This paper analyzes the impacts of foreign direct investment (FDI) in producer services. We focus on two likely effects of FDI in producer services: bilateral and third-country effects which foster the development of producer services industries; and economic integration which deters the presence of producer services. To illustrate how these forces work, we develop the Knowledge-capital model of Baltagi et al. (2007) by following the theoretical concepts of Markusen and Strand (2009). Using numerical simulation, the theoretical implications show that bilateral and third-country effects as well as economic integration dominates FDI in producer services. Afterwards, we investigate on how changes of determinants influence the U.S. FDI in producer services to ASEAN economies over the periods 1999-2008. Applying spatial panel data technique, we find that there are substantially impacts of bilateral and third-country characteristics and economic integration on FDI in producer services. Specifically, the empirical evidence tends to support theoretical implications on FDI in producer services.

JEL Classification: L80; F23; F15

Keywords: Foreign direct investment; Producer Services; ASEAN region

1. Introduction

Foreign direct investment (FDI) in services has been rapid growth in the last two decade and has become an increasing significant factor in various economies, especially the Association of Southeast Asian Nations (ASEAN). In the recent year, FDI in manufacturing and services sector accounted for almost all of total gross capital inflows to ASEAN. The inward FDI to the ASEAN steadily rose by 98% from 2004 to 2007 with a considerable increase in FDI in services sector by 74.5% and an expansion in FDI in manufacturing sector by 43% (ASEAN Secretariat 2008). Specifically, FDI in producer services increased by 57% during 2004 to 2007 captured the main share of growth in services sector in the ASEAN. It argues that the producer services industry has emerged as the fastest-growing services sector in the ASEAN. More specifically, ASEAN’s FDI in producer services industry has grown in parallel with FDI in manufacturing industry; in other words, there was strong linkage between producer services and manufacturing industry, which was also suggested by Engelbrecht (1992) and Park (1994). Indeed, the implementation of ASEAN integration agreements since the financial crisis in 1997 has fueled the growth of FDI
flows to ASEAN. Among the ASEAN agreements are the ASEAN Investment Area (AIA) agreement in 1998 enlarged through the ASEAN Comprehensive Investment Agreement (ACIA) in 2007; and the ASEAN Framework Agreement on Services (AFAS) in 1995. However, FDI inflows slightly declined 13% in 2008 as a result of the global economic slowdown and financial crisis.

Recent theoretical and empirical studies on determinants of FDI have focused on foreign direct investment in manufacturing and services sector and very few studies exist for FDI in producer services. The theoretical literature on producer services is rare and limited to the trade theory of producer services (Marrewijk et al., 1997) and theory of multinational enterprises and Knowledge-capital (KC) model focusing on bilateral determinants of FDI in producer services (Markusen and Strand, 2009; Markusen et al., 2005; Ishikawa et al., 2010; Raff and Ruhr, 2001; Long et al., 2005). Generally, the theoretical implications indicated that significant factors of FDI in producer services are country’s market size, factor endowments, labor wage, cultural distance and openness. They also indicated that home-country business presence, competitive advantages, global oligopolistic reaction, industry concentration, tradability of services, growth of firm size, local customer base, infrastructure, and reputation are determinants of producer-services FDI, as suggested by UNCTC (1993), Banga (2005) and Sandhu and Fredericks (2005). Nevertheless, there exists very limited literature on the theoretical framework for third-country determinants of FDI in producer services.

In line with the empirical literature, there were a few empirical studies regarding determinants of FDI in producer services, for example, Raff and Ruhr (2001), Yang and Huang (2008) and Nefussi and Schwellnus (2010). The others tended to indicate determinants influencing the entry of multinational enterprises (MNEs) in services sector (Kox and Lejour, 2004; Feng, 2007; Kolstad and Villanger, 2008; Wang and Wang, 2009; Babic-Hodovic et al., 2010) and in such services industries (Te Velde and Nair, 2005; Buch and Lipponser, 2005). Moreover, in spite of the rapid growth of services FDI flows, there exists very limited empirical literature on the determinants of FDI in services for developing countries. Particularly, empirical studies on services FDI flows to ASEAN countries have not been widely investigated although there has been an expansion of ASEAN FDI in all services and producer services since the signing of the AFAS in 1995.

The contribution to this paper is to fill the lack of existing studies, in theoretical and empirical. It seems to be useful to provide the insight about the reasons for which ASEAN countries remain so slightly attractive. The first main contribution is to develop the KC model of complex MNEs noted by Baltagi et al. (2007), Uttama and Péridy (2009), Markusen and Strand (2009) and Markusen et al. (2005). The numerical simulation from general-equilibrium model provides the theoretical hypotheses on determinants of FDI in producer services. Secondly, the paper contributes to investigate the impacts of country’s characteristics and economic integration on the entry of U.S. MNEs in producer services in ASEAN’s manufacturing industries. Not only do we utilize bilateral determinants, but we also employ third-country determinants to capture the effects on FDI in producer services. An analysis from the U.S. to ASEAN countries is performed using data on bilateral U.S. outward FDI stock and affiliate sales at the industry level, covering five ASEAN economies over the period 1995-2008. The spatial panel data estimation, namely Maximum Likelihood is introduced because the Moran’s I test indicates the presence of spatial correlation of the residuals. The results illustrate evidence whether bilateral and third-country effects and regional integration would certainly attract the FDI in
producer services from the U.S. to ASEAN. These findings also give important policy implications on the national and international level. Especially, governments could attract either foreign investor in producer services by adopting services stability policy, enhancing services integration and liberalization, promoting trade and investment services alliance network in ASEAN economies, and accelerating the implementation of the existing ASEAN investment agreements.

