VOLUME 8, 2013 - ISSUE 1

ISSN 2045-3345

ISSN 2045-3345

RESEARCH JOURNAL OF ECONOMICS, BUSINESS AND ICT

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FOREIGN DIRECT INVESTMENT AND TRADE: A GENERALIZED SPATIAL TWO-STAGE LEAST SQUARES

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ABSTRACT

Within the generalized spatial two stage least squares framework, this paper test for the relevance of third country effects for U.S. outward foreign direct investment (FDI), and also analyses the relationship between Foreign direct investment and trade. The empirical results indicate the significance of third country effects. Additionally, I find a complementary relationship between foreign direct investment and trade.

JEL CLASSIFICATION & KEYWORDS

■ C31 ■ F21 ■ F23 ■ FOREIGN DIRECT INVESTMENT ■ EXPORTS ■ GENERALIZED SPATIAL TWO-STAGES LEAST SQUARES

INTRODUCTION

Foreign direct investment (FDI) and international trade are often seen to promote economic growth. Foreign direct investment (FDI) has grown at a faster rate than most international transactions, in particular bilateral trade flows between countries (Blonigen, 2005). FDI is a cross border investment of "lasting interest" undertaken by multinational corporations in an existing enterprise when the direct investor owns at least 10% of the voting power (OECD, 2010). It is a valuable source of capital allowing the introduction of new technology, and stimulating domestic investment as well as facilitating improvements in the competitiveness of domestic firms by providing advanced managerial skills (Balasubramanyan et al. 1996).

Multinational corporations (MNCs) making investment decisions in a foreign country can be explained either by the market access motive or the comparative advantage motive. The first motive is known as the proximity concentration trade-off and refers to horizontal FDI in which a MNC production facility is designed to serve customers in the foreign market to avoid higher transport costs and trade barriers (Brainard, 1997). The second motive of MNC arises to exploit international factor price differentials by engaging in unskilled labor-intensive production in an unskilled labor-abundant host country, referred as vertical FDI (Baltagi et al.2007).

Direct investment by MNCs may also be a hybrid of both horizontal and vertical FDI known as complex FDI which is a function of parent and host countries characteristics such as the level of transport cost, the factor intensity of production, and the cost of investing abroad, as well as host neighbors policies and characteristics (Yeaple, 2003). Complex FDI strategies fragment production between parent and host country to serve the home market or "third market".

Recent studies use spatial econometrics to confirm the presence of third country effects to explain multinational investment decisions. That is to say a home country invests in a particular host country with the intention of serving "third markets" with exports of final goods from the affiliate in the host country (Blonigen et al. 2007). Baltagi et al. (2007) apply a spatial panel data with spatially correlated error components, and they find evidence of the presence of complex FDI, leading to the importance of third country effects. Gerretsen and Peeters (2009) analyze Dutch outbound FDI into 18 OECD host countries using the spatial autoregressive model, and they find support of the presence of complex vertical FDI with agglomerations economies.

On the other hand, spatial econometrics has been used in international trade studies to capture the cross sectional interdependence across trade flows. Behrens et al. (2007) provide evidence that the spatial autoregressive moving average model generates unbiased and consistent parameter estimates.

This paper contributes to the literature by applying the generalized spatial two stage least squares to test for the relevance of the third country effects. The advantage of the generalized spatial two stage least squares is that it also investigates whether FDI and trade are substitutes or complements. The proximity–concentration trade off hypothesis states that firms invest abroad when the gains from avoiding trade costs outweigh the advantage from production scale economies (Brainard 1997). Therefore, FDI as a consequence of distance substitute trade. On the other hand, complementary of FDI and trade suggest that the spillover effects on MNC on the productivity of local firms in host countries resulting from vertical FDI.

Estimation methods

Recently, Baltagi et al. (2007) point out that the third country effects are important if trade costs are reduced between countries i and j and the distance between i and j is small. Blonigen et al. (2007) state that MNC decisions to invest in a particular country depends on the size of the proximity markets it will be serving through exports, known as the surrounding market potential or the market potential. They also provide theoretical hypotheses to specific FDI theories by combining the expected sign of the spatial autoregressive model and the market potential. The market potential variable for region i is the accessibility of market j to goods shipped from country i (Head and Mayer, 2004). Table 1 summarizes the expected signs to identify four types of MNC strategies.

