ANNALS OF ECONOMICS AND FINANCE **19-2**, 625–651 (2018)

Official Development Assistance and Foreign Direct Investment: An Empirical Investigation of Their Implications for Domestic Capital Formation in Africa

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This study assesses the relationship between official development assistance (ODA) and foreign direct investment (FDI) and the extent to which each influenced domestically financed capital formation (DFCF) in Africa. An empirical analysis using dynamic panel data estimation methods reveals that both FDI and ODA exerted independent and interactive effects on DFCF in the typical study country. We find that the effect of FDI on DFCF is generally negative, while that of ODA is positive. Whether ODA influenced FDI is observed to depend, in part, on whether the aid was committed to complementary or productive activities in the recipient countries.

Key Words: Africa; Domestic investment; Dynamic GMM; Foreign direct investment; Official development assistance.

JEL Classification Numbers: E22, F21, F35, F41, O55.

1. INTRODUCTION

External financial flows to Africa have quadrupled since 2000 and reached $208.3 billion in 2015, making it the largest financial flow to Africa (UNCTAD, 2015). Their composition has also changed progressively with remittances and foreign investments from non-OECD countries underpinning this positive trend. Although resource rich countries remain the prime destination for FDI to Africa, manufacturing and services continue to attract an increasing share of the over 750 new Greenfield FDI projects. In contrast, ODA's share of total external flows keeps diminishing, from 37% in 2002-2006 to 28% in 2012-2016. Despite this downward trend, ODA still represents the largest external financial flow to low-income African countries, reflecting the ODA policy of many African donors.

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1529-7373/2018

Early development theory proposes that foreign aid complements the recipient economy's domestic resources, eases foreign exchange constraints, transfers modern knowledge and managerial skills, and facilitates easy access to foreign markets whose combined effects are expected to be favourable for economic growth and development (Chenery and Strout, 1966; Griffin, 1970; Ruttan, 1996). However, the unsatisfactory growth record of a number of countries despite foreign aid has given rise to aid pessimism and the radical anti-aid view (Griffin and Enos, 1970; Weisskopf, 1972).

Foreign direct investment also plays a significant role in the growth dynamics of recipient economies. The literature proposes that FDI can fill three development gaps in recipient economies. It can fill an investment/savings gap by providing a much-needed capital to supplement domestic saving and investment; a foreign exchange gap by the provision of foreign currency through their initial investment and subsequent export earnings; and a tax revenue gap by generating tax revenues through the creation of additional taxable economic activities (Quazi 2007, Anyanwu 2011). FDI can also help generate domestically financed capital formation (DFCF) by facilitating transfer of managerial skills and technological know-how, increasing competition in the domestic market, creating modern job opportunities, expanding global market access for locally produced export commodities, and through other positive spillover effects. On the negative side, FDI and multinational enterprises (MNEs) could crowd-out domestic investment (Agosin and Mayer, 2000; Qu, et al 2013).

In analysing the relationship between ODA and FDI, there are two competing views within the ODA-FDI literature. One view holds that ODA should fund human capital building projects (e.g. schools, hospitals) and infrastructure projects (e.g. roads, electricity, telecommunications), which raise the marginal productivity of capital (MPC), and can attract more FDI (Quazi, et al. 2014). The opposing view holds that since investment opportunities in LDCs are usually low and many investment projects are financed by ODA, the latter actually crowds-out other types of investment, including FDI. Only a few studies have analysed whether ODA facilitates or crowds-out FDI in LDCs, and the empirical evidence remains inconclusive. The empirical evidence is also thin and inconclusive on whether ODA and FDI independently or interactively crowd-in or crowd-out DFCF.

This paper seeks to contribute to this strand of literature by assessing the extent to which ODA influenced FDI and whether these two flows affected DFCF in Africa. More specifically, addressing the following questions constitutes the purpose of the paper. (1) To what extent is the observed rise in FDI flows to Africa attributable to the magnitude and type of ODA received? (2) What are the interactive and independent contributions of ODA and FDI to DFCF in the receiving countries? Tentative answers to these queries will be sought in an empirical investigation of panel data from

41 SSA countries, spanning the period 1995-2013, which saw considerable changes in the trajectories of FDI and ODA flows. The relationships to be explored are modeled in a dynamic setting and estimated using alternative dynamic panel data procedures.

The rest of this paper is presented as follows. Section two reviews the conceptual and theoretical foundations as well as the empirical evidence on the link between ODA and FDI and their implications for domestic investment. The empirical model and methods used for the analysis are described in the third section. The results of the analyses are presented and discussed in section four, while a summary and conclusions are offered in section five.

2. LITERATURE REVIEW

2.1. Theoretical Arguments: The link among FDI, ODA and Domestic Capital Formation

A significant number of theoretical and empirical studies have been undertaken over the last five decades to establish a relationship between external resources and domestic savings and investment. This debate started with the famous two-gap model of Chenery & Strout (1966) who extended the Harrod-Domar model using the works of Lewis and Rostow. They argued that domestic savings and foreign exchange earnings were the two most important constraints of economic growth in LDCs. External resources may relax these constraints and assist LDCs to achieve a desired rate of growth. Both ODA and FDI are expected to influence DFCF. However, the assumption that ODA supplements domestic savings was challenged by Rahman (1967), Griffin (1970) and Griffin & Enos (1970) who argued that foreign aid would be a substitute for domestic savings as long as the world interest rate was lower than the marginal product of capital.

However, there are reasons to expect the impact of ODA to be different from that of FDI (e.g. Kosack and Tobin, 2006). As ODA is mainly government-centred, its impact on DFCF is directly through increased public investment in physical infrastructure and indirectly through social infrastructure, if these belong in government spending priorities. The opposite might also be true if the government's priority is elsewhere. The role of ODA in stimulating DFCF would be minimal where it is allocated mostly for non-investment type activities such as financing recurrent government expenditures, humanitarian aid, and other government consumption expenditures, ending up enlarging the government budget rather than investment and growth (Boone, 1995; Kosack and Tobin, 2006).

On the other hand, FDI is private capital, which is expected to complement domestic savings by adding to the total supply of capital to fund new projects and create new fixed assets. Favourable indirect effects are

expected through the transfer of technology and managerial skills, the development of human capital, and an increase in total factor productivity and overall economic efficiency (Grossman and Helpman, 1991; Berthélemy and Démurger, 2000). However, whether FDI will crowd-in or crowd-out DFCF in LDCs is theoretically ambiguous, as it depends, among other factors, on the kind of FDI received and the strength of domestic firms (Agosin and Mayer, 2000).

The crowding-in effect of FDI is expected to be higher if it is a green field type that stimulates production and thereby capital formation by local firms by creating backward and forward linkages. Beneficial spillovers could also be had through imitation of, and access to, new technology, new products and processes, better management and expertise, and the opening up of new foreign markets and through heightened competition in the product and input markets (Markusen and Venables, 1999; Agosin and Mayer, 2000; Görg and Geenaway, 2004). The induced competition between MNEs and local firms is expected to improve total factor productivity in the long run as would technology and other knowledge transfers from MNEs to the local economy (Chen, 2004; Meyer & Sinani, 2009). As well, by broadening foreign and local markets, FDI could attract new local investors and could promote the transformation of the informal sector. In addition, FDI may promote domestic investment when it reduces the constraints inherent in the host country's investment climate, e.g. when FDI helps to improve physical infrastructure (Arvis, et al, 2007; Dunning, 1998).

A case can also be made that FDI could crowd out DFCF in LDCs. Multinational enterprises can destroy local businesses with their superior technological, managerial and financial know-hows, allowing them to create monopolies (Markusen & Venables, 1999; Brainard 1997; Helpman, Melitz & Yeaple, 2003). Furthermore, FDI can create unfavorable competition against local firms in the factor market, where foreign firms' demand for resources could raise input prices. Where FDI is oriented towards the exploitation of natural resources, foreign investment may disadvantage local industries through a "Dutch disease" type process (Krugman, 1987). The increase in exports of natural resources implies an increase in the real effective exchange rate, rendering the non-extractive tradable sectors of the economy less competitive (Sachs & Warner, 1997).