The rest of the paper is organized as follows. Section 2 describes theoretical framework and theoretical implications. Thereafter, section 3 provides model specification and examines empirical evidence on ASEAN countries and robustness check of our results. Policy implications for ASEAN economies are discussed and future research is highlighted in a final section.

2. Theoretical framework

In general, theory of foreign direct investment in producer services is applied from theory of FDI in manufacturing sector. In this paper, we focus on the theoretical literature on complex FDI in manufacturing sector suggested by Baltagi et al. (2007) and further improved by Uttama and Péridy (2009). Their theoretical implications pointed out the significant role of bilateral- and third-country characteristics and economic integration on bilateral complex FDI. However, the question of how the Knowledge-capital model explains the determinants of FDI in producer services seems under-researched. In order to motivate our empirical analysis of the impacts of foreign direct investment in producer services, this section develops the KC model to illustrate the main forces at hand.

We start with modeling complex multinational activities in the KC model with respect to Markusen and Strand (2009) and Markusen et al. (2005). From this model, we explore the bilateral and third-country determinants of FDI in producer services. The model is assumed with two goods: homogeneous (Y) and differentiated (X) goods; three countries: home (i), host (j) and third (k) country and four factors: physical capital (K), skilled labor (S), unskilled labor (L) and producer services (Q). In addition, there are three types of firms in the X industry: national firm (n), horizontal MNE (h) and vertical MNE (v). National manufacturing firm maintains plant domestically; horizontal manufacturing firm maintains similar plant in home and host country with headquarters in home country; and vertical manufacturing firm fragments production plant in host and third countries with headquarters in home country. Multinational enterprises’ headquarters in i serve their affiliates with physical capital and skilled labor. Homogeneous goods are produced with constant returns to scale and perfect competition by using unskilled labor only. Conversely, the production of the differentiated good uses the four factors. Producer services are produced with scale economies by using only skilled labor and are assumed that one unit of producer services is performed for one unit of goods to be consumed.

Demand

We assume Dixit and Stiglitz (1977) framework for homogenous and differentiated goods aggregated by a Cobb-Douglas function. Then, we derive a utility function where consumer utility depends on (i) the quantity of good X consumed in the home country (i) and produced by domestic firms, horizontal and vertical MNE as well as the quantity of good X produced in the host and third country (j and k), and (ii) the quantity of good Y produced in each country.
\[ U_i = \left[ N_{ii} X_i^{\frac{1}{\varepsilon}} + N_{ji} \left( \frac{X_j}{T_{ji}} \right)^{\frac{1}{\varepsilon}} + N_{ki} \left( \frac{X_k}{T_{ki}} \right)^{\frac{1}{\varepsilon}} \right] \left[ Y_i + Y_j + Y_k \right]^{1-\alpha} \] (2-1)

where \( U_i \) is country \( i \)'s utility \((i = 1, 2, 3); \alpha \) denotes the Cobb-Douglas expenditure share for differentiated products; \( \varepsilon > 1 \) is the elasticity of substitution between varieties. \( N_{ii}, N_{ji}, N_{ki} \) are number of firms serving market \( i \) from plants in \( i, j \) and \( k \). 

\( N_{ii} = n_i + h_{ij,ik} + h_{ji,jk}, N_{ji} = n_j + v_{jk,ji}, N_{ki} = n_k + v_{ik,ji} \) where \( n_i, n_j, n_k \) are national firm in \( i, j \) and \( k \). \( h_{ij,ik} \) and \( h_{ji,jk} \) are horizontal and export-platform multinational firm, \( v_{jk,ji} \) is complex vertical multinational firm. \( T_{ji}, T_{ki} \) are gross trade costs for shipping goods from \( j \) and \( k \) to \( i \); \( T_{ji} = (1 + t_{ji}) (1 + \tau_{ji}) \) and \( T_{ki} = (1 + t_{ki}) (1 + \tau_{ki}) \) where \( t \) is iceberg transport cost and \( \tau \) is tariff rate on imports. National and multinational firms are assumed to have identical technologies throughout.

After maximizing the utility function subject to a budget constraint, product market clearing equations are given by:

\[ X_i \geq p_i^{-\varepsilon} I_i^{1-\varepsilon} aM_i \quad \perp \quad p_i \geq 0 \] (2-2)

\[ X_j = p_j^{-\varepsilon} T_{ji}^{1-\varepsilon} I_i^{1-\varepsilon} aM_i \] (2-3)

\[ X_k = p_k^{-\varepsilon} T_{ki}^{1-\varepsilon} I_i^{1-\varepsilon} aM_i \] (2-4)

\[ Y_i + Y_j + Y_k \geq \left( \frac{1 - \alpha}{q_i} \right) M_i \quad \perp \quad q_i \geq 0 \] (2-5)

where \( \perp \) indicates that at least one of the adjacent conditions has to hold with equality; \( M_i \) is income (and expenditure) of the representative consumer in \( i \); \( p_i, p_j, p_k \) reflect the price of X-varieties in \( i, j \) and \( k \); and \( q_i \) refers to the price of Y-goods in \( i \). Assuming that prices of homogeneous good consumed in such country are identical no matter where the good originates from. There is no price discrimination on X varieties. The prices of goods \( X \) originating from \( j \) and \( k \) exported to \( i \) have to encounter different trade costs which amounts to \( p_j (1 + t_{ji})(1 + \tau_{ji}) \) and \( p_k (1 + t_{ki})(1 + \tau_{ki}) \), respectively.

