THE EVOLVING GEOGRAPHY OF PRODUCTION HUBS AND REGIONAL VALUE CHAINS ACROSS EAST ASIA: TRADE IN VALUE-ADDED

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ABSTRACT

The interdependence of regional trade and production networks has important implications for national prosperity, regional stability and the internationalization of production. We ask: What are the locational patterns of trade in value-added in East Asia and how are these patterns changing over time? The disintermediation of value chains and the externalization of business activity create hubs of capability and extend value chains between countries. We adopt input-output techniques to analyze the evolution of production networks in East Asia over the period 1990 – 2005 from a value chain perspective. A high density of cross-border interaction is reported alongside changing geographic dynamics, and an informal integration derived from intermediates trade in value-addition. The locational interdependence of developed and less-developed countries across the region leverages on the heterogeneity of location-specific advantages within the region.

KEY WORDS: regional integration, production networks, input-output data, trade in value-added, East Asia.

1. Introduction

Asian preeminence in attracting production activities from internationalizing firms has attracted increased attention of late. China, already the global factory (Buckley, 2011), is predicted to become the world's largest economy before 2030 (World Bank, 2012). In the 1980s, Japan was heralded as the Asian miracle with Japanese management style acclaimed for its championing Japanese industrial development (Beechler & Yang, 1994; Nonaka & Johansson, 1985). Other Asian economies have recorded envious growth over recent decades too, with the Asian miracle and Asian tigers encapsulating the rise of East Asia in the world economy (Stiglitz, 1996). However, none of these economies has developed in isolation, with production networks across national borders engaging extensively in intermediates trade, often at the regional level.

The discussion of regional economic integration and its impacts has gained significant attention in scholarly research (Dunning, Fujita & Yakova, 2007; Fratianni & Chang, 2009; Murray, 2010; Neffke & Boschma, 2011; Sierra, 2011; Verbeke & Kano, 2012). Policy-makers are concerned with a balance between creating the incentives for firms to engage across borders, and the benefits for long-term national economic development of creating these incentives (Lawton, et al., 2009; UNCTAD, 2009). International business (IB) scholars have raised the question whether this engagement in cross border activities is more extensive at the regional or the global levels (Rugman & Verbeke, 2004). This debate is embedded in the discussion of location specific issues that have been long recognized as key issues in IB research (Beugelsdijk, 2007; Dunning, 1998; Dunning, Fujita & Yakova, 2007; Vernon, 1966, 1974; Wells, 1972).

Long ago, the pioneering works of Alfred Marshall (1919) identified the externalities appropriation of firms within clusters when these near-neighborhood firms externalize activities to generate concentrations of mutually supportive industries. The externalization of IB activity has created a "... 'new geography of competition' for mobile investment (Raines, 2003) and an increasingly complex interplay between states, economic regional blocs ... and semi-autonomous regions" (Buckley & Ghauri, 2004: 91). Likewise, Dunning (1977) elaborated on his location dimension of the OLI paradigm to explain cross-border growth of international business activity and investment. In the more recent IB literature, Rugman and colleagues (2004, 2005, 2007, 2010) have elaborated the L (location) dimension in Dunning's paradigm in regard to regional dynamics.

Economic geographers have called for a better understanding of locational choice in innovation, knowledge transfer and production networks research (Aoyama et al., 2011; Bebbington, 2003). In addition, growth paths of various regions have been studied (Neffke et al., 2011) that illustrate regional agglomeration can accelerate national and regional economic development (Fan & Scott, 2003; Suder, 2011) by ameliorating challenges of foreignness and institutional distance that internationalizing firms face, and that impact business strategy (Luo, 2011; Zaheer, 1995). Yet, it has been argued that there is little overlap between the IB literature studying MNEs' operations across firm boundaries and economic geography which focuses on understanding the location-specific issues of economic activities (Mudambi, 2008).

We contribute to the location choice in IB research and the economic geography rationales by examining the changing structure of production network hubs in East Asia. We understand regional integration to be the interdependence of trade and production networks within a region, and we investigate this interdependence by analyzing intra- and inter-industry industrial production networks using trade in value-added. We chose this approach because trade in intermediates is the largest share of total trade, is growing (Meng, Fang & Yamano, 2012), and it provides additional insights into the internationalization of production. The research question we address is: *What are the locational patterns of trade in value-added in East Asia and how are these patterns changing over time?* We use a methodology, novel for the IB field, that focuses on the different stages of production rather than on trade in finished goods or of sales revenue. We conduct a longitudinal analysis on trade in value-added using macro-level input-output (IO) data. This adaptation of analytical techniques from industrial economics to IB provides us with the means to better understand how value chains and locations interlink, and thus, it offers insight about the evolution of locational advantage.

We analyze IO data from three industries (textile, chemical and machinery) from nine East Asian countries over the period 1990 to 2005 chosen because they are recognized as sectors that experience the most significant cross-border movement of production activity across the Asian region (IDE- JETRO, 1999, 2006; Kaminski et al., 2001). Our sample comprises China, Japan, Korea, Taiwan, Singapore, Malaysia, Thailand, The Philippines and Indonesia, and our data allow us to distinguish in- and out-flows of finished and unfinished intermediary products at the industry and country levels. This use of multiple country contexts represents yet another extension of the existing IB literature that traditionally focuses either on single-country studies or on emerging or developed contexts separately (Fan & Scott, 2003). We consider this approach important because the distributed production activities of goods typically span across economies at different development levels. We build our analysis on multiple environments, and diverse institutional and economic settings (Bello & Kostova, 2012b).

This study is multidisciplinary and contributes to several fields of research. First, IB scholars will be interested in the rationales behind the changing dynamics in regional integration from the value-added perspective. Our findings inform the conversation on how MNEs organize their value-added activities and undertake various types of trade and investment in a world economy that has transformed over the decades (Doh, Bunyaratavej & Hanh, 2009; Dunning, 1998; Kali & Reyes, 2007). Furthermore, this study offers new measures to understand the underlying forces behind regional integration, and allows us to better comprehend the rationales for business strategic choices between global and regional expansion that have been discussed in the IB literature. Second, this logic extends economics-based explanations for regional integration (Petri, 2006) and its geography (Neffke & Boschma, 2011) which observe that regional and free trade agreements (RTA/FTA) have emerged alongside the internationalization of production in response to globalizing forces (Suder, 2011). Third, our results contribute to a politically-based lens that draws upon macro-data to analyze the influence of harmonized and normalized laws and regulations as strategic inducement for regional integration (Cherry, 2011; Morlino & Magen 2009; Murray, 2010).