Furthermore, in countries with poor institutions, an FDI-induced exploitation of their natural resources may engender political and economic distortions and an unequal distribution of the rents accrued. These distortions create barriers to the emergence of new local manufacturing enterprises, contributing indirectly to the crowding-out of domestic investment (Sachs & Warner, 1997; Rodrik & Velasco, 1999; Farla, de Crombrugghe & Verspagen, 2013). The crowding-out effect on local businesses, in turn, is

believed to inhibit growth, increase unemployment and further marginalize the poor (Qu, et al, 2013).

While FDI and ODA may independently influence domestic investment through various mechanisms such as those outlined above, their effects could also be transmitted interactively, given the expected relationship between them. While the causal relationship could be mutual, the possible effect of ODA on FDI flows has received greater attention in the relevant literature. The effects of ODA on FDI may be channelled through several ways (Nunnenkamp & Spatz, 2016). Foreign aid could attract FDI flows if it increases the marginal productivity of private investment by improving physical and social infrastructure (Harms and Lutz, 2006; Kimura and Todo, 2010; Selaya and Sunesen, 2012) and if it helps to improve the balance of payments (Harms and Lutz, 2006). In addition, ODA is expected to play a catalysing role through the "vanguard effect" whereby aid from a given donor country would increase FDI flows from the same country (Kimura and Todo, 2010) and by mitigating the expropriation risk of FDI (Asiedu et al., 2009). On the other hand, increased ODA could adversely affect FDI in the event that the former encourages rent-seeking activity (Harms and Lutz, 2006).

2.2. The Empirical Evidence

Most of the empirical research on the economic effects of foreign aid and FDI pertains to economic growth, with domestic investment assumed as one of the key factors underlying the link. Given the scope of the present work, our review will focus on the cross-country evidence on the direct effects of foreign aid on FDI and of the two on DFCF.

2.2.1. The Effects of ODA and FDI on Domestic investment

The direct cross-country evidence on the linkage between aid and domestic investment is scanty and the indirect one is at best mixed. Serieux (2011), in his study of aid in 29 SSA countries, finds that ODA reduces the domestic savings rate. In an earlier study, Serieux (2008) reports a positive effect on growth via the investment channel. This corroborates similar findings by others that, under liberalized finance, aid tends to be positively associated with liquidity growth and investment, but, predictably, depresses domestic saving. On the other hand, a panel data analysis of 10 selected ECOWAS countries by Eregha, Sede and Ibidapo (2012) indicates that ODA negatively affects growth and investment.

Agosin and Mayer (2000) and Agosin & Machado (2005) report that FDI on average exerted a crowding-in effect in Asian and a crowding-out effect in Latin American countries included in their study both over the whole period (1970-96) and the sub-periods they constructed. For the African

sub-sample inclusive of 12 countries, the results depended on the time horizon considered: a crowding-in effect in the two sub-periods and a neutral average long-run effect during the whole period. A study of 64 developing countries by Kasuga (2007), based on panel data of 5-year moving averages, shows that saving and FDI positively affect fixed investment. The relative impacts of these financial flows are found to be dependent on the countries' income level, financial structure, and government infrastructure.

The studies that examined the impact of FDI on domestic investment in the context of Africa include that of Ndikumana and Verick (2008) and Ndikumana and Blankson (2015) who report that FDI crowded in domestic investment in a panel data of 38 and 50 countries, respectively. Ndikumana and Blankson (2015) whose study also included ODA found no evidence that it contributed to domestic investment. Adams (2009) distinguishes between initial and lagged adjustments and finds, for a panel of 42 African countries, that FDI exerts a contemporaneous negative, and a lagged positive, effect on domestic investment. Mutenyo, Asmah and Kalio (2010) present evidence for the crowding-out effect in their panel data analysis of three-year averaged observations from a sample of 34 SSA countries. Fahinde, Abodohoui & Su (2015) and Eregha (2012) report similar results based on panel data analyses for ECOWAS and WAEMU, respectively.

2.2.2. The Effect of ODA on FDI

One of the first studies to look at the relationship between ODA and FDI was that of Papanek (1973), and his results seem to indicate that there is no correlation between them. On the other hand, Selaya and Sunesen (2012), using disaggregated data from 99 countries find that foreign aid raises the marginal product of capital when it finances complementary inputs, such as public infrastructure projects and human capital investment. A crowding-out effect is observed when aid enters the economy in the shape of physical capital flows, substituting domestic private investments. The overall effect of these two types of foreign aid on FDI is found to be positive, albeit small.

Kimura and Todo (2010), in their analysis that distinguishes between aid for infrastructure and aid for other purposes, find no significant effect of aid on FDI; however, in the case of aid from Japan they find a vanguard effect. Similarly, a panel data study of 92 developing countries by Harms and Lutz (2006) shows that the marginal effect of ODA on private foreign investment is almost zero. However, this effect is found to be positive in countries with weak regulatory institutions. In contrast, Karakaplan, Neyapti & Sayek (2005), analysing panel data on 97 countries, report that

countries that receive aid also become more likely to receive FDI, but this only happens especially in the case of good governance and financial market development. On the other hand, Jansky (2012) uncovers no evidence of causal relationship between the two variables in a panel data study of 180 countries.

In sum, the direct cross-country evidence on the effect of ODA on domestic investment is rather thin; and the relationships between the two financial variables and their independent and interactive effects on DFCF remain underexplored within the same empirical framework and dataset, especially in the context of Africa. The findings of the empirical studies are quite wide ranging, from positive, negative to no relationship. Differences in the results may have partly stemmed from variations in sample composition, model specifications, estimation methods, and variable representations. The sample composition, both in terms of study countries and period is not trivial, since the relationships among the variables of interest appear to be sensitive to institutional and structural attributes, which may differ among study countries and, to a certain extent, across time.

There are also differences in specifications with implications for estimation methods and the validity of reported results. Most of the related studies analyse investment within a static framework, failing to accounting for dynamic effects. Exceptions in this regard include Agosin & Mayer (2000) and Ndikumana & Blankson (2015). A number of studies used fixed effects or similar procedures that do not take into account the possibility of mutual causation, as the case may be, between FDI and ODA, between DFCF and FDI, as well as between the dependent variable of interest and control variables considered. Estimation methods that deal with simultaneity bias such as instrumental variables were used by fewer studies (e.g. Selaya & Sunesen, 2012; Mutenyo, Asmah & Kalio, 2010; Ndikumana & Blankson, 2015). While most of the studies are panel analysis based on annual data, a few of them used three/five-year averaged data to mitigate business-cycle effects and minimize measurement errors (e.g. Kasuga, 2007; Mutenyo, Asmah and Kalio, 2010; Kimura and Todo, 2010). The majority of the studies do not distinguish between contemporaneous and delayed effects. Exceptions in this connection include Adams (2009), Agosin & Mayer (2000) and Agosin & Machado (2005). We also note differences in how domestic investment is represented and what types of foreign aid and foreign investment are considered in the empirical analysis.

3. EMPIRICAL MODEL AND METHOD

The role of ODA and FDI in domestic capital formation is assessed by estimating various versions of a two-equation model, which recognizes the possibility of, and allows for, mutual causation between FDI and DFCF, with ODA appearing as an explanatory variable in both equations. However, ODA is treated as an endogenous variable, in view of the potential for it to be influenced by domestic capital formation, as more aid may flow to economies where local investment and FDI are low — a case in point is infrastructural development aid. However, ODA is not modelled, since our focus is not on its determination. In view of the multiplicity of channels through which the said dependent variables are expected to influence each other, the empirical model specified here is not derived from a single theoretical framework. In addition to the key regressors of interest, the equation for each variable incorporates control variables the selection of which is guided by theoretical and empirical considerations.

3.1. Estimating Equations

Both FDI and ODA are expected to supplement domestic savings and thereby influence DFCF assuming that the latter is liquidity or finance-constrained. However, as previously noted, the effects of these variables on DFCF cannot a priori be presumed to be the same. They differ in the channels through which they are expected to affect DFCF. Moreover, each is determined through different mechanisms (FDI through private channels in contrast to ODA, which involves public institutions), with varying underlying motivations. Although the two variables could be simultaneously determined, they nevertheless could affect DFCF differently and interactively and are, therefore, entered as two distinct variables in the DFCF equation, allowing the data to determine their relative contributions. The effects of the two variables on DFCF are examined, controlling for a number of co-determinants including GDP growth, domestic saving rate, trade openness, financial development and intermediation, macroeconomic instability, external debt burden, and quality of institutions, most of which appear in investment equations in the related literature with varying compositions and representations (e.g. Agosin and Mayer, 2000; Agosin and Machado, 2005; Ndikumana and Blankson, 2015).