Table 1: Summary of hypothesized spatial lag and the surrounding market potential variable

FDI motivation	Sign of spatial lag	Sign of surrounding-market potential variable
Horizontal FDI	0	0
Vertical FDI	–	0
Export Platform	–	+
Complex FDI	+	0/+

Source: Baltagi et al. (2007) and Blonigen et al. (2007)

Next, I construct an inverse distance weight matrix based on the smallest distance between i and j to derive the market

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potential. An inverse distance matrix W_y $(d_{i,j})$ identifies the geographical relationship among host countries by dividing each observation by the shortest bilateral distance. The matrix W_y is a balanced matrix since distances are time invariant. The shortest distance in my sample is 173.033 km, separating Belgium and Netherlands that receives a weight of unity and all other distances within the sample a weight that declines as follows:

$$W_y(d_{i,j}) = \frac{173.033}{d_{i,j}} \text{ " } i \neq j \quad (1)$$

where W_y is a matrix of all W_y $(d_{i,j})$ defined as:

$$W_y = \begin{pmatrix} 0 & W_y(d_{i,j}) & W_y(d_{i,k}) \\ W_y(d_{j,i}) & 0 & W_y(d_{j,k}) \\ W_y(d_{k,j}) & W_y(d_{k,j}) & 0 \end{pmatrix} \quad (2)$$

As is standard in spatial econometrics, the inverse distance matrix is row standardized so that each row sums to unity. The market potential includes not only the GDP of FDI host country but also the inverse distance weight matrix weighted by the GDPs of other locations (Garretsen and Peeters, 2009). It is defined as the row sum of the product inverse distance weight matrix and the vector of all host GDP countries in the sample.

Following Kelejian and Prucha (2004), I apply a spatial panel simultaneous system of equations where all variables are in natural logarithm as follows:

$$exports = a_0 + r(IdW_y)exports + a_1 FDI + a_2 GDP + a_3 dist + a_4 lang + a_5 col + m_1 \quad (3)$$

$$FDI = a_0 + r(IdW_y)FDI + a_1 Exports + a_2 GDP + a_3 POP + a_4 MP + a_5 dist + a_6 Nafta + m_2 \quad (4)$$

$$\text{where } m_1 = \bar{U}_1 R + E_1 \text{ and } m_2 = \bar{U}_2 R + E_2 \quad (5)$$

where μ_1 and μ_2 are the disturbance of the spatial error; R is taken to be a diagonal matrix; $\bar{U}_1$ and $\bar{U}_2$ are the spatial lag of the spatial error; and E_1 and E_2 are the error terms. W_y is the inverse distance weight matrix of dimension nxn, which is the same in the system and depends on its own spatial lags as well as the spatial lags of other endogenous variables; ρ is the spatial autoregressive coefficient to be estimated assumed to lie between -1 and 1; I is the identity matrix of dimension T, and δ is the kronecker product. Since the W_y is row standardized, then (IδW_y) FDI is interpreted as row-sums being a proximity-weighted average of FDI into alternative countries (Blonigen et al., 2007) and (IδW_y) exports is the weighted average of neighboring countries exports (Porojan, 2001). GDP and POP stand for gross domestic product and population of host countries, while distance is the distance between home and host countries. MP is the market potential; dummy variables indicating whether home and host country: have the same language (lang), have a colonial relationship (col) take the value of 1, and 0 otherwise.

NAFTA is dummy variable taking the value of 1 if both home and host countries are member of the regional trade agreement and 0 otherwise.

Estimating equations (3) and (4) requires an instrumental variable since the dependent variable also appears in the exogenous variables. To circumvent this issue, Kelejian and Prucha (2004) point out that the inverse distance weight matrix defined above represents an instrument matrix for estimation purposes. Moreover, in a linear simultaneous equation model, Greene (2003) states that the order condition, which is a necessary but not a sufficient condition, requires that the number of exogenous variables excluded from one equation must be at least as large as the number of dependent variables included in that equation. Thus the order condition of my system is fulfilled because (3) excludes two variables, while (4) excludes three variables.

Finally, the simultaneous system of equation is estimated by a generalized spatial two stage least squares, three step procedure. In the first step the equations are estimated by two stage least squares (2SLS) using the inverse distance weight matrix as an instrument. In the second step, the autoregressive parameter ρ is estimated by the generalized method of moments procedure introduced in Kelejian and Prucha (1999). In the third step, the estimate for ρ accounts for the spatial autocorrelation in a Cochran–Orcutt transformation.

