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Foreign direct investment into agriculture: does it crowd-out domestic investment?

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ABSTRACT

This study contributes to the debate on whether foreign direct investment crowd-in or crowd-out domestic investment by examining the short run and long run crowding effects of foreign direct investment (FDI) on domestic investment (DI) in the agricultural economy, using a cross-section of 64 countries from 1997 to 2016. In the short run, FDI has no discernible effect on DI in developing and transition economies' agriculture. For developed economies, however, there is a crowd-out effect. Overall, is a crowding-in effect in the short run. A crowding-out effect was observed for developed countries whilst a crowding-in effect was observed for developed and economies in transition. Overall, the long-run effect is "no effect". Improving the investment environment regarding regulatory and administrative processes as well as the absorptive capacity of the host country are recommended.

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1. Introduction

Cross-border transactions instituting a long term financial concern by an inhabitant firm in one country in a firm that is resident in a country other than that of the financier, is foreign direct investment (FDI) (OECD 1999; Punthakey 2020; United Nations 2009). The inflow of FDI into host countries is known to be important for some reasons. First, inward FDI stimulates local investment by increasing domestic investment through links in the production chain when foreign firms buy locally made inputs or when foreign firms supply intermediate inputs to local firms (de Mello 1997; Gallova 2011; Kim and Seo 2003; Mileva 2008; Oualy 2019; Romer 1993). Second, the FDI augments the supply of funds for investment thus, promoting capital formation (de Mello 1997; Gallova 2011; Kim and Seo 2003; Mileva 2008; Oualy 2019; Romer 1993). Third, inward FDI increases export capacity, causing an increase in foreign exchange earnings (Gallova 2011; Kim and Seo 2003; Mileva 2008; Oualy 2019). Finally, new job opportunities and enhancement of technology transfer are associated with FDI thereby boosting overall economic growth (de Mello 1997; Gallova 2011; Kim and Seo 2003; Mileva 2008; Oualy 2019; Romer 1993). Domestic investment (DI), which is capital accumulated from within the country by local private and public sources, is also important in an economy (Jorgenson 1963, 1971; Eisner and Strotz 1963). Global investment needs are in the range of $5 trillion to $7 trillion per year. Estimates for investment needs in developing countries alone range from $3.3 trillion to $4.5 trillion per year, mainly for basic infrastructure (Djokoto 2021b; United Nations 2014), and food security (agriculture and rural development) among others.

However, FDI with the associated opening of the domestic financial markets to international transactions may increase the risks of financial crises or cause risks that are not observed in domestic

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markets, particularly foreign exchange rate risks (Desai, Foley, and Forbes 2004; Ufimtseva 2020). The possibility of multinational firms raising the level of productivity and obliging their local competitors to leave some markets exists (United Nations 2015). FDI through merger and acquisitions have also been known to discourage DI (Punthakey 2020; United Nations 1998). Domestic investments have also been discouraged through the deprivation of land to host country investors through land grab (Widengård 2019; Ludwig 2020). These are situated in the agricultural sector, the development of which is one of the most effective instruments to curtail severe financial paucity, enhance common prosperity and provide for the anticipated 9.7 billion living persons by 2050 (World Bank 2020). The agricultural sector's growth is up to four times more powerful in increasing wealth among the destitute considering other sectors (Djokoto 2021a; World Bank 2020). Analysis of 2016 data found that agriculture provided livelihood to 65% of poor working adults (Djokoto 2021a; World Bank 2020). By contributing to a third of global gross domestic product in 2014, agriculture is also essential for boosting growth of the global economy (Djokoto 2021a; World Bank 2020). Thus, agriculture holds the key to meeting SDGs such as no poverty (goal 1), zero hunger (goal 2), and decent work and economic development (goal 8) (UN General Assembly 2015). Considering these, will agricultural FDI into host economies complement or substitute agricultural DI?

Agosin and Machado (2005) investigated the influence of FDI on DI for developing economies. The study of Wang (2010) employed data on developed and developing countries, whilst Djokoto (2021b) used data for developing, transition and developed countries regarding food manufacturing. Specifically, for agriculture in Ghana, Djokoto et al. (2014) studied the influence of FDI on DI. Although the multi-country studies did not address agriculture, the study that addressed agriculture focused on one country. This paper contributes to the literature by examining the crowding effect of FDI and DI for agriculture across countries representing all continents of the world. This paper is distinct from Djokoto (2021b) in some important respects. First, Djokoto (2021b) focused on food manufacturing, whose FDI[1] is distinct from that of agriculture. Similarly, the DI of food manufacturing is also distinct from that of agriculture. Second, and as will be shown in section 3.2, the time and cross-section dimensions of the data, that depend on data availability, for the two studies, differ. Third, the results of Djokoto (2021b) and this paper differ in some respects as will be seen in section 2.2 and 4.3.

Given the importance of FDI and DI, whilst a crowd-in effect is desirable, the crowd-out effect that does not bring foreign investors with specific expertise and allows local investors to redirect resources to areas in which they might have a comparative advantage, is detrimental and requires policy actions to reverse it. The effect has implications for millions of persons whose livelihoods depend on agriculture (World Bank 2020). Policies to address these are needed.

In what follows, the theoretical and empirical review is presented in section 2. Section 3 contains the data, model, and estimation procedure. The results and discussion are captured in section 4. Section 5 is conclusions and recommendations.

2. Review of literature

2.1. Theoretical review

Although competing theories of investment exist in the literature, those that form the basis for the model used in section 3 are highlighted. The theorems of Modiglianni and Miller (1965) provided the platform for neoclassical models of investments (Jorgenson 1963, 1971). This theory holds that the investment decision is explained by the price of capital. Additionally, real, and financial decisions are two and separate decisions that firms make. Also, the current level of investment depends on the previous stock of capital (Koyck 1954). Thus, investments have a dynamic behaviour.

