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Meta-analysis of FDI Spillover Effects in Africa

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Abstract: This study uses meta-analysis to investigate the FDI spillover effects Africa. FDI spillover studies in the existing empirical literature have shown mixed results which hamper decision-making by policy-makers. There is only a limited available studies in this regard in Africa and this study intends to add to the ongoing debate. Previous studies have shown that among other factors, publication bias has made some authors to report only results that are consistent with theory. Data for this study were developed based on previously published FDI spillover studies through google search and other search engines. We use funnel asymmetry test (FAT) and precision-effect test (PET) to carry out the meta-analysis by using mixed-effect multilevel and ordinary least squares techniques of analysis to correct for the within-study dependency and between-study heterogeneity problems commonly associated with meta-analysis. We account for different study characteristics of the previous studies to examine the reason for the mixed findings and find that there is evidence of statistically significant FDI spillover effect in Africa even in the presence of publication bias. the reported effects in the existing literature suffer from positive publication bias. This means that studies that reported results with positive estimated coefficients were more likely to be accepted for publication. Based on our findings, we recommend that on the one hand, authors should try to report results dictated by the data instead according too much importance to theory. On the other hand, consumers of research findings such as policymakers should research findings with caution. More studies in this area are encouraged in Africa for a much broader understanding of the differences in the existing empirical FDI spillover literature.

1. INTRODUCTION

Foreign direct investment (FDI) has been seen by both researchers and policymakers as an important apparatus of development and a decent medium for the transfers of capital, technology and knowledge from developed economies to developing countries to improve productivity,

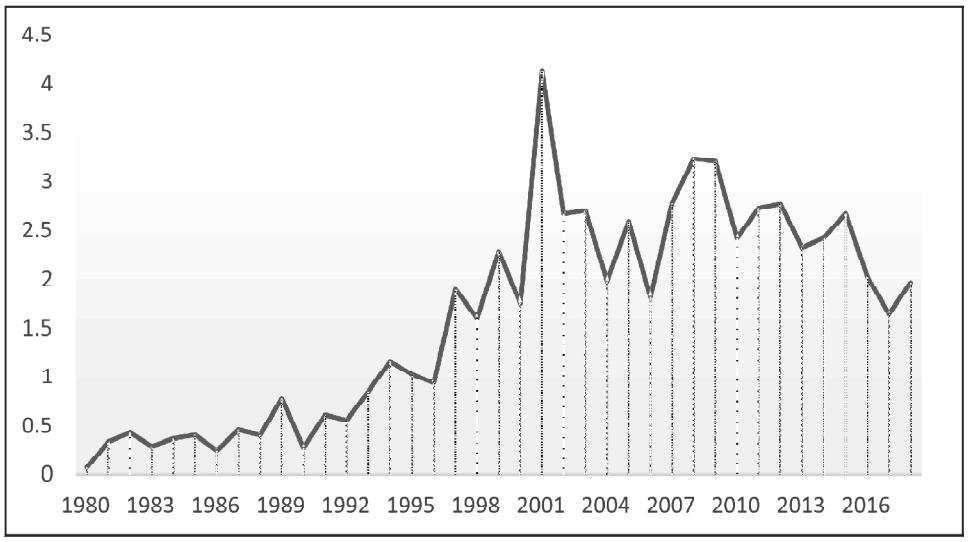
employment and economic growth through direct and spillover benefits (Javorcik, 2004; Markusen & Venables, 1999; Moran, 2011; Saggi, 2002).

Over the past few decades, African continent has experienced increasing FDI inflows as reported in figure 1 as the share of FDI inflows in GDP of the region based on Sub-Saharan Africa took an upward trend from 0.07 percent in the early 1980s to its highest value of 4 percent in 2001[1] and then settled to 3. percent and 2 percent in 2008 and 2018 respectively. The increasing FDI inflows to African region has attracted the attention of researchers who have examined different dimensions of FDI effects on the region including the spillover effects of FDI on the performance of firms.

However, the existing empirical FDI studies have provided mixed results. While some studies find positive FDI spillover effects, others have shown negative results in the region. Therefore, it becomes imperative to combine these findings in order to determine the causes of the discrepancies in the results and the degree to which the findings can be developed for policymaking and future studies.

Hence, the aim of this study is to use meta-analysis approach to determine the reason for the differences in the studies and the extent to which finding in these FDI spillover studies in Africa can be generalised. The structure of this study starts with the background, review of literature, methodology, results and discussion and conclusion.

