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On the Simultaneous Openness Hypothesis: FDI, Trade and TFP Dynamics in Sub-Saharan Africa

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Simplice A. Asongu
African Governance and Development Institute,
P.O Box 8413, Yaoundé, Cameroon.
E-mails: asongusimplice@yahoo.com; asongus@afridev.org

Joseph Nnanna
The Development Bank of Nigeria,
The Clan Place, Plot 1386A Tigris Crescent,
Maitama, Abuja, Nigeria
E-mail: jnnanna@devbankng.com

Paul N. Acha-Anyi
Department of Tourism, Hospitality and Sports Management
Buffalo City, College street campus,
Walter Sisulu University
Eastern Cape Province, South Africa
E-mails: pacha-anyi@wsu.ac.za; achasinstitute@gmail.com

Abstract

This study assesses the simultaneous openness hypothesis that trade modulates foreign direct investment (FDI) to induce positive net effects on total factor productivity (TFP) dynamics. Twenty-five countries in Sub-Saharan Africa and data for the period 1980 to 2014 are used. The empirical evidence is based on the Generalised Method of Moments. First, trade imports modulate FDI to overwhelmingly induce positive net effects on TFP, real TFP growth, welfare TFP and real welfare TFP. Second, with exceptions on TFP and welfare TFP where net effects are both positive and negative, trade exports modulate FDI to overwhelmingly induce positive net effects on real TFP growth and welfare real TFP. In summary, the tested hypothesis is valid for the most part. Policy implications are discussed.

1. Introduction

The objective of this research is to assess the relevance of trade dynamics in moderating the effect of foreign investment on productivity dynamics in Sub-Saharan Africa. The study is tailored within the context of a simultaneous hypothesis such that foreign direct investment (FDI) is complemented with dynamics of trade to influence productivity. Accordingly, it is an improved framing of the Rajan and Zingales (2003) position that concurrent opening of trade and capital accounts will lead to greater output in a domesctic economy. Moreover, the problem statement underlying this exposition is motivated within the broader context of: (i) debates in the contemporary literature on the relevance of total factor productivity (TFP) and (ii) gaps in the attendant literature. These motivational elements are expanded in the following passages.

First, no consensus is apparent in the literature on the relevance of productivity in development outcomes in Africa. In essence, while a strand of studies posits that aggregate productivity is essential in boosting economic development, authors are still divided on the mechanisms through which productivity can be boosted (Elu & Price, 2010; Baliamoune, 2009; Baliamoune-Lutz, 2011; Asongu, 2014a; Ssozi & Asongu, 2016a; Tchamyou, 2017; Cheruiyot, 2017). Among conflicting perspectives, a debate that is worth mentioning is one that centres on factor accumulation and TFP. One group, building on examples and success stories of East Asia posit that the relevance for factor accumulation is higher compared to TFP in the prosperity of nations (Young, 1995; Asongu, 2017). Conversely, another group of authors is of the perspective that, cross-country differences in economic outcomes are signtificantly traceable to disparatiies or variations in cross-country levels of TFP (Abramovitz, 1986; Romer, 1986, 1993; Klenow & Rodriguez-Clare, 1997; Temple, 1999; Nelson & Pack, 1999; Easterly & Levine, 2001; Durlauf, Johnson& Temple, 2005). As maintained by Devarajan, Easterly and Pack (2003), the African poverty tragedy is accounted for more, by low TFP than it is by investment levels. The authors caution on the importance of prioritising TFP in place of investments to lift the continent out of poverty. This research contributes to the growing debate by assessing how trade openness can modulate FDI to influence TFP dynamics in sub-Saharan Africa (SSA). This positioning is also buttressed by a corresponding gap in the scholarly literature.

Second, to the best of our knowledge, scholarship on the main variables of interest in the study can be engaged in two main strands, pertaining to TFP- and FDI-centric studies. The first on TFP-oriented scholarship has fundamentally focused on, *inter alia*: gender disparities and labour supply in SSA (Elu & Price, 2017); the rate of child labour and schooling features (Ahouakan & Diene, 2017); linkages between manufacturing and exports (Cisse, 2017); examinations of nexuses between manufacturing firms and TFP within the framework of

variations of productivity prosperity across sectors in the manufacturing industry (Kreuser & Newman, 2018) and the importance of information technology in TFP convergence (Maryan & Jehan, 2018). The second pertaining to FDI-centric research includes: regional income convergence and FDI (Dunne & Masiyandima, 2017); how portfolios in Africa's economic sectors are influenced by more globalised sectors (Boamah, 2017); nexuses between concepts underlying equity, bonds, institutional debts and economic prosperity (Fanta & Makina, 2017); modeling output gaps in view of future economic prosperity (Fedderke & Mengisteab, 2017) and how value chains are relevant in boosting the influence on economic growth and TFP (Meniago & Asongu, 2019).

The study that is closest to the present exposition is Sakyi and Egyir (2017) which has focused on the simultaneous openness hypothesis with emphasis on interactions between trade openness and FDI for economic growth in the continent of Africa. The authors assess the hypothesis that positive ramifications in terms of economic growth can be derived from interactions between exports and FDI. The geographical and temporal scopes are respectively, 45 African countries and the period spanning from 1990-2014. Using the Generalised Method of Moments (i.e. GMM), the findings reached by the authors support the tested hypothesis.

This study steers clear of Sakyi and Egyir (2017) from several fronts. (i) Within a methodological perspective, this research adopts the GMM option that is basedon forward orthogonal deviations because compared to the *system* GMM option used by the underlying study, the approach adopted in this research has been documented to produce more reliable estimated coefficients because, it among others, diminishes instrument proliferation which has been established to bias estimated coefficients in the attendant contemporary GMM-centric literature (Meniago & Asongu, 2018; Tchamyou, Erreygers & Cassimon, 2019; Tchamyou, 2020). For instance, the information criteria disclosed by the underlying study does not provide insights into this concern of instrument proliferation because the number of instruments and corresponding number countries are not disclosed for each specification, to enable an examination of whether specifications are biased by the presence of instrument proliferation. (ii) Instead of focusing on economic growth, this research is concerned with TFP dynamics. (iii) Contrary to the assessment of the tested simultaneous openness hypothesis on the premise of marginal, interactive or conditional effects, this research considers net effects (constituting both the conditional and unconditional effects) as an information criterion in the assessment of the simultaneous openness hypothesis. In essence, as emphasised by Brambor, Clark and Golder (2006) on the setbacks of interactive specifications, both the conditional and unconditional impacts are relevant for the assessment of how the modulating variables interact with the main independent variable of interest to influence the outcome variable.

