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The role of value added across economic sectors in modulating the effects of FDI on TFP and economic growth dynamics

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A G D I Working Paper

WP/21/088

**The role of value added across economic sectors in modulating the effects of
FDI on TFP and economic growth dynamics**

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The role of value added across economic sectors in modulating the effects of FDI on TFP and economic growth dynamics**Simplice A. Asongu, Christelle Meniago & Raufhon Salahodjaev**

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Abstract

This study investigates: (i) the effect of foreign direct investment (FDI) on total factor productivity (TFP) and economic growth dynamics, and (ii) the relevance of value added from three economic sectors in modulating the established effect of FDI on TFP and economic growth dynamics. The geographical and temporal scopes are respectively 25 Sub-Saharan African countries and the period 1980–2014. The empirical evidence is based on non-interactive and interactive Generalised Method of Moments. The following main findings are established. First, FDI has a positive effect on GDP growth, GDP per capita and welfare real TFP. Second, the effect of FDI is negative on real GDP and TFP, while the impact is insignificant on real TFP growth and welfare TFP. Third, values added to the three economic sectors largely modulate FDI to produce negative net effects on TFP and growth dynamics. Policy implications are discussed with particular emphasis on the need to complement added value across various economic sectors in order to leverage on the benefits of FDI in TFP and economic growth. To the best of knowledge, this is the first study to assess how value added from various economic sectors affect the relevance of FDI on macroeconomic outcomes.

JEL Classification: E23; F21; F30; F43; O55

Keywords: Economic output, total factor productivity, foreign investment, agricultural sector, manufacturing sector, service sector, sub-Saharan Africa

1. Introduction

The study is motivated by two major factors in scholarly and policy-making circles: (i) debates and (ii) gaps in the literature. The points are substantiated in chronological order. First, whereas aggregate productivity has been documented to be critical in Africa's development, there is yet no consensus in the literature on mechanisms by which such productivity can be achieved and enhanced (Tchamyou, 2017; Balamoune, 2009; Ssozi & Asongu, 2016a; Balamoune-Lutz, 2011; Cheruiyot, 2017; Elu & Price, 2010)¹. Consistent with the underlying literature, a notable debate has centred on factor accumulation and total factor productivity (hence TFP). For instance, in one strand of the literature, according to Young (1995) on a study focusing on East Asian economies, compared to TFP, factor accumulation has played a more relevant role in boosting economic development. Conversely, another strand on the literature supports the perspective that cross-country variations in TFP elucidate cross-country differences in economic development (Abramovitz, 1986; Romer, 1986, 1993; Temple, 1999; Nelson & Pack, 1999; Klenow & Rodriguez-Clare, 1997; Durlauf, Johnson & Temple, 2005; Easterly & Levine, 2001). According to Devarajan, Easterly and Pack (2003), Africa's dismal economic growth is more traceable to low productivity as opposed to investment levels. Building on the narrative, in order to promote economic growth, it will be premature to advocate for higher levels of investment in Africa without a good mastery of sources of low productivity. The positioning of this study responds to the underlying concerns by assessing how added values in different economic sectors modulate the effect of foreign investment on TFP and economic growth in Sub-Saharan Africa (SSA). Such a positioning is of relevance owing to gaps in contemporary attendant literature.

Second, the contemporary literature pertaining to the positioning of this study can be discussed in three main strands: (i) studies on TFP have fundamentally focused on the supply of labour and gender disparities in SSA (Elu & Price, 2017); the relationship between exporting and manufacturing (Cisse, 2017); characteristics of schooling and child labour intensity (Ahouakan & Diene, 2017); understanding of TFP and manufacturing firms within the framework of examining variations in the levels and growth productivity within the context manufacturing sectors (Kreuser & Newman, 2018) and the role of the diffusion of technology in TFP convergence (Maryan & Jehan, 2018).

¹ This study considers value added across economic sectors as such channels.

(ii) Recent papers on economic growth have focused on country-specific evidence on inflation and output dynamics (Bonga-Bonga & Simo-Kengne, 2018); nexuses between financial development and economic growth (Adam, Musah & Ibrahim, 2017; Assefa & Mollick, 2017); linkages between aid, aid volatility and sector growth (Kumi, Ibrahim & Yeboah, 2017); FDI drivers in SSA and Middle East and North African countries (Okafor, Piesse & Webster, 2017); innovation and economic growth volatility (Yaya & Cabral, 2017); financial development and economic growth volatility (Ibrahim & Alagidede, 2017).

(iii) Studies of FDI have been oriented towards FDI and regional income convergence (Dunne & Masiyandima, 2017); the role of global sector influence on sector portfolios in Africa (Boamah, 2017); connections among bonds, equity, institutional debt and economic development (Fanta & Makina, 2017); and estimation of output gap and future economic growth (Fedderke & Mengisteab, 2017).

Noticeably, the engaged literature has failed to explore the relevance of added values from economic sectors in driving FDI for TFP and economic prosperity. This study improves the extant strand of literature by examining how hitherto unexplored mechanisms affect the investigated relationships. The mechanisms include value added from the three economic sectors (i.e. agricultural, manufacturing and services sectors). We argue that the substantially documented relevance of FDI on macroeconomic outcomes (notably, TFP and economic output) can be influenced by the state of development of these main economic sectors. Accordingly, with the introduction of hitherto unexplored channels through which the role of FDI on TFP and economic growth can be modulated, the contribution to the literature is relevant to both direct and indirect effects of FDI. On the direct effect front, we argue that nexuses between FDI and macroeconomic outcomes have less policy relevance unless they are complemented with policy variables such as mechanisms through which FDI can be consolidated. On the indirect effect, the contemporary African literature pertaining to linkages under investigation have failed to engage the three main economic sectors².

In order to complement this attendant literature, we argue that understanding how the three main economic sectors influence the effect of FDI on macroeconomic outcomes

² For instance, Ssozi and Asongu (2016a) have investigated the education or schooling mechanism in the FDI-TFP nexus while Gui-Diby (2014) has examined the relevance of human resources on the impact of FDI on economic growth.

provides a comprehensive picture of how added values from the underlying sectors can be used to influence FDI for development outcomes.

Departing from the highlighted literature, which has largely focused on one measurement of TFP and economic development, the present study argues that in the sustainable development goals (SDGs) era, where concerns pertaining to sustainable development are articulated in scholarly and policy circles, it is relevant to articulate sustainable development by complementing extant productivity measurements with welfare productivity outcomes that put more emphasis on sustainable development. In this light, the present study employs seven proxies for TFP and economic development: TFP, GDP growth, real GDP, GDP per capita, real TFP, welfare TFP and real welfare TFP.