The price index of differentiated varieties \((I_i)\) in region \( i \) is defined as

\[ I_i^{1-\varepsilon} = N_{ii} p_i^{1-\varepsilon} + N_{ji} (p_j T_{ji})^{1-\varepsilon} + N_{ki} (p_k T_{ki})^{1-\varepsilon} \] (2-6)

The budget constraint of consumer in country \( i \) is given by

\[ M_i = w_{ki} K_i + w_{sr} S_i + w_{lu} L_i + \left( \tau_{ki} N_{ki} p_i X_{ki} - \tau_{ij} N_{ij} p_j X_{ij} \right) + \left( \tau_{ij} N_{ij} p_j X_{ij} - \tau_{ik} N_{ik} p_i X_{ik} \right) + \left( \tau_{ji} q_i Y_{ji} - \tau_{ij} q_j Y_{ij} \right) + \left( \tau_{ji} q_j Y_{ji} - \tau_{ik} q_k Y_{ki} \right) + \left( \tau_{ki} q_k Y_{ki} - \tau_{ij} q_j Y_{ij} \right) + \left( \tau_{ki} q_j Y_{ji} - \tau_{ik} q_k Y_{ki} \right) \] (2-7)

where \( w_{ki}, w_{sr}, w_{lu} \) are factor rewards of physical capital, skilled labor and unskilled labor respectively; \( p_{Qj}, p_{Qj}, p_{Qk} \) reflect the price of producer services in \( i, j \) and \( k \). In the right hand side, the first three terms denote factor income; the last six terms denote tariff revenue by the government in country \( i \) back to the representative
consumer. The equivalence of total factor income \( (M_i, M_j, M_k) \) and demand in each economy implicitly balances international payments.

Supply

There are two good sectors in the economy: homogeneous and differentiated good sector. The homogeneous good is produced for a perfectly competition market using a technology with constant returns to scale and requires only unskilled labor in its production. The differentiated good sector is monopolistically competitive. It produces differentiated good under a constant elasticity of substitution (CES) technology using physical capital, skilled labor, unskilled labor and producer services, and faces increasing returns to scale in production. Physical capital and skilled labor enter into the fixed costs to set up plants and to generate firm-specific assets (e.g. headquarters services, R&D, producer services and so on) respectively, whereas unskilled labor only enter the variable costs of production. Producer services are used to serve the differentiated good directly through the market. The producer services are only supplied domestically and/or internationally and are non-tradable. All firms employ four primary factors in \( X \) production under the same technology. The variable unit costs of differentiated goods in country \( i \) are given by

\[
c_{xi} = a_{kx}w_{ki} + a_{sx}w_{si} + a_{lx}w_{li} + a_{qx}p_{qi} \tag{2-8}
\]

where \( a_{kx}, a_{sx}, a_{lx}, a_{qx} \) are the country-specific unit input coefficient for capital, skilled, unskilled labor and producer services, respectively. The production of the differentiated good \( X \) in \( i \) for local and foreign markets is given by a nested CES production function:

\[
Y_{xi}(K, S, L, Q) = \phi \left[ aK_i^{\varepsilon} + bS_i^{\varepsilon} + cL_i^{\varepsilon} + dQ_i^{\varepsilon} \right] \tag{2-9}
\]

with \( a+b+c+d =1 \) and \( \varepsilon>1 \) reflects the elasticity of substitution between inputs. \( K, S \) and \( L \) are the quantities of capital, skilled and unskilled labor used for production, whereas and \( Q \) is the CES aggregate of producer services given by

\[
U_{qxi} = \left[ N_x Q_{xi}^{\varepsilon} + N_{qj} \left( Q_{xi} / T_{ji} \right)^{\varepsilon} + N_{qj} \left( Q_{xi} / T_{ji} \right)^{\varepsilon} \right] \tag{2-10}
\]

where \( U_{qxi} \) is the CES aggregate of producer services and \( \varepsilon>1 \) is the elasticity of substitution between various producer services. \( Q_{xi}, Q_{xj}, Q_{xk} \) are the output of representative firm in \( i, j, k \) supplying producer services to \( i \). The price index of various producer services \( \left( P_{qi} \right) \) consumed in country \( i \) can be written as

\[
I_{qi}^{-\varepsilon} = N_x p_{qi}^{-\varepsilon} + N_{qj} \left( p_{qi} T_{ji} \right)^{-\varepsilon} + N_{qj} \left( p_{qi} T_{ji} \right)^{-\varepsilon} \tag{2-11}
\]

The production of the producer services for local markets in country \( i \) (\( Q_{xi} \)) is given by Cobb-Douglas production function:

\[
Q_{xi} = \sum \left[ n_i S_{qi}^{\varepsilon} \right] \tag{2-12}
\]
where $S$ is the quantity used of skilled labor in country $i$ to produce producer services ($Q_{Xi}$). The above technology yields the conditional factor demand and input coefficient: $S_{Q_i} = a_{SQ}Q_{Xi}$ where $a_{SQ}$ is country specific input coefficient for skilled labor for producer services production. Assuming that producer services is under Dixit and Stiglitz (1977) framework which requires free entry and exit condition, price of producer services in home-country firms is given as: 

$$p_{XQ} \left[ 1 - \frac{1}{\varepsilon} \right] \leq c_{Qi}$$

where $c_{Qi}$ is marginal cost of producer services in country $i$. A producer in the producer services market equilibrium is faced with demand as

$$Q_{XQ} = p_{XQ}^{-\varepsilon} r_{XQ} a_{QX} (N_{QX})$$

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In setting up a production plant abroad, MNE with headquarters in $i$ has to supply the fixed firm inputs of capital and skilled labor from $i$. Suppose that $a$ is the amount of skilled labor required to run headquarters services and producer services; and $g$ is the amount of capital required to set up a production facility. If their values are equal to one in local production, $a - 1 > 0$ units of skilled labor and $g - 1 > 0$ units of capital are required to operate plant abroad. On the one hand, a requirement of a fixed firm input of skilled labor amounts $a$ units for each type of MNEs. That is because it arises from the joint-input nature of skill-intensive activities. On the other hand, a requirement of a fixed plant input of physical capital amounts $1 + g$ units for $h_{ij,k}$ and $h_{ij,k}$ type of MNEs and $2g$ units for $V_{ijk}$ and $V_{ijk}$ type of MNEs.

