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Foreign Direct Investment and Trade

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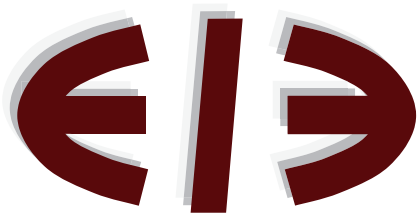

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Foreign Direct Investment and Trade in Eastern European Agriculture

ABSTRACT

Eastern Europe experienced a surge in trade and capital movements after the introduction of the market economy. We investigate the substitution and complementary effect of foreign direct investment (FDI) and trade in the agricultural sector in Eastern Europe. We employed panel data from 1995 to 2020 for the 23 countries and fitted these to fixed and random effects estimators. We found that inward FDI did not influence trade. Outward FDI substituted exports and trade openness in the transition countries of Eastern Europe. However, outward FDI complemented imports and trade openness in Eastern Europe.

Keywords: Complement, Eastern Europe, foreign direct investment, substitute, transition economies.

Word count: 6226

1. Introduction

Market economic management in Eastern Europe brought with it the freedom to trade internationally. In 1995, total agricultural trade matched agricultural value-added in Eastern Europe (FAOSTAT, 2023). This rose to 1.14 by 2000, more than doubled to 2.33 in 2010 and reached 2.46 by 2020. The freedom to move goods and services was associated with the movement of capital including agricultural foreign direct investment (FDI), an investment made by a resident firm in one economy creating a lasting interest in an enterprise that is resident in another economy. The lasting interest implies the existence of a long-term relationship between the direct investor and the direct investment enterprise and a significant degree of influence on the management of the enterprise arising from 10% or more of the voting power (UNCTADSTAT, 2023). In 1995, there were only three occurrences of inward FDI (IFDI) (FAOSTAT, 2023). By 2000, this rose to eight. That for 2010 was 17 and declined to 13 in 2020. These occurred within the environment of a general surge in FDI in Eastern Europe. The increase in FDI inflow increased the ownership and location advantages of indigenous firms (Dunning, 1981; Dunning and Narula, 1996). Their internationalisation with trade also birthed investing capital abroad. With zero outward FDI in 1995, Czechia, Hungary, Latvia, and Lithuania recorded OFDI in 2000. There was a further rise to eight observations in 2010 including Bulgaria, Croatia, Estonia, Poland, and Slovenia. There was a marginal decline to seven by 2020 amid the COVID-19 pandemic. As trade and FDI are instruments of internationalisation, theory (Mundell, 1957) suggests FDI substitutes for trade. On the contrary, empirically, Akadiri et al. (2020) have shown that FDI complements trade. Tsaurai (2018) has taken a middle ground, that FDI is neither a compliment nor a substitute for trade. Considering the developments in trade and FDI in Eastern European agriculture and the uncertainty about the relationship between trade and FDI, we answer the research question, how does FDI influence trade in Eastern European agriculture?

Existing studies on FDI and trade in Europe have analysed the two separately without any empirical causal analyses (Ali, 2018; Ando and Kimura, 2007; Guerreira, 1998; Olsson and Lönnborg, 2018). The exception is Maksum et al. (2021) that employed latent variable modelling for Europe without clarity on the specific countries. Indeed, Eastern European countries were not the specific attention of the authors. Within and outside Europe, Djokoto (2012) appears to be the only study that reported empirical findings on the FDI-trade nexus for agriculture. Whereas that focused on a single country using the Granger causality test, it did not account for other variables that also explain trade in the literature. We contribute to the literature by assessing the role of FDI in trade in Eastern European. As in Djokoto (2012), we focus on agriculture. World Bank (2023a) acknowledges that enhancing agriculture is one of the potent instruments to end severe impoverishment, encourage shared wealth, and feed a projected 9.7 billion people by 2050. Indeed, progress in the agriculture sector is between two to four times more useful in growing incomes among the most impoverishment relative to other sectors. Further, agriculture is also essential to economic progress: representing four percent of global gross domestic product (GDP) and exceeding 25% of GDP in some developing countries. Unlike Djokoto (2012), we accounted for control variables in our model. Using data from 1995 to 2020 for the 23 countries in Eastern Europe, we found that inward FDI did not influence trade. Outward FDI substituted exports and trade openness in the transition countries. However, outward FDI complemented imports and trade openness in Eastern Europe. Transition countries in Eastern Europe must reinvest in the home economy to move beyond substituting for agricultural imports and produce for exports. Production sharing can also be considered. This would increase exports and ultimately total trade. Eastern European countries should continue to enhance freedom to trade internationally, as

well as encourage multinationals in the region to invest in foreign affiliates to reap the benefits of trade.