Three underpinning perspectives or theories of FDI, a key-independent variable, are distinguishable. The first, the theory of internationalisation, describe preference of FDI to franchising as a way

[1]See further elucidation in section 3.2.

for accessing an external market (Hymer 1976). The preference for FDI to franchising is based on some drawbacks. Some of the knowledge cannot be licensed whilst, licensing of others would mean loss of control. The second perspective is based on oligopolistic industries (Knickerbocker 1973). A critical feature of such industries is the interdependence of the major players and imitation of each other's FDI strategy. Firms undertake FDI at stages in the life cycle of the product they pioneered (Djokoto 2012; Vernon 1966). They invest in other advanced countries when local demand in those countries grows large enough to support local production (Djokoto 2012). Later, production is moved to developing countries when product standardisation and market saturation give rise to price competition and cost pressures. Investment in developing countries is seen as the best way to reduce cost (Djokoto 2012). The third, states ownership, location, and internalisation explain the extent, spatial, and business composition of foreign manufacture embarked on by a multinational enterprise (MNE). This is the eclectic paradigm (Dunning 1988, 2001). Whilst the ownership relates to technology, know-how, resources, or some other form of income-generating asset(s), the natural endowments or created assets in the foreign country that can be combined with the ownership advantages constitutes the location advantages. The internalisation connotes owning or controlling these value-adding activities.

In addition to the theories of investment and FDI, a set of explanations link FDI and DI (Markusen and Venables 1999; Barrios et al. 2005). The relationship between MNEs and domestic firms on the entry of MNEs to a host economy is a competition effect and a linkage effect (Djokoto 2021b; Markusen and Venables 1999). The entry of MNEs increases competition in the final product market and reduces the profitability of domestic firms in the same market. Domestic firms do exit the market consequently (Djokoto 2021b). This is the competition effect. For the linkage effect, the entry of MNEs could cause the demand for domestic production of intermediate inputs to rise. This tends to create an increased number of domestic firms in the intermediate inputs industry (Djokoto 2012; Djokoto 2021b; Markusen and Venables 1999).

Barrios et al. (2005) theorised that as MNEs increase in the country hosting them, population of domestic firms may decline at the start and rise later, assuming that the domestic firms are less productive than the MNEs (Wang 2010). Then also, assuming MNEs enter the final product market, a rise in the population of both foreign and domestic final product industry will reduce the level of prices of the downstream product. The outcome is the decline of margins for both local and foreign firms compelling some domestic firms to exit. On the other hand, the possible linkage effect can raise the population of input producing resident enterprises and then reduce the cost of production in the final product industry for both MNEs and domestic firms (Djokoto 2021b). Consequently, the population of local or indigenous firms in the host country will finally rise.

2.2. Empirical review

The empirical review covers mostly papers that used time series and some panel data studies. The time-series data was used for individual country studies whilst panel data was used for cross-country studies. As was expected, the time series studies used an auto-regressive distributed lag model whilst the general method of moments was applied to the panel data sets. Among the panel data studies, the Agosin and Macho (2005) model was used. Cote d'Ivoire, Ghana, and South Africa were the only single countries studied from Africa whilst China and South Korea constituted the countries from Asia. The Central and Eastern European countries also attracted attention from authors on the subject. The country groups included, developing countries, transition economies, the European Union, Organisation of Economic Cooperation and Development (OECD) and developed countries. Whilst most countries reported both long-run and short-run effects of FDI on DI, few studies reported only the short-run effect based on the model specification. Domestic investment (DI) and foreign direct investment (FDI) were measured as a ratio of gross domestic product (GDP) and the growth rate of GDP in constant prices measured economic growth. Unless stated expressly, the empirical review relates to the total economy and sectors other than agriculture.

The role of economic growth in determining DI has been mixed in the literature, particularly in the case of the two-year lag of the variable (GR_2). Agosin and Machado (2005), Gallova (2011), Misun and Tomsk (2002), Pilbeam and Oboleviciute (2012) and Djokoto (2021b) found positive effects respectively for Africa, Croatia, Czech Republic, European Union-14 (EU-14) and the world. For the same lag period, however, Gallova (2011) and Misun and Tomsk (2002) found significant negative effects for Slovenia and Romania, and Poland, respectively. A middle ground, neutral effect, was reported for Asia and Latin America, Balkans and Bulgaria, and European Union-12 (EU-12) respectively by Agosin and Machado (2005), Gallova (2011) and Pilbeam and Oboleviciute (2012).

Regarding the one-year lag (GR_1), the effects have all been significantly positive (Africa, Asia, Latin America – Agosin and Machado 2005; Balkans, Bulgaria, Croatia, Slovenia Romania – Gallova 2011; Transition economies – Mileva 2008; Czech Republic, Poland – Misun and Tomsk 2002; EU-12, EU-14 – Pilbeam and Oboleviciute 2012; Cote d' Ivoire – Oualy 2019, World – Djokoto 2021b). Although, Mileva (2008) reported a neutral effect for Albania for the period 1995–2005, the sign for the coefficient was however, positive. Thus, whilst the one-year lag instigates positive effect on DI, the effect of the two-year lag is mixed. Nevertheless, economic growth is important in determining DI.

As theory has established that the current year's DIs are influenced by those of previous years' (Hall and Jorgensen 1967; Rama 1993; Serven and Solimano 1993), so has empirical literature (Agosin and Machado 2005; Djokoto 2021b). For the two-year lag, the sign of the significant coefficients was reported to be positive (Gallova 2011 – Bulgaria; Misun and Tomsk 2002 – Czech Republic, Hungary, and Poland). The neutral effect is mixed (Agosin and Machado 2005 – Developing countries; Djokoto 2021b – World; Gallova 2011 – Balkans, Croatia, Slovenia, and Romania; Pilbeam and Oboleviciute 2012 – EU-12 and EU-14). In respect of the one-year lag of DI, the available literature reports significant positive effect (Agosin and Machado 2005; Gallova 2011; Mileva 2008; Misun and Tomsk 2002; Pilbeam and Oboleviciute 2012). Thus, previous DI induces current year's DI.

The role of lagged values of FDI cannot be ruled out in the long-run analysis for the total economy and sectors other than agriculture. Misun and Tomsk (2002) and Wang (2010) have reported positive effects for Slovenia and Romania, Hungary, and Poland, and 50 developed and developing countries. Whilst the two-year lag did not exert a significant effect, Agosin and Machado (2005), Gallova (2011) and Pilbeam and Oboleviciute (2012) report a "no effect" of two-year lag of FDI on DI. Djokoto (2021b) however, reported negative and statistically significant effects for two-year lags of FDI on DI for global food manufactures.