The theoretical underpinnings surrounding the role of FDI on TFP and economic growth have been substantially documented in the literature. Recent examples of models of TFP and technological gains can be found in Ssozi and Asongu (2016a). For brevity and lack of space, instead of recycling this prior theoretical exposition that is well known, the study devotes more space to discussing the intuition motivating the directions being investigated. In essence, as argued above, the intuition for this study is simple to follow: (i) FDI is invested in three main economic sectors in an economy, and (ii) the relevance of the underlying FDI in TFP and economic growth is contingent on the value added produced by these economic sectors. Hence the main research question motivating this study is as follows: what is the role of value added across economic sectors in modulating the effects of FDI on TFP and economic growth dynamics in Sub-Saharan Africa? The focus of the attendant research question clearly departs from a study by Elu and Price (2010), which has focused on assessing whether China transfers productivity enhancing technology to Sub-Saharan Africa within the framework of manufacturing firms.

The rest of the paper is organized as follows. The next section presents the theoretical underpinnings and a brief literature review, while section 3 discusses the data and empirical methodology for the analysis. Section 4 covers the results, while section 5 presents some concluding remarks.

2. Data and methodology

2.1 Data

The present study investigates a panel of 25 countries³ in SSA using annual data for the period 1980 to 2014. The selection of countries is due to data availability constraints. The data on Foreign Direct Investment (FDI) are from the United Nations Conference on Trade and Development (UNCTAD) FDI database. FDI is measured in terms of FDI inflows as a percentage of Gross Domestic Product (GDP). While the TFP estimates are from the Penn World Table database, the remaining explanatory variables are from the World Development Indicators (WDI) and the Financial Development and Structure Database (FDSD) of the World Bank.

Three economic growth and four TFP variables are used in order to increase room for robustness. The former set of variables from WDI includes Gross Domestic Product (GDP) growth, real GDP and GDP per capita. The last-two variables are log-normalised in order to ensure that the variables are comparable. The latter set of TFP dynamics includes TFP, real TFP, welfare TFP and real welfare TFP. In the light of the motivation of the study, these variables capture both productivity and welfare related to attendant productivity. Economic development within the scope of this research entails GDP growth, real GDP and GDP per capita. It is important to lay more emphasis on the engaged welfare-relevant TFP measures in order to further substantiate the reasoning underpinning their adoption. According to the attendant literature, with the welfare of a country's representative consumer being summarized by capital stock per capita and TFP to a first order, to calculate the underlying welfare-relevant TFP, a measure of real domestic absorption, which includes investment and consumption, is required (Basu et al., 2014). The choice of the underlying GDP and TFP indicators is motivated by recent economic growth (Asongu & Odhiambo, 2020) and TFP (Basu et al., 2014; Asongu, 2020) literature.

In order to increase the policy relevance of the study, FDI is modulated with value-added indicators from the three economic sectors, namely, the agricultural, manufacturing and service sectors. Consistent with the research question motivating the present study, the choice of these channels is motivated by the need to assess how the relevance of FDI in economic

³The 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.

development and TFP can be boosted by policy measures from the three main economic sectors. The selection of the three main economic sectors (agriculture, manufacturing and service) is informed by contemporary African-centric literature on value added across economic sub-sectors (Asongu & Odhiambo, 2021a).

Consistent with recent literature on determinants of economic output, economic growth and TFP, six main control variables are adopted for the study: population, inflation, government expenditure, education, remittances and private domestic credit (Barro, 2003; Sahoo *et al.*, 2010; Basu *et al.*, 2014; Ssozi & Asongu, 2016a, 2016b; Vu & Asongu, 2020). The expected signs are discussed in chronological order. First, it is widely accepted in the literature that positive demographic change promotes output and economic activity. Some studies supporting this perspective include Becker *et al.* (1999) and Heady and Hodge (2009). Second, intuitively, inflation is negatively connected with the examined outcome variables given that investors have been documented to respond negatively to economic environments that are characterised by a substantial degree of ambiguity, such as inflation. Kelsey and le Roux (2017, 2018) are examples of studies supporting the underlying view. Third, from intuition, government expenditure is expected to be positively associated with productivity and economic output. However, this anticipated sign is contingent on the degree of corruption and mismanagement associated with such expenditure. Fourth, while Ssozi and Asongu (2016a) have established that education in SSA promotes TFP, the choice of a proxy of education that encompasses both secondary and primary enrollments is premised on the studies arguing for the importance of these education levels in development outcomes, especially when attendant countries are at early stages of industrialisation (Petraakis & Stamatakis, 2002; Asiedu, 2014; Tchamyou, 2020)⁴. Fifth, remittances have been established to be positively associated with economic output and TFP in SSA (Ssozi & Asongu, 2016b). However, the overall effect could also be contingent on how remittances affect other dynamics, such as income-inequality. For instance, remittances have been recently documented to increase inequality in SSA (Anyanwu, 2011; Meniago & Asongu, 2018; Tchamyou *et al.*, 2019a), and such income inequality is negatively associated with economic

⁴The adopted education proxy is primary and secondary (gross), gender parity index (GPI). School enrollment is used in place of educational attainment for the fundamental reason that skills needed for productivity and economic development can be acquired through school enrollment even if the school enrollment is not sanctioned by a level of completed education. Accordingly, for a certificate of educational attainment that entails five years of schooling, a student can succeed in all classes and only fail the final year exam. The fact that the student does not end up with a certificate does not imply that he/she did not acquire some learning via education.

output (Fosu, 2015). The relevance of private domestic credit in productivity and economic growth is in accordance with the extant literature (Asongu, 2015; Nyasha & Odhiambo, 2015a, 2015b).

The definitions of variables and corresponding sources, the summary statistics and correlation matrix are presented in Appendix 1, Appendix 2 and Appendix 3, respectively. From the summary statistics, it is apparent that the variables can be compared based on their mean values. Moreover, the variations in the corresponding standard deviations are indications that significant linkages will be derived from the estimations. The purpose of the correlation matrix is to ensure that variables with a high degree of substitution are not adopted in the conditioning information set. Beside the expected high correlation among the outcome variables, some correlations among independent variables merit more clarification. For instance, (i) education and GDP growth on the one hand and on the other, education and value added in the agricultural sector exhibit high correlations, and (ii) it is also apparent that the value added to the agricultural sector and value added to the manufacturing sector are negatively associated with FDI. The underlying concerns are clarified in what follows.

(i) The correlation between education and GDPg should not be an issue because GDPg is an outcome variable and education is a control variable. Accordingly, the procedure for choosing control variables is tailored such that they should influence the outcome variable and thus are expected to be correlated with the outcome variable.

(ii) The correlation between education and value added to the agricultural sector does not influence the findings and corresponding policy implications because in interactive regressions, the concern of multicollinearity is not taken into account given that estimated coefficients are not interpreted as in linear additive models (Brambor et al., 2006). This is why both the unconditional impact and conditional estimated effect (from variables that are highly correlated) are used in the computation of net effects as we have done in the study.