2. Literature

2.1 Theoretical review

The traditional trade theory has the country as its focus whereas the new trade theory uses the industry as the unit for analysis. Recently, the newest theory (the 'new' new trade theory, NNTT) emphasised the importance of firms and firm differentiation in international trade (INT)(Ciuriak et al., 2015). Mundell (1957) introduced a substitutive relationship between FDI and international trade which originated from the neoclassical Heckscher-Ohlin-Samuelson assumptions (Heckscher, 1959; Ohlin, 1933; Samuelson, 1949, 1953). Two points are worth noting. First, international trade is driven by differences in factor endowments and factor prices for homogenous products. These differences narrow when international factors become mobile between countries and international trade flows reduce. Second, import tariffs reduce exports and encourage FDI. Capital outflows, however, facilitate exports (Kojima, 1975; Lipsey and Weiss, 1981). The new trade theory (Helpman and Krugman, 1987; Krugman, 1980), focuses on intra-industry trade to explain observable specialisations and patterns of trade between countries that are differentiated at the outset based on technology and endowments.

2.2 Empirical review

We review Maksum et al. (2021) regarding the FDI-international trade nexus in the total economy in Europe and Djokoto (2012) on agriculture outside Europe. Maksum et al. (2021) used FDI inflow as an indicator of economic globalisation and assessed its effect on international trade in 20 European countries. The data were from 2014 to 2017. Using latent variable modelling, FDI inflow did not affect international trade. No reasons were assigned for the outcome.

The only agriculture sector study on the FDI-international trade nexus investigated the short-run and long-run relationship between agricultural trade with FDI in Ghana using data from 1995 to 2010. With the aid of Granger's instantaneous causality test for the short-run relationship and feedback model for the long-run relationships, Djokoto (2012) found that in the short-run, FDI inflows substituted for imports. For exports, the relationship was not statistically significant. In the long run, FDI did not cause exports. Djokoto (2012) explained that the bulk of Ghana's agricultural exports is made of cocoa beans, the production of which is largely in indigenous farm households and not an attraction to foreign firms.

Regarding the control variables, the exchange rate has a negative relationship with trade balance and trade openness (Yazici and Islam, 2012; Baek et al., 2009; Tahir et al., 2018). The exception is Mbolega (2019) that found a neutral effect on trade openness for the total economy in Africa. The only literature on the effect of freedom to trade internationally on trade is from Mbogela (2019) who found no discernible effect of the variable on trade openness. Human capital promotes trade (Tahir et al., 2018), just as agricultural GDP growth enhances trade (Osei et al., 2019; Tahir et al., 2018). Domestic agricultural investment also positively influences trade (Osei et al., 2019; Tahir et al., 2018). Similarly, trade is positively

influenced by inflation (Osei et al., 2018) and population growth (Mbogela, 2019). However, Osei et al. (2018) found a neutral effect of population growth on trade. It is apparent from the empirical review that existing studies did not address the FDI-international trade nexus in agriculture, neither in the total economy of Eastern Europe nor in the agricultural sector. We fill the latter gap.

3. Data and methods

3.1 Models and modelling

Foreign direct investment and control variables explain trade (Mbogela, 2019; Nga, 2020; Osei et al., 2019; Tahir et al., 2018).

$$TRADE = f(AIFDI, AOFDI, AGINV, AGDPG, EXRATE, FTTRADE, HC, INFLA, POPG) \quad (1)$$

TRADE is a ratio measured as *AEX*, *AIM* and *ATO*. *AEX* is the total agricultural exports divided by the agricultural value added. *AIM* is the agricultural imports divided by the agricultural value added. In the case of *ATO*, it is the sum of *AEX* and *AIM*. These ways of measuring trade have been employed in the literature (Anderson, 2022; de Azevedo et al., 2023; Djokoto, 2013, 2021a; Kastratović, 2023; Narteh-Yoe et al., 2022; Nga, 2020; Osei, et al., 2019; Tahir et al., 2018). *AIFDI* is the inflow of FDI into the agricultural sector of Eastern European countries. Owing to a few observations that could affect the efficiency of the estimates of the coefficients, we elected to measure the variable as a dummy. *AIFDI*=1 for observation of inflow of FDI into agriculture and 0 otherwise. *AOFDI* is the outflow of agricultural FDI from Eastern European countries. With even fewer observations, *AOFDI* was also defined as a dummy variable; *AIFDI*=1 for observation of outflow of agricultural FDI and 0 otherwise. *ADINV* is agricultural domestic investment measured as the ratio of

agricultural gross fixed capital formation to agricultural value added. Djokoto (2021a,b,c) and Bekoe et al. (2023) used this measure as well. *AGDPG* is the annual growth rate of agricultural value added in 2015 prices. Increasing the size of the agricultural sector can absorb more agricultural imports through the consumption of agricultural inputs and agricultural produce as raw and intermediate goods for further processing. Agricultural exports would be sourced from local agricultural production arising from the increasing *AGDPG*.