Regarding the one-year lag, statistically significant positive effect dominates in the literature; Gallova (2011) for the Balkans, Bulgaria, Romania, and Misun and Tomsk (2002) for Hungary and Poland. Agosin and Machado (2005), Pilbeam and Oboleviciute (2012) and Wang (2010) have concluded on a "no effect" of the lag of FDI on current level of domestic investment. Based on the empirical evidence, therefore, lagged FDIs have a positive effect on DI.

Unlike the lags of DI, there is a mix of significant effects of FDI on DI. Ahmad et al. (2018), Chen et al. (2017), Misun and Tomsk (2002), Wang (2010) and Djokoto (2021b) found negative effects for China, Asia, China, Poland, developed countries, and the world, respectively. On the other hand, Djokoto et al. (2014), Gallova (2008), Kim and Seo (2003), Mileva (2008) and Pilbeam and Oboleviciute (2012) respectively reported positive effects for Ghanaian agriculture; Balkans, Croatia, and Slovenia; South Korea; Commonwealth of Independence States (CIS) and Albania; and EU-12. The positive effect was attributed to technology diffusion and spillover of management knowledge by MNEs and downward and upward linkages with the agricultural and food manufacturing sectors independently (Djokoto et al. 2014; Djokoto 2021b).

Neutral effects have also been reported by Agosin and Machado 2005 – Africa, Asia, Latin America; Djokoto 2013 – Ghana; Gallova 2011 – Bulgaria, Croatia, Slovenia, and Romania; Josue et al. 2014 – South Africa; Oualy 2019 – Cote d'Ivoire; Pilbeam and Oboleviciute 2012 – EU-14; Polat 2017 – OECD and Wang 2010 – developing countries. Whilst the significant negative signs exert a contemporaneous crowd-out effect, the significant positive signs exert an instantaneous

crowd-in effect. For the long-run, not all FDI registered in the balance of payments (BOP) get transformed into real investment, for reasons such as some foreign capital is used to buy already existing assets, some foreign capital funds regular expenses by MNEs (Agosin and Machado 2005), causing a neutral effect. Another reason is the failure of MNEs to convert all FDI into investment in terms of the aggregate income.

Just as with the case of the short run influence of FDI on DI, the signs of the long run effects are also inconsistent. Agosin and Machado (2005), Gallova (2011), Misun and Tomsk (2002) and Djokoto (2021b) reported a crowd-out effect respectively for Latin America; Balkans; Poland; and developing countries. Crowd-out effects may be attributed to the difficulty of firms in host countries in obtaining financial support, lack of advanced technology, or low power in global advertising and marketing. Either consequently or independently, mergers and acquisitions by non-indigenous enterprises in the countries could result in crowding-out effects (United Nations 1998). In situations where the domestic currency depreciates, domestic businesses that do not sell in foreign markets would have challenges continuing in business as introducing additional capital will become costly (Desai et al. 2004; Djokoto 2021b). Sub-standard management capacity resulting in lesser accomplishment than foreign firms could make it difficult for host country firms to compete (Djokoto 2021b). Also, lagging in technology could make domestic firms uncompetitive hence could be crowded out (United Nations 2015). The crowd-out effect can also be attributed to foreign firms establishing supply subsidiaries as well as stronger and more effective foreign firms than host country firms (Gallova 2011).

For CIS including Albania; Czech Republic and Hungary; Cote d'Ivoire; EU-12, less developed countries, and the world, Mileva (2008), Misun and Tomsk (2002), Oualy (2019), Pilbeam and Oboleviciute (2012), Wang (2010) and Djokoto (2021b) respectively reported the crowding-in influence of FDI on DI. These conclusions from the ex-ante literature notwithstanding, there are reports of neutral effect. No long-run effect was reported by Agosin and Machado (2005) – Africa, Asia; Josue et al. (2014) – South Africa; Kim and Seo (2003) – South Korea; Pilbeam and Oboleviciute (2012) – EU-12 and Wang (2010) – developed countries. Failure of or delay in the FDI registered in the BOP becoming a real investment, are reasons stated by Agosin and Machado (2005) either due to some external investment used to buy already existing resources or to cover current disbursement by MNEs, could result in neutral crowding effect. On the contrary, the quick transition from the books to investments will induce additional DI (Misun and Tomsk 2002).

From the foregoing, the debate on whether FDI crowd-in or crowd-out DI is far from over. In the short-run, there is evidence from a sector of a country (agriculture), whole economies of countries as well as groups of countries. However, the evidence relates to the whole economies of countries as well as groups of countries in the long-run. Conspicuously absent from the literature is the long run relationship between FDI and DI for a sector of a country and across countries. This study fills the gap in the case of agriculture using cross-country panel data.

3. Methodology

3.1. Modelling

Agosin and Machado (2005), following an earlier paper (Agosin and Mayer 2000) derived a model or tool to study the relationship between DI and FDI. Popular in the DI and FDI relationship literature (e.g., Oulay 2019; Pilbeam and Oboleviciute 2012; Sing 2017), this tool is founded on the neoclassical theory of investment and adaptive expectations of economic growth. The relationship between FDI and DI is specified as below:

$$\begin{aligned} DI_{i,t} = {} & \alpha_0 + \alpha_1 DI_{i,t-1} + \alpha_2 DI_{i,t-2} + \alpha_3 FDI_{i,t} + \alpha_4 FDI_{i,t-1} + \alpha_5 FDI_{i,t-2} \\ & + \alpha_6 GR_{i,t-1} + \alpha_7 GR_{i,t-2} + \varepsilon_{i,t} \end{aligned} \tag{1}$$

where ε_{it} is the error term.

Although other studies have added other economic variables, the effect of the other controls on the key coefficients has been less important. Moreover, the segregation of the data (explained below) into developing, transition and developed countries is dependent on the basic economic conditions (United Nations 2020).