(iii) The explanation in (ii) above extends to clarifying the perspective that values added to the agricultural and manufacturing sectors were negatively associated with FDI, not least, because the overall/net effects were not exclusively based on this negative association, which is reflected by the interactive terms. Accordingly, the overall/net effect is the sum of the interactive effect and the unconditional effect of FDI. Hence, the unconditional effect of FDI

can still outweigh the apparent underlying negative correlations to produce positive overall/net effects. This is the reason an empirical analysis is worthwhile to assess if the perspective of initial correlations withstands empirical scrutiny when assessed within the framework of net/overall effects pertaining to interactive regressions.

The data is tailored to be consistent with the adoption of the estimation strategy, which is the Generalised Method of Moments (GMM). Accordingly, the estimation approach is designed for a dataset in which the number of countries is higher than the number of periods in each country. Hence, in order to meet this condition, the dataset is disaggregated in terms of averages or seven-year non-overlapping intervals. Hence, the study retains five data points, which correspond to the following intervals: 2008-2014; 2001-2007; 1994-2000; 1987-1993; and 1980-1986. It is important to note that at least five data points are required for the application of the GMM approach. During the data exploration exercise, we also derived seven five-year non-overlapping intervals. Unfortunately, this latter set of data averages produced findings that did not pass the post-estimation diagnostic instrument proliferation test. Hence, the study retained the former set of data averages or seven-year non-overlapping intervals. The use of non-overlapping intervals also has the advantage of reducing disturbances from business cycles that can substantially persist (Islam, 1995).

2.2 Methodology

2.2 Empirical Model and Estimation Procedure

2.2.1 Specification

The empirical strategy is designed to respond to two fundamental questions motivating the study: (i) the effect of FDI on TFP and economic output, and (ii) the relevance of values added from the three economic sectors in modulating the established effect. In order to make these assessments, both non-interactive and interactive regressions are employed to address the concerns in (i) and (ii) respectively. Accordingly, to address the first question, TFP and economic growth dynamics are regressed on FDI contingent on variables in the conditioning information set or control variables, while to address the second question, TFP and economic growth dynamics are regressed on FDI, which are interacted with or modulated by the value added across economic sectors proxies, contingent on control variables.

The adopted GMM approach is motivated by five main reasons. The first-two are required for the approach whereas the last three represent advantages that are related to the empirical strategy (Tchamyou, 2020; Tchamyou *et al.*, 2019b).

(i) Persistence is exhibited by majority of the outcome variables because the correlation between an outcome variable and its first lags is higher than 0.800, which the rule of thumb required for a variable to be characterised by persistence (Asongu, Nnanna & Acha-Anyi, 2020; Asongu, Nting & Nnanna, 2020).

(ii) The number of data points in each country (i.e. T=5) is lower than the total of number countries (i.e. N=25).

(iii) Some aspects of endogeneity are taken on board given that the estimation approach is tailored to employ instrumental variables to address suspected simultaneity in the regressors. Furthermore, the unobserved heterogeneity is controlled with time-invariant omitted variables that are used to control for cross sectional dependence.

(iv) Potential biases in the difference estimator are tackled using the system estimator.

(v) Cross-country differences are considered in the specifications.

Moreover, the GMM estimator has been widely used in extant cross-country research to assess the drivers of economic growth (Doytch & Uctum, 2011; Siddiqui & Ahmed, 2013) and TFP (Asongu, Nnanna & Acha-Anyi, 2020b; Di Liberto *et al.*, 2011).

The following equations in levels (1) and first difference (2) summarize the estimation procedure for TFP and economic development (i.e., GDP growth, real GDP and GDP per capita).

$$TFP_{i,t} = \sigma_0 + \sigma_1 TFP_{i,t-\tau} + \sigma_2 FDI_{i,t} + \sigma_3 VA_{i,t} + \sigma_4 Inter_{i,t} + \sum_{h=1}^6 \delta_h W_{h,i,t-\tau} + \eta_i + \xi_t + \varepsilon_{i,t} \quad (1)$$

$$TFP_{i,t} - TFP_{i,t-\tau} = \sigma_1 (TFP_{i,t-\tau} - TFP_{i,t-2\tau}) + \sigma_2 (FDI_{i,t} - FDI_{i,t-\tau}) + \sigma_3 (VA_{i,t} - VA_{i,t-\tau}) + \sigma_4 (Inter_{i,t} - Inter_{i,t-\tau}) + \sum_{h=1}^6 \delta_h (W_{h,i,t-\tau} - W_{h,i,t-2\tau}) + (\xi_t - \xi_{t-\tau}) + (\varepsilon_{i,t} + \varepsilon_{i,t-\tau}), \quad (2)$$

where $TFP_{i,t}$ is total factor productivity of country i in period t ; FDI is foreign direct investment; VA is value added from an economic sector (i.e. agricultural, manufacturing and service sectors); $Inter$ is the interaction between FDI and the value added from an economic sector; σ_0 is a constant; τ is the degree of auto-regression which is one because a lag of seven years is enough to capture past information; W is the vector of control variables (*population, inflation, government expenditure, education, remittances and private domestic credit*), η_i is the country-specific effect, ξ_t is the time-specific constant and $\varepsilon_{i,t}$ the error term. Equations (1) and (2) are replicated for the remaining six dependent variables: GDP growth, real GDP, GDP per capita, real TFP, welfare TFP and real welfare TFP.

This study adopts the Roodman (2009) extension of Arellano and Bover (1995) because it has been documented to limit the proliferation of instruments (Love & Zicchino, 2006; Boateng et al., 2018). Moreover, a two-step instead of a one-step estimation procedure is adopted because it corrects for heteroscedasticity.

2.2.2 Identification, simultaneity and exclusion restrictions

The specification of the GMM will not be robust unless some discussion on identification, simultaneity and exclusion restrictions is engaged. In what follows, the three elements are covered in the same order of presentation. For the purpose of conceptual clarification: (i) *identification* consists of selecting three main sets of variables: (a) the outcome variables, (b) the endogenous explaining variables consisting of the independent variables of interest and control and (c) the strictly exogenous variables, which also double as the main instruments. (ii) *Simultaneity* is the process through which the concern of reverse causality is addressed. (iii) *Exclusion restriction* refers to the procedure by which the assumption that the adopted strictly exogenous variables influence the outcome variable exclusively via the exogenous components of the explaining variables is confirmed.