This conception and understanding of the relevance of net effects in interactive regressions is consistent with the attendant contemporary literature on interactive specifications (Tchamyou & Asongu, 2017; Agoba, Abor, Osei, & Sa-Aadu, 2020; Tchamyou, 2019).

(iv) This research also takes on board some prevailing concerns pertaining to Sustainable Development Goals (SDGs) which are quite imperative in the post-2015 development agenda. Accordingly, departing from the strand of TFP literature which has fundamentally been based on one indicator of TFP, this research is consistent with concerns of inclusive productivity and output by adopting inclusive TFP measurements to complement the mainstream TFP indicator, namely: real TFP, welfare TFP and real welfare TFP. Hence, it also departs from Asongu, Nnanna and Acha-Anyi (2020) by focusing on TFP instead of economic growth dynamics.

The remainder of the study is structured as follows. This introduction is followed by a section on theoretical underpinnings surrounding, on the one hand, the role of openness in economic development and on the other, the importance of FDI in TFP. A section covering the data and methodology comes after these theoretical insights, followed by an empirical results section in which the findings are presened and discussed. The study concludes in the last section with implications and future research directions.

2. Theoretical underpinnings

2.1 Globalisation and economic development

The nexus between globalization and economic development is clarified by two main theoretical schools of thought, namely: the hegemonic and the neoliberal paradigms of economic thought (Tsai, 2006; Asongu & Nwachukwu, 2017a). Regarding the first paradigm on hegemony, globalization is a phenomenon that is hiding an agenda meant to establish a world order that would be driven by developed countries, multinational corporations, multilateral organizations and international financial institutions. The school posits that the fundamental premises of the hidden agenda are characterized by capital accumulation, enhanced cross-country market interactions and transactions as well as the exploitation of cheap sources of human resources (Petras & Veltmeyer, 2001). Moreover, there is increasing evidence that policies favoring openness in developing countries have fundamentally benefited richer elements of society to the detriment of their poorer counterparts. Building on this evidence, Petras and Veltmeyer (2001) envisage "*a world-wide crisis of living standards for labor*" owing to positions that "*technological change and economic reconversion endemic to capitalist development has generated an enormous growing pool of surplus labor, an industrial reserve army with incomes at or below the level of subsistence*" (p. 24).

The hegemonic school also maintains that the paradigm of globalization is characterized by production modes that substantially undervalue channels by which the fruits of economic prosperity are equitably distributed among the population. For instance, as argued by Asongu and Nwachukwu (2017a), such an unequal mechanism for the distribution of fruits of productivity run counter to the tenets of Keynesian Social Democracy. Other positions supporting the narrative include: the role of globalisation in disregarding inclusive development and promoting self-interest (Smart, 2003; Tsai, 2006) and the benefits of globalisation weighing in favour of wealthier elements of society (Scholte, 2000; Sirgy, Lee, Miller & Littlefield, 2004).

From the prism of the neoliberal paradigm, globalization reflects a mechanism of "creative destruction" through which competition improves standards of living by means of enhanced cross-border trade, improvements in technology, efficient allocation of human resources and capital flows from developed countries experiencing lower marginal productivity of capital to developing countries characterized by higher marginal productivity of capital (Asongu, 2014b). According to the school, while globalization has obvious shortcomings such as job losses and drops in workers' wages, there is a mechanism of compensation because the unskilled are provided with opportunities of getting the relevant competitive and scarce skills needed in an ever-growing competitive process in the global labour market. This is consistent with Grennes (2003) who maintains that the rewards of openness in trade and capital are apparent in the labour market

2.2 FDI and Productivity

In accordance with the literature on external flows (Toone, 2013; Gammoudi, Cherif & Asongu, 2016), there are three fundamental theoretical insights supporting the nexuses between FDI and productivity, namely: the dependency theory, the classical theory and middle path theory.

First, the depedency theory is fundamentally motivated by the features of Marxism which understand globalization as the measure by which market capitalism is propagated across the globe. Such propagation entails the use of more advanced technologies in exchange for relatively cheap sources of labour. Consistent with proponents of this theory, economic development in host economies is negatively connected with foreign investment for three main justifications. (i) The benefits of foreign investment are not distributed equally between multinational companies and governments of domestic economies because for the most part, the benefits are skewed to the interest of multinational companies. In accordance with the perspective, local asssets that are worthwhile in providing funds for economic development in host economies are absorbed by foreign investment features that make use

of opportunities of economic development in developing countries as well as the repatriation of profits to tax havens and technically-advanced countries (Jensen, 2008).

(ii) Internatinoal coporations represent a source of domestic market distortions by among others: changing customers' tastes, undermining local culture, damaging wealth distribution and adopting capital-intensive technologies that may not be appropriate for domestic investment opportunities (Taylor & Thirft, 2013). (iii) Some future alliance among the elite and foreign investors can be tailored to serve the exclusive interests of parties in the alliance with limited focus on more lofty wellbeing agenda of society and equitable distribution of fruits from economic output. Jensen (2008) is consistent with this narrative in view of the fact that, since citizens are fundamentally excluded from the underlying alliances, significant political distortions end-up characterising the system.

The classcal theory posits that FDI is an important source of domestic economic development because it is sustained by a plethora of channels, *inter alia*: capital transfers; improvements in balance of payments; utilisation of ameliorated equipments and technology; employment avenues; FDI-driven export; foreign exchange earnings; integration of host economies into global markets and infrastructural development (Toone, 2013; Gammoudi*t al.*, 2016). These theoretical insights are considerably documented in the literature pertaining to "spillovers": a phenomenon that is realised "when *the entry or presence of multinational corporation increases productivity of domestic firms in the host country and the multinationals do not fully internalize the value of these benefits*" (Javorcik, 2004, p. 607).Spillover origins which are many embody: usage of technology; working methods and insights into the management of skills that are likely to enhance productivity and output.

The "middle path" theory is a paradigm that reconciles the previous two theoretical insights fundamentally because while it cautions against the negative ramifications of foreign investment advanced by the dependency theory, it also acknowledges the benefits advanced by the classical theory in the previous paragraph (Gammoudi*t al.*, 2016). This theory recommends openness policies to alignwith measures of government regulation in order to address the negative issues associated with full or complete openness of trade and capital accounts. These regulation policies can also be tailored such that FDI is channelled to targeted sectors of the economy as well as geographical locations that are characterised with some disadvantages that domestic governments are focused on addressing.

Building on the theoretical underpinnings discussed above, the study argues that trade openness can modulate FDI to induce positive effects on TFP productivity dynamics. The theoretical importance of trade as a policy instrument in moderating FDI for enhanced productivity is consistent with the insights disclosed by Hussien, Ahmed and Yousaf (2012).