The primary explanatory variables of interest in the FDI equation are ODA and DFCF. As mentioned, ODA is expected to play a catalysing role or could potentially substitute for FDI, suggesting that the sign of its coefficient is indeterminate a priori. The empirical investigation of the relation-

ship between DFCF and FDI has mostly been premised on the assumption of a unidirectional causation running from the latter to the former. The reverse causation is considered by fewer studies, although this terrain of causation can be justified on several grounds (e.g. Ndikumana and Verick, 2008; Lautier and Moreaub, 2012; and the references therein). McMillan (1998), as cited by Lautier and Moreaub (2012), rationalizes causation in the presence of asymmetry of information where domestic firms enjoy better information about local market conditions than foreign investors and where the level of investment in the host country would send a signal to foreign investors about economic conditions. In a similar vein, Ndikumana and Verick (2008) use the signalling effect whereby higher investment activity at home signals to foreign investors that returns to capital are high. Also, increased public investment in the form of infrastructural development could attract FDI by increasing factor productivity and reducing transaction costs.[1]

The effects of ODA and DFCF on FDI are examined conditional on a number of other economic and non-economic determinants identified to be relevant in related empirical studies and on which data are available (e.g. Dunning, 1998; Harms and Lutz, 2006; Kimura and Todo, 2010; Anyanwu, 2012; Cleeve, Debrah and Yiheyis, 2015). The control variables considered include real GDP, population, real GDP per capita, real GDP growth, openness, endowment of natural resources, quality of institutions, macroeconomic instability, and financial, infrastructural and human capital development.

The two variables, DFCF and FDI, are also specified to depend on their lagged values to capture inertia and partial adjustment. The baseline estimating equations take the following form.[2]

$$\begin{aligned} dfcf_{it} &= \alpha_0 + \alpha_1 dfcf_{it-1} + \alpha_2 fdi_{it} + \alpha_3 fdi_{it-1} + \alpha_4 oda_{it} + \alpha_5 oda_{it-1} \\ &+ \phi_{1J} Z_{1it} + \mu_{1i} + \varepsilon_{1it} \qquad (1) \\ fdi_{it} &= \alpha_0 + \alpha_1 fdi_{it-1} + \alpha_2 dfcf_{it} + \alpha_3 dfcf_{it-1} + \alpha_4 oda_{it} + \alpha_5 oda_{it-1} \\ &+ \phi_{2J} Z_{2it} + \mu_{2i} + \varepsilon_{2it} \qquad (2) \end{aligned}$$

where Z is a vector of control variables listed elsewhere.

[1] See Lautier and Moreaub (2012) for details on these and a summary of other effects, mostly indirect, of domestic investment on FDI.

[2] See appendix (Table A1) for a summary of definitions and representations of variables as well as data sources.

3.2. Estimation Issues and Method

The parameterizing of the model specified above involves several estimation issues including the following. First, actual or observed data are unavailable on DFCF, which is to be distinguished from domestic fixed capital formation, an aggregate of DFCF and FDI. Most of the studies with domestic investment as the dependent variable use aggregate investment inclusive of the foreign-financed component. Although the effect of FDI on DFCF can be indirectly calculated from a regression of aggregate investment, for our purpose, which also includes determining the separate effects of ODA both on FDI and DFCF, it will be useful to use DFCF, rather than aggregate domestic fixed capital formation, as the dependent variable. Following, among others, Younas (2011), we generate the DFCF series as a residual by subtracting FDI, as defined above, from aggregate domestic fixed capital formation. This approach is far from perfect partly because not all FDI flows represent actual investment that translates into increased domestic physical capital stock, especially when is not a greenfield type, although attempt is made to circumvent this problem by using the change in FDI stock as a measure of FDI flows.

Second, the main variables of interest, such as DFCF, FDI and ODA, tend to be subject to volatility and sensitive to domestic and foreign business-cycle effects. Third, in common with other macro data, aggregation and measurement errors are expected in the annual series of the variables of interest. To overcome these problems and in recognition of the fact that ODA and FDI may take time before their effects are felt, we use a three-year averaged series, which possess the additional advantage of dealing with missing observations.[3] Fourth, as mentioned, some of the variables in the model are likely to be simultaneously determined. As well, certain control variables are likely to be influenced by the dependent variables they are hypothesized to explain, raising the issue of potential endogeneity and simultaneity bias. Cases in point are economic growth, real GDP per capita, and to a certain degree, ODA.

Lastly, the estimating equations include lagged dependent variables as explanatory variables in their respective equations, rendering a panel esti-

[3]We use the three-year average, rather than the more common five-or ten-year average series, to allow a reasonable period dimension to avoid significant loss of information and degrees of freedom, given our relatively short sample period, 1995-2013 (for a similar approach, see e.g. Kimura and Todo, 2010; Mutenyo, Asmah and Kalio, 2010, Cleeve and Yiheyis, 2014). Accordingly, the unbalanced panel data from 41 study countries comprise a maximum of six periods, depending on data availability. The 6th period covers four years, 2010-2013.

mation method controlling for country-specific effects, such as fixed-effect or random-effects procedure, inappropriate because of the correlation between the lagged dependent variable and the error terms. One of the preferred estimation procedures in this case is the generalized method of moments (GMM) dynamic panel data estimator. The "difference" version of this approach uses appropriate lags—in level form—of the dependent variable (dated $t-2$ or earlier) and available lags of the other regressors as instruments of the differenced lagged dependent variable (Arellano and Bond, 1991).

However, for a data series that exhibit persistence and are close to random walk, lagged levels are shown to be poor instruments for their differenced counterparts, in which case using a "system"-GMM approach is recommended (Arellano and Bover, 1995; Blundell and Bond, 1998). This would be our preferred method in view of the stylized fact about the time-series property of macroeconomic indicators, which constitute the majority of the model variables. This estimator combines the regression in differences (relevant variables instrumented by appropriate lags of the dependent and endogenous variables) and regression in levels (relevant variables instrumented by lagged differences). This estimator also conveniently handles the previously mentioned simultaneity bias that would arise because of the other endogenous explanatory variables (fdi, $dfcf$ $gdppc$, Δinf) or predetermined regressors ($gdpgr-1$), using appropriate lags as instruments.

4. RESULTS AND DISCUSSION

Various versions of the two equations were estimated using alternative procedures for purposes of comparison and checking robustness.

4.1. Estimates of the domestic investment model

Table 1 records the parameter estimates of the domestic investment model. Application of OLS to the pooled data, assuming that the study countries are otherwise homogenous, generates the results in Column I. Foreign aid and fdi have disparate effects, signed positive and negative, respectively, although the former is significant only at the 10% level. The signs are reversed at one-period lag. Accounting for heterogeneity across countries using the fixed-effects procedure expands the vector of significant coefficient estimates. However, as mentioned, the use of this method in a dynamic setting introduces an endogeneity problem owing to the correlation between the dependent variable and the country-specific fixed effects.

The results from the "difference" GMM method, which addresses this problem, appear in Column III.[4] This procedure assumes that there is no second-order serial correlation, AR(2), in first-differenced errors and that the instruments are valid. The null hypotheses of no serial correlation and of over-identifying restrictions (whether the instruments as a group appear exogenous and are valid) are tested using the Arellano-Bond tests of second-order serial correlation and the Sargan/Hansen tests of over-identifying restrictions, respectively.[5] The diagnostic tests confirm that the first-differenced series are not serially correlated of second order and that the instruments are valid. Focussing on the key variables of interest, the coefficients on oda and the lagged term of fdi emerged statistically zero.

The results generated from employing the preferred system-GMM method are recorded in Columns IV-IX.[6] As in the previous case, the diagnostic test results for all specifications fail to reject the null hypotheses of no second-order serial correlation and of valid over-identifying restrictions or valid instruments. Looking at the baseline model (Column IV), oda's contemporaneous effect on dfcf turns out to be significantly positive; and the coefficients on fdi retain their signs, albeit at a lower level of significance with respect to its lagged term.[7] The lagged dependent variable now becomes significantly positive as would be expected. Invariably, the control variables open and govt were found highly insignificant regardless of the estimator employed; and the popgr coefficient is rendered statistically zero when the preferred method is applied.