First, regarding the identification strategy, the study is consistent with recent empirical literature on GMM application in defining time invariant variables are strictly exogenous while all independent variables are acknowledged as endogenous explaining or suspected endogenous (Tchamyou & Asongu, 2017; Meniago & Asongu, 2018; Tchamyou et al., 2019b). The procedure of identification is also in accordance with Roodman (2009) who has argued that years are appropriate strictly exogenous instruments because it is unfeasible for

years to become endogenous after a first difference. Building on these insights, the GMM equation is specified such that the time invariant variables are within the instrumental variables (*iv* or *ivstyle*) framework (i.e. ‘*iv* (propositions, years, eq(diff))’). Hence, the corresponding procedure for assessing the endogenous explaining variables is the *gmmstyle*. The underpinning exclusion restriction assumption is that, the adopted strictly exogenous variables influence the outcome variables exclusively via the proposed mechanisms or endogenous explaining variables.

Secondly, in order to address the concern of simultaneity or reverse causality, forward differenced variables are used as instrumental variables, contrary to the employment of lagged explanatory variables in the standard differenced GMM approach. To this end, Helmert transformations are employed to remove fixed effects, which can potentially bias estimated coefficients because such fixed effects are correlated with the error terms. Such an approach to the purging of fixed effects is consistent with the extant literature (Arellano & Bover 1995; Love & Zicchino, 2006). Note should be taken of the fact that such an instrumentation process is quite distinct from the standard process of subtracting non-contemporary observations from associated contemporary observations. In other words, in place of first differences, forward mean-differences are used (Roodman, 2009). These transformations are conducive for orthogonal or parallel conditions between, the lagged and forward-differenced observations.

Thirdly, concerning exclusion restrictions, the Difference in Hansen Test (DHT) for instrument exogeneity is used to assess whether the adopted strictly exogenous instruments influence the outcome variables exclusively through the investigated channels. The null hypothesis of this test is the position that the strictly exogenous instruments are valid.

3. Empirical results

The empirical findings are presented in Tables 1-4. Whereas the first-two tables are focused on non-interactive regressions, the last-two tables reflect findings pertaining to interactive estimations. Table 1 and Table 3 (Table 2 and Table 4) focus on GDP-related (TFP-oriented) estimations. There are consistently three main specifications, notably: a first specification in which FDI is the main independent variable of interest; a second specification with the first set of three control variables and a third specification with the second set of three control variables. The use of variables from the conditioning information set in two distinct specifications is to mitigate concerns of instrument proliferation when more control variables

are employed. For all the tables, the information criteria discussed in Section 3 is used to examine the validity of the GMM models⁵.

The following findings can be established from Tables 1-2. First, FDI has a positive effect on GDP growth, GDP per capita and welfare real TFP. Second, the effect of FDI is negative on real GDP and TFP while the impact is insignificant on real TFP growth and welfare TFP. The negative magnitude of the FDI effects on the outcome variables is substantially low when compared with the corresponding positive magnitude of FDI on the outcome variables. This may imply that for the established negative effects, FDI is a necessary but not a sufficient condition for positive outcomes in the engaged dependent variables. The significant control variables have the expected signs for the most part.

⁵ “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).

Table 1: Non-interactive Growth-oriented regressions

	Dependent variables: Economic growth dynamics								
	GDP growth			lnRGDP			lnGDPpc		
Constant	2.561*** (0.001)	-6.155** (0.017)	2.212** (0.025)	5.775*** (0.009)	-0.085 (0.893)	1.107** (0.037)	-1.869*** (0.000)	-0.974*** (0.004)	-0.511*** (0.005)
GDP growth(-1)	0.144 (0.282)	-0.056 (0.348)	0.242*** (0.000)	---	---	---	---	---	---
lnRGDP(-1)	---	---	---	0.446** (0.039)	0.868*** (0.000)	0.941*** (0.000)	---	---	---
lnGDPpc(-1)	---	---	---	---	---	---	1.263*** (0.000)	1.040*** (0.000)	1.067*** (0.000)
FDI	0.213*** (0.001)	0.215*** (0.000)	0.168*** (0.000)	-0.008 (0.716)	-0.007* (0.060)	-0.007 (0.370)	0.009* (0.062)	0.001 (0.602)	-0.001 (0.687)
Population	---	1.473*** (0.000)	---	---	0.132** (0.028)	---	---	0.035 (0.407)	---
Inflation	---	-0.002*** (0.000)	---	---	-0.0002 (0.000)	---	---	-0.0002 (0.000)	---
Education	---	6.877*** (0.005)	---	---	1.545*** (0.000)	---	---	0.791** (0.010)	---
Gov't Exp.	---	---	0.072 (0.182)	---	---	-0.008 (0.374)	---	---	-0.003 (0.560)
Remittances	---	---	-0.075** (0.016)	---	---	-0.0006 (0.908)	---	---	0.002 (0.439)
Private Credit	---	---	-0.016* (0.084)	---	---	0.001 (0.351)	---	---	-0.0002 (0.842)
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR(1)	(0.042)	(0.166)	(0.034)	(0.745)	(0.835)	(0.665)	(0.626)	(0.642)	(0.465)
AR(2)	(0.730)	(0.815)	(0.065)	(0.357)	(0.343)	(0.180)	(0.126)	(0.296)	(0.224)
Sargan OIR	(0.414)	(0.189)	(0.047)	(0.000)	(0.142)	(0.026)	(0.640)	(0.806)	(0.241)
Hansen OIR	(0.489)	(0.644)	(0.291)	(0.032)	(0.538)	(0.570)	(0.751)	(0.757)	(0.857)
DHT for instruments									
(a) Instruments in levels									
H excluding group	(0.515)	(0.274)	(0.062)	(0.315)	(0.529)	(0.641)	(0.787)	(0.980)	(0.661)
Dif(null, H=exogenous)	(0.391)	(0.792)	(0.708)	(0.023)	(0.466)	(0.440)	(0.605)	(0.457)	(0.800)
(b) IV (years, eq(diff))									
H excluding group	(0.226)	(0.401)	(0.237)	(0.035)	(0.553)	(0.738)	(0.309)	(0.712)	(0.849)
Dif(null, H=exogenous)	(0.580)	(0.987)	(0.476)	(0.105)	(0.378)	(0.201)	(0.830)	(0.557)	(0.529)
Fisher Instruments	14.16***	1311.28***	106.21***	57.88***	103.00***	544.96***	285.29***	903.08***	4453.62***
Countries	10	22	22	10	22	22	10	22	22
Observations	25	25	24	24	24	24	24	24	24
	99	83	83	96	80	83	94	78	81

***, **, *: 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 Fisher 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. The total number of countries in all specifications is not 25 because of missing data for South Africa.