Factor demand for differentiated goods is derived from the production by using a standard Lagrange optimization approach:

$$L = K_i w_{K_i} + S_i w_{S_i} + L_i w_{L_i} + Q_i p_{Q_i} + \lambda \left[ Y_{Xi} - \phi \left( aK_{i}^{\varepsilon - 1} + bS_{i}^{\varepsilon - 1} + cL_{i}^{\varepsilon - 1} + dQ_{Xi}^{\varepsilon - 1} \right) \right]$$

(2-16)

The first order conditions are:

$$\frac{\partial L}{\partial K_i} = w_{K_i} - \lambda \phi aK_{i}^{\varepsilon - 1} \left( aK_{i}^{\varepsilon - 1} + bS_{i}^{\varepsilon - 1} + cL_{i}^{\varepsilon - 1} + dQ_{Xi}^{\varepsilon - 1} \right)^{\frac{1}{\varepsilon - 1}} = 0$$

(2-17)

$$\frac{\partial L}{\partial S_i} = w_{S_i} - \lambda \phi bS_{i}^{\varepsilon - 1} \left( aK_{i}^{\varepsilon - 1} + bS_{i}^{\varepsilon - 1} + cL_{i}^{\varepsilon - 1} + dQ_{Xi}^{\varepsilon - 1} \right)^{\frac{1}{\varepsilon - 1}} = 0$$

(2-18)

$$\frac{\partial L}{\partial L_i} = w_{L_i} - \lambda \phi cL_{i}^{\varepsilon - 1} \left( aK_{i}^{\varepsilon - 1} + bS_{i}^{\varepsilon - 1} + cL_{i}^{\varepsilon - 1} + dQ_{Xi}^{\varepsilon - 1} \right)^{\frac{1}{\varepsilon - 1}} = 0$$

(2-19)

$$\frac{\partial L}{\partial Q_{Xi}} = p_{XQ} - \lambda \phi dQ_{Xi}^{\varepsilon - 1} \left( aK_{i}^{\varepsilon - 1} + bS_{i}^{\varepsilon - 1} + cL_{i}^{\varepsilon - 1} + dQ_{Xi}^{\varepsilon - 1} \right)^{\frac{1}{\varepsilon - 1}} = 0$$

(2-20)
\[
\frac{\partial L}{\partial \lambda} = Y_{Xi} - \phi \left( a K_i^{\varepsilon-1} + b S_i^{\varepsilon-1} + c L_i^{\varepsilon-1} + d Q_{Xi}^{\varepsilon-1} \right)^{\varepsilon-1} = 0
\]  

(2-21)

Dividing (2-18), (2-19) and (2-20) by (2-17), we obtain:

\[
S_i = \left( \frac{a w_{Si}}{b w_{ki}} \right)^{\varepsilon-1} K_i
\]

(2-22)

\[
L_i = \left( \frac{a w_{Li}}{c w_{ki}} \right)^{\varepsilon-1} K_i
\]

(2-23)

\[
Q_{Xi} = \left( \frac{a p_{Qi}}{d w_{ki}} \right)^{\varepsilon-1} K_i
\]

(2-24)

Inserting (2-22), (2-23) and (2-24) into (2-21) makes it possible to obtain the demand for physical capital for the production of good X:

\[
K_i = Y_{Xi} \frac{1}{\phi} \left( a + b H_{1i} + c H_{2i} + d H_{3i} \right)^{\varepsilon-1} = Y_{iX} a_{XX}
\]

(2-25)

where: \( H_{1i} = \left( \frac{a w_{Si}}{b w_{ki}} \right)^{\varepsilon-1} \); \( H_{2i} = \left( \frac{a w_{Li}}{c w_{ki}} \right)^{\varepsilon-1} \); \( H_{3i} = \left( \frac{a p_{Qi}}{d w_{ki}} \right)^{\varepsilon-1} \) and \( a_{XX} \) is the country specific input coefficient for physical capital of good X’s production. Inserting equation (2-25) into (2-22), (2-23) and (2-24) we derive the other factor demands for the production of good X:

\[
S_i = Y_{Xi} \frac{1}{\phi} \left( \frac{H_{1i}^\varepsilon}{H_{2i}^\varepsilon} \right) \left( a + b H_{1i} + c H_{2i} + d H_{3i} \right)^{\varepsilon-1} = Y_{iS} a_{SX}
\]

(2-26)

\[
L_i = Y_{Xi} \frac{1}{\phi} \left( \frac{H_{2i}^\varepsilon}{H_{3i}^\varepsilon} \right) \left( a + b H_{1i} + c H_{2i} + d H_{3i} \right)^{\varepsilon-1} = Y_{iL} a_{LX}
\]

(2-27)

\[
Q_{Xi} = Y_{Xi} \frac{1}{\phi} \left( \frac{H_{3i}^\varepsilon}{H_{1i}^\varepsilon} \right) \left( a + b H_{1i} + c H_{2i} + d H_{3i} \right)^{\varepsilon-1} = Y_{iQ} a_{QX}
\]

(2-28)

Finally, factor market clearing conditions which ensure all factors are fully employed in X-goods, Y-goods and producer services production for country \( i \) can be derived as

\[
K_i \geq a_{XX} \left( N_{ii} X_{ii} + N_{ij} X_{ij} + N_{ik} X_{ik} \right) + n_i \left( 1 + g \right) \left( h_{ij,ik} + h_{ij,ji} \right) + 2g \left( v_{ji,ij} + v_{ji,ki} \right)
\]