According to the authors, international trade is acknowleged as a crucial determinant of TFP because, *inter alia*, trade: eases the processes of adopting new technology (Holmez & Schmitz, 1995) and enhances the reallocation of resources to more efficient corporations from their less efficient counterparts in order to enhance overall productivity and output (Melitz, 2003). The corresponding testable research hypothesis is the following.

Hypothesis 1: trade openness complements FDI for overall positive effects on TFP dynamics. Whether this stated hypothesis withstands empirical scrutiny is the focus of the following sections.

3. Data and methodology

3.1 Data

The study uses data from 25 countries in SSA[1]. The period of study is from 1980 to 2014. The restriction to the number of countries and corresponding periodicity are motivated by constraints in TFP data at the time of the study. In order to align the data structure with the empirical strategy to be adopted by the research, the data is restructured in terms of non-overlapping intervals in order to ensure that the number of cross-sections is superior to the number of annual observations in every cross section: such is a condition for the employment of the GMM empirical strategy. The study derives five seven-year and seven five-year non-overlapping averages and after a preliminary investigation, it is apparent that the latter set of data averages leads to instrument proliferation and by extension unrobust estimated models, even when the option of collapsing instruments is taken on board. Hence, the fiveseven-year data averages that are retained for the study are: 1980-1986; 1987-1993; 1994-2000; 2001-2007; 2008-2014[2].

The main independent variable of interest which is Foreign Direct Investment (FDI) comes from the United Nations Conference on Trade and Development (UNCTAD) FDI database. It is measured as FDI inflows as a percentage of Gross Domestic Product (GDP). The Penn World Table database is the source of the TFP dynamics, namely: TFP, real TFP, welfare TFP andreal welfare TFP. In accordance with the motivational elements of this research articulated in the introduction, the main TFP is complemented with other dynamics in order to provide room for findings that are relevant to SDGs (Asongu, 2020). Therefore, the adopted TFP variables are consistent with both productivity and the welfare implications of such output.

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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.
[2]The rationale of using data averages is to avoid instrument proliferation during post-estimation diagnostics tests. For instance, it is apparent in the findings that the number of instruments is consistently lower than the corresponding number of cross sections in each specification.

The trade moderating variables which have been theoretically justified towards the end of Section 2.2, building on Hussien et al. (2012), are exports and imports of commodities from World Development Indicators (WDI) of the World Bank. The adopted elements in the conditioning information set employed to control for variable omission bias are from the WDI and the Financial Development and Structure Database (FDSD) of the World Bank. While private domestic credit is from the FDSD, remittances, government expenditure and inclusive education are from the WDI of the World Bank. The selection of these conditioning indicators is informed by the attendant productivity and output scholarship (Becker, Laeser & Murphy, 1999; Barro, 2003; Heady & Hodge, 2009; Sahoo, Dash & Nataraj, 2010; Ssozi & Asongu, 2016a; Tchamyou, 2017). Except for remittances that are anticipated to negatively influence the outcome variables, the remaining three indicators are expected to positively affect the engaged TFP dynamics. These expected signs are expanded in the following passages.

First, while remittances have been documented to positively influence output in Africa (Ssozi & Asongu, 2016b; Asongu, Biekpe & Tchamyou, 2019), the effect is also contingent on the proportion of remittances allocated for consumption purposes. Hence, in scenarios where remittances are used more for consumption than for production, the expected positive effect should be taken with caution. Hence, a priori, the sign of the indicator cannot be determined with absolute certainty. However, it is expected to significantly affect the outcome variable. Second, the caution on the expected sign from remittances can also be extended to financial access and govermement expenditure which have also been documented to positively affect output and productivity (Asongu, 2015; Nyasha & Odhiambo, 2015a, 2015b). On the one hand, if government expenditure is tailored more for expenses that are designed to boost economic output, the expected sign should be positive. However, if such expenditure is clouded in corrupt practices and largely tailored towards unproductive investments, a negative sign can be expected. On the other, the allocation of credit to productive investments from intuition is likely to increase productivity while the corresponding productivity is anticipated to decrease if such credit is allocated for productive investments. Third, the importance of education in driving socio-economic progress has been substantially documented in the economic development literature (Petrakis & Stamatakis, 2002; Asiedu, 2014; Tchamyou, 2020).The definitions and sources of variables are provided in Appendix 1, the summary statistics is disclosed in Appendix 2 while the correlation matrix is provided in Appendix 3.

3.2 Methodology

3.2.1 Specification

Some insights into the choice of the GMM empirical strategy have already been provided in the data section, notably: the need to restructure the data in order to fulfill an elementary

requirement for the adoption of the estimation approach. Accordingly, after restructuring the dataset in terms of five seven-year non-overlapping intervals, the N>T condition that is imperative for the choice of the empirical strategy is met[3]. Other justifications for the choice of the technique include: (i) persistence in the TFP dynamics in the light of the fact that their first difference and level series are correlated to a height that is higher than 0.800 which is the established threshold in contemporary GMM-oriented literature as the rule of thumb for the establishment of persistence in an outcome indicator (Tchamyou, 2019; Efobi, Asongu, Okafor; Tchamyou & Tanankem, 2019).

(ii) Cross-country variations are acknowledged in the estimation exercise because the data structure is panel-oriented. (iii) The issue of endogeneity that is imperative for a robust empirical analysis is taken on board from two main premises, notably: simultaneity or reverse causality is addressed by the adoption of internal instruments and the time invariant omitted indicators are also employed to take into account the unobserved heterogeneity.

The following equations in levels (1) and first difference (2) summarize the estimation procedure for the relevance of trade dynamics in modulating FDI to influence TFP.

$$TFP_{i,t} = \sigma_0 + \sigma_1 TFP_{i,t-\tau} + \sigma_2 FDI_{i,t} + \sigma_3 T_{i,t} + \sigma_4 Inter_{i,t} + \sum_{h=1}^{4} \delta_h W_{h,i,t-\tau} + \eta_i + \xi_t + \varepsilon_{i,t} \quad (1)$$

$$TFP_{i,t} - TFP_{i,t-\tau} = \sigma_1(TFP_{i,t-\tau} - TFP_{i,t-2\tau}) + \sigma_2(FDI_{i,t} - FDI_{i,t-\tau}) + \sigma_3(T_{i,t} - T_{i,t-\tau})$$
$$+ \sigma_4(Inter_{i,t} - Inter_{i,t-\tau}) + \sum_{h=1}^{4} \delta_h(W_{h,i,t-\tau} - W_{h,i,t-2\tau}) + (\xi_t - \xi_{t-\tau}) + (\varepsilon_{i,t} + \varepsilon_{i,t-\tau}) \quad (2)$$

where $TFP_{i,t}$ denotes total factor productivity dynamics (i.e. realTFP, TFP, real welfare TFP and welfare TFP) of country i in period t; FDI represents foreign direct investment; T is a trade dynamic (i.e. imports and exports); $Inter$ reflects theinteraction between FDI and a trade dynamic; σ_0 is a constant; τ is the degree of auto-regression which isacknowledged as one in this research because a one period lag or seven year non-overlapping interval is required to capture previous information; W entails the vector of control variables (*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 other TFP dynamics, notaby: real TFP, welfare TFP and real welfare TFP. For the purpose of this research, the GMM empirical approach with forward orthogonal deviations is adopted. This GMM option which is an improved version of the Arellano and Bover (1995)