In order to investigate the relevance of added values from economic sectors in the effect of FDI on TFP and economic growth dynamics, net effects are computed in Table 3 and Table 4. In both tables, Panel A, Panel B and Panel C are focused respectively, on the

modulating roles of the agricultural sector, the manufacturing sector and service sector. Like with the previous two tables, there are consistently three sets of specifications, notably: a first specification with the FDI and modulating policy variables; a second specification with the first set of three control variables and a third specification with the second set of three control variables. The use of variables in the conditioning information set in two distinct specifications is also motivated by the need to mitigate concerns of instrument proliferation when more control variables are employed. For lack of space, estimated coefficients corresponding to the control variables are not disclosed. For all the tables, the information criteria discussed in Section 3 is used to examine the validity of the GMM models.

Table 2: Non-interactive TFP-related regressions

	Panel A: Total Factor Productivity Regressions					
	Total Factor Productivity (TFP)			Real Total Factor Productivity Growth (RTFPg)		
Constant	0.071 (0.186)	-0.189** (0.019)	0.078*** (0.003)	0.305*** (0.002)	0.440*** (0.000)	0.335*** (0.000)
TFP(-1)	0.758*** (0.000)	0.619*** (0.000)	0.792*** (0.000)	---	---	---
RTFP(-1)	---	---	---	0.729*** (0.000)	0.600*** (0.000)	0.657*** (0.000)
FDI	0.0004 (0.801)	-0.001 (0.212)	-0.002*** (0.003)	0.0003 (0.830)	-0.00005 (0.969)	0.0001 (0.958)
Population	---	-0.003 (0.728)	---	---	-0.006 (0.428)	---
Inflation	---	-0.00007*** (0.000)	---	---	-0.00009*** (0.000)	---
Education	---	0.441*** (0.000)	---	---	-0.061 (0.341)	---
Gov't Exp	---	---	-0.001 (0.516)	---	---	0.003 (0.101)
Remittance	---	---	0.001** (0.030)	---	---	-0.001 (0.219)
Private Credit	---	---	0.0005 (0.290)	---	---	-0.0003 (0.647)
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes
AR(1)	(0.771)	(0.953)	(0.508)	(0.067)	(0.809)	(0.142)
AR(2)	(0.959)	(0.260)	(0.928)	(0.109)	(0.246)	(0.087)
Sargan OIR	(0.365)	(0.752)	(0.051)	(0.074)	(0.014)	(0.112)
Hansen OIR	(0.546)	(0.539)	(0.438)	(0.396)	(0.174)	(0.119)
DHT for instruments						
(a) Instruments in levels						
H excluding group	(0.346)	(0.616)	(0.163)	(0.631)	(0.570)	(0.047)
Dif(null, H=exogenous)	(0.535)	(0.419)	(0.678)	(0.279)	(0.101)	(0.394)
(b) IV (years, eq(diff))						
H excluding group	(0.866)	(0.416)	(0.590)	(0.260)	(0.496)	(0.049)
Dif(null, H=exogenous)	(0.385)	(0.666)	(0.192)	(0.422)	(0.042)	(0.863)
Fisher	61.63***	253.53***	2413.12***	18.43***	2392.58***	65.33***
Instruments	10	22	22	10	22	22
Countries	25	25	24	25	25	24
Observations	100	84	83	100	84	83

Panel B: Welfare Total Factor Productivity Regressions						
	Welfare Total Factor Productivity (WTFP)			Welfare Real Total Factor Productivity (WRTFP)		
Constant	0.110** (0.040)	-0.133** (0.043)	0.052** (0.011)	0.438*** (0.000)	0.268** (0.013)	0.414*** (0.000)
WTFP(-1)	0.721*** (0.000)	0.598*** (0.000)	0.760*** (0.000)	---	---	---
WRTFP(-1)	---	---	---	0.606*** (0.000)	0.477*** (0.000)	0.622*** (0.000)
FDI	0.001 (0.456)	0.001 (0.100)	-0.0002 (0.560)	0.003* (0.087)	0.001** (0.015)	0.002 (0.147)
Population	---	-0.011 (0.177)	0.001* (0.079)	---	0.008 (0.250)	---
Inflation	---	-0.00006*** (0.000)	-0.001 (0.174)	---	-0.00008*** (0.000)	---
Education	---	0.386*** (0.000)	0.001*** (0.003)	---	0.159* (0.067)	---
Gov't Exp.	---	---	---	---	---	0.003 (0.131)
Remittance	---	---	---	---	---	-0.004* (0.067)
Private Credit	---	---	---	---	---	-0.001** (0.020)
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes
AR(1)	(0.601)	(0.824)	(0.800)	(0.015)	(0.171)	(0.061)
AR(2)	(0.323)	(0.329)	(0.425)	(0.302)	(0.287)	(0.192)
Sargan OIR	(0.361)	(0.891)	(0.163)	(0.354)	(0.030)	(0.092)
Hansen OIR	(0.381)	(0.491)	(0.597)	(0.678)	(0.275)	(0.407)
DHT for instruments						
(a) Instruments in levels						
H excluding group	(0.462)	(0.333)	(0.285)	(0.437)	(0.352)	(0.360)
Dif(null, H=exogenous)	(0.302)	(0.547)	(0.726)	(0.635)	(0.268)	(0.420)
(b) IV (years, eq(diff))						
H excluding group	(0.843)	(0.502)	(0.635)	(0.276)	(0.238)	(0.248)
Dif(null, H=exogenous)	(0.245)	(0.372)	(0.359)	(0.771)	(0.428)	(0.811)
Fisher	44.24***	250.69***	672.71***	13.20***	6435.19***	56.11***
Instruments	10	22	22	10	22	22
Countries	25	25	24	25	25	24
Observations	100	84	83	100	84	83

***, **, *: 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 Fisher 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. The total number of countries in all specifications is not 25 because of missing data for South Africa.

The computation of net effects (i.e. in order to assess the overall effect of the policy relevance of the modulating variables on the outcome variables) is consistent with recent African development literature (Tchamyou, 2019, 2020; Asongu et al., 2017). For instance, in the fourth column of Table 3, the net effect of the role of added value from the agricultural sector in modulating the effect on FDI on GDP growth is $0.071([0.020 \times 26.673] + [-0.462])$, where: the mean value of added value from the agricultural sector is 26.673, the unconditional impact of FDI is -0.462 whereas the conditional impact from the interaction between FDI and added value from the agricultural sector is 0.020.

The following main findings can be established from the interactive regressions: value added from the three economic sectors largely modulate FDI to produce negative net effects on TFP and growth dynamics.