The data are made up of developing, transition, and developed economies. The effects of the explanatory variables on the dependent variable, DI, may be different, thus, equation 1 is re-specified to isolate these groups.

$$\begin{aligned} DI_{i,t} = {} & \beta_0 + \beta_1 DI_{i,t-1} + \beta_2 DI_{i,t-2} + \beta_3 FDI_{i,t} + \beta_4 FDI_{i,t-1} + \beta_5 FDI_{i,t-2} + \beta_6 GR_{i,t-1} + \beta_7 GR_{i,t-2} \\ & + \beta_8 FDI\_DVP_{i,t} + \beta_9 FDI\_DVP_{i,t-1} + \beta_{10} FDI\_DVP_{i,t-2} + \beta_{11} DI\_DVP_{i,t-1} \\ & + \beta_{12} DI\_DVP_{i,t-2} + \beta_{13} FDI\_TRS_{i,t} + \beta_{14} FDI\_TRS_{i,t-1} + \beta_{15} FDI\_TRS_{i,t-2} + \beta_{16} DI\_TRS_{i,t-1} \\ & + \beta_{17} DI\_TRS_{i,t-2} + \vartheta_{i,t} \end{aligned} \tag{2}$$

Table 2 contains the variables and the sources of the associated data.

The short run is the sum of the first-order partial derivatives of DI with respect to FDI, thus, for developing countries, for which DVP = 1,

$$\hat{\beta}_{ST1} = \beta_3 + \beta_8 = 0 \tag{3}$$

And for transition economies for which TRS = 1,

$$\hat{\beta}_{ST2} = \beta_3 + \beta_{13} = 0 \tag{4}$$

Finally, for developed countries, DVP = TRS = 0, therefore,

$$\beta_{ST3} = \beta_3 = 0 \tag{5}$$

The specifications in 3, 4 and 5 are also the null hypotheses. Not rejecting the null hypothesis with a chi-square test suggests FDI does not have instantaneous effect on DI. Denunciation of the null hypothesis and that $\beta_{STk} > 0$ means there is an instantaneous crowding-in influence of FDI on DI. On the other hand, $\beta_{STk} < 0$ is evidence of the contemporaneous crowding-out effect of FDI on DI.

The long-run requires the summation of the first-order partial derivatives of DI for FDI, FDI_1, FDI_2, DI_1, DI_2[2]. Thus, for developing countries for which DVP = 1, the long-run effect is

$$\hat{\beta}_{LT1} = \sum_{j=1}^{5} \hat{\beta}_j + \sum_{j=8}^{10} \hat{\beta}_j = 1 \tag{6}$$

For transition economies, TRS = 1, therefore, the long-run effect is

$$\hat{\beta}_{LT2} = \sum_{j=1}^{5} \hat{\beta}_j + \sum_{j=12}^{16} \hat{\beta}_j = 1 \tag{7}$$

As regards developed countries, DVP = TRS = 0, hence, the long-run effect is

$$\hat{\beta}_{LT3} = \sum_{j=1}^{5} \hat{\beta}_j = 1 \tag{8}$$

As the specifications in 6, 7 and 8 are also the null hypotheses,

(a) Failure to reject the null hypothesis $\hat{\beta}_{LTk} = 1$, is evidence that an increase in FDI of one US dollar, becomes one US dollar of additional total investment in the long run.

[2] Agosin and Machado (2005) proposed $\hat{\beta}_{LT} = \frac{\sum_{j=3}^{5} \hat{\beta}_j}{1 - \sum_{j=1}^{2} \hat{\beta}_j} = 1$. However, multiplying by $1 - \sum_{j=1}^{2} \hat{\beta}_j$ and adding $\sum_{j=1}^{2} \hat{\beta}_j$ to both sides gives equation 6,7 and 8.

(b) Rejecting the null hypothesis, $\hat{\beta}_{LTk} = 1$ and $\hat{\beta}_{LTk} > 1$, is indication of long run crowding-in effect (CI) on DI based on FDI. In the long-run, one additional US dollar of FDI becomes more than one US dollar of total investment.
(c) Finally, rejection of the null hypothesis, $\hat{\beta}_{LTk} = 1$ and that $\hat{\beta}_{LTk} < 1$, is evidence of long run crowding-out effect. One more US dollar of FDI would result in one US dollar decrease in total investment. Impliedly, there is a dislodging of DI by FDI.

3.2. Data

Panel data has been used in *extant* studies on spillover effects of FDI on DI because it combines both the cross-sectional and time dimensions (Gujarati and Porter 1999; Greene 2003). This study used panel data for the period 1997 to 2016 in 64 countries and 689 observations (Table 1) due to the availability of data. The data Djokoto (2021b) used for the food manufacturing study consisted of 49 countries for the period 1993 to 2016 (with many gaps) and 460 observations. All data was extracted from FAOSTAT, that derived their data from its surveys as well as sources from United Nations Conference on Trade and Development (UNCTAD), International Trade Centre (INTRACEN), and OECD. The data from these sources were then disaggregated into sectors; agriculture, forestry, and fishing (AFF) as well as food, beverage, and tobacco (FBT), the latter described as food manufacturing in Djokoto (2021b). The FDI sectoral disaggregation followed the International Standard Industrial Classification of All Economic Activities, Revision 4 (ISIC, Rev. 4) (United Nations 2008) according to FAOSTAT (2021). As the ISIC Revision 4 clearly delineates agriculture and food manufacturing, so does FAOSTAT distinctly describes FDI into agriculture (AFF) and FDI into food manufacturing (FBT). Thus, FDI for AFF and FBT are separate and not joint (Appendix). FAOSTAT remains the authentic data source for cross country agricultural data globally.

The classification of the countries into developing, transition, and developed economies was informed by the United Nations (2020). Aside from the fact that the development classifications depict the basic economic (including agriculture) conditions, classifying countries according to the

Table 1. List of countries.