2. Perspectives on Regional Integration

The international business perspective The regional aspect of international expansion has long been the focus of traditional firm internationalization theories. The Uppsala School (Johanson & Vahlne, 1977, 2009) stresses the importance of the home region in the early phases of a firm's internationalization,

arguing that cross-border activity will incrementally follow a path of experiential learning and knowledge acquisition that evolves commensurate with psychic distance considerations, which in general correlate with geographic proximity. In the home region, internationalization is generally less risky because there are fewer differences in national, institutional and business cultures, reinforcing a proximity factor in international business. The liability of foreignness (Eden & Miller, 2001; Zaheer, 1995) is minimized as are the costs of doing business abroad. Recently, scholarly attention has shifted to a global perspective on internationalization although some studies have questioned the dominance of global scale in firm expansion abroad. Scrutiny of foreign sales patterns of large MNEs has revealed regional rather than global distributions, and Rugman and Verbeke (2004), Rugman (2005) and Piekkari et al. (2010) have observed the regional nature of large Fortune 500 MNEs' activities.

In the 1980s, Ohmae (1985) argued that successful MNEs were present in three predominant regions of the world, the USA, Europe and Japan. Success or failure within each of these regions has been considered dependent on 'insiderization' (Rugman & Verbeke, 2004: 4) rather than 'outsidership' (Johanson & Vahlne, 2009), and the availability of what these authors have termed a fourth market in which market share could be obtained more easily compared to other global markets, and typically located in a less-developed economy. Reported by Rugman and Collinson (2005: 430), "... of the 380 firms with regional sales data examined by Rugman and Verbeke (2005), North American firms averaged 77.2% of their sales in their home region, the Europeans averaged 62.8% and the Asian firms averaged 74.3%". UNCTAD (2007) noted that these three regions represented more than 80% of world manufacturing value-added, raising scholarly interest in scrutinizing internationalization at the regional level.

Interestingly, Rugman and Verbeke (2004) identified that home region oriented MNEs were different from other MNEs in decision styles and downstream firm-specific advantages (FSAs). They argued strong regional interests to be a reflection of unequal sales distributions, unequal accessibility and attractiveness to consumers, limits in applying experience gained in one market across into another market and location specific FSAs (Rugman & Verbeke, 2004). That is, they suggested there is a need to translate country specific advantages (CSA) that firms encounter across borders into FSAs for successful international business if firms are to leverage on operations and experience in one country for application in another. A similar logic has been revealed in studies of emerging market MNEs, where the empirical evidence suggests that few are yet global companies, and that most of these firms are dependent on domestic regions for their initial growth (Banalieva & Santoro, 2009; Collinson & Rugman, 2007; Jormanainen & Koveshnikov, 2010; McGuire et al., 2011; Morck et al., 2008; Rugman & Li, 2007; Sethi & Judge, 2009). Most emerging market MNEs are regional with a strong home country orientation (Narula, 2012). Contrary to Mathews (2002) for example, aggressive expansion by emerging market MNEs into developed countries is atypical due to the preference for network capability leverage, and a mix of location, demand and knowledge factors (Banalieva & Santoro, 2009; Musteen et al., 2010).

From a transaction-cost perspective, the transaction costs incurred in home regional markets are likely to be lesser than those incurred in distant, more dissimilar markets, as market imperfections in nearby markets are likely to be fewer than in more distant markets. From a resource based view, another set of benefits stems from intra-regional locational production network strategies. Additional region bound FSAs are applied to achieve scale economies, scope economies, exploitation of national differences in nearby markets as well as arbitrage and externality benefits. These benefits enable an "evolutionary strategy of resource combinations" and "platforms for future investments" (Kogut & Zander, 1993: 16) linked to knowledge bundling amongst more localized partners.

It seems that over the last two decades, the economic rationale behind informal regional integration has become increasingly stronger than the politically-based explanations of formal institutionalization which have dominated the prior literature. In this context, Kali and Reyes (2007) examined the global trading system as an interdependent and complex network, and concluded that the more integrated a country is within a given network, the better the ability for this country to counterbalance the lack of location or technological advantages through interconnectivity advantages. These interconnectivity advantages are evidenced in physical capital (increased human capital productivity through centrality effects), links to other countries (network density), and/or clustering (transitivity of partnerships). By

drawing upon country-specific advantage explanations, they concluded that “international trade relations are not determined by the number of trading partners that each country has” (Kali & Reyes, 2007: 603), but rather by cultural, social and geographical attributes that lead to comparative advantage (Isogai, Morishita & Rüffer, 2002; James & Movshuk, 2003; Widodo, 2009). That is, there are country specific specializations and country specific advantages that underlie a country’s comparative advantage. The informal and formal integration of these specializations and advantages through value-adding networks and through political normalization shape the pattern of a firm’s regional activities.

Here, it is useful to distinguish between economic integration and intra - and inter - industry trade integration (Greenaway, 1987). Accordingly, horizontal specialization leads to intra- industry trade whereas vertical specialization leads to inter - industry trade and integration (Ando, 2006; Fukao et al., 2003; Greenaway, 1987). The nature of specialization depends on factor endowments such as cheap labor and complementarity in production structures. These factor endowments represent CSAs and determine the value-added activities firms are likely to place in particular locations (Chen, 1996; Park, 1993). Studies that refer to such value-added distributions take different perspectives of global value chains (GVCs) and supply chains, and of fragmentation and outsourcing (Ernst & Guerrieri, 1998; Kimura & Ando, 2003; Wakasugi, 2007). One view emphasizes the positive aspects of globalization, including spillover effects, knowledge diffusion, employment creation and new opportunities for capital formation by local suppliers in developing countries (Ernst & Kim, 2002), whereas in contrast, an alternative view points out the uneven distribution of global values, and argues that developing countries tend to be locked-in to low-margin production activities (Gereffi, 1999; Henderson, 1998; Kaplinsky, 2000; Widodo, 2009). Methodologies applied thus far have not provided the analytical refinement needed to resolve these dilemmas.

This study thus attempts to contribute to this debate in the IB literature about the extent and nature of regional integration by offering novel measures to assess regional integration. It does so in terms of the evolution of production hubs and value chains over time, with a focus on finished and intermediate product flows between locations of differing CSAs. Our measures enable us to understand how location within a region matters for different types of value-added activities, and thus holds the potential to explain international business strategy more comprehensively. The value of this approach arises from its longitudinal nature with empirical evidence now presented that was not previously available in the IB literature.