Figure 1: FDI inflows as percentage of GDP in Africa, SSA (1980-2018)



Source: Authors' plot based on data from WDI (2019)

Meta-analysis technique has been employed to integrate and summarize the estimates of the previous empirical studies as suggested in the literature. Despite the significant recognition of this meta-analysis, there is limited number of studies that have used this approach in Africa.

The pioneer economics studies that used meta-analysis include Ashenfelter *et al.* (1999) who estimate the returns to schooling, Gorg and Strobl (2001), Djankov and Murrel (2002) for enterprise restructuring analysis in transition economies, Gallet and List (2003) for cigarette demand and De Mooij and Ederveen (2003) for elasticities of tax-rate (Meyer & Sinani, 2005). From then, numerous studies in economics have employed the use of meta-analysis.

Meta-analysis is used to statistically combine empirical estimates of previous studies that have investigated same or similar issues. Hence, a meta-analyst collects numerous existing empirical studies and analyse them to determine the reason for the inconclusiveness in the results. It also determines the authenticity of the reported effects (genuine effect) and whether such effects are due to publication selection bias.

A publication selection bias is an imperative issue in meta-analysis for the reason that some authors, editors and reviewers may be more likely to publish certain estimates compared to others. Certain estimates may more likely to be reported in terms of signs and statistically significance, and in most cases tempted to report and publish positive estimates, especially for developing countries. In other words, researchers, reviewers and editors may be more likely to accept and publish estimates that demonstrate statistical significance and or that are consistent with the leading theory (Hampl, Havranek & Irsova, 2019).

2. LITERATURE REVIEW

FDI spillovers have been seen as essential channels of knowledge and technology transfer from foreign-owned firms to local firms (Hanousek, Kocenda & Maurel, 2010) through competition, labour movement, or linkages based on supply chain relationships (Vertical channels). The dominant transmission channels of spillovers as identified in the literature are competition, imitation or demonstration, and labour turnover or labour mobility (Crespo *et al.* 2009; Javorcik, 2004, 2007). These channels fall under the category of horizontal FDI spillovers in which technology and knowledge transfers take place as a result of the interactions between foreign and local firms operating within the same industry.

It has been argued in the literature that the entrance of foreign multinational enterprises into a particular industry in a host country

triggers competition in the industry forcing the domestic firms to upgrade their technologies, efficiently employ existing resources, improve their performance and subsequently improve their innovation and productivity (Lenaerts & Merlevede, 2011; Javorcik, 2007, Blomstrom & Kokko, 1998; Crescenzi *et al.*, 2015). Initially, competition from multinational enterprise may have a crowding out effect on domestic firms where the activities of foreign owned firms would force the inefficient and unproductive local firms out of business allowing only the competitive ones (Narula & Marin,2005; Markusen & Venables, 1999). The demonstration effect or imitation channel of horizontal spillover is an important channel where domestic firms learn technologies introduced by foreign owner firms through learning-by watching or by imitating the technologies of the foreign firms. This channel proved effective in many emerging economies and it works best for domestic firms that have adequate absorptive capacity. Labour turnover or mobility has been regarded as an essential horizontal FDI channel of technology and knowledge transfer. The technology or knowledge may spill over from foreign to domestic firms through the movement of workers from foreign owned firms to locally owned firms. The idea is that workers might have received training and become conversant with the technologies used by foreign multinational firms, and this knowledge is successively transmitted to domestic firms thereby improving their productivity.

Researchers have argued that it is likely that labour turnover may favour foreign multinational enterprise since they are likely to pay higher wages than domestic firms (Heyman *et al.* 2007; Taylor & Driffield, 2005, Vahter & Masso, 2018) making it easier for them to attract the most productive workers from locally owned firms. Both anecdotal and empirical evidences have shown that foreign owned firms pay higher wages than domestic firms and therefor they tend to draw the most productive employees from domestic firms (Sinani & Meyer, 2004; Crespo & Fontoura, 2009; Saggi, 2002). However, the hiring and firing of workers by foreign firms and voluntary quitting of jobs by workers of foreign firms may facilitate such labour movement from foreign to domestic firms thereby increasing the productivity of the latter since these workers might have already acquired knowledge from previous employers (Gorg & Strobl, 2005; Girma, 2003; Glass & Saggi, 2002).