Developing countries		Transition economies	Developed economies
Afghanistan	Thailand	Albania	Australia
Algeria	Tunisia	Kazakhstan	Austria
Bangladesh	Turkey	North Macedonia	Belgium
Bolivia	United Rep. Tanzania	Russian Federation	Bulgaria
Brazil	Uruguay		Croatia
Cambodia	Viet Nam		Cyprus
Chile	Yemen		Czechia
China, mainland	Zambia		Estonia
Colombia			France
Costa Rica			Germany
Ecuador			Greece
El Salvador			Hungary
Fiji			Iceland
Honduras			Italy
Israel			Japan
Lao PDR			Latvia
Malaysia			Lithuania
Mauritius			Netherlands
Mexico			Poland
Morocco			Portugal
Mozambique			Romania
Nicaragua			Slovakia
Paraguay			Spain
Peru			Sweden
Philippines			UK
Republic of Korea			USA

Table 2. Variable descriptions.

Variable	Definition	Measurement
DI	Domestic investment into agriculture	Gross fixed capital formation divided by agriculture value-added both in current US$
DI_1	Domestic investment into agriculture with a one-year lag	Gross fixed capital formation divided by agriculture value-added with one-year lag both in current US$
DI_2	Domestic investment into agriculture with a two-year lag	Gross fixed capital formation divided by agriculture value-added with two-year lag both in current US$
FDI	Foreign direct investment into agriculture	Foreign direct investment into agriculture divided by agriculture value-added both in current US$
FDI_1	Foreign direct investment into agriculture with a one-year lag	Foreign direct investment into agriculture divided by agriculture value-added with one-year lag both in current US$
FDI_2	Foreign direct investment into agriculture with a two-year lag	Foreign direct investment into agriculture divided by agriculture value-added with two-year lag both in current US$
GR_1	The growth rate of agriculture with a one-year lag	The growth rate of agricultural value added at 2010 prices with a one-year lag
GR_2	The growth rate of agriculture with a two-year lag	The growth rate of agricultural value added at 2010 prices with a two-year lag
DVP	Developing economies	Developing countries = 1, and 0 otherwise
TRS	Transition economies	Transition economies = 1 and 0 otherwise
FDI_DVP	Interaction of FDI and DVP	Value = FDI and 0 otherwise
FDI_DVP_1	Interaction of FDI_1 and DVP	Value = FDI_1 and 0 otherwise
DI_DVP_1	Interaction of DI_1 and DVP	Value = DI_1 and 0 otherwise
DI_DVP_2	Interaction of DI_2 and DVP	Value = DI_2 and 0 otherwise
FDI_TRS	Interaction of FDI and TRS	Value = FDI and 0 otherwise
FDI_TRS_1	Interaction of FDI_1 and TRS	Value = FDI_1 and 0 otherwise
FDI_TRS_2	Interaction of FDI_2 and TRS	Value = FDI_2 and 0 otherwise
DI_TRS_1	Interaction of DI_1 and TRS	Value = DI_1 and 0 otherwise
DI_TRS_2	Interaction of DI_2 and TRS	Value = DI_2 and 0 otherwise

Note: All data from FAOSTAT: http://www.fao.org/faostat/en/#home.

level of income (GNI) was considered. However, it was observed that the status of many countries was inconsistent over the study period. Within the context of structural transformation, as countries develop, the share of agricultural GDP in the total GDP declines (Chenery 1960; Clark 1957; Kuznets 1966). Thus, the development classification implicitly captures classifications based on agricultural GDP.

3.3. Estimation procedure

The inclusion of lags of the dependent variable as additional explanatory variable produces dynamic panel data (DPD), which cannot be consistently estimated by Ordinary Least Squares. Generalised Method of Moments (GMM) estimators are appropriate (Arellano and Bond 1991; Arellano and Bover 1995). Moment conditions are specified for use in estimating the coefficients as instrumental variables approach do not adequately make use of all the information available in the sample. Two-step GMM was employed to obtain consistent and asymptotically efficient estimates. System GMM was also estimated.

Checking the validity of the overidentifying restrictions is accomplished by the Sargan test. The estimates are not reliable if the null hypothesis of the test is rejected. It is worth noting that the Sargan test is tantamount to an under-identification test (Arellano 2002; Arellano et al. 1999). Although, the second order (AR(2)) of serial correlation is not permissible, the first-order autocorrelation (AR(1)) is admissible.

4. Results and discussion

4.1. Description of data

Developing countries constitute more than half of the number of countries (36 out of 64) followed by developed economies (24 out of 64) and the rest is made up of economies in transition (Table 1).

The countries thus, vary in terms of agricultural development. The destination of FDI in developed, (transition) and developing countries is in line with the theory of Vernon (1966) explained earlier.

The data are constituted as an unbalanced panel thus, the number of observations is not the same for each variable but vary, from 884 to 1,280 (Table 3). Domestic investment and its lags (DI, DI_1, DI_2) ranged from 0.0209 to 0.9066, with means varying from 0.1869 to 0.1917. The standard deviations are lower than the means, suggesting a low spread of the observations around their mean values. Considering this low variance, obtaining statistically significant coefficients would depend largely on the variability in the explanatory variables. The case of FDIs is different (FDI, FDI_1, FDI_2). The standard deviations are more than three times the means, an indication of high variability in FDI. The trend does not differ with the segregation of the economies into the development groups (FDI_DVP, FDI_TRS, FDI_DVD). Indeed, the variances are higher than the respective means, which could be a pointer to the over-dispersion of the FDI series. The means of agricultural economic growth are 2.35 (GR_1) and 2.47 (GR_2). As standard deviations are more than 4 times the means, agricultural growth appears highly dispersed. This is understandable as the level of development of the countries are not the same. This may be a pointer to the wide dispersion of agricultural development globally.

4.2. Model selection

Different lags would produce different estimates of coefficients and standard errors. So, as the computation of the Wald statistics for the long and short run effects are dependent on the size of coefficients and the standard errors, the need to choose the appropriate lag is crucial. Different numbers of lag were estimated for the GMM and system GMM. The lags selected were based on the highest number of statistically significant coefficients. These are presented in Table 4. For both estimations, the Wald statistics are statistically significant at 1%. The covariates therefore jointly explain the variability in the DI. The null hypothesis that over-identifying restrictions are valid could not be rejected. As noted earlier, the test for over-identifying restrictions is tantamount to an under-identification test (Arellano 2002; Arellano et al. 1999), Also, AR(1) for both models is statistically significant whilst that for AR(2) is statistically insignificant, as expected. Although the GMM model has one more statistically significant coefficient than the system GMM model, the latter is known to be more robust than the standard GMM, hence the system GMM was preferred to the GMM for discussion.