Dropping these three controls in the interest of parsimony and re-estimating the model produce no qualitative changes on the coefficients of interest, except that the lagged term of fdi is no longer significant (Column V).[8] However, the null hypotheses that the contemporaneous and lagged terms of the two variables of interest are each jointly equal to zero are soundly rejected, and the sums of the two effects for each variable are found statisti-

[4]See Table A2, note 1.

[5]The Hansen J statistic is robust to heteroscedasticity and autocorrelation, while the Sargan test of over-identifying restrictions is not. Since all our estimations are based on robust standard errors, the former is the relevant test. However, this statistic is weakened by many instruments (Roodman, 2009). The two test results are juxtaposed to indicate the validity of the instruments under both assumptions.

[6]For example, for Column IV the internal instruments used are listed in Table A2, note 2.

[7]We used two lags for the variables of interest in initial estimations. The second lags were found highly insignificant and were, therefore, dropped. In addition, in initial estimations period dummy variables were included but were found jointly insignificant.

[8]A Wald F test fails to reject the null hypothesis that the three variables are jointly equal to zero.

cally significant.[9] The results suggest that in the long-run, ceteris paribus, a one percentage-point increase in oda leads to nearly a proportionate increase in domestically financed capital formation. On the other hand, an equivalent rise in FDI flows would crowd out domestic investment by 0.82 percentage point.[10]

Thus far, the independent effects of *oda* and fdi were examined on holding the other variable constant. A regression excluding one of the two variables while keeping the other weakens the statistical significance of *oda*'s contemporaneous effect (Column VI) and strengthens that of fdi's lagged effect (Column VII), with an increase in their numerical significance, especially in the latter's case. This is probably suggestive of the appropriateness of controlling for one in determining the effect of the other.

The estimations so far are based on data of the two variables of interest as a continuous series, which tend to involve cyclicality and measurement errors, although period averaging was used to mitigate the potential bias thereof. To check the robustness of the results, the two variables were admitted as dichotomous rather than as a continuous series by dividing the pooled data into two groups using their respective median values as cut-off points. The binary variables are constructed as follows:

$highnoda = 1$ if $noda >=$median of $noda$, zero otherwise

$highfdi = 1$ if $fdi >=$median of fdi, zero otherwise.

Replacing *oda* and fdi with highnoda and highfdi, respectively, and treating both as endogenous variables, we find the estimates appearing in Column VIII. Both emerge significant at the 5% level, noda with a favourable and fdi with a negative effect. The estimates suggest that the domestic investment rate is seven percentage points higher when noda is above the median than when it is not. On the other hand, high fdi is associated with a 10 percentage-point decrease in the domestic investment rate compared to the base category of low fdi. As noted, the contemporaneous effect of fdi on domestic investment by residents is significantly negative, while its delayed effect is positive, albeit not always significant. We also use the pre-existing stock of FDI in lieu of lagged FDI inflows

[9] Using specification in column V, null hypothesis: Jointly equal to zero—oda_t and oda_{t-1} ($F - stat = 4.16$, $prob. = 0.023$), fdi_t and fdi_{t-1} ($F = 7.4$, $prob. = 0.002$), and all four ($F = 4.33$, $prob. = 0.005$). Null hypothesis: Linear combinations (sum of coefficients) equal to zero—oda_t and oda_{t-1}[coefficient = 0.4198 $(2.88)^{***}$], fdi_t and fdi_{t-1}[coefficient = -0.3336 $(3.01)^{***}$].

[10] Given the estimates in column V, the long-run effects on dfcf are similarly signed. A non-linear combination test of the sum of the two terms of each variable divided by 1 minus the estimated coefficient on the lagged dependent variable yield the following results: *oda*[coefficient = 1.03 $(2.69)^{**}$] and fdi[coefficient = -0.8184 $(6.30)^{***}$].

— as a measure of accumulated (embodiment of) the benefits and detriments of FDI previously outlined. The estimates in Column IX clearly show that the pre-existing stock of FDI favourably influences domestic investment more strongly than lagged FDI flows, with contemporaneous FDI remaining significantly negative.

TABLE 1.

Estimates of the investment model Dependent variable: $dfcf$

Expl. Variables	Pooled OLS	Fixed Effects	DIFF GMM	System GMM					
	I	II	III	IV	V	VI	VII	VIII	IX
$dfcf_{t-1}$	0.7215	0.5665	0.4734	0.5811	0.5924	0.7916	0.7456	0.6585	0.5073
	$(9.60)^{***}$	$(6.1)^{***}$	(1.53)	$(5.89)^{***}$	$(5.18)^{***}$	$(6.88)^{***}$	$(4.83)^{***}$	$(5.21)^{***}$	$(3.64)^{***}$
oda_t	0.1507	0.2611	0.0274	0.3603	0.3393	0.3914		7.3776	0.4253
	$(1.72)^{*}$	$(3.31)^{***}$	(0.13)	$(2.44)^{**}$	$(2.08)^{**}$	$(1.82)^{*}$		$(2.15)^{**}$	$(2.08)^{**}$
oda_{t-1}	−0.0724	0.1151	0.0039	0.0456	0.0806	0.1845			
	(1.16)	$(1.91)^{*}$	(0.04)	(0.40)	(0.76)	(0.224)			
fdi_t	−0.7473	−0.7355	−0.6285	−0.6375	−0.5349		−0.5717	−10.0176	−0.4302
	$(11.03)^{***}$	$(12.25)^{***}$	$(4.17)^{***}$	$(3.4)^{***}$	$(3.65)^{***}$		$(3.60)^{***}$	$(2.43)^{**}$	$(3.29)^{***}$
fdi_{t-1}	0.4631	0.3336	0.1880	0.2484	0.2013		0.3472		
	$(5.21)^{***}$	$(2.85)^{***}$	(0.95)	$(1.79)^{*}$	(1.58)		$(2.41)^{**}$		
gds_t	0.0772	0.1334	0.2385	0.1518	0.1566	0.2138	0.082	0.1791	0.1328
	$(2.86)^{***}$	$(1.98)^{**}$	$(1.83)^{*}$	$(2.92)^{***}$	$(2.18)^{**}$	$(2.00)^{**}$	$(2.96)^{***}$	$(2.02)^{**}$	(1.52)
$gdpgr_{t-1}$	−0.0203	−0.0003	−0.2906	−0.0333					
	(0.24)	(0.00)	(1.53)	(0.30)					
Δinf	−0.0004	−0.0008	−0.0005	−0.0006	−0.0001	−0.0013	−0.0008	−0.0009	−0.0009
	$(1.81)^{*}$	$(5.48)^{***}$	$(2.03)^{**}$	$(2.12)^{**}$	$(3.46)^{***}$	$(3.18)^{***}$	$(2.88)^{***}$	$(2.16)^{**}$	$(3.14)^{***}$
$open_t$	0.0019	0.0353	0.0171	0.0267					
	(0.17)	(0.82)	(0.23)	(0.87)					
$crdt_t$	0.0238	0.1081	−0.0076	0.0539	0.0518	0.0712	−0.0165	0.1054	0.0222
	(1.13)	$(2.47)^{**}$	(0.1)	(1.56)	(1.38)	(1.39)	(0.640)	$(1.66)^{*}$	(0.52)
$insttn_t$	0.4336	1.6302	2.1435	0.5584	0.6754	0.2593	0.4947	0.5624	0.8363
	$(2.11)^{**}$	$(3.05)^{***}$	$(2.46)^{**}$	$(1.68)^{*}$	$(2.51)^{**}$	(0.99)	(1.56)	$(1.71)^{*}$	$(2.92)^{***}$
$popgr_t$	0.7915	0.7140	1.7694	0.2984					
	$(1.80)^{*}$	(1.47)	$(2.37)^{**}$	(0.52)					
$govt_t$	0.0762	−0.0811	−0.0194	0.0461					
	(1.06)	(0.57)	(0.10)	(0.63)					
$dbts_t$	−0.2190	−0.3083	−0.1797	−0.2752	−0.2378	−0.3522	−0.2325	−0.3375	−0.2354
	$(2.43)^{**}$	$(4.06)^{***}$	(1.29)	$(2.48)^{**}$	$(2.27)^{**}$	(1.19)	$(1.88)^{*}$	(1.36)	$(1.87)^{*}$
$logfdistk_{t-1}$									0.8147
									$(3.24)^{***}$