(2-29)

\[
\perp w_{ki} \geq 0
\]

\[
S_i \geq a_{SX} \left( N_{ii} X_{ii} + N_{ij} X_{ij} + N_{ik} X_{ik} \right) + a_{SY} \left( N_{ii} Q_{Xi} + N_{ij} Q_{Xj} + N_{ik} Q_{Xk} \right) + n_i + a \left( h_{ij,ik} + h_{ij,ji} + v_{ji,ij} + v_{ji,ki} \right)
\]

(2-30)

\[
\perp w_{Si} \geq 0
\]

\[
L_i \geq a_{LX} \left( N_{ii} X_{ii} + N_{ij} X_{ij} + N_{ik} X_{ik} \right) + Y_i + Y_j T_{ij} + Y_k T_{jk}
\]

(2-31)

\[
\perp w_{li} \geq 0
\]

\[
Q_{Xi} \geq a_{QX} \left( N_{ii} X_{ii} + N_{ij} X_{ij} + N_{ik} X_{ik} \right)
\]

(2-32)

\[
\perp p_{Qi} \geq 0
\]
Zero profit condition

The product market equilibrium in the differentiated good sector is a key to analyze multinational activities. In doing so, we look first at the structure of MNE activity determined jointly by market clearing conditions and zero profit conditions with respect to each type of firms which are derived below. To obtain zero profit conditions in each type of firms, the assumption of free entry and exit is required. The zero profit conditions are written individually as follows.

\[
\Pi_{Q_{X_i}} : p_i (X_{i} + X_{j} + X_{k})/\varepsilon \leq 0 \\
\downarrow Q_{X_i} \geq 0
\]

(2-33)

\[
\Pi_{n_i} : p_i (X_{i} + X_{j} + X_{k})/\varepsilon - w_{Si} - w_{K_i} \leq 0 \\
\downarrow n_i \geq 0
\]

(2-34)

\[
\Pi_{h_{ij,k}} : (p_{i} X_{i} + p_{j} X_{j} + p_{k} X_{k})/\varepsilon - aw_{Si} - (1 + g)w_{K_i} \leq 0 \\
\downarrow h_{ij,k} \geq 0
\]

(2-35)

\[
\Pi_{h_{ij,s}} : (p_{i} X_{i} + p_{j} X_{j} + p_{k} X_{k})/\varepsilon - aw_{Si} - (1 + g)w_{K_i} \leq 0 \\
\downarrow h_{ij,s} \geq 0
\]

(2-36)

\[
\Pi_{v_{jk,i}} : (p_{i} X_{i} + p_{j} X_{j} + p_{k} X_{k})/\varepsilon - aw_{Si} - 2 gw_{K_i} \leq 0 \\
\downarrow v_{jk,i} \geq 0
\]

(2-37)

\[
\Pi_{v_{jk,s}} : (p_{i} X_{i} + p_{j} X_{j} + p_{k} X_{k})/\varepsilon - aw_{Si} - 2 gw_{K_i} \leq 0 \\
\downarrow v_{jk,s} \geq 0
\]

(2-38)

The general equilibrium model consists of the number of unknown variables, for example, number of national and multinational firms, outputs, good prices and factor prices. Regarding Walras’s law, it is possible to analyze the model with respect to concerned parameters. Thereafter, applying the numerical simulation illustrates the impacts of changes in the bilateral- and third-country determinants such as total market size, similarity in economic size, relative endowments of skilled labor, transport costs as proxy for trade costs, and tariffs as proxy for regional economic integration on bilateral FDI in producer services. The theoretical propositions of bilateral FDI in producer services can be obtained as follows (see Appendix A).

**Proposition 1:** Bilateral FDI in producer services rises with a larger market size, not only in case of bilateral determinants, but in case of third-country determinants.

Market size is regarded as primary factor to surge FDI inflows. Certainly, it encourages foreign investors to duplicate multinational plant, fragment production process and perform export platform activity in destination country.

**Proposition 2:** Bilateral FDI in producer services increases with dissimilarity of two economies, in both cases of bilateral and third-country determinants.

Dissimilarity in country size encourages investors to fragment production plant abroad in order to exploit low-cost production factors; meanwhile, it also motivates investors to expand production and market base abroad.
**Proposition 3:** Bilateral FDI in producer services rises with a ratio of skilled labor endowments in two countries, in both bilateral and third-country determinants.

Differences in skilled labor abundance indicate comparative advantages in running headquarters services and producer services abroad.

**Proposition 4:** Bilateral FDI in producer services rises with transport costs, in both cases of bilateral- and third-country determinant.

The transport costs represent foreign trade barriers or trade costs. Setting producer-services affiliate tends to reduce trade costs and increases distribution and management efficiency. Hence, the entry of MNEs in producer services leads to substitute trade eventually.

**Proposition 5:** Bilateral FDI in producer services tends to decline with the reduction in tariffs of destination country, not only in case of bilateral determinants, but in case of third-country determinants.

Indeed, the tariffs are as proxy for regional economic integration. The deeper degree of RIAs tends to enhances trade among nations and to diminish multinational producer services firms. On the other hand, this outcome is positive effect of national firm supplying producer services for exports.

In sum, the theoretical derived model provides the significant impacts of bilateral- and third-country determinants on FDI in producer services. First, country characteristics can influence producer-services FDI either positively or negatively. Second, regional integration can positively influence producer-services FDI. Specifically, we will employ all of these plausible theoretical predictions on FDI to investigate empirically the determinants of FDI in producer services from non-member ASEAN countries.