Economic geography and value chain perspectives Studies in the field of economic geography present a number of rationales for organizing production activities on a regional basis (Bell & Albu, 1999; Chen, 1996). Specifically, Fan and Scott (2003) emphasize the benefits arising from inter-firm transactions organized within a network (Behir & Fouquin, 2006; Krueger, 1999; Scott 1988), alongside the ease of acquisition, processing and acting on information about labor supply opportunity and shared production networks. In addition, the existence of close business links provides for efficient exchange and spillovers of business knowledge (Fan & Scott, 2003), while regional cooperation supports the formation of alliances between firms and the development of distinctive business cultures. Studies have also revealed economies of scale from sharing infrastructure, with efficiency derived from industrial linkages and subcontracting (Chen, 1999; Tsai, 1993), the division of labor (Park, 1993; Tang, 1996) and common regional governance structures (Amin, 1999) supporting the development of regional industrial hubs. Finally, in analyzes of trade flows, there is evidence that points to steadily increasing intra-regional demand for finished and unfinished intermediate products (Pula & Peltonen, 2009).

One of the analytical approaches that has gained increasing attention in the economic geography literature is a GVC approach (Grossman & Rossi-Hansberg, 2008; Mudambi, 2008). This approach concentrates on how different tasks, activities and types of operations positioned in the value-chain are distributed across locations. The rise of GVCs has been considered one of the most important features of rapid economic globalization in recent decades. The economic and popular literatures have described phenomena relating to GVCs as “vertical specialization”, “production fragmentation”, “outsourcing”, “offshoring”, “global supply chains”, and so on. Despite the use of these different terms, they all point to the same fact: higher volumes of intermediate products such as parts, components and intermediate

services are being produced in stages or processes across different countries and then exported to other countries for further production. Given the increasing complexity and sophistication in GVCs, it has been difficult to identify who produces what kind of value for whom by what kind of activity in the chain.

We argue that there is considerable potential for further developments within this domain and we suggest that an understanding of the evolution of value chains at the regional level requires better measurement than that applied to date. We identify at least two reasons for this view. First, current international trade statistics fall short in terms of the research requirements needed to understand GVCs. This is perhaps why WTO statistical officers have stated ‘what you see is not what you get’¹. Second, better measurement can help provide more relevant and reliable information to policy-makers, particularly since ‘you can’t manage what you can’t measure.’ IO methodology, providing insights into finished and intermediary product stages can advance the work of Humphrey and Schmitz (2002), for example, in incorporating location appropriately into GVC investigations, and thus bring new insight for IB strategy.

IO is one of three methods currently used to measure GVCs. One such method is based on survey data obtained for a specific firm and product. Studies can use this quantitative firm-level data to analyze locations of value-added activities at the level of the MNE or depict particular activities in the chain as spatially distributed (Cantwell & Mudambi, 2005; Doh, Bunyaratavej & Hahn, 2009), such as case studies about China’s role in Apple’s global supply chain (Dedrick et al., 2010; Linden et al., 2009; Mudambi, 2008). Xing and Detert (2010) examined the case of the iPhone and found that China contributed only 3.6% of \$2.0 billion of export to the US. The remainder simply constituted a transfer from Germany, Japan, Korea, the US and other countries. These studies rely on tear-down analyzes that assign the value of individual components to source companies and their countries. Such firm- and product-based case studies can provide important intuitive images of GVCs as part of MNEs’ cross-border activities. However, when we examine the role of the Chinese economy in global production networks, its share of total value-added through the export of final products to the United States was around 75% in 2005 (Meng, Yamano & Webb, 2011). This indicates that tear-down case studies may be too limited in focus to inform the locational impacts on a broader level. Their contributions are not representative of, for example, the broader role of China’s domestic production networks and inter-industrial linkages in the total value creation process.

The second approach relies on trade statistics-based measurement. Trade data can provide global insights on the interactions (e.g., trade flows and patterns) of countries in terms of a specific good or service, and of global trade balances. For example, Kali and Reyes (2007) combine data on international trade linkages with network methods to examine the global trading system. However, using trade data alone does not reveal the role that inter-industrial production networks play in GVCs. In addition, a product shipped from one country to another may incorporate a third country’s parts and components. This implies that using traditional customs statistics may cause a double-counting problem in the measurement of GVCs.

The third approach is based on the international IO model. Using IO tables allows the analyst to avoid the shortcomings of firm- and product- based case studies as domestic inter-industry relationships are explicitly considered. An international IO table consists of detailed information about both inter-country (trade data) and inter-industry (IO) linkages. New measures of GVCs have been developed in industrial economics using international IO databases, including Degain and Maurer (2010), WTO-IDE (2011), Meng, Fang and Yamano (2012), Johnson and Noguera (2012), Stehrer (2012), OECD and WTO (2013) and Koopman et al. (2014). These new measures can be useful in understanding IB issues. They can inform, for example, enquiry into the differentiation of subsidiaries and their contributions to the total value chain. This stream of analyzes can shed light on high knowledge activities, typically undertaken by competence-creating subsidiaries (Cantwell & Mudambi, 2005). This also informs the study of internationalization knowledge and its sourcing (Riviere & Suder, 2013). As pointed out by Cantwell and Mudambi (2011), competence-creating subsidiaries tend to be industry leaders that rapidly gain insider status in local economies. IO thus contributes to detecting crucial factors and dynamics that instruct

¹ Source: Maurer and Degain (2010).

business strategy. In this paper, we follow the concept of ‘Trade in Value-Added (TiVA)’ proposed by Johnson and Noguera (2012).

Compared with conventional trade statistics, such as customs export data, the use of TiVA has the following three advantages. First, using TiVA can avoid the well known double counting problem because the conventional trade statistics capture the gross value of products at each border crossing, rather than the net value-added between border crossings. Second, TiVA measures how much the value-added produced in a source country is absorbed by a destination country. This can help us understand who produces the value-added, how much and for whom. Third, when measuring a country’s total trade balance (a country’s net export to the rest of the world), there is no in-principle difference between conventional trade statistics and TiVA. However, at the bilateral level, using conventional trade statistic causes a discrepancy in bilateral trade balances because a country’s intermediate products can travel to their final destination country by an indirect route through third countries. TiVA can be used to remove this discrepancy in bilateral trade balances.