Data and empirical results

Data

The empirical analysis is performed with a panel of annual data on U.S. Direct Investment Abroad into 24 OECD host countries taken from the U.S Bureau of Economic Analysis (BEA) for the period 1999-2009 is used for foreign direct investment. The U.S. Direct Investment Abroad is U.S. outward direct investment stock measured at the historical cost basis expressed in millions of dollars of operations of parent companies and their foreign affiliates (BEA, 2011).

Trade data are total exports from the United Nations Commodity Trade Statistics Database (UNCOMTRADE) under the Standard International Trade Classification system (SITC- Revision.3). Host countries GDPs and population data come from the World Development Indicators (WDI). Distance, language, and colony data are drawn from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII).

I chose U.S. outward direct investment to OECD countries for two reasons. First, this allows me to test the third country effects by isolating vertical FDI, since horizontal FDI is more prevalent among industrialized countries (Aizenman and Noy, 2006). Second, as noted by Blonigen and Wang (2004), pooling rich and poor countries in empirical FDI studies is inappropriate, leading to misleading results.

Empirical results

Estimation results for the generalized spatial two stage least squares are presented in Table 1. Column1 displays the result of the FDI equation, while column 2 shows the result of the export equation. In column (1), the estimated coefficients on GDP and population have the expected sign and are statistically significant at the 1 % level. For example the positive sign of GDP indicate that the larger the economic size of an economy, the greater potential to attract FDI, while a negative coefficient on population suggests that lower capital stock per worker available for production, ceteris paribus, thereby discouraging the flows of FDI. The variable NAFTA is statistically insignificance.

The market potential has a strong effect in attracting FDI from the U.S. This findings (see Table 2) suggests that U.S. FDI increases if a particular country has a large market potential, in other words, it is surrounded by countries with relatively large GDP levels. A positive and statistical significance of the spatial autoregressive associated with the market potential confirm the presence of the complex FDI with agglomeration economies. This result is in line with Garretsen and Peeters (2009) who support this finding for

Table 2: Generalized spatial two stage least squares		
Variable	FDI -1	Exports -2
Constant	-9.24*	-3.91*
	(-3.78)	(-2.37)
GDP	0.67*	0.89*
	(4.72)	(25.22)
Population	-0.66*	–
	(-7.11)	
Distance	-0.38*	-0.64*
	(-2.09)	(-8.22)
Language	–	0.32*
		(2.52)
Market potential	0.20*	–
	(2.26)	
Colony	–	-0.74*
		(-6.09)
NAFTA	-0.17	–
	(-0.35)	
Exports	0.59*	–
	(6.41)	
FDI	–	0.25*
		(8.10)
p	0.81*	0.72*
	(6.88)	(7.00)
Notes : T-statistics are in parentheses; * Significant at the 1% level.		

Dutch FDI into OECD countries. The coefficient estimate of export is positive and statistically significant at the 1% level. This result suggests a 1% increase in exports causes FDI to increase by 0.59%, implying a complementary relationship between U.S. FDI and exports for OECD countries. This result is consistent with findings in Clausing (2000) who finds a complementary relationship between U.S. FDI and exports to OECD countries.

Column 2 of Table 2 presents the result for the export equation. The parameter estimate on GDP positively influences exports while distance negatively impacts exports. The variable language has clear strong effect of attracting U.S. exports. The coefficient estimate of colony is statistical significant, but it has the opposite sign. With regard to the relationship between FDI and exports, the positive statistical significance of FDI in column2 reinforces results from column 1. The parameter estimate on FDI suggests that a 1% increase in FDI causes a 0.25% increase in exports. Thus a complementary relationship exists between FDI and exports. The coefficient estimate of the spatial autoregressive is positive and statistically significant at the 1% level. This implies that a 1% increase in export causes a 0.72% increase of the proximity weighted average exports of host countries.

Conclusion

This paper test for the relevance of third country effects for U.S. outward FDI, and also establishes the relationship between FDI and trade between the U.S. and 24 OECD countries over the period 1999-2009. Using the generalized spatial two stage least squares, I find evidence of the complex FDI with agglomeration economies, suggesting that investment of MNCs is a function of country characteristics as well as characteristics of its neighbors in attracting FDI. Additionally, results show a complementary relationship between FDI and trade. The empirical results for exports also indicate complementary relationship between FDI and trade. This finding suggests that host countries will benefit attracting FDI to gains from spillover effects.

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