TABLE 1—*Continued*

Expl. Variables	Pooled OLS	Fixed Effects	DIFF GMM	System GMM					
	I	II	III	IV	V	VI	VII	VIII	IX
No. Obs.	234	234	191	234	235	235	235	235	235
F stat	47.3***	156.2***	10.5***	57.7***	76.8***	22.5***	68.5***	19.4***	84.6***
AB-AR(1)			0.067	0.002	0.005	0.002	0.007	0.005	0.011
AB-AR(2)			0.192	0.302	0.985	0.520	0.734	0.351	0.931
Sargan test			0.077	0.169	0.638	0.681	0.495	0.409	0.450
Hansen test			0.049	0.231	0.45	0.247	0.755	0.564	0.505

Notes: All regressions except the Difference GMM are estimated with a common intercept, not shown in the table. Figures in parentheses are absolute values of t-ratios, which are based on robust standard errors. Significance at 10%, 5% and 1% levels are denoted by *, **, ***, respectively. Entries for AB Sargan/Hansen tests are probabilities for their respective null hypotheses of no autocorrelation and no overidentification, respectively. In Column VIII, noda and fdi are represented by dichotomous variables highnoda and highfdi, respectively.

With respect to the control variables, the parameter estimate of the lagged dependent variable is sizeable and highly significant, indicating the path dependence of investment activity in the study countries. Overall, the estimates also suggest that an increase in the domestic saving rate, an improvement in the quality of institutions, and a decrease in the debt burden spur domestic investment. Higher macroeconomic instability as measured by changes in the inflation rate appears to deter investment activity.

To check for nonlinearity and examine the robustness of the results, quadratic terms of the key variables were separately added in their respective regressions (Columns I and II of Table 2). The estimates of the coefficients on the quadratic terms associated with oda and fdi are found to be statistically zero, while their linear counterparts remain significant, retaining their previously reported signs. The results provide no evidence of nonlinearity in the respective relationships and attest to the robustness of the contemporaneous effects.[11]

One of the notable attributes of FDI to Africa is that it is predominantly of the resource-seeking type. This implies limited complementarity with, and diminished crowding-in effect on, local investment. The implication of the type of FDI inflows for the relationship between the latter and DFCF is examined by interacting fdi with a destination's resource endowment. We used resource rent (% of GDP) as a proxy for resource endowment and

[11] As a further check on nonlinearity, we tested if the relationships between $dfcf$, on the one hand, and oda and fdi, on the other, were conditional on the relative size of the last two variables by segmenting observations into two categories. The differential slope estimates were found statistically insignificant.

TABLE 2.
Estimates of the dfcf model with interactive effects and alternative measures of oda: System GMM estimates

Explanatory Variables				$ODA =$ S&E	Production	Production	Total (oda)
	I	II	III	IV	V	VI	VII
ODA_t	0.5384	0.4711	0.4347	0.7394	1.478	2.0890	0.3775
	$(2.46)^{**}$	$(2.32)^{**}$	$(2.15)^{**}$	(0.83)	(0.89)	$(1.79)^{*}$	$(2.19)^{**}$
ODA_{t-1}				0.3415	1.949		
				(0.74)	$(2.69)^{**}$		
fdi_t	−0.4279	−0.4391	−0.4291	−0.8172	−0.7868	−0.5385	−0.3332
	$(3.46)^{***}$	$(3.33)^{***}$	$(3.73)^{***}$	$(8.94)^{***}$	$(9.08)^{***}$	$(4.27)^{***}$	(1.54)
fdi_{t-1}				0.2970	0.2084		
				$(2.2)^{**}$	(1.18)		
$oda_t \times fdi_t$							−0.0333
							$(2.43)^{**}$
$ODA_t \times fdi_t$						−0.1269	
						$(1.71)^{*}$	
$fdi_t \times natres\_h$			−0.1433				
			$(1.86)^{*}$				
Oda_t^2	−0.0057						
	(0.95)						
fdi_t^2		−0.0003					
		(0.15)					
No. Obs.	235	235	235	196	196	196	196
F stat	100.8^{***}	121.4^{***}	263.3^{***}	90.8^{***}	126^{***}	70.7^{***}	106.3^{***}
AB-AR(1)	0.013	0.006	0.004	0.01	0.002	0.003	0.004
AB-AR(2)	0.967	0.912	0.757	0.853	0.557	0.819	0.674
Sargan test	0.582	0.131	0.342	0.441	0.204	0.080	0.036
Hansen test	0.692	0.228	0.676	0.627	0.441	0.165	0.271

Notes: Estimates are generated controlling for the other variables included in model V in table 1 using the one-step system GMM estimator. In columns I-III and VII, official development assistance is represented by oda, as defined before. In columns IV, V and VI, the disaggregated components of aid are considered. The sample size in the last four columns is adjusted to be the same to make the estimates comparable. The type of aid considered in each column of results is indicated in the respective column captions. S & E: Aid committed to social and economic infrastructure use and services. See also notes to table 1.

classified the sample on the basis of the period average rate of resource rents, with 25% as a cut-off point, such that $natres\_h = 1$ if resource rents (as % of GDP) is above 25%, and zero otherwise. The interactive term is estimated with a negative sign, and it is statistically significant at the 10% level (Column III). According to the estimation results, FDI exerts a

negative contemporaneous effect on domestically financed capital formation in the typical study country; however, its crowding-out effect appears to be larger in countries where the resource-seeking type of FDI inflows is sizeable, consistent with the view previously stated.[12]

As mentioned, whether foreign aid favorably impacts domestic investment is expected to depend on the composition of aid received. The model in Column V of Table 1 was, therefore re-estimated on disaggregated data.[13] Following, among others, Selaya and Sunesen (2012), we make a distinction between two types of aid, as per OECD's sectoral disaggregation. One of the categories considered is aid committed to social infrastructure use and services (education, health, water supply projects and the like) and economic infrastructure uses and services including energy, transportation and communications. This category of aid may be viewed as contributing to the supply of complementary factors. The second type of aid is that allocated directly to the production sectors of the economy such as agriculture, manufacturing, and trade. Official development assistance associated with complementary inputs, as defined above, appears to have a positive but highly insignificant contemporary and lagged effect on domestic investment (Table 2). In contrast, the effect of aid allocated to the productive sector is more sizable, with a significantly positive lagged effect.

Focusing on contemporaneous relationships, we observe in Columns IV and V of Table 2 that fdi and foreign aid exert both independent and interactive effects on domestic investment, albeit at varying levels of significance. The results suggest that while official development assistance favorably influences domestic investment, its impact seems to diminish with a rise in fdi. Likewise, the contemporaneous crowding-out effect of fdi appears to increase with foreign aid. One may surmise from the signs of the separate and interactive effects that the financial inflows in question have been substitutes in influencing domestic investment activity in the study coun-

[12]Including natural resource rent (natres) as an additional regressor (as a continuous series, treated as endogenous) and interacting it with fdi generates negative coefficients on fdit and the interactive term, and a positive coefficient on natrest, all significant at the 1% level.

[13]For this purpose, we used the time series data disaggregated by sector from OECD Development Assistance Community (DAC), which includes the major donors to the study countries for most of the period under consideration. We use data on aid commitments rather than disbursements because of the relative paucity of time series data on the latter. However, the two series are highly correlated, and committed funds could be taken as a reasonable proxy for their disbursed counterparts (Selaya and Sunesen, 2012 and the references cited therein). All are expressed as % of GDP.

tries. Clearly, the findings suggest no evidence that the two flows have been complementary.

TABLE 3.