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[3]The main period is 1980-2014 and using seven year data averages produces five data points (1980-1986; 1987-1993; 1994-2000; 2001-2007; 2008-2014). Hence, 1980-1986 is an average corresponding to a data point; 1987-1993 is also an average corresponding to a data point and so on. Therefore, the findings cannot be presented exclusively for a given data point because, it would amount to a cross-sectional study and as we all know; at least 5 data points are required for the use of GMM (Asongu & Nwachukwu, 2017d). The rationale of using data averages to avoid instrument proliferation during post-estimation diagnostics tests is apparent in the presented findings in which, the number of instruments is consistently lower than the corresponding number of cross sections in each specification.

approach by Roodman (2009) has been documented to provide estimated coefficients that are more efficient compared to less contemporary *difference* and *system* GMM approaches (Boateng, Asongu, Akamavi & Tchamyou, 2018; Tchamyou, Erreygers, & Cassimon, 2019).

3.2.2 Identification, simultaneity, and exclusion restrictions

For every GMM strategy, clarification on identification, simultaneity and exclusion restrictions are very fundamental for a tight specification. This research takes the specifics in turn. First, the identification framework entails the definitions of three categories of variables involved in the specification exercises, namely, the outcome variables, the predetermined or endogenous explaining variables and the strictly exogenous variables. Obviously, the outcome variables are dynamics of TFP. Building on contemporary GMM-oriented studies based on forward orthonongal deviations, the strictly exogenous variables are years while the endogenous explaining indicators are independent variables of interest (FDI and trade dynamics) and adopted control variables(Tchamyou & Asongu, 2017; Meniago & Asongu, 2018). It is important to clarify that this approach to identification and exclusion restriction is broadly consistent with Roodman (2009) who has argued that years are feasible strictly exogenous variables because they cannot become endogenous after a first difference. It follows from these clarifications that the exclusion restriction assumption underpinning the identification process assumes that the identified strictly exogenous variables influence the outcome variable exlusively via the identified predetermined variables.

Second, the concerns about simultaneity corresponding to the issue of reverse causality are taken on board through instrumental variables that are forward differenced. The process entails the use of Helmet transformations to eliminate fixed impacts that are succepible to biasing estimated coefficients owing to a correlation between the lagged outcome variable and fixed effects. This procedure to purging fixed effects is consistent with extant literature on the subject (Arellano & Bover, 1995; Love & Zicchino, 2006; Roodman, 2009). These transformations permit orthogonal or parallel conditions between lagged and forward differenced observations.

Third, the exclusion restriction assumption clarified in the first strand of this section can be assessed with the Difference in Hansen Test (DHT) within a GMM framework based on forward orthogonal deviations. The null hypothesis of the underlying test should not be rejected because it is the position that the identified strictly exogenous variables influence the TFP dynamics exclusively via the engaged predetermined variables. This criterion for validating exclusion restrictions is not very different from traditional instrumental variable (IV) approaches that are founded on the basis that the null hypothesis of the Sargan/Hansen test

should not be rejected in order for the exclusion restriction assumption to hold (Beck, Demirgüç-Kunt& Levine, 2003; Amavilah, Asongu & Andrés, 2017).

4. Empirical results

4.1 Presentation of results

This section provides the empirical findings in Tables 1-4. While Table 1 is concerned with linkages between TFP, FDI and Trade, the focus of Table 2 is on real TFP growth, FDI and Trade. In Table 3, findings pertaining to linkages between welfare TFP, FDI and Trade are disclosed while results on nexuses between welfare real TFP, FDI and Trade are provided in Table 4. Each table is characterized by sub-sections pertaining to import- and export-oriented specifications on the left-hand and right-hand side, respectively. Moreover, five main specifications feature in each sub-section: four with one conditioning information set and one without a conditioning information set.

It is worthwhile to emphasise that limiting of elements in the conditioning information set is a common practice in so far as the objective of doing so is to avoid instrument proliferation that potentially bias estimated GMM models. Hence, even when the option of collapsing instruments is taken on board, it is apparent that only one variable from the conditioning information set can be involved in each regression. For instance, examples of GMM-centric studies that have not engaged control variables with the objective of avoiding instrument proliferation are: Osabuohien and Efobi (2013) and Asongu and Nwachukwu (2017c).

For every specification, the overall validity of models is informed by four criteria of information[4].Based on these criteria, the estimated models are overwhelmingly valid with a few exceptions where the null hypotheses are rejected in the: (i) Hansen and (ii) second order Arellano and Bond autocorrelation in difference tests. Hence, for these invalid models, net effects are not computed to assess the testable hypothesis motivating this study.

In the light of the above, following contemporary studies founded on interactive regressions (Tchamyou & Asongu, 2017; Agoba *et al*., 2020), the hypothesis motivating this study is assessed by computing net effects from the unconditional effect of FDI and the conditional or interactive effects between FDI and trade dynamics. To put this computation into more

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[4] "*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).

perspective, in the second column of Table 1, the net effect on TFP from the relevance of imports in modulating the role of FDI on TFP is 0.003 ([40.422× -0.0003] + [0.016]). In the compution, the average value of imports is 40.422; the unconditional impact of FDI on TFP is 0.016 whereas the conditional effect pertaining to the interaction between exports and FDI is -0.0003.

The following results are apparent from Tables 1-4. First, trade imports modulate FDI to overwhelmingly induce positive net effects on TFP, real TFP growth, welfare TFP and real welfare TFP. Second, with exceptions on TFP and welfare TFP where net effects are both positive and negative, trade exports modulate FDI to overwhelmingly induce positive net effects on real TFP growth, welfare real TFP. In summary, the tested hypothesis is valid for the most part. Third, most of the significant control variables reflect the expected signs.

