)Instruments in levels										
H excluding group	---	(0.170)	(0.395)	(0.066)	(0.033)	---	(0.295)	(0.593)	(0.023)	(0.220)
Dif(null, H=exogenous)	(0.065)	(0.050)	(0.145)	(0.172)	(0.340)	(0.214)	(0.488)	(0.148)	(0.308)	(0.515)
(b) IV (years, eq(diff))										
H excluding group	(0.008)	(0.017)	(0.281)	(0.035)	(0.119)	(0.090)	(0.391)	(0.193)	(0.020)	(0.210)
Dif(null, H=exogenous)	(0.529)	(0.542)	(0.151)	(0.628)	(0.294)	(0.485)	(0.505)	(0.297)	(0.999)	(0.905)
Fisher	5793.76***	6504.63***	2359.39***	12816.97***	686.72***	9335.91***	13169.67***	22.82***	37900.25***	19500.06***
Instruments	14	18	18	18	18	14	18	18	18	18
Countries	24	24	24	24	24	24	24	24	24	24
Observations	92	92	78	92	90	92	92	78	92	90

***,**,*: significance levels at 1%, 5% and 10% respectively. DHT: Difference in Hansen Test for Exogeneity of Instruments Subsets. Dif: Difference. OIR: Over-identifying Restrictions Test. The significance of bold values is twofold. 1) The significance of estimated coefficients and the Wald statistics. 2) The failure to reject the null hypotheses of: a) no autocorrelation in the AR(1) & AR(2) tests and; b) the validity of the instruments in the Sargan and Hansen OIR tests. Gov't: Government. nsa: not specifically applicable because the estimated model is not valid. na: not applicable because at least one estimated coefficient required for the computation of net effects is not significant. The mean value of credit access is 21.009. Constants are included in all regressions.

5. Concluding implications and future research directions

The purpose of this study is to investigate whether enhancing financial access influences productivity in Sub-Saharan Africa. The research focuses on 25 countries in the region with data for the period 1980-2014. The adopted empirical strategy is the Generalised Method of Moments. The credit channel of financial access is considered and proxied by private domestic credit while four main total factor productivity (TFP) dynamics are adopted for the study, namely: TFP, real TFP, welfare TFP and real welfare TFP. It is apparent from the findings that enhancing financial access positively affects welfare TFP whereas the effect is not significant on TFP, real TFP and welfare TFP. Before discussing the policy implications, it is first of all worthwhile to clarify why the study has reported findings that are largely

characterised by net effects that could not be computed owing to the fact that at least one estimated coefficient relevant for the computation of the corresponding net effects is not significant.

The research question motivating this study as articulated in the first sentence of the first paragraph of the introduction is more relevant to this study compared to findings associated with the methodology used to assess if the research question withstands empirical scrutiny. In other words while the findings do not overwhelmingly validate the relevance of enhancing financial access for productivity dynamics, it is relevant to note that the research has proceded to reporting them because insignificant findings have as much policy and economic relevances as significant results. Hence, this study departs from mainstream studies in which strong and significant findings are preferred over weak and insignificant findings. Therefore reporting these findings as they are is an approach to scholarly reporting in which the "file drawer problem" or "publication bias" is not relevant (Rosenberg, 2005; Franco, Malhotra & Simonovits, 2014). Accordingly, the insignificant results may translate concerns in the financial intermediary sector that limit access to finance needed by economic operators to improve productivity and output.

The fact that enhancing financial access does not overwhelmingly improve productivity apparently contrasts with the substantially documented concerns of surplus liquidity prevalent in financial institutions of Africa (Saxegaard, 2006; Fouda, 2009). Hence, measures aimed at improving access to finance for productivity purposes can still be deterred by other attendant concerns that limit financial access, *inter alia*: transaction costs, collateral requirements and information asymmetry. Hence, a direct policy implication is that policy measures designed to limit information asymmetry should be improved in view of restricting adverse selection on the part of banking institutions and moral hazard from corporations when they have been granted access to credit.

The findings and corresponding policy implications obviously leave space for future research, particularly in the domain of investigating how taking instruments that reduce information asymmetry on board can improve what is currently known about the investigated relationships. Hence, future studies can engage information sharing offices (i.e. public credit registries and private credit bureaus) as well as information information technology in the finance-productivity nexus. Such instruments have been documented in contemporary financial development literature to reduce information asymmetry associated with financial access in the African banking industry (Kusi, Agbloyor, Ansah-Adu, & Gyeke-Dako, 2017; Kusi, & Opoku- Mensah, 2018; Asongu, Batuo, Nwachukwu, & Tchamyou, 2018).

Appendices

Appendix 1: Definitions and sources of variables

Variables	Signs	Variable Definitions (Measurements)	Sources
TFP1	TFP	Total Factor Productivity (TFP)	Penn World Table database
TFP2	RTFP	Real Total Factor Productivity Growth (RTFPg)	Penn World Table database
TFP3	WTFP	Welfare Total Factor Productivity (WTFP)	Penn World Table database
TFP4	WRTFP	Welfare Real Total Factor Productivity (WRTFP)	Penn World Table database
Credit Access	Private credit	Domestic credit to private sector (% of GDP)	FDSD
Foreign Direct Investment	FDI	Foreign Direct Investment Inflows(% of GDP)	UNCTAD
Education	Education	SEPSGPI: School enrollment, primary and secondary (gross), gender parity index (GPI)	WDI
Population	Population	Logarithm of Population (in millions)	WDI
Government Expenditure	Gov't Expenditure	Governments final consumption expenditure (% of GDP)	WDI

WDI: World Development Indicators. GDP: Gross Domestic Product.UNCTAD: United Nations Conference on Trade and Development. FDSD: Financial Development and Structure Database.

Appendix 2: Summary statistics

	Mean	SD	Minimum	Maximum	Observations
Total Factor Productivity	0.539	0.310	0.121	1.884	125
Real Total Factor Productivity Growth	0.539	0.276	0.123	1.381	125
Welfare Total Factor Productivity	0.984	0.189	0.605	1.664	125
Welfare Real Total Factor Productivity	0.927	0.190	0.456	1.785	125
Credit Access	21.009	22.256	2.238	144.397	121
Foreign Direct Investment	1.903	2.795	-3.440	22.118	124
Education	0.854	0.177	0.465	1.341	107
Population	2.515	0.818	-0.242	4.165	125
Government Expenditure	16.066	5.358	6.085	36.155	122

S.D: Standard Deviation.

Appendix 3: Correlation matrix (uniform sample size: 124)

TFP	RTFP	WTFP	WRTFP	Credit	FDI	Education	Pop	Gov. Ex	
1.000	0.228	0.957	0.127	0.240	-0.129	0.270	0.025	0.079	TFP
	1.000	0.244	0.604	0.093	0.028	-0.094	-0.208	0.074	RTFP
		1.000	0.123	0.287	-0.090	0.287	-0.050	0.172	WTFP
			1.000	0.197	0.109	-0.142	-0.078	-0.050	WRTFP
				1.000	0.033	0.172	-0.122	0.153	Credit
					1.000	0.224	0.054	0.130	FDI
						1.000	0.026	0.335	Education
							1.000	-0.326	Pop
								1.000	Gov. Ex

TFP: Total Factor Productivity. RTFP: WTFP: Welfare Total Factor Productivity. WRTFP: Welfare Real Total Factor Productivity. FDI: Foreign Direct Investment. Pop: population growth. Gov. Ex: Government Expenditure.

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