Estimates of the fdi model

	Pooled OLS	Panel Fixed Effects	DIFF GMM	System GMM		
Explanatory Variables	I	II	III	IV	V	VI
fdi_{t-1}	0.5506	0.2967	0.4052	0.5299	0.5678	0.5643
	$(5.72)^{***}$	$(2.36)^{***}$	(1.58)	$(3.11)^{***}$	$(4.67)^{***}$	$(3.24)^{***}$
$dfcf_t$	−0.9639	−0.9267	−0.7635	−0.8766		−0.9809
	$(15.4)^{***}$	$(20.95)^{***}$	$(3.43)^{***}$	$(6.29)^{***}$		$(6.77)^{***}$
$dfcf_{t-1}$	0.6766	0.4136	0.7093	0.7185		0.8615
	$(8.08)^{***}$	$(3.72)^{***}$	$(2.19)^{**}$	$(3.94)^{***}$		$(4.21)^{***}$
$noda_t$	0.1297	0.0553	0.0983	0.0225	0.1839	
	(1.3)	0.56	(0.28)	(0.12)	(0.50)	−2.8075
$noda_{t-1}$	−0.0347	0.1594	−0.0955	−0.1206	−0.2987	(0.69)
	(0.45)	$(2.05)^{**}$	(0.47)	(1.15)	$(1.71)^{*}$	
$open_t$	0.0157	0.0922	0.1047	0.0372	0.1079	0.0477
	(1.00)	(1.62)	(1.00)	(0.88)	$(1.85)^{*}$	(0.89)
$\log(gdppc_t)$	0.0964	−9.3005	−8.2465	−5.6721	−5.3969	−8.2713
	(0.15)	$(2.55)^{**}$	(0.39)	$(2.57)^{**}$	(1.28)	$(2.77)^{***}$
$gdpgr_t$	0.3077	0.3207	0.9746	0.9380	−0.2144	1.0670
	$(1.67)^{*}$	$(2.38)^{**}$	(1.03)	$(2.07)^{**}$	(0.20)	$(2.3)^{**}$
Δinf_t	−0.0004	−0.0013	−0.0006	−0.0009	0.0005	−0.0011
	$(1.97)^{**}$	$(6.39)^{***}$	(1.28)	$(2.26)^{**}$	(1.23)	$(2.26)^{**}$
$insttn_t$	0.3561	1.3446	0.5151	1.3429	0.8928	1.6071
	(1.28)	$(3.5)^{***}$	(0.42)	$(2.44)^{**}$	(1.07)	$(2.82)^{***}$
$\log(pop_t)$	0.0907	18.2687	13.1866	−1.5573	−0.6217	−1.9410
	(0.27)	$(3.83)^{***}$	(0.87)	(1.63)	(0.40)	(1.59)
$infst_t$	0.0465	0.0272	0.0596	0.0885	0.0685	0.1079
	$(4.05)^{***}$	$(1.68)^{*}$	(0.98)	$(4.54)^{***}$	$(1.79)^{*}$	$(3.78)^{***}$
$natres_t$	0.0357	−0.1198	−0.0475	0.2176	0.1536	0.2004
	(1.00)	(1.41)	(0.09)	$(3.04)^{***}$	(0.98)	$(2.11)^{**}$
No. Obs.	241	241	198	241	241	241
F stat	61.7^{***}	133.9^{***}	29.9^{***}	71.1^{***}	25.6^{***}	35.7^{***}
AB-AR(1)			0.094	0.030	0.003	0.046
AB-AR(2)			0.951	0.704	0.163	0.779
Sargan test			0.727	0.065	0.221	0.546
Hansen test			0.000	0.432	0.502	0.450

Notes: In Column VI, noda is represented by a dichotomous variable, highonda. See also notes to Table 1.

4.2. Estimates of the fdi model

The estimates of the fdi model are reported in Table 3. According to the pooled OLS estimates, fdi significantly responds to $dfcf$, but imperceptibly so to noda, the lagged effect of which becomes significantly positive only when heterogeneity across countries is assumed. The parameter estimates of dfcf remain robust to the application of the difference GMM estimator unlike those of noda, which now become insignificant (Column III).[14] The system-GMM estimates are qualitatively similar to their difference GMM counterparts with respect to the variables of interest (Column IV). One of the noticeable differences pertains to the coefficient on the lagged dependent variable, which emerges significantly positive, when the system-GMM estimator is applied.[15]

TABLE 4.

Estimates of the fdi model with alternative measures of ODA: System GMM Estimates

	$ODA =$			
	Bilateral	Multilateral	S&E	Production
Explanatory Variables	I	II	III	IV
ODA_t	−0.1338	0.0382	−1.1427	1.6357
	(0.57)	(0.05)	(1.77)*	(0.60)
ODA_{t-1}	−0.3807	−0.5988	0.7132	1.8773
	(2.31)**	(1.48)	(1.93)*	(1.18)
$dfcf_t$	−0.7250	−0.6736	−0.9238	−1.0933
	(4.29)***	(4.43)***	(7.6)***	(6.41)***
$dfcf_{t-1}$	0.6813	0.6229	0.6229	0.6488
	(3.55)***	(3.36)***	(3.93)***	(4.43)***
No. Obs.	201	201	201	201
F stat	33.9***	59.8***	54.1***	91.2***
AB-AR(1)	0.019	0.020	0.002	0.001
AB-AR(2)	0.646	0.507	0.795	0.467
Sargan test	0.105	0.323	0.608	0.405
Hansen test	0.626	0.117	0.566	0.298

Notes: Estimates are generated controlling for the other variables included in model IV in table 3 using the one-step system GMM estimator. S&E: Aid committed to social and economic infrastructure use and services. See also notes to table 1.

[14] For the difference GMM (Column III), the instruments used are $\Delta(open\ insttn\ logpop\ infst)$ and $L(2/3)$. $(dfcf\ noda\ fdi\ \Delta inf\ loggdppc\ gdpgr\ natres\ gdpgr)$ where $L(2/3)$ =lag 2 to 3.

[15] For example, for Column IV the internal instruments used are listed in Table A2, note 3.

The coefficients on the other control variables in the baseline model have the expected signs except logpop, which, however, is insignificant. Trade openness appears to help attract FDI, but the parameter estimate is not robust to different estimations. In contrast, the logarithm of per capita real GDP, for the most part, emerges significantly negative. This is to be expected, if real GDP per capita is taken as a proxy for real wage, or the reciprocal of it as a return on investment. Excluding dfcf from the regression makes the lagged term of noda significantly negative at the 10% level. We also segmented observations on noda into two categories, its median as a cutoff point. The results indicate that higher level of noda is associated with lower fdi; however, its coefficient is highly insignificant (Column VI).

The balance of the evidence thus far suggests that noda exerted no robust, statistically significant impact on fdi. The contemporaneous effect is consistently statistically zero, while the lagged effect, as per the preferred estimator, is negative, attaining no greater than a 10% level of significance, even that only when dfcf is not controlled for. As mentioned in the literature review, the type of ODA received could matter for the relationship between the latter and FDI. To test this hypothesis, we use data disaggregated based on whether it was bilateral or multilateral and whether was allocated to complementary or productive activities, as previously described (Table 4).[16] The results suggest that, like total aid, neither bilateral nor multilateral aid has discernable contemporaneous effect on fdi. While both types of aid appear to discourage fdi with a lag, the relationship is significant only in the case of bilateral aid. This indicates that the lagged adverse FDI impact of oda is driven by bilateral aid and that bilateral donors commit more aid where FDI inflows are relatively low, contradicting the view that the two flows are complementary.

There is a clear difference between aid committed to complementary and productive activities in terms of both the nature and significance of the observed FDI effects. Contemporaneously, aid that contributes to the supply of complementary inputs negatively affects fdi at the 10% level, while that allocated to the productive sector has an imperceptibly positive impact. The delayed effects of both are positive but only that associated with complementary inputs is moderately significant. The results suggest that the FDI effect of aid marginally depends on the purpose for which it is allocated and how it is used. While allocations to the productive sector,

[16] The multilateral aid series are generated as a residual, subtracting bilateral aid from total ODA.

which may be viewed as competing with FDI, hardly influenced the latter, there is a slight evidence to suggest that aid augmenting complementary inputs may have the potential to attract FDI inflows, albeit with a lag.

5. SUMMARY AND CONCLUSIONS

This paper assesses the impact of official development assistance on FDI and of both on domestically financed capital formation in 41 SSA countries over the period 1995-2013. The relationship between FDI and ODA together with their separate and interactive effects on domestic fixed capital formation is examined in a two-equation model, both formulated in a dynamic setting reflective of partial adjustments and inertia.