Table 3: Interactive TFP-related regressions

Dependent variable: Economic growth dynamics									
Panel A: Agricultural value added									
	GDP growth		lnRGDP				lnGDPpc		
Constant	5.846*** (0.002)	-11.130 (0.070)	4.380* (0.053)	3.570*** (0.000)	-0.933* (0.056)	1.462** (0.021)	1.208** (0.020)	0.373 (0.625)	1.369* (0.061)
Growth(-1)	0.040 (0.627)	-0.096 (0.203)	0.038 (0.637)	0.708*** (0.000)	0.991*** (0.000)	0.913*** (0.000)	0.912*** (0.000)	0.885*** (0.000)	0.886*** (0.000)
FDI	-0.295 (0.211)	0.331 (0.149)	-0.462*** (0.000)	-0.049 (0.158)	-0.005 (0.811)	-0.043** (0.018)	-0.058* (0.072)	-0.031 (0.174)	0.002 (0.923)
Agriculture(Agri)	-0.085* (0.077)	0.063 (0.378)	-0.108** (0.020)	-0.015*** (0.000)	0.0005 (0.922)	-0.012** (0.021)	-0.019*** (0.008)	-0.008 (0.189)	-0.009* (0.099)
FDI×Agri	0.016** (0.037)	-0.004 (0.526)	0.020*** (0.000)	0.001* (0.053)	0.0003 (0.631)	0.001** (0.015)	0.001* (0.061)	0.001 (0.155)	0.00001 (0.981)
Net effects	na	na	0.071	na	na	-0.016	-0.031	na	na
Control variables	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Validity Post-estimation diagnostic tests	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: Manufacturing value added									
Constant	0.315 (0.472)	1.208** (0.020)	1.030 (0.178)	0.457 (0.214)	-0.608 (0.221)	0.308 (0.616)	-1.543*** (0.000)	-2.297*** (0.000)	0.080 (0.853)
Growth(-1)	0.084 (0.188)	0.912*** (0.000)	0.100** (0.014)	0.916*** (0.000)	0.959*** (0.000)	0.938*** (0.000)	1.181*** (0.000)	1.110*** (0.000)	0.907*** (0.000)
FDI	0.597*** (0.000)	-0.058* (0.072)	0.523*** (0.000)	0.056*** (0.009)	0.034*** (0.001)	0.042*** (0.004)	0.057*** (0.005)	0.055*** (0.001)	0.028** (0.018)
Manufacturing(Manu)	0.159*** (0.000)	-0.019*** (0.008)	0.091** (0.012)	0.032*** (0.000)	0.022*** (0.002)	0.031*** (0.000)	0.031*** (0.001)	0.034*** (0.005)	0.028*** (0.000)
FDI×Manu	- (0.046***)	0.001* (0.061)	-0.036*** (0.000)	-0.006*** (0.000)	-0.003*** (0.001)	-0.005*** (0.003)	-0.006*** (0.000)	-0.005*** (0.001)	-0.004*** (0.000)
Net effects	0.003	-0.045	0.058	-0.021	-0.005	-0.022	-0.020	-0.009	-0.023
Control variables	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Validity Post-estimation diagnostic tests	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Panel C: Services Added Value									
Constant	-0.070 (0.979)	-9.031*** (0.001)	2.468 (0.156)	0.590 (0.767)	0.185 (0.805)	0.236 (0.467)	-2.010*** (0.000)	-0.755 (0.136)	-1.037*** (0.000)
Growth(-1)	0.171* (0.074)	-0.057 (0.342)	0.236*** (0.000)	0.903*** (0.000)	0.843*** (0.000)	0.998*** (0.000)	1.265*** (0.000)	0.996*** (0.000)	1.120*** (0.000)
FDI	0.718** (0.021)	0.770* (0.080)	0.961*** (0.003)	0.020 (0.817)	-0.050 (0.165)	0.013 (0.739)	0.044 (0.137)	-0.085** (0.047)	-0.008 (0.585)
Service	0.130 (0.294)	0.112 (0.280)	-0.012 (0.869)	0.022*** (0.007)	-0.002 (0.750)	0.005** (0.018)	0.005 (0.472)	-0.018** (0.012)	0.002 (0.303)
FDI×Service	-0.023 (0.109)	-0.023 (0.179)	-0.032 (0.013)	-0.0006 (0.836)	0.001 (0.229)	-0.0006 (0.702)	-0.001 (0.232)	0.003** (0.034)	0.0003 (0.625)
Net Effects	na	na	na	na	na	na	na	-0.026	na
Control variables	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Validity Post-estimation diagnostic tests	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes

*** **, *: 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 Fisher 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. Mean value of agriculture value added: 26.673. Mean value of manufacturing value added: 12.916. Mean service value added: 19.339.