Given all this, there are mixed findings regarding the effect of horizontal FDI spillover on productivity of firms in the host countries. Some studies find empirical evidence in support of positive horizontal spillover effects (Vahter, 2004; Ayyagari & Kosova, 2010; Damijan *et al.*, 2003b), others find negative effect through this channel (Konigs, 2000; Atieno, 2015) and yet there are studies that find no effect at all (Damijan *et al.*,2003a).

Other important channels of FDI spillovers are the supply chains, also called vertical spillover channels which occur through the backward and forward linkages between foreign owned firms and locally owned firms in the downstream and upstream sectors. The backward FDI spillovers arise as a result of linkages between foreign owned firms and their domestic suppliers of intermediate inputs in the downstream sector. The forward spillovers on the other hand are due to the linkages between foreign owned firms and their domestic customers of intermediate inputs in the upstream sector. Both these supply chain relationships result in the transfer of technology and knowledge from foreign to domestic owned firms through offering of training, technical assistance, deadlines, other related supports provided by the multinational enterprises to their domestic suppliers and customers in the host countries.

There is an argument that backward spillover channel is more effective in transferring technology and knowledge because foreign subsidiaries have no incentive to prevent such knowledge to their domestic suppliers (Javorcik, 2004) since they also benefit from the high quality of inputs from such relationship. Many FDI spillover studies find evidence in support of positive backward spillover effect in the host countries (Boly *et al.*,2015; Javorcik, 2004; Lenearts & Merlevede, 2017) whereas few find evidence of negative backward spillover effect (Di Ubaldo *et al.*, 2018; Dogan, Wong & Yap, 2017). Some of the main reasons attributed to the negative backward spillover effect include proximity to home countries of foreign subsidiaries, internalisation of supply chain and lack of absorptive capacity by the domestic firms. Forward FDI spillover channel also tends to be effective for technology transfer since local customers benefit from high quality of inputs they purchase from foreign owned firms. Using high quality inputs may reduce damages, risks and improve productivity. Studies that provide evidence of forward FDI spillovers include Lenearts and Merlevede (2011).

2.1. FDI Spillovers in Africa

The rising importance of FDI inflows in Sub-Saharan Africa over the past few decades has attracted the attention of researchers to examine the effect of FDI on the economy of the region as well as the spillover effect of FDI on the performance of firms in the region. Amendolagine *et al.* (2015) was the first study that extensively examined the spillover effect of FDI in SSA using a novel cross sectional data collected by UNIDO[2] (2010) on 19 SSA countries. Their results provided evidence in support of a positive backward spillover effect which was attributed to high demand of local inputs by foreign owned firms as well as firms owned by Africans in diaspora.

Similarly, Gorg and Seric (2015) used the same dataset of UNIDO (2010) and examined the linkages between foreign subsidiaries and the performance of local firms in SSA by accounting for the role of assistance from foreign owned firms and from the government. They find evidence of both forward and backward spillover effect in increasing the innovation and productivity of domestic firms in the region. In the same vain, Amendolagine (2016) and Amendolagine *et al.* (2016) examined the spillover effect of FDI in the region by considering the role of investor's country of origin and showed that foreign multinational investors that originated from OECD[3] countries generate more domestic linkages and FDI spillovers compared to firms that originated from BRICS[4] countries. In contrast, Seyoum *et al.* (2015) examined the effect of Chinese foreign investments on local firms in this case of Ethiopia and find evidence that foreign firms are more productive than domestic firms and they generate positive spillover effects for domestic firms that have adequate absorptive capacity.

Sanfilippo and Seric (2015) examined the spillover effect of FDI on performance of firms in Africa using multilevel analysis, where they emphasized on the role of agglomerations and found a negative correlation between horizontal spillover and performance of local firms. This result was attributed to the negative competition effect associated with FDI where foreign subsidiaries take away the market shares of domestic firms and crowd out domestic investors. Atieno (2015) also finds a negative horizontal spillover effect but positive backward spillover effect in the case of Kenyan manufacturing sector. This confirms the argument that backward spillover is most likely to take place due to the fact that foreign owned firms may not want to prevent knowledge spillover to their domestic suppliers because they equally benefit from such relationship. Malikane and Chitambara (2018) also find a positive but weak evidence of FDI spillovers in African countries conditional on the technological gap between foreign and domestic owned firms. Similar outcome was also shown by Danquah and Amakwah-Amoah (2017) in a group of 45 African countries while Barasa *et al.* (2019) find a negative outcome for the FDI spillovers for countries within the region.