3. Hypotheses

While we acknowledge the partial contributions of each perspective discussed above, we expect a better understanding of locational patterns of trade in value-added and of regional integration will result from adopting an interdisciplinary approach which integrates the IB and economic geography literatures. An industrial economics methodology, IO analysis, for data interrogation will assist. We concentrate on understanding how hubs of value-added activities have evolved over time in a region where countries have undergone significant economic and political transformation, thus shaping trade patterns through IB activity. We hypothesize

H1: The nexus between the economic geography of production networks and regional integration dynamics among countries has evolved trade in value-added that derives from locational choices in international business.

Understanding better the patterns of trade in value-added that ensue from these locational choices may subsequently enable us to better theorize about the change in the location of value-added activities associated with different types of FDI as regional integration progresses (Dunning, 1998).

We also take into consideration the politico-economic approach, with the claim that the integration of countries has been marked as an interdependence “defined as the region’s preference for trade with regional partners” (Petri, 2006: 381). While the economic literature argues that “developing countries at early stages of industrial development benefit less from regional integration than those with a more diversified production structure” (UNCTAD, 2007: 41), developing countries are an integral part of RTA/FTA networks (Sierra, 2011). We hypothesize that

H2: There is a role for developed and emerging and lesser developed economies in the evolution of the patterns of trade in value-added. This evolution progresses because of the roles of countries at different stages of industrial development.

Consistent with studies that have focused on the analysis of institutional contexts and the role of governmental in explaining the regional nature of production network activities in Asian regions (Amin, 1999; Murray, 2010), Petri (1993) earlier had studied the historical trends of interdependence over several decades, examining factors such as military interventions, special bilateral agreements and the balance of power in world trade. It was found that trends towards greater inter-country interdependence strengthened from the mid-1980s for political reasons (Kawai, 2005; Petri, 1993), consistent with the beginning of mature globalization trends in IB. We conjecture that this intra-regional integration is not concentrated in developed economies solely, or in emerging and lesser developed economies, but that trade in value-added occurs at the micro-level originating from all types of firms from the diversity of countries in a region, and flows to firms in countries at different stages of economic development. Indeed, Ghemawat (2003) labeled regionalism of firms to be a form of semi-globalization, representing an incomplete global integration of economies. Externalization of a firm’s value-added activities into regional markets results in high regional unfinished-product trade flows, both into and from member countries. Hence, we hypothesize

H3: Regional integration is enhanced with the increasing density of cross-border within-region production networks of value-added trade activity, and this economic geography is dynamic, evolving over time with shifts in value generation possibilities across production stages and across locations.

This process likely takes place along the lines of the patterns revealed by Rugman and Verbeke (2004), because in the home region, with easier market penetration, local market experience vastly reduces the liability of foreignness encountered when doing business abroad within the home region, as compared with doing business in other regions.

4. Method of Analysis Our methodology applies the IO model² for the analysis of cross - national production networks. The IO model is typically used in industrial economics and international trade studies to provide a mapping of international transactions. Such a mapping enables us to detect detailed flows of goods and services among industrial sectors across countries, alongside the sequences of value-added activity within an industry from conception through production to end use. This characterizes value chains as a whole and depicts changing economic geographies over time within those value chain activities. Our primary data sources are the Asian International Input-Output (AIO) tables for the years from 1990 - 2005³, constructed by the Institute of Developing Economies, JETRO. The AIO table is designed and calculated to represent spatial and inter-industrial networks within the nine East Asian countries: Indonesia, China, Malaysia, Korea, Japan, The Philippines, Singapore, Taiwan and Thailand⁴. We concentrate on the three industries that have the highest levels of regional integration of their production network: textiles, chemicals and machinery⁵ (For more information about the AIO table, refer to IDE, 1999, 2001, 2006).

Insert Figure 1 about here

We first capture the movements in and intensification of production networks using unfinished product data (intermediate goods). We are then able to study dynamic change captured by calculating the share of bilateral trade in total international trade for each country over time. Consequently, we can analyze (a) the evolution of interdependencies between countries through a matrix of cross-border transfers of intermediate goods by origin and destination, (b) value-added distributions and their evolution across the sample region, and (c) how a country's (Country A) value-added is induced by its partner country's (Country B) final demand. In doing so, we investigate the development of regional interdependencies through value chain mappings between countries over time.

² For detailed information on the origins, implications, strengths and weaknesses of the IO model, refer to Leontief (1996), Miller and Blair (1985, 2009) and Ford et al. (1998).

³ The data used here are constrained by availability. Because of the time requirement for data collection, quality checking and construction process, in general, most countries can compile one benchmark national IO table every five years only. Furthermore, making international IO tables is not just a patchwork of the pieces taken from national tables, but rather a product of compilation of supplementary data, specific survey and manual reconciliation, that takes on average an additional two years. The most up-to-date AIO table available is for 2005.

⁴ In Asia, some emerging countries such as Vietnam and Myanmar have become thriving locations for low cost manufacturing and have attracted manufacturing formerly located in China. However, due to data availability (the AIO table covers only nine Asian economies) we could not include them here. In addition, compared to trade databases which can cover 200 countries (see Kali & Reyes, 2007), the survey based international IO data cannot reach such a level of country coverage because of data availability limitations. Recently, a WIOD project (www.wiod.org) covered 40 countries, but without sufficient coverage of Asian countries for our purposes. Furthermore, the construction of AIO data is based on specific survey material from countries that covers information of the domestic use of import goods. This kind of survey is not conducted by other international IO data construction and is a unique attribution.

⁵ The AIO data are available for 76 industrial sectors for the most detailed classification.

5. Findings

The evolution of interdependencies between countries

In order to first obtain an insight into the development of spatial economic interdependence in East Asia, the shares of bilateral trade compared to total intra-regional trade for intermediate goods is a relevant measure, and these are presented in Figure 1. This figure shows the share of bilateral inter-country trade in total international trade for the focus region. The contour map provides for better visualization. The vertical and horizontal axes refer to the countries of origin and destination, respectively. From variations in the range of contour lines from 1990 to 2005, we observe the changing roles of Asian economies in regard to location for value chain activity and their economic interdependence that evolved over the two-decade period. In 1990, the main international trade flows were centered on Japan. Indeed, the deeper the shading of the maps, the larger the share of bilateral trade in international trade consistent with the strength of inter-country trade interdependence. Figure 1 thus reveals the following:

- 1) In 1990, most countries depended on Japan's exports and imports in the Asian region, but in 2005, significant changes are observed. China assumes activity from Japan and becomes a dominant hub of Asian international trade.
- 2) By 2005, almost all Asian developing countries enhanced their presence in international trade in this region. There are two notable features: the increasing interaction and complexity between China, Korea, Japan and Taiwan, and the increasing interdependence between East Asia and ASEAN.⁶

This period witnessed the significant emergence of China as a regional actor, and this has broadened the regional dimension of Asian production networks to include all developed and lesser developed economies in the region, to varying degrees.