Table 4: Interactive TFP-related regressions

Dependent variable: Total Factor Productivity (TFP) Dynamics												
Panel A: Agricultural value added												
	Total Factor Productivity (TFP)			Real Total Factor Productivity Growth (RTFPg)			Welfare Total Factor Productivity (WTFP)			Welfare Real Total Factor Productivity (WRTFP)		
Constant	0.386***	0.145	0.342***	0.497**	0.636***	0.662***	0.337**	0.110	0.376***	0.592***	0.698***	0.702***
	(0.000)	(0.466)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.346)	(0.001)	(0.000)	(0.000)	(0.000)
TFP(-1)	0.548***	0.613**	0.550**	0.650**	0.657**	0.509***	0.532**	0.583***	0.512***	0.560***	0.419***	0.541***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
FDI	-0.028***	-0.019***	-0.022***	-0.025***	-0.023***	-0.032***	-0.007***	-0.003	-0.013***	-0.009	-0.006	-0.018***
	(0.007)	(0.006)	(0.001)	(0.000)	(0.000)	(0.000)	(0.036)	(0.304)	(0.000)	(0.184)	(0.428)	(0.000)
Agriculture(Agri)	-0.007***	-0.003*	-0.006***	-0.004***	-0.004***	-0.006***	-0.005***	-0.002*	-0.006***	-0.004***	-0.004*	-0.009***
	(0.000)	(0.087)	(0.002)	(0.001)	(0.016)	(0.000)	(0.000)	(0.064)	(0.000)	(0.002)	(0.067)	(0.000)
FDI xAgri	0.0008***	0.0005***	0.0007***	0.0008***	0.0008***	0.001**	0.0002*	0.0001	0.0004***	0.0004**	0.0003	0.0007***
	(0.003)	(0.006)	(0.000)	(0.000)	(0.000)	(0.000)	(0.015)	(0.161)	(0.000)	(0.037)	(0.249)	(0.000)
Net Effects	-0.006	-0.005	-0.003	-0.003	-0.001	-0.005	-0.001	na	-0.002	na	na	0.006
Control variables	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Post-estimation diagnostic tests	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Panel B: Manufacturing value added												
Constant	-0.114**	-0.339**	-0.199***	0.206**	0.125	0.109	-0.090*	-0.252***	-0.230***	0.220***	0.214*	0.122
	(0.037)	(0.016)	(0.000)	(0.008)	(0.417)	(0.234)	(0.060)	(0.006)	(0.000)	(0.009)	(0.053)	(0.208)
TFP(-1)	0.721***	0.783***	0.842***	0.679**	0.650**	0.700**	0.682**	0.708***	0.851***	0.541***	0.440***	0.624***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
FDI	0.022***	0.010***	0.021**	0.011**	0.005	0.011**	0.017**	0.008***	0.018***	0.014***	0.009**	0.012***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.135)	(0.038)	(0.000)	(0.008)	(0.000)	(0.003)	(0.025)	(0.002)
Manufacturing(Manu)	0.016***	0.006**	0.014**	0.004**	0.004**	0.003	0.013**	0.006**	0.009***	0.010***	0.008***	0.008***
	(0.000)	(0.002)	(0.000)	(0.023)	(0.018)	(0.226)	(0.000)	(0.013)	(0.001)	(0.000)	(0.001)	(0.000)
FDI xManu	-0.002***	-0.001***	-0.002***	-0.0008**	-	-0.0009	-0.001***	-0.0008***	-0.002***	-0.001***	-0.001**	-0.001***
	(0.000)	(0.000)	(0.000)	(0.010)	(0.064)	(0.109)	(0.000)	(0.009)	(0.000)	(0.005)	(0.024)	(0.003)
Net Effects	-0.003	-0.003	0.010	0.006	na	na	0.004	-0.002	-0.008	0.001	-0.004	-0.001
Control variables	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Post-estimation diagnostic tests	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Panel C: Services Added Value												
Constant	0.056	-0.300**	-0.071	0.372***	0.570**	0.539***	0.072	-0.199**	-0.009	0.460***	0.545***	0.507***
	(0.292)	(0.012)	(0.287)	(0.000)	(0.002)	(0.002)	(0.172)	(0.014)	(0.820)	(0.000)	(0.000)	(0.000)
TFP(-1)	0.835***	0.705***	0.821***	0.665***	0.585***	0.568**	0.878**	0.710***	0.824***	0.610***	0.416***	0.601***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
FDI	0.008	-0.019	0.023*	-0.007	-0.021	-0.005	0.006	-0.003	0.017**	0.001	-0.021***	-0.010
	(0.319)	(0.190)	(0.061)	(0.411)	(0.184)	(0.729)	(0.481)	(0.511)	(0.037)	(0.885)	(0.000)	(0.197)
Service	-0.001	-0.005**	0.003*	0.0003	-0.001	-0.003	-0.001	-0.001	0.001	-0.001	-0.003	-0.001
	(0.392)	(0.017)	(0.065)	(0.910)	(0.616)	(0.198)	(0.392)	(0.244)	(0.224)	(0.690)	(0.153)	(0.303)
FDI xService	-0.0003	0.0007	-	0.0003	0.0009	0.0003	-0.0001	0.0002	-0.0007**	0.0001	0.0009***	0.0005
	(0.324)	(0.193)	(0.041)	(0.397)	(0.165)	(0.654)	(0.627)	(0.314)	(0.031)	(0.758)	(0.000)	(0.114)
Control variables	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Net effects	na	na	0.003	na	na	na	na	na	0.003	na	-0.003	na
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Post-estimation diagnostic tests	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

***, **, *: 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 Fisher 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. Mean value of agriculture value added: 26.673. Mean value of manufacturing value added: 12.916. Mean service value added: 19.339.

Concerning the negative net effects related to the interactive regressions, it implies that other complementary variables are needed to complement the investigated nexus in order to engender the positive effects on some of the outcome variables. Overall, while some of the findings are unexpected, they are informative because they provide policy makers and scholars with insights into which nexuses need to be completed with other variables in order to achieve the desired macroeconomic outcomes. Hence, complementary FDI policies are needed for some development outcomes.

4. Concluding remarks, implications and future research directions

This study has investigated: (i) the effect of foreign direct investment (FDI) on total factor productivity (TFP) and economic growth dynamics and (ii) the relevance of value added from three economic sectors in modulating the established effect of FDI on TFP and economic growth dynamics. The geographical and temporal scopes are respectively 25 sub-Saharan African countries and the period 1980-2014. The empirical evidence is based on non-interactive and interactive Generalised Method of Moments. The following main findings are established. First, FDI has a positive effect on GDP growth, GDP per capita and welfare real TFP. Second, the effect of FDI is negative on real GDP, TFP while the impact is insignificant on real TFP growth and welfare TFP. Third, values added to the three economic sectors largely modulate FDI to produce negative net effects on TFP and growth dynamics. Policy implications are discussed with particular emphasis on the need to complement added value across various economic sectors in order to leverage on the benefits of FDI on TFP and economic growth.

To put the above into more specific context, while some of the findings are unexpected, they are informative because they provide policy makers and scholars with insights into which nexuses need to be complemented with other variables in order to achieve the desired macroeconomic outcomes. Hence, complementary FDI policies are needed for some development outcomes. Such additional policies include complementing value added across economic sectors with other policy measures in order to enhance their complementarities with FDI and ultimately engender the desired positive effects on the outcomes variables⁶. The corresponding policy implications are tailored to discuss measures

⁶ It empirical literature, when some findings are unexpected, especially within the framework of interactive regressions, it can be established that the investigated channels are necessary but not sufficient conditions for the enhancement of the outcome variable and by extension, complementary policies based on other proxies can be

that can be used to enhance such value added across economic sectors. Hence, given that these are proposed complementary measures, they connect with the findings from a policy standpoint.

First, in order to improve value added to the agricultural sector, it is imperative for sampled countries to develop policies and tools that can be used to boost the agrifood industry and simulate the development of the food value chains. This should entail inclusion and support of smallholder farmers, especially food enterprises in rural communities. The main concerns to be addressed should centre on, *inter alia*: (i) inclusive contract on farming and capacity building for enhanced market access that encompass support for knowledge dissemination, advocacy and field projects; (ii) the development of sustained food value chains as a comprehensive consolidation of the performance of food systems, structural transformation and integration of sustainability concepts; (iii) initiating private-public innovation partnerships which have the potential of mitigating doing business risks in the agricultural sector and involves society, government and agribusiness actors; (iv) attracting transformative investments in the sector by creating special economic zones, economic corridors, agro-based clusters and agro-industrial parks; (v) promoting innovation, entrepreneurship and agribusiness start-ups via agribusiness incubators and inclusive business models and (v) organising programmes for institutional procurement through which governments of sampled countries can award public tenders to address the needs of the state's procurement as well as associated economic, environmental and social issues. The recommendations are consistent with the FAO (2017) on value added to the agricultural sector.