### 3. Empirical Evidence

This section aims to investigate bilateral and third-country factors influencing foreign investors in their decision to locate foreign producer services firms in ASEAN countries. Bilateral and third-country characteristics and economic integration variables are defined in a spatial regression model\(^2\). The model specification for estimation is given by

\[^2\] The spatial regression model allows for spatially weighted exogenous variables to capture not only the third-country effects of bilateral FDI, but the spatial correlation in the error term to control the transmission of shocks across host countries. The error term \(u_{ijt} = \rho W_{ij} u_t + \varepsilon_t\) is assumed to be with \(|\rho| < 1\), where \(\varepsilon_{ijt} = \mu_{ij} + \nu_{ijt}\). The term \(\mu_{ij}\) is country-pair effects to be control for time-invariant heterogeneity effects. The term \(\nu_{ijt}\) is classical error assumed to be uncorrelated over all \(i, j\) and \(t\). The term \(\rho\) is a coefficient on the spatially correlated errors which measures how third-country observations affect the dependent variable. However, if \(|\rho| = 0\), then the disturbances are not spatially correlated.
\[ \ln(FDI_{jt}) = \beta_0 + \beta_1SGDP_{jt} + \beta_2RGDP_{jt} + \beta_3RS_{jt} + \beta_4DIST_{jt} + \beta_5TAR_{jt} + \beta_6W_{ijt}SGDP_{jt} + \beta_7W_{ijt}RGDP_{jt} + \beta_8W_{ijt}RS_{jt} + \beta_9W_{ijt}DIST_{jt} \]  
\[ + \beta_{10}W_{ijt}TAR_{jt} + u_{ijt} \]  

(3-1)

The dependent variable, \( FDI_{jt} \) is the value of U.S. outward FDI stock and affiliate sales in host-country \( j \) at year \( t \) where \( j = 1, \ldots, N_i \) and \( t = 1, \ldots, T \) where \( j \) includes Indonesia, Malaysia, the Philippines, Singapore and Thailand, \( T \) is 14 years (1995-2008) and \( N_i \) is a number of country-pair observed at year \( t \). Bilateral explanatory variables consists of bilateral size \( (SGDP_{jt}) \), similarity in size \( (RGDP_{jt}) \), relative factor endowment of skilled labor \( (RS_{jt}) \), trade costs \( (DIST_{jt}) \), and tariffs \( (TAR_{jt}) \) as proxy for economic integration.\(^3\) Third-country explanatory variables are represented by spatially weighted averages to capture the impacts of determinants in third country other than host country.\(^4\) These include bilateral size \( (WSGD_{jt}) \), similarity in size \( (WRGDP_{jt}) \), relative factor endowment of skilled labor \( (WRS_{jt}) \), trade costs \( (WDIST_{jt}) \), and tariffs \( (WTAR_{jt}) \).

To obtain the robust empirical results, the diagnostic tests are first conducted to choose an appropriate estimator, then, the spatial panel data model is estimated by the chosen estimators. The Hausman test is used for identify the correlation between the residuals and some independent variables (endogeneity test). The Moran’s I test is used to check for spatial autocorrelation in residuals, the Breusch-Pagan test for the heteroskedasticity, the Jarque-Bera test for the normality, and the variance inflation factor (VIF) for the multicollinearity. Estimations are performed with the spatial econometrics toolbox by LeSage (1998, 1999) developed on MATLAB.

We start with the diagnostic tests for FDI stocks and Table 1 provides their results. The Moran’s I test unsurprisingly indicates the presence of spatial correlation of the residuals in the data. This suggests that the spatial regression model with spatially correlated residuals should be provided. The complementary tests suggest that the error term is normally distributed (Jarque-Bera) and the hypothesis of homoskedasticity is not rejected (Breusch and Pagan). However, the VIF statistic indicates some multicollinearity but can be ignored because it does not exceed 30 (Greene 2003). Then, the Maximum Likelihood (ML) estimator on fixed effect model (FEM) and random effect model (REM) is particularly appropriate in testing our model (Kelejian and Prucha 1999).

\(^3\) \( SGDP_{jt} = \ln(GDP_{jt} + GDP_{jt}) \) measures total bilateral economic size, where \( GDP \) refers to real gross domestic product. \( RGDP_{jt} = \ln\left[\frac{1}{2}(GDP_{jt}/GDP_{jt} + GDP_{jt})\right] - \left[\frac{1}{2}(GDP_{jt}/GDP_{jt} + GDP_{jt})\right]^{2}\) measures two countries’ similarity in economic size. \( RS_{jt} = \ln(S_{jt}/S_{jt}) \) is home-to-host endowment ratios in skilled labor. \( DIST_{jt} = \ln(DIST_{jt}) \) refers to bilateral geographical distance as a proxy for transport costs.

\(^4\) The spatially weighting matrix \( W_{ij} \) is \( N_i \times N_i \), based on distance between the capitals of host and third countries \( (d_{ij}) \). It is row-normalized with typical elements \( w_{ij} = d_{ij}^{\alpha}/\sum_{k=1}^{N_i} d_{ik}^{\alpha} \) if \( j \neq k \) and \( w_{ij} = 0 \) if \( j = k \). The spatially-weighted explanatory variables account for if FDI from home to host countries is affected by determinants between home and other host countries.
Table 1: Estimation Results for U.S.-ASEAN FDI