Value-added distributions The value-added that a country can gain from or give-out to other countries through engagement in trade, and the resulting value-added obtained and distributed, can be analyzed through a matrix of cross-border transfer of value-added by origin and destination. In our model, to capture inter-country interdependence through production networks (rather than trade relationships), we need to evaluate the impact of each country's final demand change on all other countries' GDPs. In Table 1, for example, the entry at the intersection of Japan's row and China's column for 1990 is 0.0172. This indicates that in 1990, a 0.0172 unit of GDP could be induced in Japan if final demand in China increased by one unit. We use this measure of 'one unit change of final demand' for all countries for standardization purposes, so that country size effects do not contaminate our observations. In this regard, the column sum of China (0.0266) in 1990 represents the total GDP spillover that China brings to the other countries in the region, which can be defined as China's GDP give-out potential. The row sum for Japan (0.5529) shows the total spillover effect that Japan receives from the other countries, which can then be defined as Japan's GDP gain potential. The interdependence between these countries is significant and includes linkages that twenty years ago were not present, or were insignificantly so, and that extent across the entire region.

Insert Table 1 about here

The development of cross-border transfers of value-added can be illustrated by plotting the standardized indices, presented in Figure 2. Notably, Japan has the largest gain potential, but has a small give-out potential to the other countries in our sample. In contrast, the ASEAN countries excluding Indonesia have large give-out potentials but small gain potentials, while Indonesia and NIEs-3 are at the immediate level for both potentials. Over fifteen years, Japan's gain-potential from the production network and regional value chains participation had reduced. However, its give-out potential (the distribution of its value chains) had somewhat increased and become more regional. China's gain-

⁶ This dynamic change is also captured by the Coefficients of Variation (CV) for each contour map: i.e., $CV(1990) = 2.57$ and $CV(2005) = 1.27$. The decline in these CVs is interpreted to be an increasing variation in international trade and the expansion of spatial economic interdependence among countries within the region.

potential, spurred by its emergence as an economy of significance, had increased substantially and so had its give-out potential. The data thus indicate that the emergence of China's economy has resulted in a different and broader regional distribution of production linkages. Japan, in keeping its competitive advantage of highly sophisticated technology and knowledge increased its give-out potential, yet its economy attracts fewer gains. In our analysis, it appears that the Japanese economy is dependent on its high value-added orientation, and its future role as a location in the very dynamic regional production networks may take advantage of greater integration with other Asian countries.

Pattern of changes in gain and give-out potentials The pattern of changes in the indices represented in Figure 2 for each country demonstrates significant variation across the region. This potential crucially impacts the significance of a country in its role as a location within value chains. For the Philippines, Thailand, Indonesia and China, both gain and give-out potentials increased rapidly from 1990 to 2005 in general. This is an important indication implying that these four economies receive and give an increasing inter-country effect from and to regional partners in terms of GDP creation and distribution, though relatively weakening in 2005 for the Philippines's give-out. Taiwan mainly enhanced its give-out potentials from 1990 to 2005 and did so rapidly, while it lost gain potential to some extent. Korea does not show remarkable change for give-out potential until 2000 and its gain potential after 1995 remained stable.

Insert Figure 2 about here

Singapore and Malaysia's give-out potentials have decreased remarkably. Singapore is a very small country that enjoys an open economy and achieved international interdependence in the 1990s. When the other Asian economies became more integrated into their regional production networks (Figure 1), Singapore's presence decreased relatively. Singapore's give-out potential decreased. In 1990, Singapore showed a very high interdependence on value chain links with Malaysia (Table 1). However, due to the extension of Asian production network, this Malaysia-Singapore link has become relatively weaker and Singapore is linking more so with other Asian countries.

In this period, Japan began with a very high gain potential that has decreased. This can be explained as follows. First, a part of Japan's production capacity has moved to other developing countries as FDI. This implies that the final demand of these other countries has a decreasing impact on Japan's GDP creation. A complementary explanation is that the economic growth of China (and its increasing production capacity) makes it a value chain substitute able to replace Japan in providing final goods to other countries. China's increasing importance results in decreases in other countries, as revealed by the standardized indexes, which accommodate all countries' average levels.

All other countries start with low gain potentials, and mostly they remain low over the fifteen years. Since the gain potentials of Japan and China are very large, the situation for other countries is not as obvious. However, with the ASEAN and other East Asian economies, some comments are warranted. Why do Japan and China present such large gain potentials? These countries have fully developed sets of production capacity at home, whereas smaller countries have to focus on a selection of specific production processes to maintain some attractiveness in regional value chains. If one considers the case of Japan for example, many provinces have a similar economic size as Malaysia, for instance. Malaysia's evolution is thus similar to that of Singapore. Figure 2 thus reflects the change of a country's participation and presence in the GDP creation process by the way of production networks. While Figure 1 is a direct image of inter-country interdependence using an international trade perspective, Figure 2 permits us to consider both the direct and indirect impact of production networks. Indirect in this context means a country's final demand may directly induce its partner country's export, and further, indirectly, this may induce its partner country's partner's exports.

Value added induced by partners' final demand A matrix of cross-border transfers of value-added activity by origin and destination for the years 1990 and 2005 identifies the amount of added-value that a country gains from or delivers into other countries. This is calculated as a proportion of a home-country's GDP spilling over to other host-countries included in the production network to which its firms belong when a firm moves production stages from one country to another until the final product is complete, assembled and ultimately delivered to the product's owner ordered in the home country. Within a

fragmented value chain, the induction stage of the main final-product TiVA accumulation for each country can be consumption and production-driven. This is summarized in Figure 3. This figure shows how a country's value added (Country A) is induced by its partner country's (Country B) final demand for a product, thus isolating the value-dimension of production networks of locations. This has been defined as Country A's exports of value-added to Country B in the international IO model earlier presented.