Second, the development of value added in the manufacturing and service sectors is also crucially worthwhile. Some policies in this direction include: (i) providing conducive employment and immigration measures that enable skilled workers to freely move across regions; (ii) making sure that policies on trade should not be exclusively restricted to local services such that the underlying services should not only be limited to specific countries but extended to serve other countries as well as benefit from the support systems of these countries; (iii) the adoption of investment regimes that are of continental scope and offer better prospects for the enhancement of qualifications that can be mutually recognized; (iv)

suggested. Examples of contemporary interactive regression studies focusing on policy thresholds and thresholds for complementary policies as applied in this study are Asongu and Odhiambo (2021b, 2021c).

constructing service hubs of excellence such as high-tech parks (v) boosting regulations in transport, insurance, banking and telecoms that are pro-competition and (vi) involving services that are enshrined in the African Continental Free Trade Agreement.

Overall, global value chains (GVCs) provide a valuable perspective for the development of Africa. This is essentially because, as wages begin to rise on Southeast and East Asia, new platforms of production may provide opportunities to attract FDI into Africa. However, our findings have shown that value added in the three main economic sectors need to be improved in order for African countries to leverage on the benefits of FDI in TFP and economic growth. In order for African countries to benefit from these potential shifts, *inter alia*: (i) the reduction of trade costs and policy reforms are needed to enhance investment and trade and (ii) improvement in governance in order to support efficient and effective social and environmental regulation.

Future studies can focus on country-specific cases in order to assess whether the established findings withstand empirical scrutiny. Such is relevant for more targeted implications. This recommendation is motivated by the fact that country-specific effects are theoretically and practically eliminated from the adopted GMM approach in order to control for some dimensions of endogeneity. Moreover, engaging a comparative study to provide lessons of benchmark countries to their less technically-developed counterparts in terms of value added across economic sectors is worthwhile. While the focus of this study on unexplored mechanisms by means of value added to the agriculture, manufacturing and service sectors, is based on constraints in data availability at the time of the study, in future studies, other dimensions such as value added from sectors such as mining could be considered contingent on data availability. This recommendation for future research is premised on the fact that there are several countries in the dataset where mining or drilling contributes more towards GDP.

Appendices

Appendix 1: Definitions and sources of variables

Variables	Signs	Definitions of Variables (Measurements)	Sources
Growth 1	GDPgrowth	GDP growth (annual %)	WDI
Growth 2	lnRGDP	Logarithm of Real GDP: Output-side real GDP at chained PPPs (in mil. 2011US\$)	WDI
Growth 3	lnGDPpc	Logarithm of GDP per capita	WDI
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
Foreign Direct Investment	FDI	Foreign Direct Investment Inflows(% of GDP)	UNCTAD
Agriculture value added	Agri	Agricval: Agriculture, hunting, forestry, fishing (% of GDP) (ISIC A-B)Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs.	WDI
Manufacturing value added	Manu	Manufacturing value added (% of GDP) (ISIC D). Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs.	UNCTAD
Service value added	Service	Service, value added (% of GDP). Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs.	WDI
Population	Population	Logarithm of Population (in millions)	WDI
Inflation	Inflation	Consumer Price Index (annual %)	WDI
Education	Education	SEPSGPI: School enrollment, primary and secondary (gross), gender parity index (GPI)	WDI
Government Expenditure	Gov't Expenditure	Governments final consumption expenditure (% of GDP)	WDI
Remittances	Remittances	Personal remittances, received (% of GDP)	WDI
Credit Access	Private credit	Domestic credit to private sector (% of GDP)	FDSB

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

Appendix 2: Summary statistics

	Mean	SD	Minimum	Maximum	Observations
Gross Domestic Product(GDP) growth	3.569	2.953	-6.154	10.109	124
Real GDP (log)	9.527	1.104	7.670	13.638	120
GDP per capita (log)	7.657	0.838	6.255	9.702	119
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
Foreign Direct Investment	1.903	2.795	-3.440	22.118	124
Agriculture value added	26.673	13.910	2.527	56.751	116
Manufacturing value added	12.916	6.933	2.152	36.895	116
Service value added	19.339	7.015	0.000	32.825	120
Population	2.515	0.818	-0.242	4.165	125
Inflation	42.868	347.967	-3.601	3820.096	120
Education	0.854	0.177	0.465	1.341	107
Government Expenditure	16.066	5.358	6.085	36.155	122
Remittances	4.768	12.917	0.003	89.354	107
Credit Access	21.009	22.256	2.238	144.397	121

S.D: Standard Deviation.

Appendix 3: Correlation matrix

	GDPg	lnRGDP	lnGDPpc	TFP	RTFP	WTFP	WRTFP	FDI	Agri	Manu	Service	Pop	Inflation	Education	Gov. Ex	Remit	Credit
GDPg	1.000																
lnRGDP	0.107	1.000															
lnGDPpc	-0.010	0.241	1.000														
TFP	-0.138	0.177	0.729	1.000													
RTFP	-0.042	-0.052	0.309	0.278	1.000												
WTFP	-0.130	0.109	0.725	0.953	0.299	1.000											
WRTFP	-0.120	0.037	0.244	0.148	0.578	0.148	1.000										
FDI	0.413	0.063	-0.005	-0.140	-0.013	-0.101	0.080	1.000									
Agri	-0.075	-0.243	-0.796	-0.624	-0.170	-0.627	-0.169	-0.056	1.000								
Manu	-0.071	0.002	0.262	0.076	-0.063	0.209	0.026	-0.049	-0.386	1.000							
Service	0.015	0.506	0.076	0.039	-0.129	0.053	0.066	0.112	-0.266	0.220	1.000						
Pop	0.089	0.044	-0.454	-0.196	0.143	-0.249	0.116	-0.053	0.380	-0.246	-0.105	1.0000					
Inflation	-0.082	0.081	-0.126	0.210	0.040	0.254	-0.271	-0.123	0.098	-0.104	0.161	-0.169	1.000				
Education	0.363	0.201	0.475	0.237	-0.080	0.244	-0.083	0.235	-0.528	0.062	-0.114	-0.377	-0.035	1.000			
Gov. Ex	0.129	-0.327	0.167	0.067	0.053	0.162	-0.033	0.126	-0.316	0.099	-0.453	-0.111	-0.197	0.276	1.000		
Remit	-0.008	-0.225	-0.034	-0.154	-0.274	-0.070	-0.087	0.038	-0.117	-0.004	-0.161	-0.186	-0.019	0.379	0.306	1.000	
Credit	-0.089	0.140	0.511	0.211	0.114	0.258	0.239	0.039	-0.391	0.214	0.228	-0.327	-0.195	0.144	0.105	-0.075	1.000

GDPg: Growth growth. lnRGDP: Logarithm of Real GDP. lnGDPpc: Logarithm of GDP per capita. TFP: Total Factor Productivity. RTFP: Welfare Total Factor Productivity. WRTFP: Welfare Real Total Factor Productivity. FDI: Foreign Direct Investment. Agri: Agricultural value added. Manu: Manufacturing value added. Service: Service value added. Pop: population. Gov. Ex: Government Expenditure. Remit: Remittance. Credit: access to credit

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