Table 3. Summary statistics.

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
DI	1,262	0.1917	0.1297	0.0209	0.9066
DI_1	1,256	0.1893	0.1284	0.0209	0.9066
DI_2	1,250	0.1869	0.1275	0.0209	0.9066
FDI	884	0.0087	0.0268	−0.3000	0.3020
FDI_1	893	0.0085	0.0267	−0.3000	0.3020
FDI_2	896	0.0083	0.0266	−0.3000	0.3020
GR_1	1,280	0.0235	0.0871	−0.3893	0.7801
GR_2	1,280	0.0247	0.0891	−0.4395	0.7801
FDI_DVP	1,280	0.0041	0.0189	−0.0275	0.3020
FDI_DVP_1	893	0.0059	0.0223	−0.0275	0.3020
FDI_DVP_2	896	0.0059	0.2228	−0.0275	0.3020
DI_DVP_1	1,280	0.0589	0.0725	0	0.4016
DI_DVP_2	1,280	0.0584	0.0720	0	0.4016
FDI_TRS	1,280	0.0001	0.0015	−0.0365	0.0235
FDI_TRS_1	1,280	0.0001	0.0015	−0.0365	0.0235
FDI_TRS_2	1,280	0.0001	0.0015	−0.0365	0.0235
DI_TRS_1	1,280	0.0070	0.0315	0	0.2733
DI_TRS_2	1,280	0.0066	0.0306	0	0.2733

Table 4. Results of estimation of GMM and System GMM.

	GMM	System GMM
VARIABLES	DI	DI
DI_1	0.3824***	0.6383***
	(0.0013)	(0.0051)
DI_2	−0.1223***	−0.0572***
	(0.0005)	(0.0032)
FDI	−0.0247***	0.1213***
	(0.0042)	(0.0189)
FDI_1	−0.1268***	−0.0408***
	(0.0058)	(0.0129)
FDI_2	0.4045***	0.6462***
	(0.0068)	(0.0156)
GR_1	0.0277***	0.0399***
	(0.0005)	(0.0017)
GR_2	0.0183***	0.0443***
	(0.0009)	(0.0022)
FDI_DVP	0.0571***	−0.1369***
	(0.0094)	(0.0332)
FDI_DVP_1	0.1290***	−0.0001
	(0.0084)	(0.0253)
FDI_DVP_2	−0.3988***	−0.6886***
	(0.0125)	(0.0291)
DI_DVP_1	0.0145	−0.1677***
	(0.0189)	(0.0296)
DI_DVP_2	−0.0171***	−0.3105***
	(0.0048)	(0.0304)
FDI_TRS	−0.5519	1.5322*
	(0.4919)	(0.8363)
FDI_TRS_1	−0.7552	1.1074
	(0.6966)	(1.0250)
FDI_TRS_2	−0.7963**	−0.5405
	(0.3632)	(1.1082)
DI_TRS_1	0.5689***	−0.2433
	(0.1647)	(0.3590)
DI_TRS_2	−0.7596***	−0.3543***
	(0.1810)	(0.1369)
CONSTANT	0.1363***	0.1113***
	(0.0054)	(0.0029)
Model properties		
Observations	607	689
Number of countries	63	64
AR(1)	−2.8916***	−2.8729***
AR(2)	−1.3369	−1.4559
Sargan	51.5785	51.0812
Wald statistic (17)	4.08e+07***	1.15e+07***

Note: 1. Standard errors in parentheses. 2. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.3. Discussion of the selected model

Both GR coefficients are statistically significant. That for GR_1 of 0.0399 suggests an increase in growth rate by 1%, will induce an increase in DI by 3.99% (Table 4). The magnitude of GR_2 is larger at 0.0443. The gestation period of projects in agriculture could reach beyond 2 years. Indeed, most agricultural investors would certainly invest the previous year's increased income in projects in the current year. As financial statements are often prepared annually, how much (or additional) funds to invest is known after preparation and audit of the books. This declaration of surplus funds to be invested from corporate resources would be known a year later. Moreover, disbursement of investment funds could span more than one year, hence the statistical significance of GR_1 and GR_2 coefficients. The tendency to invest previous year's income for investment in the current year is so pervasive that the literature for whole economies all concluded on the significant positive effect (World – Djokoto 2021b; Developing countries – Agosin and Machado 2005; Balkans,

Bulgaria, Croatia, Slovenia, Romania – Gallova 2011; Transition economies – Mileva 2008; Czech, Poland – Misun and Tomsk 2002; EU-12 and EU-14 – Pilbeam and Oboleviciute 2012; Cote d' Ivoire – Oualy 2019). Although Mileva (2008) reported a neutral effect for Albania for the period 1995–2005, the sign for the coefficient was however, positive. Growth in the agricultural economy thus spurs investment in agriculture.

Foreign direct investment has no effect on domestic investment for the agriculture of developing economies regarding the short run (Table 5). This is like the findings of whole economies for least developed countries (Wang 2010), Asia and Latin America (Agosin and Machado 2005), global food manufacturing (Djokoto 2021b), Ghana (Djokoto 2013), South Africa (Josue et al. 2014), and Cote d'Ivoire (Oualy 2019). This result is however at variance with the findings of other whole economy studies such as for China (Ahmad et al. 2018) who found a crowd-out effect and for South Korea (Kim and Seo 2003) who reported a crowding-in effect.

In the long-run, FDI crowds out DI for developing economies. A dollar rise in FDI would lead to 0.41 cents rise in DI. This result is like that of whole economies' findings for Latin America (Agosin and Machado 2005), developing countries (Morrissey and Udomkerdmongkol 2012), developing country food manufacturing (Djokoto, 2021b) but departs from the no effect by Agosin and Machado (2005) for Africa and Asia, and Kim and Seo (2003) for South Korea. Whilst Djokoto (2013) found crowd-in effect for agriculture in Ghana, there is a crowd-in effect for whole economies for Cote d'Ivoire, developing countries and least developed countries, respectively (Oualy 2019; Wang 2010).