These dissimilarities in the findings have been a matter of concern for both researchers and policy makers since it is difficult to understand the right findings for policy recommendations. Hence, researchers over the last few years have adopted the use of meta-analysis in the field of economics in order to better understand the genesis of these divergences and the possible way forward and how it can be beneficial for policy making particularly in developing countries.

2.2. Meta-analysis and FDI Spillovers

The use of meta-analysis in economics and business dates back to the work of Ashenfelter *et al.* (1999) and Gorg and Strobl, (2001). Since then, many researchers have adopted this research approach in order to understand the reason for divergent findings in the existing FDI spillover literature. Gorg and Strobl (2001) employed meta-analysis to examine the effect of research design and data on the reported FDI spillover effects and showed that model specification and data type impact the heterogeneity in the previous studies.

In the same way, Hanousek, Kocenda and Maurel (2010) used meta-analysis to examine the direct and indirect effects of FDI in emerging European markets and showed that both the direct and indirect effects decrease over time. While they have discovered the presence of publication bias and they also showed that research design has effect on the existing empirical results. Similarly, Demena and Bergeijk (2016) examined the effect of FDI spillover on the performance of firms in developing countries and found that publication bias impacts FDI spillovers by overstating the FDI spillover effects.

Harvanek and Irsova (2010) studied the meta-analysis of horizontal FDI spillovers and found a significant effect of research design and publication bias on the results of the previous spillover studies. Wooster and Diebel (2006) examined the spillover effect of FDI on productivity in developing countries using meta-analysis in which they accounted for a variety of research design to determine the aspect that influence the size, significance and sign of FDI spillover effects. They found that the mixed results of the FDI spillovers in developing are partly due to model specification.

3. METHODOLOGY

This study follows the standard methodology for meta-analysis by critically reviewing the existing meta-analyses and primary[5] studies to analyse the sources of heterogeneity in the existing empirical studies and whether there publication bias does exist. The relevant and available published and unpublished FDI spillover related studies in Africa have been reviewed. The relevant primary studies were identified with the use of extensive search engines such as , Internet Explorer, Google, Google scholar, Scopus and Econlit using keywords such as "FDI spillovers Africa", "effects of FDI spillovers on productivity of firms in Africa", "FDI productivity spillovers in Africa". While numerous FDI studies appeared, only studies that relate to FDI spillovers, productivity and domestic linkages, and have

reported both the estimates and their standard errors were incorporated in the sample.

Therefore, a total of 21 primary studies as presented in table 1 met the criteria we have set which provided the required data of 1668 observations. There are thirty-one (43) potential sources of heterogeneity identified, including journal quality coded from the primary studies.

We use funnel asymmetry test (FAT) and precision-effect test (PET) in line with previous meta-analyses to determine the publication bias and genuine FDI spillover effects. Funnel plots have been used to obtain the visual suggestion of the degree of publication bias in the primary studies. The problems of within-study dependency and between-study heterogeneity have been addressed by estimating the study-clustered standard errors and by employing the mixed-effects multilevel (MEM) modelling approach and Ordinary Least Squares (OLS). The standard meta-regression model (MRM) is specified as follows:

$$e_{ij} = \alpha + \beta\, se_{ij} + u_{ij} \tag{1}$$

Where e stands for the FDI spillover estimates from primary studies, se stands for the standard errors and u represents the disturbance terms.

It is expected that e_{ij} (spillover estimates) varies randomly around α, and the standard errors (se_{ij}) approaches zero and be independent of their standard errors. We divide equation (1) by the to adjust for the possibility of heteroskedasticity and this method yields the following standard meta-regression model in the form of weighted least square model in which the t-statistics is now the response variable.

$$t_{ij} \equiv (e_{ij} / se_{ij}) = \alpha + \beta\left(\frac{1}{se_{ij}}\right) + \gamma X_{ij} + \varepsilon_{ij} \tag{2}$$

Where t_{ij} represents the t-statistics of spillover estimate i from study j and ε_{ij} is ratio of the error term to standard errors in equation (1). The slope of equation (2) estimates the magnitude and direction of a genuine spillover effect (PET) while the constant or intercept term tests for publication bias in the effect (FAT). X_{ij} consists of control variables that account for different sources of heterogeneity in the previous empirical findings of the FDI spillover effects.