<table>
<thead>
<tr>
<th></th>
<th>Model 1: FDI stock</th>
<th></th>
<th>Model 2: Affiliate sales</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FEM</td>
<td>REM</td>
<td>FEM</td>
<td>REM</td>
</tr>
<tr>
<td></td>
<td>( \beta ) t-test</td>
<td>( \beta ) t-test</td>
<td>( \beta ) t-test</td>
<td>( \beta ) t-test</td>
</tr>
<tr>
<td>SGDP</td>
<td>1.14</td>
<td>0.11</td>
<td>0.31</td>
<td>0.32</td>
</tr>
<tr>
<td>RGDP</td>
<td>2.57</td>
<td>2.63*</td>
<td>0.21</td>
<td>1.65***</td>
</tr>
<tr>
<td>RS</td>
<td>0.19</td>
<td>1.20</td>
<td>-7.85</td>
<td>-0.86</td>
</tr>
<tr>
<td>DIST</td>
<td>-50.89</td>
<td>-2.41*</td>
<td>-0.18</td>
<td>-2.23**</td>
</tr>
<tr>
<td>TAR</td>
<td>-0.24</td>
<td>-5.76*</td>
<td>-8.78</td>
<td>-1.11</td>
</tr>
<tr>
<td>WSGDP</td>
<td>0.02</td>
<td>0.01</td>
<td>3.22</td>
<td>1.22</td>
</tr>
<tr>
<td>WRGDP</td>
<td>-0.14</td>
<td>-0.37</td>
<td>0.69</td>
<td>1.95*</td>
</tr>
<tr>
<td>WRS</td>
<td>0.75</td>
<td>1.65***</td>
<td>14.68</td>
<td>1.19</td>
</tr>
<tr>
<td>WDIST</td>
<td>-2.52</td>
<td>-0.10</td>
<td>-0.27</td>
<td>-0.84</td>
</tr>
<tr>
<td>WTAR</td>
<td>-0.08</td>
<td>-0.19</td>
<td>0.73</td>
<td>5.12*</td>
</tr>
<tr>
<td>Rho</td>
<td>0.34</td>
<td>0.98</td>
<td>-0.65</td>
<td>-0.61</td>
</tr>
<tr>
<td>constant</td>
<td>537.45</td>
<td>1.62***</td>
<td>5.48</td>
<td>0.92</td>
</tr>
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<td>Goodness of fit</td>
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<tr>
<td>Observations</td>
<td>280</td>
<td>280</td>
<td>280</td>
<td>280</td>
</tr>
<tr>
<td>Adj. R</td>
<td>0.41</td>
<td></td>
<td>0.40</td>
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<tr>
<td>Log Likelihood</td>
<td>-641.84</td>
<td></td>
<td>-699.95</td>
<td></td>
</tr>
<tr>
<td>AIC</td>
<td>4.71</td>
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<td>5.21</td>
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<tr>
<td>BIC</td>
<td>-236.27</td>
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<td>-95.07</td>
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<tr>
<td>Variance</td>
<td>5.73</td>
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<td>8.50</td>
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<td>Diagnostic tests</td>
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<tr>
<td>Jarque-Bera</td>
<td>32.85*</td>
<td></td>
<td>38.12*</td>
<td></td>
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<tr>
<td>VIF</td>
<td>1.82</td>
<td></td>
<td>1.82</td>
<td></td>
</tr>
<tr>
<td>Breusch-Pagan</td>
<td>44.06*</td>
<td></td>
<td>44.02*</td>
<td></td>
</tr>
<tr>
<td>Moran’s I</td>
<td>178.72*</td>
<td></td>
<td>185.81*</td>
<td></td>
</tr>
<tr>
<td>Hausman Test</td>
<td>1.27</td>
<td></td>
<td>11.79</td>
<td></td>
</tr>
</tbody>
</table>

Note: The subscripts *, ** and *** denote the 1%, 5% and 10% significance level.

Table 1 summarizes the results from the ML estimation for U.S. FDI in producer services to ASEAN with the FEM and REM. Model 1 relies on FDI stock while Model 2 relies on affiliate sales. The estimated results show that all almost significant explanatory variables are in line with the theoretical propositions developed previously. However, there is obvious difference in the estimates between two models. In the discussion of the results, we focus on the REM estimates because the Hausman test accepts the REM. The results for FDI in producer services given in Model 1 indicate that country’s similarity determinant of FDI stock exhibits positive and significant sign, whereas trade-costs determinant of FDI stock exhibits negative and significant sign. Third-country determinants of FDI in producer services i.e. similarity in size and regional economic integration have an expected positive sign. Importantly, the signs of significant parameters of Model 1 tend to support types of vertical FDI (Uttama and Péridy, 2009). The estimated results for FDI in producer services given in Model 2 indicate that most sign of significant parameters are in line with the theoretical predictions. On the one hand, market size determinant of affiliate sales has an expected positive sign. On the other hand, third-country determinants of FDI i.e. market size and similarity in size have an expected negative sign, whereas tariffs as proxy for regional integration exhibit positive and significant sign. The signs of parameters in Model 2 tend to support bilateral and complex vertical FDI (Uttama and Péridy, 2009).

Summing up, the estimated results of Model 1 and Model 2 provide that bilateral and third-country determinants are significant to bilateral FDI in producer services.
Especially, the variable of our interest, regional integration indicator, is significant and tend to support bilateral and complex vertical FDI.

4. Conclusion

This paper examines the impacts of bilateral- and third-country characteristics and regional integration on FDI in producer services to Southeast Asian countries. In this regard, we perform theoretical predictions and empirical investigation corresponding to bilateral and third-country determinants of FDI in producer services in ASEAN. In the theoretical studies, we refine the Knowledge-Capital (KC) model of Baltagi et al. (2007) and Uttama and Péridy (2009) following the conceptual framework of Markusen and Strand (2009) and Markusen et al. (2005). This model is derived and then simulated using GAMS/MPSGE to provide the theoretical hypotheses on determinants of FDI in producer services. In the empirical studies, we investigate the impacts of bilateral- and third-country effects and regional integration on the U.S. producer-services FDI to ASEAN using Maximum Likelihood estimator. Data on U.S. FDI stock and affiliate sales to ASEAN over the period of 1995-2008 are employed. The estimated results from U.S.-ASEAN FDI reveal that the significant parameters tend to support bilateral and complex vertical FDI. However, all almost results are interpreted in line with our theoretical predictions. Of course, the findings confirm the important and significant relationship between FDI in producer services and regional economic integration.