The magnitude of the Wald statistics for the short run for transition economies is 1.6534. This is statistically insignificant hence FDI has no effect on DI in the short run, just as developing countries. This result departs from that for whole economies of CIS and Albania (Mileva 2002) for which crowd-in effects were reported. In the long-run, the Wald statistic of 2.8092 is statistically significant at a 1% level of significance. This suggests, one dollar rise in FDI would exert a 2.8092 rise in DI. This long-run effect is like the findings of CIS and Albania (Mileva 2008) but departs from the crowding out effect found by Djokoto (2021b) for food manufacturing.

Regarding developed countries, both the short and long run Wald statistics were statistically significant with opposite effects. While the short run is a crowding-out effect, the effect is a crowding-in in the long run. A dollar increase in FDI would induce 12.13 cents rise in DI in the short run. The crowding-out of DI would reduce DI into agriculture. As DI is a factor in the computation of agricultural GDP, decrease in DI would reduce agricultural GDP, hence decline in growth. This short-run result is consistent with the whole economy findings of Wang (2010) for developed countries and food manufacturing for developed countries (Djokoto 2021b). Whilst Pilbeam and Obolevicuite (2012) found a crowd-in effect for EU-12, Polat (2017) and Pilbeam and Obolevicuite (2012) however, found a "no effect" for whole economies for OECD and EU14 respectively.

Table 5. Short and long-run crowding effects of foreign direct investment on domestic investment.

	Computed Statistic	Chi square test value	Effect
	Developing economies		
Short run	−0.0156	0.84	No effect
Long run	0.0041	387.88***	Crowd-out
	Transition economies		
Short run	1.6534	3.86	No effect
Long run	2.8092	0.63***	Crowd-in
	Developed economies		
Short run	0.1213	40.98***	Crowd-out
Long run	1.3078	80.80***	Crowd-in
	Combined: Developing, transition and developed economies		
Short run	1.5166	3.31*	Crowd-in
Long run	1.5055	0.05	No effect

Note: 1. Standard errors in parentheses. 2. *** $p < 0.01$, * $p < 0.1$.

A dollar increase in FDI would induce 1.3078 dollars rise in DI for the long-run. The increase in DI induced by the FDI in the long-run would increase agricultural GDP, *ceteris paribus*, leading to growth in the sector. This outcome aligns with those of Misun and Tomsk (2002) for Czech, Hungary and Poland, and Pilbeam and Oboleviciute (2012) for EU-12. Inconsistencies found in this result is based on the findings of Gallova (2011) for Bulgaria, Croatia, Slovenia, Romania, and the Balkans together and Djokoto (2021b) for developed country food manufacturing. These studies reported the crowd-out effect. Pilbeam and Oboleviciute (2012) and Wang (2010) reported "no effect" for EU-14 and developed countries, respectively.

Aggregating all countries; taking the various agricultural economies together, there is a crowding-in effect in the short run. One dollar increase in FDI would exert 1.5166 dollars rise in DI. This result goes contrary to that of Wang (2010) who noted a crowding-out outcome for whole economies of least developed and developed countries for the period 1970 to 2004. Djokoto (2021b) found "no effect" for global food manufacturing.

In the short run, developing and transition economies posted "no effect" whilst developed countries posted a crowding-out effect. However, in the long run, whilst developing countries posted crowd-out effect, transition and developed economies posted crowd-in effects. The weak short-run effect for all the agricultural economies taken together arose from the dampening effect of the "no effect" for transition and developing countries on the crowding-out effect of developed countries. The strong crowding-in effects of economies in transition and developed economies were unable to switch the crowd-out effect to a crowd-in effect, hence the resultant "no effect".

It is noteworthy, that the crowd-in effect is stronger for economies in transition (2.8092) than for developed economies (1.3078). Following the fall of the Communist government in the Soviet Union and subsequent independence of the member states, the economies sort free-market economy approach to economic management. Consequently, FDI from Africa and other developing countries experienced a reduction but increases for transition economies. Between 1997 and 2016, for example, as much US$452billion was pumped into the economies in transition (UNCTADSTAT 2020). Moreover, over the study period, FDI into transition economies grew at an annual average rate of 17.9% compared to 8.2% for Africa and 14.9% for developed economies (UNCTADSTAT 2020).

The explanations underlying the neutral influence in the short run for transition and developing countries are statistical and economic. From Equation (3), the short-run effect (Wald statistic) for developing and economies in transition are the sum of the coefficient of FDI and FDI_DVP, and FDI and FDI_TRS respectively. Although, these coefficients are significant, the negative sign of the FDI_DVP reduced the size of the numerator of the statistics. For the economies in transition, the sum of the coefficients is small relative to the standard errors. Also, the high standard errors of the coefficients result in a high square root of the sum of the square of the standard errors. Using this as a divisor reduces the quotient such that the z-score and the chi-square value becomes statistically insignificant. Either as greenfield investments or mergers and acquisitions, investments and re-investments require elapsed time. Coupled with the generally long gestation period for agricultural projects, as there are more greenfield investments than mergers and acquisitions in developing countries (UNCTAD 2010), obtaining short-run FDI spillover effects is uncommon for agriculture. Indeed, the speedy translation of the FDI on the BOP into real investments is rare.

The crowd-out effect for developed economies in the short run and developing countries, for the long run, mergers and acquisitions are responsible as these tend to be the mode of entry more than greenfield investments (UNCTAD 2010). In the case of acquisitions, the host country business ceases to exist. This eliminates domestic investment by the value of the acquired investment. For mergers, crowd-out is exacerbated when the shareholding of the merged firms weighs in favour of the foreign investor. Thus, consequently or independently, mergers and acquisitions by MNEs in the resident countries do result in crowding-out effects (United Nations 1998). Owing to relatively weak local capacity in developing countries, partnerships with foreign investors are low. Consequently, the competition effect tends to preponderate over the linkage effect (Markusen and Venables 1999).