For China, we observe an increase over time in TiVA obtained from its exports of final products. That of Japan parallels this increase over the same period of time. This can be explained by Japan's early highly sophisticated production input and the additional impact stemming from the opening up of its markets. However, China surpassed Japan's early advance with a large TiVA induced by its export of final products (consumption-induced), indicating its rapidly emerging integration into the world economy, but also the potential it holds as a high value market.

Coupled with our data from Figure 1, we observe that the dynamics of the regional production network in our sampled countries became 'flatter' over the twenty years. That is, the integration of a variety of countries into these dynamics has resulted in a regionally dependent integration, with gain- and give-out focused production hubs around Japan and China that impact the development of an entire region⁷. As an illustration, this shall be interpreted as follows. For the case of iPhone's export from China to the USA, the gross (quantitative) export of iPhones is large. However, in terms of value-added, China's contribution to these exports represents a very small portion to the US in the iPhone trade. Using the international IO model, we can calculate who produces what, how much and for whom. Figure 3 is illustrative for our Asian sample. The upper part of this figure shows the TiVA at the absolute level. The lower part shows the percentage share of TiVA. The main findings of Figure 3 are:

- (1) In 1990, imports of value added by Japan dominate the Asian region's regional value chains at the absolute level. However, in 2000, China's imports of value added have increased, but are still lower than Japan's. As for Taiwan, China's performance exceeded Japan in 2000. For 2005 (after China's accession to the WTO in 2001), China's imports of value-added are the largest, followed by Japan. This reflects the rapidly increasing potential of China to be a growth engine of regional trade through its value-added gain potential.
- (2) South Korea's presence in the gain of value-added from regional markets also increased rapidly. A similar phenomenon can also be found for the other Asian economies, such as Thailand and Indonesia. This reflects the increasing participation of relatively large developing economies in the value chains of the Asian region between 1990 and 2005. For Taiwan, the similar tendency continues until 2000. However, from 2000 to 2005, its presence of value-added transfer with its partner counties excluding China has decreased.
- (3) When looking at the components of the TiVA figures by country, we can see that in 1990, the final demands of Japan were the main sources in the value-added creation processes of almost all Asian countries. In 2005, however, China exported much more value-added, especially to the East Asian economies (Japan, South Korea and Taiwan). This indicates that China is not simply a 'global factory' or 'supply center', but also a 'demand center', at least for the Asian region.

In addition, considering Figure 4, the features and changing pattern of a country's industrial value-added exports to its partner countries can be summarized as follows. In 1990, most Asian countries' value-added exports produced by the textile industry were mainly absorbed by final demand in Taiwan and Japan. However, in 2005, Taiwan and Japan's positions were completely replaced by China. For the Chemical and Machinery sectors, Japan's final demand played a dominant role on other Asian countries' value-added creation over time. The increasing presence of China is remarkable. These facts clearly reflect the observation that China's final demand is having much larger impacts on the creation of value-added in other Asian countries in the three industries considered here. This not only reflects the increasing

⁷ It should be noted that all explanations concerning the results are under the following assumption: there is no impact through the rest of the world (especially through EU). This is mainly because the data used treat the rest of the world as exogenous.

power of China's economic size, but also the deepening linkages between China and other Asian countries in this regional value chain pattern. Due to the scale of its final demand, China's direct imports of final goods from other Asian countries can induce their value-added directly. On the other hand, China's final demand for domestic goods can also induce large imports of intermediate goods from other Asian countries. Most Asian countries have been the main provider of parts and components to China in these Asian regional value chains.

6. Discussion

The primary empirical findings revealed economic interdependencies in the East Asian region that reflects locational patterns of value chains in this particularly dynamic region. First, since 1990, Japan had been and remained the dominant member country for East Asian regional production networks to the year 2005. At the same time, China's emergence is coupled with a significant broadening of the regional dimension of GVCs in Asia towards the end of this time period. Over this time period, Japan's outstanding gain potential suggests that the production system in East Asia derives from the emergence of supply networks extending from Japanese home-country production bases. This supports our initial hypothesis about the nexus between the economic geography of production networks and regional integration dynamics that emerge from those inter-linkages and which evolve over time. Second, even though other emerging economies in this region are less significant players in the distribution of value-added in the three industries examined here, most of these countries increased the value of at least one index, gain or give-out, over this time period, implying that they have become more firmly integrated into the production networks in this region over time. As a group, they now have a significant influence in shaping the regional production structure and potentially could dynamically shift the economic geography of the region accordingly. This confirms the second hypothesis about the roles of developed, emerging and lesser developed economies in the evolution of the distribution of value-added in the industries studied here.

Alongside Japan, the countries that show an increase in give-out potential but a slight decrease in gain potential (i.e. most inclined to the former increased give-out potential) are Korea and Taiwan, leading advanced economies in the region. These are followed by China, Indonesia, Thailand and The Philippines, showing an increase in both potentials, while these countries are known to have significant FDI inflows from other advanced economies and have rapidly promoted their technological profiles as a country-specific advantage. The remaining two countries, Malaysia and Singapore, decreased in both potentials.

As is evidenced in our analysis, a country with more advanced production technologies tends to be a location engaged more in the upstream segments of the vertical production process (such as the production of manufacturing parts and components) which generally require more advanced production systems and logistics skills (Fukao et al., 2003; Wakasugi, 2007). By advancing along the technological trajectory, a location is likely to shift away from being a mere assembler of final products to the more sophisticated production of intermediate items. As a result, it becomes a key supplier of important parts and components to other countries in the region which guarantees its dominant position in the value-added payoff across the regional production networks. This country might then be labeled a hub in the regional production network, with an important and highly integrated in- and out-potential and gain.

We thus identify Japan and Korea, amongst the countries represented here, over this time period, as the most recognized hubs of added-valued across this increasingly integrating region, in terms of production location of intermediate and finished products. We also observe the emergence of China towards the end of the time period in 2000, and most significantly in our 2005 data, which confirms the above developmental trajectory. Further, China has also emerged by 2005 as the market for high value final products. In general, the give-out and gain potentials depend on both the openness to trade and the technological level of a country in the region. A small country has relatively large give-out potential. This is because a small country could not produce everything to fulfill its domestic final demand. Its demand on foreign products naturally induces relatively more value-added for its partner countries, which can be reflected in a relative higher give-out potential (see Singapore and Malaysia's cases in Figure 2). In addition, if a country can satisfy foreign demands by focusing on high knowledge specialized activities, a

relatively higher gain potential can be observed, since high knowledge implies a high value-added rate (see Japan's case in Figure 2).