The other variables are not agricultural sector-specific. *EXRATE* is the official exchange rate, measured as the annual average of the number of an Eastern European country's currency per US$. A high amount of local currency to the US dollar would increase the price of agricultural imports and could discourage agricultural imports whilst encouraging agricultural exports. Ultimately, agricultural exporters would expect more revenue. The exchange rate influences trade in agriculture (Esmaili and Ghahremanzadeh, 2020; Yazici, 2008, Yazici and Islam, 2012). We follow Mbogela (2019) and define *FTTRADE* as the freedom to trade internationally. As a composite measure of the absence of tariff and non-tariff barriers that affect imports and exports of goods and services, *FTTRADE* has two constituents: the trade-weighted average tariff rate and non-tariff barriers. As different imports entering a country experience different tariff, the weighted average tariff uses weights for each tariff based on the share of imports for each good. A lower score represents a lower opportunity to trade than a higher score. Whilst the latter would enhance international trade (*TRADE*) the former would discourage *TRADE* (Mbogela, 2019). Human capital, *HC*, is the secondary school enrolment per cent of gross enrolment. Increased *HC* contribute to employment in the production of goods and services, a source of products for exports. Imported resources could also be combined with *HC* to produce for local consumption and exports. *HC* has a positive

relationship with trade (Tahir et al., 2018). *INFLA*, inflation, is measured as the annual growth rate of the consumer price index. Increased price level reduces the purchasing power of consumers and producers. This could weaken imports as well as exports. Inflation has been found to discourage trade (Osei et al., 2019). *POPG* is the annual growth rate of the population of males and females. The increased population provides an increased market for the consumption of imports as well as increased labour for production for exports. Thus, *POPG* could influence *TRADE* (Mbogela, 2019).

We specify equations 2 – 4 from equation 1.

$$AEX_{it} = \alpha_0 + \alpha_1 AIFDI_{it} + \alpha_2 AOFDI_{it} + \alpha_3 AGINV_{it} + \alpha_4 AGDPG_{it} + \alpha_5 EXRATE_{it} + \alpha_6 FTTRADE_{it} + \alpha_7 HC_{it} + \alpha_8 INFLA_{it} + \alpha_9 POPG_{it} + \omega_{it} \quad (2)$$

$$AIM_{it} = \beta_0 + \beta_1 AIFDI_{it} + \beta_2 AOFDI_{it} + \beta_3 AGINV_{it} + \beta_4 AGDPG_{it} + \beta_5 EXRATE_{it} + \beta_6 FTTRADE_{it} + \beta_7 HC_{it} + \beta_8 INFLA_{it} + \beta_9 POPG_{it} + \varphi_{it} \quad (3)$$

$$ATO_{it} = \gamma_0 + \gamma_1 AIFDI_{it} + \gamma_2 AOFDI_{it} + \gamma_3 AGINV_{it} + \gamma_4 AGDPG_{it} + \gamma_5 EXRATE_{it} + \gamma_6 FTTRADE_{it} + \gamma_7 HC_{it} + \gamma_8 INFLA_{it} + \gamma_9 POPG_{it} + \tau_{it} \quad (4)$$

Where *i* are the countries and *t* are time in years. α, β and γ are parameters to be estimated whilst ω, φ and τ are idiosyncratic error terms. We defined Eastern European countries according to United Nations (2022) and categorise them into transition and developed economies based on United Nations (2021). There is no developing country in Eastern Europe. We contend that the effects of FDI on trade could differ based on this categorisation. So, we introduced TRS=1 for transition countries and 0 otherwise (developed countries).

Consequently, we interacted TRS=1 with *AIFDI* and *AOFDI* to give *AIFDI_TRS* and *OIFDI_TRS* which we introduced into equations 2 – 4 to yield equations 5 - 7.

$$AEX_{it} = \delta_0 + \delta_1 AIFDI_{it} + \delta_2 AIFDI\_TRS_{it} + \delta_3 AOFDI_{it} + \delta_4 AOFDI\_TRS_{it} + \delta_5 AGINV_{it} + \delta_6 AGDPG_{it} + \delta_7 EXRATE_{it} + \delta_8 FTTRADE_{it} + \delta_9 HC_{it} + \delta_{10} INFLA_{it} + \delta_{11} POPG_{it} + \sigma_{it} \quad (5)$$

$$AIM_{it} = \theta_0 + \theta_1 AIFDI_{it} + \theta_2 AIFDI\_TRS_{it} + \theta_3 AOFDI_{it} + \theta_4 AOFDI\_TRS_{it} + \theta_5 AGINV_{it} + \theta_6 AGDPG_{it} + \theta_7 EXRATE_{it} + \theta_8 FTTRADE_{it} + \theta_9 HC_{it} + \theta_{10} INFLA_{it} + \theta_{11} POPG_{it} + \rho_{it} \quad (6)$$

$$ATO_{it} = \vartheta_0 + \vartheta_1 AIFDI_{it} + \vartheta_2 AIFDI\_TRS_{it} + \vartheta_3 AOFDI_{it} + \vartheta_4 AOFDI\_TRS_{it} + \vartheta_5 AGINV_{it} + \vartheta_6 AGDPG_{it} + \vartheta_7 EXRATE_{it} + \vartheta_8 FTTRADE_{it} + \vartheta_9 HC_{it} + \vartheta_{10} INFLA_{it} + \vartheta_{11} POPG_{it} + \pi_{it} \quad (7)$$

δ, θ and ϑ are parameters to be estimated whilst σ, ρ and π are the idiosyncratic error terms. Based on the estimates from equations 2 – 7, the effect of FDI on *TRADE* is presented in Table 1.