Estimates of the domestic investment equation suggest that FDI crowds out domestic investment contemporaneously with a moderately favourable lagged effect. The contemporaneous effect of ODA is in general significantly positive. Its delayed effect is found significantly favourable only with respect to the part of aid allocated to production. Foreign direct investment is found to respond more significantly to domestic investment activity than to ODA. Taken together, the results from the two equations point to a mutual causation between FDI and DFCF and suggest that fostering domestic investment activity could potentially serve as a catalyst for FDI with a lag, although the long-run effect is not encouraging. On balance, an increase in ODA is not found to encourage FDI inflows. In fact, a negative association is observed depending on the type of aid and the lag structure considered. The interactive effects of the two flows on domestic investment are significantly negative, suggesting that the two flows lack complementarity. Neither multilateral aid nor bilateral aid is observed to have contemporaneous effect on FDI; and bilateral aid tends to discourage FDI with a lag, implying that they are substitutes for each other.

In conclusion, the findings of this study provide no evidence that the two sources of external finance have been complementary in their impacts on domestic capital formation in the typical study country. The observed crowding out effect of FDI suggest that to the extent FDI contributes to economic growth in the receiving countries, as some studies suggest, it is apparently not because of its positive impact on locally financed investment activity. The contemporaneous crowding out effect, not offset by the lagged crowding in effect hardly attests to the role of FDI in fostering and sustaining economic growth through domestic investment in the typical destination country in the continent. The crowding-out effects reported in this and other studies may, in part, reflect policies that have been

pursued to lure FDI, which may have ended up adversely impacting local entrepreneurship and investment activity, suggesting the need to review FDI-related incentives and investment policies in general with a view to mitigating and circumventing the likes of the adverse effects observed. The favorable effect of ODA independent of and separate from FDI indicate that there is a potential role for it to offset the adverse effect of FDI if receiving governments were to use it judiciously and donors were to target and monitor its use once disbursed.

APPENDIX

TABLE 1.

VARIABLE REPRESENTATIONS AND DATA SOURCES

Variable Symbol	Definition and Representation	Source
fdi	Foreign direct investment, generated as a change in the stock of foreign direct investment (% of GDP)	UNCTAD FDI database http://unctad.org/en/Pages/Statistics.aspx World Bank's World Development Indicators database (WDI)
dfcf	Domestic fixed capital formation by residents (% of GDP), derived by subtracting fdi from aggregate domestic fixed capital formation (% of GDP)	UNCTAD and WDI for base variables
oda	Official development assistance (% of GDP)	Aggregate ODA and bilateral ODA: World Bank's WDI. Disaggregate ODA data by sector from OECD's International Development Statistics (IDS) (http://stats.oecd.org/qwids/).
open	The sum of exports and imports (% of GDP): Trade openness:	WDI
crdt	Credit to the private sector (% of GDP): Degree of financial intermediation/development*	WDI
dbts	Debt service (% of GNI): External debt burden	WDI
insttn	Indicator of quality of governance/ institutions: We use the first principal component of six governance indicators, each ranging from −2.5 to 2.5, with higher values reflecting better governance outcomes.**	WDI

TABLE 1—*Continued*

Variable Symbol	Definition and Representation	Source
govt	Government consumption expenditure (% of GDP): Fiscal policy	WDI
natres	Natural resources rent (% of GDP): Natural resources endowment: For a similar representation, see e.g. Cleeve, Debra and Yiheyis (2015) & Ndikumana and Blankson (2015).	WDI
rgdp	Real GDP: Market size	WDI
rgdpg	Real GDP growth: Market growth	WDI
rgdppc	Real GDP per capita in constant US dollars: Purchasing power, productivity, return on investment	WDI
pop	Population: Market size popgr=population growth rate	WDI
Δinf	Macroeconomic instability: Change in CPI inflation where available; GDP deflator otherwise: Macroeconomic instability	WDI
Z_{it}	Vector of other control variables identified above	See above
μ_{it}; ε_{it}	Unobserved country-specific effect; the error term	Not applicable
it	i denotes the study country and t the period.	Not applicable

Notes:

* This may also represent domestic credit availability, which would be pertinent to consider in the presence of credit constraint where the availability/quantity of credit is more relevant than its cost as a determinant of investment.

** These indicators represent six dimensions of system of governance that rate a country's administrative and political performance (Kaufmann, Kraay and Mastruzzi, 2009, p.5). The indicators are: voice and accountability, political instability and violence, government effectiveness, regulatory burden, rule of law, and control of corruption. The first principal component is used to reduce the excessive number of regressors (relative to the sample size) that the inclusion of the indicators would otherwise entail.

TABLE 2.

Further Explanation and Notes on the Estimation Results

Note No.	Extended notes/explanations
1.	We used the Xtabond2 syntax developed by Roodman (2009) to implement the dynamic panel data estimation in Stata. With a view to reducing the number of instruments, the collapse option whereby one instrument for each variable and lag distance, rather than the default of one for each period, variable and lag distance is used for the endogenous and predetermined variables. Not all available internal instruments were used as doing so generated large number of instruments relative to the number of observations. In the investment equation, lags up to 5 were used. For the difference GMM (Column III), the instruments used are $\Delta(dbts\ gds\ crdt\ open\ insttn\ popgr\ govt)$ and $L(2/5).(dfcf\ noda\ fdi\ \Delta inf\ gdpgr)$ where $L(2/5)$ =lag 2 to 5.
2.	Instruments for first differences equation: Standard: $\Delta(dbts\ gds\ crdt\ open\ insttn\ popgr\ govt)$ GMM-type: $L(2/5).(dfcf\ noda\ fdi\ \Delta inf\ gdpgr)$ where $L(2/5)$ =lag 2 to 5, maximum set at 5 since greater lag yielded large number of instruments relative to sample size. Instruments for levels equation: Standard: dbts gds crdt open insttn popgr govt constant. GMM-type: $L(2/5).(dfcf\ noda\ fdi\ \Delta inf\ gdpgr)$ where $L(2/5)$ =lag 2 to 5. The internal instrument set for other versions of the model are similarly constructed, adjusted according to the vector of regressors in use.
3.	Instruments for first differences equation: Standard: $\Delta(open\ insttn\ logpop\ infst)$ and $\Delta(dbts\ gds\ crdt\ open\ insttn\ popgr\ govt)$. GMM-type: $L(2/3).(dfcf\ noda\ fdi\ \Delta inf\ loggdppc\ gdpgr\ natres\ gdpgr)$ where $L(2/3)$ =lag 2 to 3 where $L(2/3)$ =lag 2 to 3, maximum set at 3 since greater lag yielded large number of instruments relative to sample size. Instruments for levels equation: Standard: $open\ insttn\ logpop\ infst\ constant$. GMM-type: $L(2/3).(dfcf\ noda\ fdi\ \Delta inf\ loggdppc\ gdpgr\ natres\ gdpgr)$. The internal instrument set for other versions of the model are similarly constructed, adjusted according to the vector of regressors in use.

REFERENCES

Adams, S., 2009. Foreign direct investment, domestic investment and economic growth in sub-Saharan Africa. *Journal of Policy Modelling* **31(6)**, 939-949.

Agosin, M. R. and R. Mayer, 2000. Foreign investment in developing countries does it crowd in domestic investment? UNCTAD/OSG/DP/146.

Agosin, M. R. and R. Machado, 2005. Foreign investment in developing countries: does it crowd in domestic investment? *Oxford Development Studies* **33(2)**, 149-162.

Anyanwu, J. C., 2011. Determinants of foreign direct investment inflows to Africa, 1980-2007. Working Paper Series 136, African Development Bank, Tunis, Tunisia.

Anyanwu, J. C., 2012. Why does foreign direct investment go where it goes? New evidence from African countries. *Annals of Economics and Finance* **13(2)**, 425-462.

Arellano, M. and S. Bond, 1991. Some tests of specification for panel data: monte carlo evidence and an application to employment equations. *The review of economic studies* **58(2)**, 277-297.

Arellano, M. and O. Bover, 1995. Another look at instrumental variables estimation of error-component models. *Journal of Econometrics* **68**, 29-51.

Arvis, J.-F., M. A. Mustra, J. Panzer, L. Ojala, and T. Naula, 2007. Connecting to compete: trade logistics in the global economy. World Bank, Washington, DC. http://www.worldbank.org/lpi.