We model a list of possible heterogeneity sources, and by following previous meta-analyses, these sources are based on specifications, estimation techniques, data and publication characteristics of the primary studies. Our estimations have been carried out using Stata 16 which is the recent version.

Table 1
Primary Studies used in the Analysis

S/N	*Primary studies*	*Frequency*	*Percent*	*Cumulative frequency*
1	Amendolagine *et al.* (2013)	66	3.96	3.96
2	Amendolagine *et al.* (2017)	132	7.91	11.87
3	Atieno (2015)	81	4.86	16.73
4	Blanas *et al.* (2019)	55	3.30	20.02
5	Boly *et al.*(2015)	28	1.68	21.70
6	Demena (2016)	51	3.06	24.76
7	Dunne and Masiyandima (2014)	72	4.32	29.08
8	Dutse (2012)	6	0.36	29.44
9	Farole and Winkler (2012)	31	1.86	31.29
10	Gold *et al.* (2017)	119	7.13	38.43
11	Gorg and Seric (2015)	192	11.51	49.94
12	Gorg and Strobl (2005)	102	6.12	56.06
13	Mugendi (2014)	19	1.14	57.19
14	Mugendi and Njuru (2016)	7	0.42	57.61
15	Perez and Seric (2015)	250	14.99	72.60
16	Reyes (2018)	9	0.54	73.14
17	Sanfilippo and Seic (2015)	157	9.41	82.55
18	Seyoum *et al.* (2015)	123	7.37	89.93
19	Waldkirch and Ofosu (2010)	102	6.12	96.04
20	Winkler (2014)	51	3.06	99.10
21	Yauri (2006)	15	0.90	100.00
	Total	1,668	100.00	

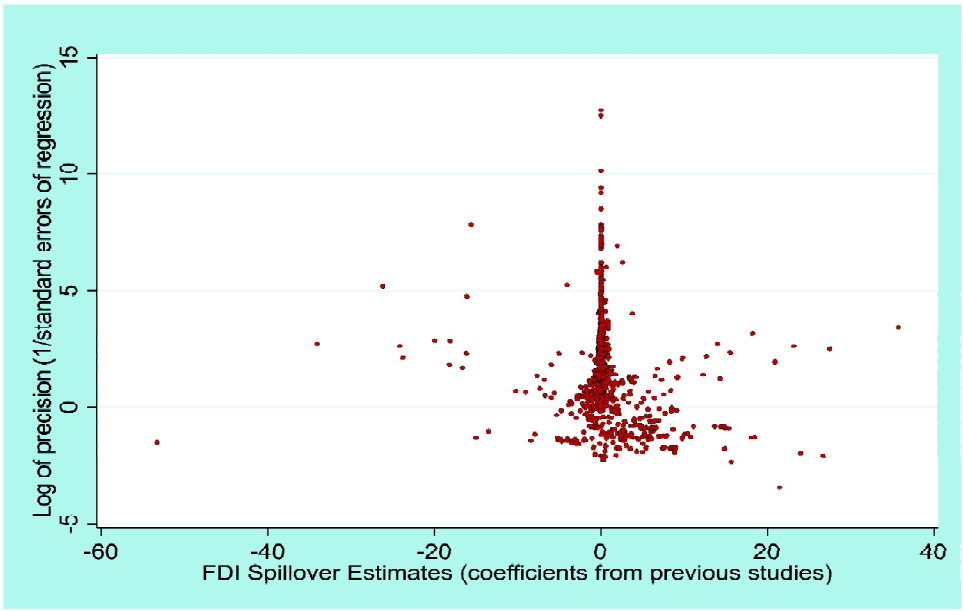
Source: Author's construction from previous studies

4. RESULTS AND DISCUSSION

In line with previous studies, we report the funnel plots for determining the publication bias in figure 2 and figure 3 which appear to be full and symmetrical. However, the right portion of the funnels for both figure 2 and figure 3 seem to be a little heavier than the left portion, suggesting the presence of a positive publication bias of the FDI spillover estimates. This indicates that studies that reported negative FDI spillover estimates were less likely to be accepted for publication or authors were less likely to report negative estimates.