Data on international agricultural trade and FDI is drawn from FAOSTAT (2023), whereas all others are drawn from World Development Indicators of the World Bank (2023b). The data employed is panel data of the 23 Eastern European countries from 1995 to 2020. However, not all countries had data for the period 1995 to 2020. For example, data for Serbia started in 2006. Thus, the average period (year) is 20.5.

3.2 Estimation procedure

We employ fixed effects (FE) and random effects (RE) estimators and choose between the two using the Hausman test (Hausman, 1978). We use the Wooldridge test for autocorrelation in panel data (Wooldridge, 2002), to examine the presence of serial correlation in the errors of the models. In the case of the existence of serial correlation in FE, we applied the pooled ordinary least squares (POLS) to correct it. We use the lag of the dependent variable in the case of the RE. We ascertained homoscedasticity using the Modified Wald test for groupwise heteroskedasticity in the FE regression model (Baum, 2001) and Breusch and Pagan Lagrangian multiplier test for RE (Breusch and Pagan, 1980). In the former case, homoscedasticity was ensured by using Driscoll-Kraay standard errors (Driscoll and Kraay, 1998) and robust standard errors for the latter. We evaluate the effects of agricultural FDI on international agricultural trade using the Wald and test with the chi-squared test.

4. Results and discussions

4.1 Profile of data

The mean *AEX* is 0.8016 and that of *AIM* is 1.0320. Consequently, *ATO* is 1.8336. The *ATO* ranged from 0.1435 (Albania in 1995) to 6.2877 (Slovenia in 2018). About 70% of the 496 observations are *AIFDI*. The other 30% is for *AOFDI*.

4.2 Results

The Hausman test selected the RE estimator for the estimations of equation 5 (Table 3). The coefficients of *AIFDI_TRS* and *AOFDI* are all statistically insignificant. Whilst those of *AIFDI* are mostly statistically significant, most of the coefficients of *AOFDI_TRS* are statistically insignificant. However, the coefficients of *AIFDI, AIFDI_TRS, AOFDI,* and

AOFDI_TRS are similar in magnitude and sign across models 1 - 9. Overall, the estimates of the key variables are robust to the control variables.

In the case of the estimation of equation 6 (Table 4), the coefficients of *AOFDI* and *AOFDI_TRS* are statistically indistinguishable from zero across models 10 - 18. Whilst the coefficients of *AIFDI* are mostly statistically significant, those of *AIFDI_TRS* are all statistically distinguishable from zero. It must be noted that for each of the key variables, the coefficients are similar in magnitude and sign across models 10 – 18 and are robust to the control variables.

The coefficients of *AOFDI* and *AOFDI_TRS* are statistically insignificant (Table 5). Whilst those of *AIFDI* are positive and statistically significant, those of *AIFDI_TRS* are all negative and statistically significant. It would be observed that the coefficients of all the key variables are similar in magnitude and sign across models 19 – 27. This consistency points to the robustness of the estimates to the control variables.

We assembled models 1, 10 and 19 in Table 6. Then, we added the estimations of equations 2 – 4, that is models 28 - 30. Whilst models 1, 10 and 19 are from an RE estimator, those of 28 – 30 arise from an FE estimator. The models are statistically significant overall, based on the statistically significant Wald and F statistics. The R squared is also large, close to 1. This implies the explanatory variables explain almost all the variabilities in the dependent variables. The F test implies the explanatory variables jointly explain the explained variable. The statistical significance of the lag of the dependent variables suggests the serial correlation in the models has been accounted for. In the case of the FE, the POLS corrected for the presence of the serial correlation. The results in Table 6 also reveal the consistency of the

estimates of the control variables. Across all six models, the magnitude of the coefficients is similar. In the case of *EXRATE*, *HC*, *INFLA* and *POPG*, there is also consistency in sign and statistical significance. Thus, whilst the estimates of the key variables are robust to the control variables, the estimates of the control variables are robust to the measure of *AEM*, *AIM* and *TO* as well as the estimator used. These impressive model properties suggest the appropriateness and adequacy of the models representing the phenomenon under investigation.

4.3 Discussion of control variables

The coefficients of *ADINV* are positive but weakly statistically significant in only models 10 and 19 (Table 6). The positive tendency is like the findings of Osei et al. (2019) and Tahir et al. (2018). The coefficients of *EXRATE* are negative and statistically significant across all models. Currency depreciation enhances trade however measured in Eastern Europe. This is consistent with the existing literature (Baek et al., 2009; Osei et al., 2019; Tahir et al., 2018). We found that freedom to trade internationally enhances trade. Mbogela (2019) however, found no significant effect of *FTTRADE* on trade openness in Africa. We also found that human capital enhances trade, consistent with the finding of Tahir et al. (2018). Inflation discouraged trade, however, measured. This is contrary to Osei et al. (2019) who found a positive effect for both lower-income and middle-income countries in Africa. Population growth did not significantly affect trade in line with the finding of Osei et al. (2019) but contrary to Mbogela (2019) who found a positive effect.