Table 1: TFP, FDI and Trade

| | Dependent variable: Total Factor Productivity (TFP) | | | | | | | | | |
	Trade Imports (Imports)					Trade Exports (Exports)				
TFP (-1)	0.800*** (0.000)	0.795*** (0.000)	0.810*** (0.000)	0.826*** (0.000)	0.834*** (0.000)	0.512*** (0.000)	0.626*** (0.000)	0.588*** (0.000)	0.616*** (0.000)	0.493*** (0.000)
FDI	0.016*** (0.001)	0.010 (0.192)	0.012* (0.091)	0.009 (0.216)	0.026*** (0.000)	0.026*** (0.000)	0.023*** (0.000)	0.026*** (0.000)	0.028*** (0.000)	0.035*** (0.000)
Imports	0.002*** (0.000)	0.001** (0.048)	0.002*** (0.000)	0.003*** (0.008)	0.003*** (0.000)	---	---	---	---	---
Exports	---	---	---	---	---	0.008*** (0.000)	0.004*** (0.000)	0.006*** (0.000)	0.007*** (0.000)	0.008*** (0.000)
FDI× Imports	-0.0003*** (0.001)	-0.0002 (0.162)	0.0002* (0.070)	-0.0002 (0.161)	-0.0005*** (0.000)	---	---	---	---	---
FDI× Exports	---	---	---	---		-0.001*** (0.000)	-0.0009*** (0.000)	-0.0009*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
Education	---	-0.017 (0.903)	---	---		---	0.060 (0.412)	---	---	---
Gov't Expenditure	---	---	0.001 (0.463)	---		---	---	0.002 (0.295)	---	---
Remittances	---	---	---	-0.003** (0.031)		---	---	---	0.0007 (0.159)	---
Private Credit	---	---	---	---	-0.0002 (0.534)	---	---	---	---	0.002* (0.064)
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Net Effects	0.003	na	0.003	na	0.005	nsa	-0.002	0.0003	-0.0004	0.006
AR(1)	(0.823)	(0.400)	(0.787)	(0.683)	(0.898)	(0.788)	(0.469)	(0.751)	(0.460)	(0.778)
AR(2)	(0.982)	(0.772)	(0.963)	(0.819)	(0.480)	(0.061)	(0.443)	(0.146)	(0.549)	(0.198)
Sargan OIR	(0.338)	(0.558)	(0.290)	(0.207)	(0.618)	(0.139)	(0.342)	(0.110)	(0.245)	(0.549)
Hansen OIR	(0.249)	(0.284)	(0.524)	(0.494)	(0.581)	(0.417)	(0.482)	(0.355)	(0.352)	(0.508)
DHT for instruments (a)Instruments in levels										
H excluding group	(0.256)	(0.477)	(0.077)	(0.122)	(0.260)	(0.267)	(0.174)	(0.128)	(0.100)	(0.606)
Dif(null, H=exogenous) (b) IV (years, eq(diff))	(0.257)	(0.233)	(0.839)	(0.719)	(0.664)	(0.435)	(0.632)	(0.534)	(0.579)	(0.415)

H excluding group	**(0.904)**	**(0.498)**	**(0.422)**	**(0.512)**	**(0.567)**	**(0.203)**	**(0.380)**	**(0.151)**	**(0.366)**	**(0.475)**
Dif(null, H=exogenous)	**(0.034)**	**(0.123)**	**(0.580)**	**(0.365)**	**(0.437)**	**(0.819)**	**(0.577)**	**(0.992)**	**(0.328)**	**(0.447)**
Fisher	4822.08 ***	119.44 ***	8554.72 ***	268.10 ***	262.84 ***	1435.70 ***	268.40 ***	714.95 ***	257.33 ***	626.29 ***
Instruments	18	22	22	22	22	18	22	22	22	22
Countries	24	24	24	24	24	24	24	24	24	24
Observations	93	81	91	83	91	93	81	91	83	91

***,**,*: 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 imports is 40.422 while the mean value of exports is 28.459. Constants are included in all regressions.

Table 2: Real TFP growth, FDI and Trade

	Dependent variable: Real Total Factor Productivity Growth (Real TFP growth)									
	Trade Imports (Imports)					Trade Exports (Exports)				
Real TFP growth (-1)	**0.712*****	**0.662*****	**0.670*****	**0.696*****	**0.764*****	**0.663*****	**0.494*****	**0.594*****	**0.484*****	**0.694*****
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
FDI	**0.024****	0.005	**0.040*****	**0.012*****	**0.023*****	**0.049*****	**0.033*****	**0.048*****	**0.050*****	**0.048*****
	(0.034)	(0.624)	**(0.000)**	**(0.002)**	**(0.001)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Imports	**0.002****	0.001	**0.002*****	**0.002*****	**0.002*****	---	---	---	---	---
	(0.030)	(0.344)	**(0.001)**	**(0.002)**	**(0.001)**					
Exports	---	---	---	---	---	**0.005*****	**0.005*****	**0.005*****	**0.005*****	**0.006****
						(0.001)	**(0.002)**	**(0.000)**	**(0.000)**	**(0.011)**
FDI× Imports	**-0.0004****	-0.0001	**-0.0007*****	**-0.0003*****	**-0.0004*****	---	---	---	---	---
	(0.029)	(0.474)	**(0.000)**	**(0.001)**	**(0.001)**					
FDI× Exports	---	---	---	---	---	**-0.001*****	**-0.001*****	**-0.001*****	**-0.001*****	**-0.001*****
						(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Education	---	-0.212	---	---	---	---	**-0.494*****	---	---	---
		(0.124)					**(0.000)**			
Gov't Expenditure	---	---	**0.006*****	---	---	---	---	**0.005***	---	---
			(0.000)					**(0.065)**		
Remittances	---	---	---	-0.001	---	---	---	---	**-0.001****	---
				(0.193)					**(0.018)**	
Private Credit	---	---	---	---	-0.0004	---	---	---	---	0.0003
					(0.584)					(0.567)
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Net Effects	0.007	na	nsa	-0.012	0.006	nsa	0.004	0.019	0.021	0.019
AR(1)	(0.060)	**(0.290)**	(0.045)	**(0.132)**	**(0.124)**	(0.070)	**(0.270)**	(0.058)	**(0.112)**	**(0.185)**
AR(2)	**(0.156)**	**(0.337)**	(0.082)	**(0.212)**	**(0.315)**	**(0.125)**	**(0.311)**	**(0.104)**	**(0.328)**	**(0.285)**
Sargan OIR	(0.049)	**(0.124)**	(0.055)	(0.021)	(0.055)	(0.028)	(0.091)	(0.046)	(0.000)	(0.015)
Hansen OIR	**(0.185)**	**(0.180)**	(0.044)	**(0.167)**	**(0.140)**	(0.042)	**(0.207)**	(0.118)	**(0.179)**	**(0.123)**
DHT for instruments										
(a)Instruments in levels										
H excluding group	(0.047)	(0.150)	(0.042)	(0.110)	(0.030)	(0.030)	(0.117)	(0.072)	(0.209)	(0.057)
Dif(null, H=exogenous)	**(0.391)**	**(0.258)**	**(0.132)**	**(0.280)**	**(0.434)**	**(0.125)**	**(0.333)**	**(0.248)**	**(0.217)**	**(0.292)**
(b) IV (years,										

eq(diff))