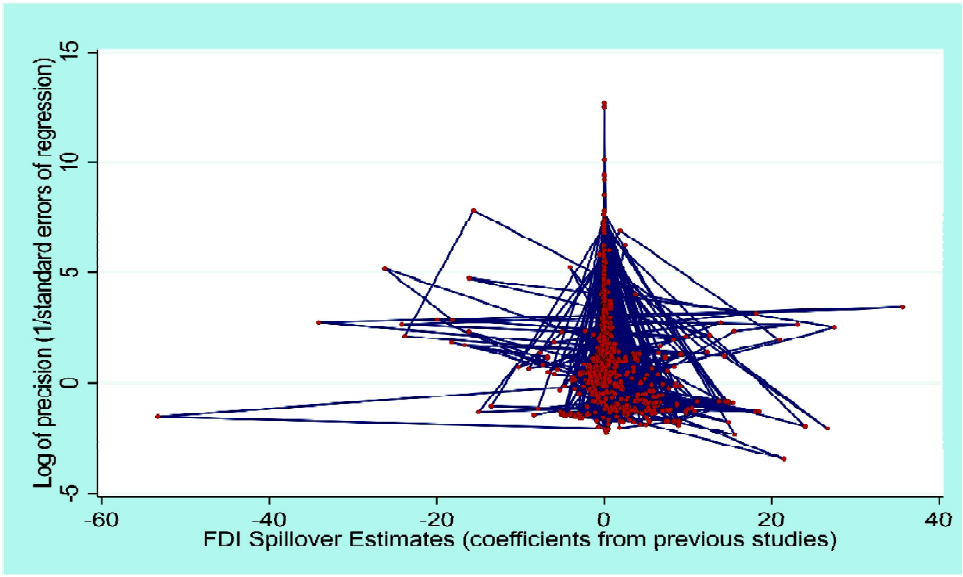
Since visual inspection of the plots may likely be subjective, we present the formal publication bias test using funnel asymmetric test (FAT) as shown in table 2 which also confirms the result shown by the funnel plots.

Figure 2: Funnel Plot Indicating Positive Publication Bias



Source: Authors' plot using data constructed from primary studies

Figure 3: Funnel Plot Indicating Positive Publication Bias (Connected)



Source: Authors' plot using data constructed from primary studies

Table 2
Bivariate Meta Regression for FAT and PET Tests

	All samples (1)	*Peer-reviewed studies (2)*	*Studies in High Ranking Journals (3)*
	Dependent variables: t-statistics		
Publication bias (FAT)	0.416*** (0.057)	0.463*** (0.063)	0.357*** (0.061)
Genuine effect (PET)	0.116*** (0.019)	0.104*** (0.023)	0.109*** (0.020)
Observations	1111	820	841

Note: ***, * stands for 1% and 10% level of significance respectively. Mixed-effects multilevel estimation technique with study-clustered standard errors is used to correct for possible heterogeneity as well as within-study dependency.

The FAT shows that there is strong evidence of positive publication selection bias for all the models in 2. The coefficients on the publication bias for the full sample and the adjusted samples are positive and statistically significant at 1 percent level of significance. This result confirms the result of funnel plots in figure 2 and figure 3,

Similarly, the precision-effect test (PET) which estimates the genuine effect, shows that for all the three specifications, FDI spillover effect is positive and statistically at 1 percent level of significance. This result implies that the reported FDI spillover effects in Africa may be genuine even in the presence of publication bias.

There are many factors that can explain the heterogeneity in the existing empirical spillover findings in Africa which include research designs. We account for most of these factors following previous studies and report the reduced-form multivariate meta-regression results sources of heterogeneity as shown in table 3. Largely, we control for model specifications, estimation methods, data type, and quality of publication of the studies.

The sources of heterogeneity appear to have differing influence on FDI spillover effects in Africa. The specification of the studies appears to have strongly influenced the reported FDI spillovers in Africa. It shows that studies that included joint venture, foreign share, backward spillover, R&D and technology gap in their analyses were more likely to report negative FDI spillover effects in Africa whereas studies that forward spillover and horizontal spillover were more likely to report positive FDI spillover effects.

The reported FDI spillover estimates in African countries are also strongly influenced by estimation methods. Our result in table 3 shows that studies that employed OLS TSLS and FGLS are more likely to find positive FDI spillovers in Africa. On the other hand, studies that employ fixed effects and tobit methods appear to find negative spillover effects.