4.4 Discussion of effects of FDI on trade in Eastern European agriculture

Inward and outward FDI has no discernible effect on export, import and trade openness in developed Eastern European countries (Table 7). This is contrary to the theory of substitutive

effect between FDI and trade (Heckscher, 1959; Mundell, 1957; Ohlin, 1933; Samuelson, 1949, 1953) and the empirical finding of Djokoto (2012) for Ghana. However, the finding is in line with the evidence for Europe (Maksum et al., 2021).

In the case of transition economies, inward FDI has no discernible effect on trade, however, measured. This is like the results for developed Eastern European countries. There are statistically insignificant effects of inward FDI on all the trade measures and outward FDI on imports for transition economies. These results are inconsistent with the theoretical positions (Heckscher, 1959; Mundell, 1957; Ohlin, 1933; Samuelson, 1949, 1953) and for Ghana (Djokoto, 2012) but in line with the empirical evidence of Maksum et al. (2021).

Regarding imports and trade openness for transition economies, outward FDI has a substitutive effect. Outward FDI from Eastern Europe originates from parent companies in Eastern Europe. A decrease in imports implies that the parent companies in the home country have increased the domestic production of agricultural products to serve the domestic market. This reduces the need for imports, hence, the decrease in imports. As the effect of *AOFDI* on trade is negative but statistically insignificant, the decrease in imports would be favourable to the trade balance for agriculture. The strength of the negative effect for imports seemed to have magnified that of trade openness. The negative but statistically insignificant effect of *AOFDI* on imports and trade openness suggests agricultural multinationals in transition economies in Eastern Europe appear to honour their export orders from the production of their foreign affiliates and not from parent firms at home. This is consistent with production-sharing arrangements in firm internationalisation (Dunning, 1981; Dunning and Narula, 1996). Our result is consistent with the theoretical propositions (Heckscher, 1959; Mundell, 1957; Ohlin, 1933; Samuelson, 1949, 1953) and the empirical evidence of imports and

inward FDI for Ghana (Djokoto, 2012). It is, however, contrary to the empirical evidence of Maksum et al. (2021).

Outward FDI promotes exports and trade openness for all of Eastern Europe. This is interesting. Unlike the segregation into transition and developed countries that was based on the computation of the Wald from models 1, 10 and 19, the effects of FDI on trade are based on models 28 – 30. Thus, the positive effects in the top pane of Table 7 are inherent in these results. As outward FDI increases, parent firms and foreign affiliates become more international to the extent of recognising their international relationships more than the territorial boundaries. Foreign affiliates would share production entirely or partly with parent companies at home, in Eastern Europe (Dunning, 1981; Dunning and Narula, 1996). Further, some Eastern European countries are well suited for some agricultural produce such as grains and fertilisers in Ukraine and Russia. Agriculture still contributes more to GDP than Western European countries (FAOSTAT, 2023; Pouliquen, 1998). These explain the positive effect.

5. Conclusions and recommendations

Following the surge in FDI in Eastern Europe in the aftermath of the introduction of the market economy, we investigated the role of *AIFDI* and *AOFDI* on trade in the agricultural sector. We employed panel data from 1995 to 2020 for the 23 countries and fitted these to FE and RE estimators. We found that FDI does not influence trade in developed Eastern European countries. In the transition economies, however, *AOFDI* discouraged imports and trade openness. For all of Eastern Europe however, *AOFDI* enhanced exports and trade openness. Transition countries in Eastern Europe must reinvest in the home economy to move beyond substituting for agricultural imports and produce for exports. Production sharing in favour of domestic production must also be considered. This would increase exports and

ultimately total trade. Eastern European countries should continue to enhance freedom to trade internationally, as well as encourage multinationals in the region to invest in foreign affiliates to reap the benefits thereof.

Disclosure statement

No potential conflict of interest was reported by the author(s)

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APPENDIX. Eastern European countries in the data.

Transition economies			
Albania	Belarus	Moldova	Russian Federation
Armenia	Bosnia and Herzegovina	Montenegro	Serbia
Azerbaijan	Georgia	North Macedonia	Ukraine
Developed economies			
Bulgaria	Estonia	Lithuania	Slovak Republic
Croatia	Hungary	Poland	Slovenia
Czech Republic	Latvia	Romania	

Note: The designation as Eastern Europe and categorisation as transition and developed are informed by United Nations (2021, 2022).

Table 1. Effects of agricultural foreign direct investment on Eastern European agricultural trade.

	Exports	Imports	Trade openness
All Eastern European economies			
Inward foreign direct investment	α_1	β_1	γ_1
Outward foreign direct investment	α_2	β_2	γ_2
Developed Eastern European economiesα			
Inward foreign direct investment	δ_1	θ_1	ϑ_1
Outward foreign direct investment	δ_2	θ_2	ϑ_2
Transition Eastern European economies			
Inward foreign direct investment	$\delta_1+\delta_2$	$\theta_1+\theta_2$	$\vartheta_1+\vartheta_2$
Outward foreign direct investment	$\delta_3+\delta_4$	$\theta_3+\theta_4$	$\vartheta_3+\vartheta_4$

Table 2. Descriptive statistics.