As recognized by Jacobides and Hitt (2005), the internationalization of productive capabilities has redefined the nature of the world economy in that the capacity to undertake manufacturing activity is no longer concentrated exclusively in a few economies in the developed world. With increasing codification of production technologies and the disaggregation of value chains, and the imperative to seek out both cost- and talent (Manning, Massini & Lewin, 2008) competitive production sites, the interfacing of country-specific comparative advantage with firm-specific competitive advantage is altering the geography of industrialization. The location choice decision (Mudambi & Venzin, 2010) now open to firms has been broadened and extended across national borders, and this is altering firm boundaries and refining the scale and scope of the modern firm (Liesch et al., 2012). Whether to externalize the internationalization of production into independent firms or whether to internalize productive capability into captive offshored facilities is largely determined by the relative efficacy of market transacting (Buckley & Casson, 1976; Doh, Bunyaratavej & Hahn, 2009; Kedia & Mukherjee, 2009; Liesch et al., 2012; Narula, 2012), and a firm's bargaining power (Hennart, 2012). Liesch et al. (2012) argue that alongside foreign direct investment, foreign involvement of various forms is redefining the scale and the scope of the firm in our modern era. Facilitating this redefinition is the 'worldwide market for market transactions' a concept they introduce to encapsulate and represent the nature of the modern world economy (Liesch et al., 2012) and which is enabling firms large and small from anywhere to access the capabilities of firms elsewhere. We thus have provided evidence in support of hypothesis three.

As such, evidence consistent with all three hypotheses which elaborate the research question: *what are the locational patterns of trade in value-added in East Asia and how are these patterns changing over time*, has been presented. We contribute to the locational choice in international business and economic geography literatures in that we have provided a rationale for the changing structure of production hubs in East Asia. Trade in value-added is redefining the region. We have offered an approach, new to the IB field through an application of IO analysis, that has enabled us to reveal how trade in value-added is shaping the regional economics landscape in East-Asia through the activities of MNEs and other firms as they seek out productive capabilities across the region. Not only is trade in finished product conditioning this landscape, but as we demonstrate, economies throughout the region at different stages of economic development, are enabling a dynamic pattern of integration to evolve as these firms take decisions on the location of value-added production. The multi-disciplinarity of these processes is in evidence. Macroeconomic rationales for these patterns of international production are conjoint with the microeconomic decisions of firms, and the resulting patterns are tracing out a regional integration as would be likely if a formalized process of RTA/FTA were to occur. Questions of political motivations for formalized integration that have been asked of the region have been at least partially addressed in that our analyzes have shown the decisions of firms seeking efficiencies in the production of value-added, and of its trade, can produce a regional integration in the absence of formalized macro-level agreements.

Consistent with the resource dependency theory (Pfeffer & Salancik, 1978), firms no longer internalize production activity to the extent they once did (when market imperfections were more widespread and a barrier to exchange), and their internationalization in search of talent and cost-efficiency – productive capability – is achieving economic interdependence through regional integration, and is defining a "... 'new geography of competition' ... and the increasingly complex interplay between states, economic regional blocs ... and semi-autonomous regions" (Buckley & Ghauri, 2004: 91). This new geography of competition is one in which a firm's ownership-specific assets interact with the location-specific assets of countries elsewhere in different ways that are constrained by the firm's FSAs and its home-country origins, and these differences are pronounced for countries at different stages of economic development (Narula, 2012). However, as to whether new frameworks are needed to explain these processes for internationalizing firms from countries at different stages of economic development remains an open question, with persuasive argument suggesting new frameworks are not needed (Narula, 2012; Verbeke & Kano, 2012).

The implications of this study support the importance of addressing CSA factors in greater depth, as these have only been discussed in broad terms in this paper. The interactions between CSAs and the FSAs inherited by firms due to their country of origins, and how these might develop over time as the firm involves itself across borders is emerging to be a topic of interest in the international business field. Also needing attention is the question of how analysis of consumption hubs might potentially influence the patterns revealed here. How important to regional interdependence is the role of large MNEs from inside and from outside this Asian region? What is the role of government in the long-term development of regional integration, and in the deployment of regional trade agreements (RTAs) in this region, and the interfaces of this region with beyond? From our analysis, it appears that RTAs in, or with, this East Asia region are negotiated mainly amongst high gain - potential countries. A more extensive analysis of this phenomenon will be illuminating. Will China's role be affected by FTAs between South Korea and the EU or the US, or with Japan in this context? Finally, the forthcoming publication of new and more recent IO data will permit further longitudinal analysis. Desirably, additional extension to a comparative study with the US and European IO data will be revealing as to whether the patterns we have observed are universal, and how they can be used to analyze the results of business strategy at the global level.

7. Conclusions

The three main findings from our IO analysis over the period 1990 through to 2005 are: (1) Japan retains its outstanding gain-potential throughout the period studied and displays a basic layer of supply networks extending from Japanese production bases; (2) most of the countries represented here increased the value of at least one index, and have become more firmly integrated into the regional production networks over time, creating hubs of intensive gain and give-out potential; and (3) a country's level of integration is likely to be explained by its production technology (through IO analysis) and its CSAs.

We report clear indications that regional integration is aligned in the East Asian region with value-adding production network activities and that this integration is informal in that it is motivated by the decisions of firms as they internationalize in search of productive capabilities outside of the firm. This aligns with Verbeke and Kano (2012: 138) in that "the key determinant of the MNE's geographic scope is the firm's ability to recombine FSAs with CSAs in order to reach its strategic goals". It also aligns with Narula (2012) in that diversity in regional CSAs will determine the initial FSAs of internationalizing firms which will condition their internationalization strategies as they search for productive capabilities to internalize through various forms of international involvement regionally (Liesch et al., 2012). The patterns of production flows we observe are motivated primarily by firm strategy as little formal institutional-mandated regional integration, as is the case in the EU, is in place in East Asia. We contribute to the Buckley and Ghauri (2004) call for the international business scholarly community to address a shortfall in spatial analyses of the geographical and temporal spread of international business activity in the light of the new international division of labor, global commodity chains and regional production networks.