H excluding group	**(0.288)**	**(0.401)**	**(0.154)**	**(0.697)**	**(0.444)**	**(0.569)**	**(0.534)**	**(0.119)**	**(0.313)**	**(0.249)**
Dif(null, H=exogenous)	**(0.163)**	(0.081)	(0.043)	(0.020)	(0.043)	(0.007)	(0.058)	**(0.274)**	**(0.126)**	(0.099)
Fisher	18268.85 ***	39079.78 ***	1298.48 ***	42611.09 ***	10724.99 ***	5782.34 **	59.91***	162393 ***	32257 ***	26.20***
Instruments	18	22	22	22	22	18	22	22	22	22
Countries	24	24	24	24	24	24	24	24	24	24
Observations	93	81	91	83	91	93	81	91	83	91

***,**,*: 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 imports is 40.422 while the mean value of exports is 28.459. Constants are included in all regressions.

Table 3: Welfare TFP, FDI and Trade

	Dependent variable: Welfare Total Factor Productivity (Welfare TFP)									
	Trade Imports (Imports)					Trade Exports (Exports)				
Welfare TFP (-1)	**0.766***** **(0.000)**	**0.728***** **(0.000)**	**0.821***** **(0.000)**	**0.814***** **(0.000)**	**0.779***** **(0.000)**	**0.632***** **(0.000)**	**0.689***** **(0.000)**	**0.661***** **(0.000)**	**0.693***** **(0.000)**	**0.596***** **(0.000)**
FDI	0.008 (0.112)	0.005 (0.220)	0.018 (0.133)	0.002 (0.546)	**0.014***** **(0.000)**	**0.009**** **(0.011)**	**0.007**** **(0.022)**	**0.009***** **(0.000)**	**0.010**** **(0.028)**	**0.018***** **(0.000)**
Imports	**0.001***** **(0.001)**	0.0001 (0.787)	**0.001**** **(0.047)**	**0.002***** **(0.003)**	**0.001***** **(0.003)**	---	---	---	---	---
Exports	---	---	---	---	---	**0.005***** **(0.000)**	**0.002**** **(0.022)**	**0.002**** **(0.016)**	**0.004***** **(0.001)**	**0.005***** **(0.000)**
FDI× Imports	-0.0001 (0.118)	-0.00006 (0.426)	-0.0003 (0.140)	-0.00009 (0.441)	**-0.0002 ***** **(0.000)**	---	---	---	---	---
FDI× Exports	---	---	---	---	---	**-0.0003 ***** **(0.005)**	**-0.0002**** **(0.023)**	**-0.0003 ***** **(0.000)**	**-0.0004 ***** **(0.007)**	**-0.0007 ***** **(0.000)**
Education	---	**0.139**** **(0.042)**	---	---	---	---	0.103 (0.143)	---	---	---
Gov't Expenditure	---	---	**0.005***** **(0.009)**	---	---	---	---	**0.003**** **(0.011)**	---	---
Remittances	---	---	---	**-0.004***** **(0.003)**	---	---	---	---	**0.0009**** **(0.010)**	---
Private Credit	---	---	---	---	**0.001**** **(0.014)**	---	---	---	---	0.001 (0.319)
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Net Effects	na	na	na	na	0.005	nsa	0.001	nsa	-0.001	-0.001
AR(1)	**(0.556)**	**(0.333)**	**(0.636)**	**(0.640)**	**(0.540)**	**(0.584)**	**(0.369)**	**(0.406)**	**(0.951)**	**(0.490)**
AR(2)	**(0.214)**	**(0.191)**	**(0.167)**	**(0.172)**	**(0.581)**	(0.081)	**(0.169)**	(0.078)	**(0.224)**	**(0.127)**
Sargan OIR	**(0.511)**	**(0.491)**	**(0.637)**	**(0.482)**	**(0.710)**	**(0.269)**	**(0.552)**	**(0.237)**	**(0.359)**	**(0.686)**
Hansen OIR	**(0.700)**	**(0.395)**	**(0.678)**	**(0.514)**	**(0.651)**	**(0.169)**	**(0.482)**	**(0.491)**	**(0.285)**	**(0.288)**
DHT for instruments (a)Instruments in levels										
H excluding group	**(0.474)**	**(0.474)**	**(0.307)**	**(0.241)**	**(0.307)**	**(0.551)**	**(0.627)**	**(0.293)**	**(0.160)**	**(0.856)**
Dif(null, H=exogenous)	**(0.658)**	**(0.342)**	**(0.737)**	**(0.603)**	**(0.707)**	**(0.128)**	**(0.382)**	**(0.536)**	**(0.396)**	**(0.173)**
(b) IV (years,										

eq(diff))									
H excluding group	**(0.546)**	**(0.673)**	**(0.419)**	**(0.615)**	**(0.399)**	**(0.138)**	**(0.401)**	**(0.286)**	**(0.225)**	**(0.313)**
Dif(null, H=exogenous)	**(0.680)**	**(0.120)**	**(0.970)**	**(0.274)**	**(0.956)**	**(0.354)**	**(0.529)**	**(0.868)**	**(0.471)**	**(0.294)**
Fisher	152.07***	15542.43 ***	295.07***	4475.85 ***	167.96 ***	1633.02 ***	672.82 ***	915.41 ***	1767.59 ***	2177.41 ***
Instruments	18	22	22	22	22	18	22	22	22	22
Countries	24	24	24	24	24	24	24	24	24	24
Observations	93	81	91	83	91	93	81	91	83	91

***,**,*: 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 imports is 40.422 while the mean value of exports is 28.459. Constants are included in all regressions.