Variable	Observation	Mean	Standard deviation	Minimum	Maximum
AEX	496	0.8016	0.6669	0.0108	3.3141
AIM	496	1.0320	0.7795	0.1186	3.7293
ATO	496	1.8336	1.3370	0.1435	6.3877
AIFDI	496	0.6835	0.4656	0	1
AOFDI	496	0.3226	0.4679	0	1
ADINV	496	0.4041	0.1351	0.0503	1.0727
AGDPG	496	0.0161	0.1079	-0.3893	0.5466
EXRATE	496	58.3180	113.2517	0.0012	578.7630
FTTRADE	496	77.3520	10.5766	44.2000	89.4000
HC	496	93.7544	10.1612	26.8866	115.9301
INFLA	496	15.0427	66.1096	-1.5841	1,058.3740
POPG	496	-0.4060	0.6222	-3.8477	1.1557
TRS	496	0.4698	0.4996	0	1
DVD	496	0.5302	0.4996	0	1

Table 3. Robustness of key variables to control variables with agricultural exports to GDP ratio.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	*AEX*	*AEX*	*AEX*	*AEX*	*AEX*	*AEX*	*AEX*	*AEX*	*AEX*
L.AEX	0.9649***	0.9852***	0.9858***	0.9880***	0.9842***	0.9729***	0.9699***	0.9853***	0.9867***
	(0.0206)	(0.0168)	(0.0174)	(0.0157)	(0.0169)	(0.0208)	(0.0174)	(0.0167)	(0.0162)
AIFDI	0.0374	0.0472**	0.0494**	0.0473**	0.0452*	0.0413*	0.0519**	0.0396	0.0447*
	(0.0261)	(0.0232)	(0.0229)	(0.0235)	(0.0234)	(0.0238)	(0.0243)	(0.0243)	(0.0242)
AIFDI_TRS	-0.0330	-0.0385	-0.0393	-0.0379	-0.0350	-0.0443	-0.0381	-0.0383	-0.0347
	(0.0326)	(0.0289)	(0.0290)	(0.0294)	(0.0294)	(0.0304)	(0.0299)	(0.0291)	(0.0298)
AOFDI	0.0054	0.0135	0.0132	0.0110	0.0150	0.0077	0.0063	0.0124	0.0168
	(0.0382)	(0.0336)	(0.0329)	(0.0337)	(0.0338)	(0.0344)	(0.0372)	(0.0333)	(0.0353)
AOFDI_TRS	-0.0603	-0.0785	-0.0804*	-0.0773	-0.0822	-0.0846*	-0.0486	-0.0789	-0.0769
	(0.0546)	(0.0499)	(0.0470)	(0.0505)	(0.0509)	(0.0481)	(0.0576)	(0.0496)	(0.0509)
ADINV	0.0749		0.0585						
	(0.0592)		(0.0580)						
AGDPG	-0.0910			-0.1265					

	(0.0981)			(0.1001)					
EXRATE	-0.0001**				-0.0000				
	(0.0000)				(0.0000)				
FTTRADE	0.0013					0.0018**			
	(0.0008)					(0.0008)			
HC	0.0022***						0.0024**		
	(0.0009)						(0.0010)		
INFLA	-0.0003***							-0.0004***	
	(0.0001)							(0.0001)	
POPG	-0.0171								-0.0137
	(0.0111)								(0.0118)
CONSTANT	-0.2908**	0.0282**	0.0031	0.0287**	0.0318**	-0.0973**	-0.1858**	0.0379**	0.0212
	(0.1168)	(0.0140)	(0.0237)	(0.0139)	(0.0144)	(0.0423)	(0.0850)	(0.0150)	(0.0172)
Model diagnostics									
Observations	472	472	472	472	472	472	472	472	472
Countries	23	23	23	23	23	23	23	23	23

Wald	16,553***	5,826***	6,440***	5,877***	7,381***	7,115***	6,736***	6,989***	9,270***
R-squared	0.9402	0.9376	0.9377	0.9376	0.9381	0.9380	0.9384	0.9384	0.9377
Mean obs. Per group	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5
Estimator	RE	RE	RE	RE	RE	RE	RE	RE	RE

Notes: [a]Robust standard errors in parentheses. [b]*** p<0.01, ** p<0.05, * p<0.1. [c]Obs – observations.

Table 4. Robustness of key variables to control variables with agricultural imports to GDP ratio.