Table 3
Reduced-form Multivariate Meta-Regression for Heterogeneity Sources

	Model 1 Mixed-effect multilevel (MEM)	*Model 2 Ordinary Least Squares (OLS)*
	Dependent variable: t-statistics	
Bias (intercept)	5.068***	3.628***
	(0.615)	(0.512)
Specification		
Foreign share	–1.777***	–0.545***
	(0.223)	(0.182)
Joint venture	–1.539***	
	(0.219)	
Backward spillover	–4.555***	–0.943***
	(0.704)	(0.188)
Forward spillover	2.797***	
	(0.577)	
Horizontal spillover	0.868***	0.260**
	(0.167)	(0.118)
R&D	–0.872***	–0.335***
	(0.217)	(0.118)
Technology gap	–1.726***	
	(0.217)	
Estimation method		
OLS	–1.199***	
	(0.291)	
TSLS	2.572***	
	(0.317)	
FGLS	1.962***	
	(0.559)	
Fixed effects	–2.783***	–0.333*
	(0.633)	(0.199)
Tobit	–1.876***	–0.438***
	(0.551)	(0.152)
Data		
Time span	–0.175***	–0.225**
	(0.043)	(0.036)
Cross section	–2.339***	–1.729***
County specific	(0.389)	(0.353)
	–1.186***	
	(0.267)	
Publication		
Working paper	2.516***	
	(0.493)	
Observations	1560	1560
Sd (Residual)	1.356 (0.092)	
95% Conf. Interval	[1.187 ,1.548]	

Note: ***, * stands for 1% and 10% level of significance respectively. Mixed-effects multilevel estimation technique with study-clustered robust standard errors is used to correct for possible heterogeneity as well as within-study dependency reported in model 1. Model 2 is estimated using OLS with study-clustered robust standard errors as robustness check and the results do not appear to differ significantly. General -to-specific modelling approach is used to arrive at the reduced form models which provided only significant estimates. The genuine effect (precision variable) is dropped because it appears to be statistically insignificant repeatedly.

Correspondingly, reported FDI spillover effects depend on the characteristics of data used as such effects decrease with the time-span of the data, cross-section studies and country specific studies. In other words, studies employing longer time span, cross-sectional and country specific data are strongly likely to report negative FDI spillovers compared to other studies that do not use such data. Results of previous studies that are based on working papers tend to report positive FDI spillovers,

We have shown that accounting for the study characteristics does not reduce the positive publication bias. This indicates that studies are more likely to report positive FDI spillover estimates irrespective of the significant influence of the sources of heterogeneity or the study design. The available evidence for the significant genuine effect may largely be due to the publication selection bias.

5. CONCLUSION

This study employs meta-analysis to examine the findings of the previous FDI spillover studies in Africa. Based on the results of the study, we show important findings that are consistent with majority of the previous meta-analyses in the FDI spillover literature and which have potential policy implications. The reported positive spillover effects in the primary studies have been supported statistically but these studies have been found to suffer from severe positive publication bias. This has a great policy implication especially in the time when African governments are in need of a policy guide. Therefore, results from the existing FDI spillover studies in African countries must be treated with cautions and policymakers since publication bias can hinder the true effect of FDI spillovers in African countries.

It is imperative for researchers, reviewers and publishers to adhere to research and publication ethics rather than according too much importance to studies that produced estimates which are in line with existing theory. This may exacerbate the proliferation of publication bias among the researchers and publishers which may be misleading for policymaking. In line with our findings, there is a need for more studies on FDI spillovers in Africa using the meta-analysis techniques to provide better understanding of the differences in the existing empirical literature.

Notes

1. The higher value of FDI inflows of 4.13 as a percentage of GDP recorded in 2001 has been most due to the favourable investment policies adopted by most countries in the Sub-Saharan African region around late 19s. The discovery of oil and other mineral resources in some African countries during this period also contributed to this high percentage of FDI inflows in the GDP of the region.

2. United Nations Industrial Organisation (UNIDO) collected a unique firm level dataset from 19 Sub-Saharan African countries in 2010 which gave many researchers the opportunity to undertake extensive studies on FDI spillovers in the region.
3. This stands for the Organisation for Economic Cooperation and Development and its members consists of developed countries.
4. This refers for countries of Brazil, Russia, India, China and South Africa which are regarded to be developing countries which are on the path to becoming developed.
5. Primary studies are the existing studies that have investigated the FDI spillover effects in SSA which we have used to construct a database for the analysis in this study. We follow the established methodology to arrive at the final dataset used for the analysis.

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