Our results provide the policy implication aiming at supporting inward FDI in producer services to ASEAN. On the one hand, foreign firm’s decision in producer-services FDI is contingent upon tariffs and liberalization policy in the regional level. On the other hand, the foreign investment policy for non-member ASEAN countries should focus on the most common types of FDI to ASEAN i.e. export-platform and complex vertical FDI. With this regard, policies for promoting FDI in producer services to ASEAN might be promoting trade and investment services alliance network in ASEAN economies, adopting services stability policy, enhancing services integration and liberalization, and accelerating the implementation of the existing ASEAN investment agreements, especially ASEAN Investment Area, ASEAN Comprehensive Investment Agreement and ASEAN Framework Agreement on Services. Moreover, it is indeed beneficial to enhance economic growth in the ASEAN economies.

Even though this study is able to accomplish the significant results, there are two potential extensions that would be addressed in the future research. First, the present work is still limited by the lack of data at firm level, as well as by the incomplete data sets at industry level which could be helpful to investigate with more accuracy the impacts of bilateral and third-country determinants of FDI in producer services. Second, with improvements in measurement and analytical methods, there should be more consistent empirical results. All issues are left for future research.

5. References


6. Appendix

Appendix A: Parameterized Variables

In this paper, the general equilibrium model among inequalities associated with complementary variables provided in section 2 is solved using numerical analysis, namely GAMS/MPSGE. In order to examine bilateral and third-country changes on complex multinational activities, we change host- and third-country endowment configurations from 90% to 110%. To investigate the impact of regional economic integration, we raise value of tariffs by 50%. The parameter values are assumed as follows: (i) world physical capital endowment $K_i = 40; K_j = K_k = 20$, world skilled labor endowment $S_i = 15; S_j = S_k = 7.5$, and world unskilled labor endowment $L_i = 40; L_j = L_k = 30$ where $i$ is capital-abundant country, $j$ and $k$ are unskilled-labor-abundant countries (ii) stable parameters i.e. elasticity of substitution between varieties $\varepsilon = 4$, expenditure share for differentiated varieties $\alpha = 0.8$, iceberg transport costs $t_{ij} = t_{jk} = t_{ik} = 0.07$ and $t_{ik} = t_{ij} = 0.27$, fixed skilled labor endowment for running headquarters services $a = 1.01$, fixed physical capital endowment for setting up a plant $g = 1.07$ and input coefficient $a_{kX} = 0.3; a_{sx} = 0.1; a_{lx} = 0.5; a_{gx} = 0.1$, (iii) tariff policy parameter $\tau_{ij} = \tau_{ik} = 0.15$ $\tau_{jk} = \tau_{kj} = 0.15$ and $\tau_{kj} = \tau_{ki} = 0.075$ (see Egger et al., 2004).

5 The General Algebraic Modeling System/Mathematical Programming System for General Equilibrium (GAMS/MPSGE) has a robust non-linear complementarity solver in it (Markusen, 2005).
Appendix B : Data Source and Descriptive Statistics

We use data on bilateral U.S. outward FDI stock and affiliate sales in producer services\(^6\) at industry level, published by the Bureau of Economic Analysis. All data cover the period 1995-2008. Data on real GDP at 1990 U.S. million dollars are available from the United Nations Statistics Division. Real GDP is used to build up the bilateral market size and country’s similarity. Skilled labor endowment is calculated by using tertiary school enrollment and the country’s labor force, published in World Development Indicators and UNESCO Institute for Statistics. More precisely, skilled labor endowment is measured by the labor force multiplied by the share of people with tertiary school enrollment. Data on bilateral tariff rate are available from the UNCTAD database. It is as a proxy for regional economic integration. Table 6 summarizes the descriptive statistics.

Table 6: Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Mean</th>
<th>Std.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bilateral FDI</td>
<td>280</td>
<td>4.20</td>
<td>2.75</td>
<td>-</td>
<td>8.82</td>
</tr>
<tr>
<td>Affiliate sales</td>
<td>280</td>
<td>3.66</td>
<td>3.27</td>
<td>-</td>
<td>10.74</td>
</tr>
<tr>
<td>Bilateral size</td>
<td>280</td>
<td>15.91</td>
<td>0.11</td>
<td>15.69</td>
<td>16.09</td>
</tr>
<tr>
<td>Similarity in size</td>
<td>280</td>
<td>-3.63</td>
<td>0.42</td>
<td>-4.23</td>
<td>-2.86</td>
</tr>
<tr>
<td>Relative skilled labor endowment</td>
<td>280</td>
<td>0.80</td>
<td>1.16</td>
<td>-</td>
<td>3.85</td>
</tr>
<tr>
<td>Distance</td>
<td>280</td>
<td>9.61</td>
<td>0.06</td>
<td>9.52</td>
<td>9.69</td>
</tr>
<tr>
<td>Tariffs</td>
<td>280</td>
<td>-1.63</td>
<td>5.00</td>
<td>-11.51</td>
<td>2.74</td>
</tr>
</tbody>
</table>

Note: All variables are in logarithms.

\(^6\) It includes wholesale trade; information; finance (except banking) and insurance; and professional and scientific, and technical services.