	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
VARIABLES	*AIM*	*AIM*	*AIM*	*AIM*	*AIM*	*AIM*	*AIM*	*AIM*	*AIM*
L.AIM	0.9358***	0.9605***	0.9523***	0.9663***	0.9576***	0.9492***	0.9590***	0.9593***	0.9600***
	(0.0220)	(0.0126)	(0.0145)	(0.0116)	(0.0134)	(0.0150)	(0.0119)	(0.0126)	(0.0124)
AIFDI	0.0341	0.0381	0.0484*	0.0377	0.0347	0.0302	0.0380	0.0347	0.0387
	(0.0329)	(0.0290)	(0.0281)	(0.0293)	(0.0302)	(0.0318)	(0.0296)	(0.0302)	(0.0297)
AIFDI_TRS	-0.0880**	-0.0802**	-0.0882**	-0.0776**	-0.0739**	-0.0882**	-0.0781**	-0.0810**	-0.0812**
	(0.0442)	(0.0371)	(0.0366)	(0.0382)	(0.0369)	(0.0411)	(0.0368)	(0.0374)	(0.0384)
AOFDI	-0.0371	-0.0233	-0.0212	-0.0273	-0.0205	-0.0344	-0.0291	-0.0236	-0.0239
	(0.0458)	(0.0435)	(0.0407)	(0.0430)	(0.0436)	(0.0479)	(0.0453)	(0.0438)	(0.0447)
AOFDI_TRS	-0.0334	-0.0185	-0.0243	-0.0170	-0.0260	-0.0235	-0.0041	-0.0189	-0.0188
	(0.0457)	(0.0522)	(0.0474)	(0.0523)	(0.0515)	(0.0513)	(0.0576)	(0.0523)	(0.0519)
ADINV	0.1704*		0.1457**						
	(0.0875)		(0.0648)						
AGGDPG	-0.1986			-0.2415					

	(0.1720)			(0.1538)					
EXRATE	-0.0001**				-0.0001**				
	(0.0001)				(0.0000)				
FTTRADE	0.0026*					0.0023**			
	(0.0013)					(0.0011)			
HC	0.0006						0.0010		
	(0.0009)						(0.0010)		
INFLA	-0.0001							-0.0002***	
	(0.0001)							(0.0001)	
POPG	0.0041								0.0027
	(0.0165)								(0.0150)
CONSTANT	-0.1972*	0.0782***	0.0222	0.0773***	0.0871***	-0.0751	-0.0168	0.0843***	0.0798***
	(0.1168)	(0.0272)	(0.0184)	(0.0265)	(0.0302)	(0.0535)	(0.0796)	(0.0285)	(0.0292)
Model diagnostics									
Observations	472	472	472	472	472	472	472	472	472
Countries	23	23	23	23	23	23	23	23	23

Wald	53,752***	20,678***	18,810***	46,368***	30,909***	16,681***	23,892***	20,883***	26,330***
R squared	0.9177	0.9150	0.9156	0.9161	0.9152	0.9156	0.9151	0.9152	0.9150
Mean obs. Per group	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5
Estimator	RE	RE	RE	RE	RE	RE	RE	RE	RE

Notes: [a]Robust standard errors in parentheses. [b]*** p<0.01, ** p<0.05, * p<0.1. [c]Obs – observations.

Table 5. Robustness of key variables to control variables with agricultural trade openness.

	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)
VARIABLES	*ATO*	*ATO*	*ATO*	*ATO*	*ATO*	*ATO*	*ATO*	*ATO*	*ATO*
L.ATO	0.9411***	0.9672***	0.9634***	0.9727***	0.9647***	0.9509***	0.9596***	0.9659***	0.9684***
	(0.0237)	(0.0157)	(0.0175)	(0.0153)	(0.0162)	(0.0194)	(0.0143)	(0.0158)	(0.0161)
AIFDI	0.0767	0.0896*	0.1009**	0.0883*	0.0845*	0.0777	0.0939*	0.0794	0.0869*
	(0.0566)	(0.0487)	(0.0476)	(0.0494)	(0.0498)	(0.0534)	(0.0506)	(0.0515)	(0.0511)
AIFDI_TRS	-0.1264	-0.1222*	-0.1297**	-0.1180*	-0.1127*	-0.1411*	-0.1197*	-0.1235*	-0.1183*
	(0.0771)	(0.0654)	(0.0653)	(0.0671)	(0.0653)	(0.0734)	(0.0658)	(0.0660)	(0.0679)
AOFDI	-0.0260	-0.0034	-0.0007	-0.0109	0.0015	-0.0196	-0.0195	-0.0040	-0.0009
	(0.0815)	(0.0742)	(0.0702)	(0.0734)	(0.0742)	(0.0802)	(0.0811)	(0.0745)	(0.0770)
AOFDI_TRS	-0.0941	-0.1005	-0.1082	-0.0973	-0.1121	-0.1137	-0.0521	-0.1016	-0.0991
	(0.0979)	(0.0993)	(0.0911)	(0.0999)	(0.0994)	(0.0968)	(0.1137)	(0.0992)	(0.0996)
ADINV	0.2364*		0.1863						
	(0.1386)		(0.1196)						
AGDPG	-0.2859			-0.3663					

	(0.2502)			(0.2300)					
EXRATE	-0.0002**				-0.0001***				
	(0.0001)				(0.0001)				
FTTRADE	0.0042**					0.0045**			
	(0.0021)					(0.0019)			
HC	0.0032**						0.0036**		
	(0.0016)						(0.0018)		
INFLA	-0.0005***							-0.0006***	
	(0.0002)							(0.0001)	
POPG	-0.0126								-0.0115
	(0.0268)								(0.0266)
CONSTANT	-0.5304**	0.1093***	0.0346	0.1080***	0.1223***	-0.1935**	-0.2180	0.1257***	0.1027**
	(0.2310)	(0.0387)	(0.0357)	(0.0380)	(0.0413)	(0.0974)	(0.1490)	(0.0404)	(0.0439)
Model diagnostics									
Observations	472	472	472	472	472	472	472	472	472
Countries	23	23	23	23	23	23	23	23	23

Wald	28,028***	12,066***	11,837***	14,405***	13,049***	14.091***	14,599***	327***	12,995***
R squared	0.9261	0.9232	0.9235	0.9240	0.9233	0.9240	0.9237	0.9223	0.9232
Mean obs. Per country	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5
Estimator	RE	RE	RE	RE	RE	RE	RE	RE	RE

Notes: [a]Robust standard errors in parentheses. [b]*** p<0.01, ** p<0.05, * p<0.1. [c]Obs – observations.