With the entry of MNEs into the resident economy, the population of the resident firms may decline initially (Barrios et al. 2005). This is true in the short-run.

For the long-run, there is the crowding-in effect for developed as well as economies in transition. Statistically, the standard errors are low relative to the size of the coefficients. Theoretically, Barrios et al. (2005) noted that notwithstanding the initial effect of the drop in the resident country firms, the possible linkage effect can raise the population of final product domestic firms and then curtail production cost in the input industry for both MNEs and resident country firms (Djokoto 2021b). As a result, the population of the resident country firms will finally increase. Markusen and Venables (1999) also acknowledged the linkage effect. Economies in transition and developed economies have the absorptive capacity for FDI, hence the crowd-in effect (Djokoto 2021b).

Empirically, Misun and Tomsk (2002) have noted the acquisition processes that translate into real assets with certain lags, high FDI inflow, as well as the expansion of production, does stimulate a new stream of domestic investment. In transition and developed economies, more domestic companies become suppliers of foreign MNEs. The crowd-in effect is further enhanced with the introduction of investment-incentive schemes.

In the long-run, there is a crowd-out effect in developing countries. Statistically, the low standard errors combine with the small size of the coefficients to produce the statistic of 0.0041. Theoretically, the competitive effect (Markusen and Venables 1999) can be adduced. Regarding policy, every country engages in agriculture by employing domestic resources. Attracting foreign investment suggests the local resources are insufficient given the circumstances. Hence, more attractive conditions would be required to attract foreign investment. Consequently, foreign investors tend to access some gains which may be unavailable to indigenous investors (Djokoto 2021b).

Empirical reasons can also explain this result. The first is the entry mode. Mergers and acquisitions by foreign firms in resident economies could also lead to crowding-out effects and this is not likely to be the case for greenfield investments (Djokoto 2021b; Punthakey 2020; United Nations 1998). Secondly, foreign firms could also establish affiliate businesses within the resident country or buy inputs from associated and non-associated firms abroad (Djokoto 2021b; Gallova 2011).

Thirdly, the macroeconomic environment. The local currency can decline in value partly due to profit transfers from time to time by MNEs and the exposure of the financial markets to foreigners (Djokoto 2021b; Ufimtseva 2020). Indigenous agriculture businesses that do not sell to foreign markets would have challenges continuing their operations as re-introducing capital will become more costly (Desai et al. 2004; Djokoto 2012).

In the fourth place, there is evidence in the literature about land grab arising from FDI for example in Africa (Matenga and Hichaambwa 2017; Widengard 2019), Latin America (Mollett 2016; Perreault 2018), Asia (Ludwig 2020; Rauf 2017) and the Americas (Fraser 2019; Ribeiro 2019). Land grab largely by foreign investors dispossesses domestic agriculturists of farmland. The amounts paid for land by the "grabbers" are more than what domestic investors can afford to pay. Further, some of the large tracts of land are not cultivated but left fallow. These contribute to the reduction in investment by domestic investors in agriculture.

In the fifth place, lower managerial skill and resulting sub-standard performance than foreign firms could make it challenging for indigenous businesses to compete and failure of indigenous firms to improve technology may result in them becoming uncompetitive hence, could be crowded out (Djokoto 2013, 2021b; United Nations 2015).

5. Conclusions and recommendations

This paper adds to the knowledge on the short run and long run crowding influence of foreign direct investment on domestic investment in the agricultural economy using data on cross-section of 64 countries from 1997 to 2016.

Agricultural growth spurs domestic investment. A combination of policies is required to increase agricultural trade, government expenditure in the agricultural economy, and a good balance

between consumption and savings. These would increase agricultural growth and consequently increase domestic investment. This should sustain growth and promote domestic investment over time and across countries.

In the short-run, foreign direct investment makes no discernible effect on domestic investment of the agriculture of developing and transition economies but there is a crowd-out effect for developed economies. Overall, the short-run effect is crowd-in. In the long-run, however, developing countries experienced a crowding-out effect whilst economies in transition as well as developed countries enjoyed a crowding-in effect. Overall, the long-run effect is "no effect".

In as much as the investment policy seek to attract foreign investors, the policy or other policies should adequately boost investment by local investors in developing countries. Regulatory regimes of foreign investments may require strengthening to influence the mode of entry that does not reduce the role of local investors. Greenfield investments should be encouraged. Between the duo of mergers and acquisition, investment regulations in host countries should encourage partnership between local and foreign investors. Host country governments should improve the macroeconomic environment for agriculture and the wider economy. Structural transformation is necessary for the long term so that economies would be resilient to foreign currency shocks, among others. To dampen the effect of land grab, regulation should encourage partnership through a shareholding of landowners with foreign investors or a combination of rent and shareholding. Finally, whilst domestic firms learn from foreign firms, host country governments need to improve management education and innovation and the technology environment for local investor benefit.

Economies in transition and developed economies should continue to strengthen their economic environment to absorb the multinational enterprises in the long-run. There is the need to enhance the administrative and regulatory environment to support foreign investment as well as processes that increase the pass-through of the foreign direct investment into benefits on domestic investment into agricultural economies globally.

Disclosure statement

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Appendix. Distinction between agricultural FDI and food manufacturing FDI

Agriculture is section A in the ISIC Rev 4., described as " … the exploitation of vegetal and animal natural resources, comprising the activities of growing of crops, raising and breeding of animals, harvesting of timber and other plants, animals or animal products from a farm or their natural habitats." (ISIC Rev. 4 page 65). The specific divisions are 01, 02 and 03.

Manufacturing generally " … . includes the physical or chemical transformation of materials, substances, or components into new products, although this cannot be used as the single universal criterion for defining manufacturing (see remark on processing of waste below). The materials, substances, or components transformed are raw materials that are products of agriculture, forestry, fishing, mining or quarrying as well as products of other manufacturing activities. Substantial alteration, renovation or reconstruction of goods is generally considered to be manufacturing." (ISIC Rev. 4, page 85).

The relevant specific divisions are 10, 11 and 12. As these sectors are distinct in the classifications, so is the FDI segregated based on the classification. Hence, FDI into agriculture is distinct from FDI into food manufacturing (food, beverage, and tobacco).