Table 4: Welfare real TFP, FDI and Trade

	Dependent variable: Welfare Total Factor Productivity (Welfare real TFP)									
	Trade Imports (Imports)					Trade Exports (Exports)				
Welfare real TFP (-1)	**0.597*****	**0.524*****	**0.562*****	**0.617*****	**0.668*****	**0.589*****	**0.457*****	**0.568*****	**0.625*****	**0.611*****
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
FDI	0.014	0.010	**0.020***	**0.020****	**0.023****	**0.042*****	**0.024*****	**0.030*****	**0.037*****	**0.037*****
	(0.179)	(0.107)	**(0.054)**	**(0.026)**	**(0.025)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Imports	**0.002****	**0.002****	0.001	**0.003****	**0.002*****	---	---	---	---	---
	(0.022)	**(0.028)**	(0.141)	**(0.016)**	**(0.005)**					
Exports	---	---	---	---	---	**0.005*****	**0.006*****	**0.003*****	**0.005*****	**0.004*****
						(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.002)**
FDI× Imports	-0.0003	**-0.0002***	**0.0004***	**0.0004****	**-0.0004 ****	---	---	---	---	---
	(0.150)	**(0.097)**	**(0.055)**	**(0.030)**	**(0.028)**					
FDI× Exports	---	---	---	---	---	**-0.001 ****	**-0.0006 ****	**-0.0009 ****	**- 0.001****	**- 0.001****
						(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.001)**
Education	---	-0.051	---	---	---	---	**- 0.274*****	---	---	---
		(0.593)					**(0.002)**			
Gov't Expenditure	---	---	**0.006****	---	---	---	---	**0.005*****	---	---
			(0.032)					**(0.001)**		
Remittances	---	---	---	-0.003	---	---	---	---	**0.0007****	---
				(0.119)					**(0.013)**	
Private Credit	---	---	---	---	**- 0.002*****	---	---	---	---	-0.0008
					(0.005)					(0.231)
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Net Effects	na	na	0.003	na	0.006	0.013	0.006	0.004	0.008	0.008
AR(1)	(0.015)	**(0.129)**	(0.020)	(0.046)	(0.021)	(0.019)	(0.047)	(0.043)	(0.027)	(0.048)
AR(2)	**(0.752)**	**(0.403)**	**(0.327)**	**(0.700)**	**(0.292)**	**(0.513)**	**(0.120)**	**(0.333)**	**(0.791)**	**(0.789)**
Sargan OIR	**(0.265)**	**(0.138)**	**(0.244)**	**(0.164)**	**(0.325)**	**(0.164)**	**(0.743)**	**(0.105)**	**(0.282)**	(0.033)
Hansen OIR	**(0.233)**	**(0.311)**	**(0.155)**	**(0.538)**	**(0.313)**	**(0.375)**	**(0.702)**	**(0.302)**	**(0.602)**	**(0.256)**
DHT for instruments (a)Instruments in levels										
H excluding group	**(0.236)**	**(0.241)**	**(0.157)**	**(0.105)**	**(0.141)**	(0.074)	**(0.107)**	(0.075)	**(0.388)**	**(0.261)**
Dif(null, H=exogenous)	**(0.248)**	**(0.360)**	**(0.216)**	**(0.797)**	**(0.458)**	**(0.607)**	**(0.932)**	**(0.567)**	**(0.604)**	**(0.281)**
(b) IV (years, eq(diff))										
H excluding group	**(0.385)**	**(0.521)**	**(0.354)**	**(0.523)**	**(0.463)**	**(0.191)**	**(0.678)**	**(0.313)**	**(0.651)**	**(0.196)**
Dif(null,	**(0.157)**	**(0.134)**	(0.079)	**(0.426)**	**(0.172)**	**(0.753)**	**(0.494)**	**(0.319)**	**(0.354)**	**(0.473)**

Fisher	73.14***	48585***	349.64***	338.17***	291.64***	8278.98***	75.68***	14174.99***	321.88***	245.75***
Instruments	18	22	22	22	22	18	22	22	22	22
Countries	24	24	24	24	24	24	24	24	24	24
Observations	93	81	91	83	91	93	81	91	83	91

***,**,*: 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. na: not applicable because at least one estimated coefficient required for the computation of net effects is not significant. The mean value of imports is 40.422 while the mean value of exports is 28.459. Constants are included in all regressions.

4.2 Further discussion of results

While it is revelvant to discuss the confirmed simultaneous openness hypothesis in the light of extant literature, it is also worthwhile to note that the Rajan and Zingales (2003) hypothesis pertaining to simultenous openness has largely been investigated within the context of financial development. Hence, as clarified in the introduction, this study has departed from the extant literature by investigating the attendant hypothesis within the context of productivity. Hence, the discussion of results in the light of prior literature on the simultenously hypothesis would largely compare the findings of this study with those established in the financial development literature. Let us recall that, according to Rajan and Zingales (2003), concurrent opening of trade and capital accounts will lead to greater financial development in a domestic economy and by extension, productivity in a domestic economy as framed in this study. Two strands of the literature are worth comparing with the established findings, notably: a strand that has confirmed the hypothesis and another strand that has not confirmed the hypothesis.

On the strand that has confirmed the hypothesis; the findings of this study are broadly consistent with Sakyi and Egyir (2017) who have confirmed the hypothesis within the context of economic growth in 45 African countries during the period 1990-2014 using the GMM estimation technique. In this same strand, Onanuga (2016) confirms the simultaneous opening of finance and trade accounts for financial development in Nigeria using the GMM estimation strategy while Law (2017) establishes using dynamic heterogeneous panel data (from 68 countries for the period 1980-2001 that) that, openness in terms of capital and trade are most potent in driving financial development in middle-income nations, compared to high-income and low-income countries where the influence is relatively small.

With respect to the strand of studies that has not confirmed the underlying hypothesis, Ajayi and Aluko (2019) use data from 1990 to 2015 and an instrumental variable estimation approach to establish that simultaneous increases in financial and trade openness restricts stock market and banking sector developments in Nigeria. Baltagi, Demetriades and Law

(2009) provide only partial support for the hypothesis by finding that openning either trade accounts or capital accounts (i.e. openning one without the other) can still improve financial sector development. Using GMM estimators on data from 1996-2013 in 53 developing and developed countries, Abdallah (2016) does not find support to the simultaneous openness hypothesis. Al-Fayoumi and Abuzayed (2014) have also not confirmed the hypothesis in 12 Arab countries from 1985 to 2011 using the GMM, Fixed Effects and Random Effects estimation strategies. Hauner, Prati and Bircan (2013) also find little support for the underlying hypothesis using *de jure* measures of openness and financial development. Karimu and Marbuah (2017) focus on 44 developing economies and use a nonparametric modelling approach to confirm that both openness dimensions positively affect financial development and consequently, provide loose support for the simultaneous openness hypothesis.

It is worth noting that the conclusions on evidences or not of the simultaneous openning hypothesis from the extant literature are based on interactive effects, while the conclusions of this study are based on net effects. It follows that findings of the studies used to compare our findings are characterised by some pitfalls in interactive regressions documented in Brambor et al. (2006) and contemporary literature (Asongu & Odhiambo, 2020a, 2020b). Accordingly, in interactive regressions, the overall effect should be based on both the conditional (or interactive effect) and the unconditional effect.