Table 6. Complete models of the effect of foreign direct investment on trade in Eastern European countries.

	(1)	(10)	(19)	(28)	(29)	(30)
VARIABLES	*AEX*	*AIM*	*ATO*	*AEX*	*AIM*	*ATO*
L.AEX	0.9649***					
	(0.0206)					
L.AIM		0.9358***				
		(0.0220)				
L.ATO			0.9411***			
			(0.0237)			
AIFDI	0.0374	0.0341	0.0767	0.0204	0.0776	0.0979
	(0.0261)	(0.0329)	(0.0566)	(0.0560)	(0.0725)	(0.1193)
AIFDI_TRS	-0.0330	-0.0880**	-0.1264			
	(0.0326)	(0.0442)	(0.0771)			
AOFDI	0.0054	-0.0371	-0.0260	0.1730**	0.1117	0.2846**
	(0.0382)	(0.0458)	(0.0815)	(0.0667)	(0.0727)	(0.1341)
AOFDI_TRS	-0.0603	-0.0334	-0.0941			
	(0.0546)	(0.0457)	(0.0979)			
ADINV	0.0749	0.1704*	0.2364*	0.0757	0.1812	0.2569
	(0.0592)	(0.0875)	(0.1386)	(0.2705)	(0.1810)	(0.4361)
AGDPG	-0.0910	-0.1986	-0.2859	0.1820	0.1679*	0.3499
	(0.0981)	(0.1720)	(0.2502)	(0.1300)	(0.0942)	(0.2083)
EXRATE	-0.0001**	-0.0001**	-0.0002**	-0.0013**	-0.0031***	-0.0044***
	(0.0000)	(0.0001)	(0.0001)	(0.0006)	(0.0006)	(0.0011)

FTTRADE	0.0013	0.0026*	0.0042**	0.0208***	0.0183	0.0391***
	(0.0008)	(0.0013)	(0.0021)	(0.0026)	(0.0020)	(0.0044)
HC	0.0022***	0.0006	0.0032**	0.0125***	0.0062*	0.0187 ***
	(0.0009)	(0.0009)	(0.0016)	(0.0029)	(0.0032)	(0.0057)
INFLA	-0.0003***	-0.0001	-0.0005***	-0.0005***	-0.0003*	-0.0008**
	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0002)	(0.0003)
POPG	-0.0171	0.0041	-0.0126	-0.0685	-0.0600	-0.1285
	(0.0111)	(0.0165)	(0.0268)	(0.0545)	(0.0444)	(0.0944)
CONSTANT	-0.2908**	-0.1972*	-0.5304**	-2.0289***	-0.9656*	-2.9946***
	(0.1168)	(0.1168)	(0.2310)	(0.2272)	(0.2341)	(0.3766)
Model diagnostics						
Observations	472	472	472	496	472	472
Countries	23	23	23	23	23	23
Wald/ F statistics	16,553***	53,752***	28,028***	22.50***	370.30***	19,877***
R squared	0.9402	0.9177	0.9261	0.4099	0.7355	0.9251
Mean obs. per group	20.5	20.5	20.5	20.5	20.5	20.5
Estimator	RE	RE	RE	FE	FE	FE

Notes: [a]Robust standard errors in parenthesis in models 1, 10, and 19. [b]Driscoll-Kraay standard errors in parenthesis in models 28 - 30. [c]Wald and F statistics are for RE and FE respectively. [d]*** p<0.01, ** p<0.05, * p<0.1. [e]For the FE models, the POLS corrected the serial correlation. [f]Obs – observations.

Table 7. Total effects of agricultural foreign direct investment on agricultural trade in Eastern European countries.

	Exports	Imports	Trade openness
Transition Eastern European economies			
Inward foreign direct investment	0.0044	-0.0539	-0.0497
	[0.05]	[2.40]	[1.04]
Outward foreign direct investment	-0.0549	-0.0705	-0.1201
	[2.08]	[5.24]**	[3.31]*
Developed Eastern European economies			
Inward foreign direct investment	0.0374	0.0341	0.0767
	[2.05]	[1.07]	[1.84]
Outward foreign direct investment	0.0054	-0.0371	-0.0260
	[0.02]	[0.66]	[0.10]
All Eastern European economies			
Inward foreign direct investment	0.0204	0.0776	0.0979
	[0.13]	[1.14]	[0.67]
Outward foreign direct investment	0.1730	0.1117	0.2846
	[6.73]***	[2.36]	[4.51]**

Note: *** p<0.01, ** p<0.05, * p<0.1.