Asiedu, E., Y. Jin, and B. Nandwa, 2009. Does foreign aid mitigate the adverse effect of expropriation risk on foreign direct investment? *Journal of International Economics* **78**, 268-275.

Berthélemy, J. C. and S. Démurger, 2000. Foreign direct investment and economic growth: theory and application to China. *Review of Development Economics* **4**, 140-55.

Blundell, R. and S. Bond, 1998. Initial conditions and moment restrictions in dynamic panel-data models. *Journal of Econometrics* **87**, 115-143.

Boone, P., 1995. Politics and the effectiveness of foreign aid. NBER Working Paper 5308. Cambridge, MA: National Bureau of Economic Research.

Brainard, S. B., 1997. An empirical assessment of the proximity-concentration trade-off between multinational sales and trade. *American Economic Review* **8**, 520-544.

Chen, C. J., 2004. The effects of knowledge attribute, alliance characteristics, and absorptive capacity on knowledge transfer performance. *R&D Management* **34(3)**, 311-321.

Chenery, H. B.and A.M. Strout, 1966. Foreign assistance and economic development. *American Economic Review* **56**, 679-733.

Cleeve, E. and Z. Yiheyis, 2014. Mobile telephony and economic growth in Africa. *Thunderbird International Business Review* **56(6)**, 547-562.

Cleeve, E. A., Y. Debrah, and Z. Yiheyis, 2015. Human capital and FDI inflow: an assessment of the African case. *World Development* **74**, 1-14.

Dunning, J. H., 1998. Location and the multinational enterprise: a neglected factor? *Journal of International Business Studies* **20**, 45-66.

Eregha, P. B., 2012. The dynamic linkages between foreign direct investment and domestic investment in ECOWAS countries: a panel cointegration analysis. *African Development Review* **24(3)**, 208-220.

Eregha, P. B., P. I. Sede, and F. O. Ibidapo, 2012. Foreign aid flows, investment and economic growth in Africa: does uncertainty matter? *African Journal of Social Sciences* **2(2)**, 100-107.

Fahinde, C., A. Abodohoui, and Z. SU, 2015. External financial inflows and domestic investment in the economies of WAEMU: crowding-out versus crowding-in effects. *The Journal of Developing Areas* **49**, 229-48.

Farla, K., D. de Crombrugghe, and B. Verspagen, 2013. Institutions, foreign direct investment, and domestic investment: crowding out or crowding in? United Nations University, Maastricht Economic and social Research and training Centre on Innovation and Technology.

Griffin, K. B., 1970. Foreign capital, domestic savings and economic development. *Oxford Bulletin of Economics and Statistics* **32**, 99-112.

Griffin, K. B. and J. Enos, 1970. Foreign assistance, objectives and consequences. *Economic Development and Cultural Change* **18**, 313-327.

Grossman, G. and E. Helpman, 1991. Innovation and Growth in the Global Economy. Cambridge, Mass.: MIT Press.

Harms, P. and M. Lutz, 2006. Aid, governance, and private foreign investment. *Economic Journal* **116(513)**, 773-790.

Helpman, E., M. J. Melitz, and S. R. Yeaple, 2003. Export versus FDI. NBER Working Papers 9439. Cambridge, MA: National Bureau of Economic Research.

Jansky, P., 2012. Aid and foreign direct investment: substitutes, complements or neither? *International Journal of Trade and Global Markets* **5(2)**, 119-132.

Karakaplan, M. U., B. Neyapti, and S. Sayek, 2005. Aid and foreign investment: international evidence. Departmental Working Paper, Bilkent University.

Kasuga, H., 2007. Evaluating the impacts of foreign direct investment, aid and saving in developing countries. *Journal of International Money and Finance* **26**, 213-228.

Kaufmann, D., A. Kraay, and M. Mastruzzi, 2009. Governance matters VIII: aggregate and individual governance indicators for 1996-2008. The World Bank.

Kimura, H., and Y. Todo, 2010. Is foreign aid a vanguard of foreign direct investment? A gravity-equation approach. *World Development* **38(4)**, 482-497.

Kosack, S., and J. Tobin, 2006. Funding self-sustaining development: the role of aid, fdi, and government in economic success. *International Organization* **60**, 205-243.

Krugman, P., 1987. The narrow moving band, the Dutch disease, and the competitive consequences of Mrs. Thatcher: notes on trade in the presence of dynamic scale economies. *Journal of development Economics* **27(1)**, 41-55.

Lautier, M. and F. Moreaub, 2012. Domestic investment and FDI in developing countries: the missing link. *Journal of Economic Development* **37(3)**, 1-23.

Markusen, J. R., and A. J. Venables, 1999. Foreign direct investment as a catalyst for industrial development. *European Economic Review* **43(2)**, 335-356.

Meyer, K. E. and E. Sinani, 2009. When and where does foreign direct investment generate positive spillovers? A meta-analysis. *Journal of International Business Studies* **40(7)**, 1075-1094.

Mutenyo, J., E. Asmah, and A. Kalio, 2010. Does foreign direct investment crowd-out domestic private investment in sub-Saharan Africa? *The African Finance Journal* **12(1)**, 27-52.

Ndikumana, L. and S. Verick, 2008. The linkages between FDI and domestic investment: unravelling the developmental impact of foreign investment in sub-Saharan Africa. IZA DP No.3296.

Ndikumana, L. and T. Blankson, 2015. Financing domestic investment in African countries: does the source of finance matter? *Journal of African Development* **17**, 21-44.

Nunnenkamp, P. and J. Spatz, 2016. Determinants of FDI in developing countries: has globalization changed the rules of the game? Transnational Corporations 2(2), UNCTAD.

OECD, 2015. Global aid outlook 2015. www.oecd.org/dac/aidoutlook (last accessed 15/10/2015).

Papanek, G., 1973. Aid, foreign private investment, savings, and growth in less developed countries. *The Journal of Political Economy* **81**, 120-130.

Qu, T., J. C. Chen, S. M. Li, and H. Xiang, 2013. Impact of inward FDI, import on domestic innovation: evidence from China. *The International Journal of Business and Finance Research* **7(3)**, 119-136.

Quazi, R. M., 2007. Investment climate and foreign direct investment: a study of selected countries in Latin America. *Global Journal of Business Research* **1(2)**, 1-13.

Quazi, R. M., M.F. Williams, R. Baldwin, J. Vesey, and W. E. Ballentine, 2014. Impact of foreign aid on foreign direct investment in South Asia and East Asia. *International Business Research* **7(12)**, 44-52.

Rahman, M. A., 1967. The welfare economics of foreign aid. *The Pakistan Development Review* **7(2)**. 141-159.

Rodrik, D., and A.Velasco, 1999. Short-term capital flows. National Bureau of Economic Research (No. w7364).

Roodman, D., 2009. A note on the theme of too many instruments. *Oxford Bulletin of Economics and Statistics* **71(1)**, 135-158.

Ruttan, V. W., 1996. United States Development Assistance Policy: The Domestic Politics of Foreign Economic Aid. Baltimore: The Johns Hopkins University Press.

Sachs, J. D. and A. M. Warner, 1997. Sources of slow growth in African economies. *Journal of African economies* **6(3)**, 335-376.

Selaya, P. and E. R. Sunesen, 2012. Does foreign aid increase foreign direct investment? *World Development* **40(11)**, 2155-2176.

Serieux, J., 2008. Financial liberalization and domestic resource mobilization in sub-Saharan Africa: an assessment. Brasilia International Poverty Centre, Working Paper.

Serieux, J., 2011. Aid and resource mobilization in sub-Saharan Africa: the role of reverse flows. *Journal of Development Studies* **47(7)**, 1080-1107.

United Nations Conference on Trade and Development (UNCTAD), 2015. Global Investment Trends Monitor, No. 18, 29 January 2015.

Weisskopf, T. E., 1972. The impact of foreign capital inflow on domestic savings in underdeveloped countries. *The Journal of International Economics* **2(1)**, 25-38.

Younas, J., 2011. Role of foreign direct investment in estimating capital mobility: a reappraisal of Feldstein-Horioka puzzle. *Applied Economics Letters* **18(12)**, 1133-1137.