5. Concluding implications and future research directions

This study assesses the simultaneous openness hypothesis that trade modulates foreign direct investment (FDI) to induce positive net effects on total factor productivity (TFP) dynamics. Twenty-five countries in Sub-Saharan Africa and data for the period 1980 to 2014 are used. The empirical evidence is based on the Generalised Method of Moments. First, trade imports modulate FDI to overwhelmingly induce positive net effects on TFP, real TFP growth, welfare TFP and real welfare TFP. Second, with exceptions on TFP and welfare TFP where net effects are both positive and negative, trade exports modulate FDI to overwhelmingly induce positivenet effects on real TFP growth and welfare real TFP. In summary, the tested hypothesis is valid for the most part.

In the light of the above, the tested hypothesis is overwhelmingly valid because the positive net effects substantially outweigh the negative net effects. Evidence of positive and negative net effects is not also surprising given the conflicting theoretical underpinnings engaged in Section 2. The negative net effects can also be elicited from several perspectives. FDI may not engender positive ramifications on TFP if multinational companies operate within sectors that are not competitive or when FDI is implemented within a context where-by it dampens

domestic investment and savings. Hence, FDI can also enclave investment, reduce external balances owing to substantial repatriation of profits. It is also important to emphasize that in scenarios where FDI is not tailored to international trade, but for domestic consumption, limited exports can adversely affect the current account balance and by extension foreign reserves. In summary, the fact that the overall effects on the outcome variable are contingent on adopted elements in the conditioning information set is also evidence of the fact that initial macroeconomic conditions are necessary in order to leverage on overall positive effects. Moreover, some initial conditions are more favourable for the anticipated positive net effects than others. In what follows, some implications pertaining to the validity of the tested hypothesis are engaged.

Overall, it is worthwhile to emphasize that the findings are relevant to the sampled countries in SSA because a trade-driven FDI-TFP nexus is likely to bring-in foreign exchange earnings, improve economic performance and encourage the establishment and/or consolidation of new/competitive productivity capacities. The net effects can be further improved if the established nexuses are tailored in the light of the following.

First, the established findings should be fundamentally articulated along the imperative of forstering export oriented FDI given that the suggested approach has the advantage of attracting investments that contribute both to the consolidation of foreign exchange and domestic employment opportunities. The approach should also be contingent on comparative competitiveness of the countries, strategic niches of production, targeted locations and the relevance of productivity that is aligned with global value chains.

Second, the positive net effects on welfare focused TFP dynamics is evidence of the relevance of the findings in the post-2015 development agenda in which, societal welfare is fundamental in driving sustainable development. Hence, FDI policies should also be constructively aligned to the degree by which the targeted productivity can boost socio-economic and inclusive development objectives of sampled countries. Therefore, the FDI approaches should be tailored to promote, the rights of workers, working conditions and skills upgrading.

Third, in order to boost domestic economic development in other sectors and improve values chains, foreign investors should be encouraged to foster nexuses with local firms and suppliers. Moreover, the linkages should promote knowledge transfer, technology catch-up and skills diffusion between domestic firms and multinational companies. Other worthwhile endeavours that should be prioritised in the connection between multinational companies and local firms include: collaborative training, participation in joint programs for human

capital improvement and encouragement of foreign partners to contribute towards the construction of local capacities.

Fourth, the imperative of fostering and consolidating export related FDI is contingent on the nation's capacity to build domestic resources. Accordingly, as established by Hassan (2005), countries that have been most successful in driving-up exports have adopted a two-pronged strategy: improvement of domestic capabilities and foreign resources targeting. The approach entails, *inter alia*: the institution of specialised agencies that promote the targeting of FDI in accordance with industrial strategies and broader development objectives of a nation; upgrading of human resources and system of training workers; building of relevant industrial infrastructure that is of world premier standard; establishment of funds promoting capital investment and support for domestic corporations.

Fifth, in summary, to improve overall productivity as well as welfare implications of the underlying productivity, countries also need to be aware of issues that can substantially jeopardize the development prospects of SSA nations. Such issues include a good understanding of tendencies in comparative advantages such that domestic policies are designed to avoid foreign investments that are weapons of dumping and unfair competition. In essence, the degree by which nations can benefit from new avenues brought about by systems of international production is contingent on the their idiosyncratic actions, which entail: the consolidation of instutituional frameworks, promotion of investment opportunities that are export-oriented and building of networks for skills and technology transfer between multinational companies and local firms.

The findings obviously leave room for future research particularly, withiin the framework of understanding how the formation of industrial clusters can be consolidated by trade openness in efforts to form three types of FDI-driven clusters. These are: (i) targeted business and investment promotion; (ii) institutions building and (iii) training of human resources.

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
Foreign Direct Investment	FDI	Foreign Direct Investment Inflows(% of GDP)	UNCTAD
Commodity Imports	Imports	Import of Goods and Services (% of GDP)	WDI
Commodity Exports	Exports	Export of Goods and Services (% of GDP)	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)	FDSD

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

	Mean	S.D.	Min	Max	N
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
Imports	40.422	26.980	6.664	163.198	116
Exports	28.459	16.635	3.199	66.722	116
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 (uniform sample size: 123)

TFP	RTFP	WTFP	WRTFP	FDI	Imports	Exports	Education	Gov. Ex	Remit	Credit	
1.000	0.260	0.954	0.132	-0.137	-0.035	0.498	0.253	0.093	-0.153	0.281	TFP
	1.000	0.279	0.572	-0.009	-0.077	0.333	-0.075	0.042	-0.273	0.099	RTFP
		1.000	0.129	-0.098	0.086	0.505	0.266	0.190	-0.071	0.265	WTFP
			1.000	0.075	0.069	0.322	-0.115	-0.063	-0.082	0.212	WRTFP
				1.000	0.280	0.193	0.239	0.128	0.038	0.036	FDI
					1.000	0.522	0.422	0.538	0.779	0.210	Imports
						1.000	0.347	0.350	0.050	0.427	Exports
							1.000	0.322	0.352	0.153	Education
								1.000	0.287	0.139	Gov. Ex
									1.000	-0.082	Remit
										1.000	Credit

TFP: Total Factor Productivity. RTFP: Real Total Factor Productivity. WTFP: Welfare Total Factor Productivity. WRTFP: Welfare Real Total Factor Productivity. FDI: Foreign Direct Investment. Mobile: Mobile Phone penetration. Internet: Internet penetration. Gov. Ex: Government Expenditure. Remit: Remittance. Credit: access to credit.

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