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Table 1: Cross-border Transfer of the Value-added Creation Effect in East Asia: 1990-2005 (at the relative level)

1990	Taiwan	Japan	Korea	China	Indonesia	Malaysia	Singapore	Thailand	Philippines	Row Sum	Gain potential
Taiwan		0.0020	0.0024	0.0031	0.0046	0.0177	0.0167	0.0087	0.0087	0.0637	0.6504
Japan	0.0608		0.0459	0.0172	0.0393	0.1233	0.1493	0.0791	0.0381	0.5529	5.6428
Korea	0.0037	0.0025		0.0011	0.0042	0.0098	0.0106	0.0059	0.0056	0.0434	0.4426
China	0.0004	0.0033	0.0003		0.0046	0.0106	0.0210	0.0090	0.0033	0.0525	0.5359
Indonesia	0.0036	0.0035	0.0046	0.0019		0.0050	0.0095	0.0018	0.0031	0.0330	0.3364
Malaysia	0.0029	0.0015	0.0040	0.0017	0.0023		0.0362	0.0095	0.0043	0.0624	0.6363
Singapore	0.0019	0.0004	0.0009	0.0007	0.0030	0.0253		0.0050	0.0033	0.0405	0.4128
Thailand	0.0015	0.0009	0.0011	0.0007	0.0011	0.0097	0.0099		0.0022	0.0270	0.2757
Philippines	0.0006	0.0005	0.0006	0.0002	0.0003	0.0022	0.0017	0.0006		0.0066	0.0669
Column Sum	0.0754	0.0144	0.0598	0.0266	0.0594	0.2035	0.2548	0.1194	0.0685	0.8819	
Give-out potential	0.7699	0.1472	0.6104	0.2713	0.6067	2.0766	2.6005	1.2187	0.6986		
1995	Taiwan	Japan	Korea	China	Indonesia	Malaysia	Singapore	Thailand	Philippines	Row Sum	Gain potential
Taiwan		0.0015	0.0021	0.0043	0.0041	0.0186	0.0123	0.0079	0.0098	0.0605	0.5433
Japan	0.0674		0.0440	0.0319	0.0340	0.1690	0.1169	0.0851	0.0504	0.5987	5.3773
Korea	0.0067	0.0022		0.0075	0.0058	0.0209	0.0180	0.0078	0.0070	0.0759	0.6819
China	0.0058	0.0051	0.0085		0.0049	0.0126	0.0180	0.0080	0.0067	0.0697	0.6258
Indonesia	0.0049	0.0023	0.0046	0.0023		0.0076	0.0153	0.0027	0.0059	0.0457	0.4104
Malaysia	0.0044	0.0014	0.0030	0.0022	0.0025		0.0283	0.0090	0.0066	0.0574	0.5157
Singapore	0.0028	0.0005	0.0013	0.0015	0.0035	0.0281		0.0057	0.0043	0.0477	0.4284
Thailand	0.0026	0.0011	0.0010	0.0016	0.0022	0.0109	0.0150		0.0036	0.0381	0.3425
Philippines	0.0009	0.0004	0.0007	0.0002	0.0003	0.0030	0.0018	0.0009		0.0083	0.0746
Column Sum	0.0956	0.0145	0.0651	0.0516	0.0573	0.2707	0.2257	0.1271	0.0944	1.0020	
Give-out potential	0.8588	0.1301	0.5851	0.4634	0.5146	2.4314	2.0274	1.1417	0.8475		
2000	Taiwan	Japan	Korea	China	Indonesia	Malaysia	Singapore	Thailand	Philippines	Row Sum	Gain potential
Taiwan		0.0020	0.0029	0.0093	0.0043	0.0177	0.0077	0.0087	0.0080	0.0607	0.6166
Japan	0.0665		0.0320	0.0248	0.0299	0.1120	0.0829	0.0671	0.0428	0.4579	4.6514
Korea	0.0092	0.0025		0.0093	0.0065	0.0132	0.0096	0.0067	0.0102	0.0672	0.6827
China	0.0097	0.0079	0.0114		0.0091	0.0204	0.0192	0.0142	0.0075	0.0993	1.0083
Indonesia	0.0051	0.0027	0.0054	0.0025		0.0134	0.0117	0.0059	0.0063	0.0531	0.5398
Malaysia	0.0043	0.0017	0.0030	0.0020	0.0046		0.0309	0.0076	0.0078	0.0618	0.6282
Singapore	0.0029	0.0005	0.0016	0.0014	0.0028	0.0185		0.0058	0.0065	0.0400	0.4063
Thailand	0.0028	0.0012	0.0012	0.0013	0.0039	0.0123	0.0091		0.0044	0.0362	0.3679
Philippines	0.0013	0.0006	0.0008	0.0005	0.0005	0.0029	0.0013	0.0017		0.0097	0.0989
Column Sum	0.1018	0.0191	0.0582	0.0512	0.0617	0.2104	0.1725	0.1177	0.0935	0.8860	
Give-out potential	1.0345	0.1937	0.5914	0.5198	0.6265	2.1372	1.7520	1.1956	0.9493		
2005	Taiwan	Japan	Korea	China	Indonesia	Malaysia	Singapore	Thailand	Philippines	Row Sum	Gain potential
Taiwan		0.0024	0.0030	0.0125	0.0037	0.0116	0.0072	0.0091	0.0085	0.0580	0.5426
Japan	0.0695		0.0330	0.0328	0.0273	0.0502	0.0506	0.0730	0.0267	0.3631	3.3970
Korea	0.0087	0.0033		0.0158	0.0067	0.0105	0.0093	0.0110	0.0062	0.0715	0.6689
China	0.0253	0.0179	0.0219		0.0226	0.0351	0.0424	0.0322	0.0116	0.2090	1.9553
Indonesia	0.0069	0.0036	0.0063	0.0034		0.0202	0.0419	0.0086	0.0058	0.0967	0.9047
Malaysia	0.0040	0.0020	0.0031	0.0033	0.0062		0.0212	0.0132	0.0054	0.0584	0.5464
Singapore	0.0025	0.0008	0.0036	0.0022	0.0080	0.0150		0.0069	0.0044	0.0434	0.4060
Thailand	0.0033	0.0019	0.0016	0.0026	0.0095	0.0147	0.0083		0.0046	0.0465	0.4350
Philippines	0.0016	0.0008	0.0010	0.0019	0.0012	0.0030	0.0021	0.0038		0.0154	0.1441
Column Sum	0.1218	0.0327	0.0735	0.0745	0.0852	0.1603	0.1830	0.1578	0.0732	0.9620	
Give-out potential	1.1395	0.3059	0.6876	0.6970	0.7971	1.4997	1.7121	1.4763	0.6848		
change rate (%) between 1990 and 2005	Taiwan	Japan	Korea	China	Indonesia	Malaysia	Singapore	Thailand	Philippines	Row Sum	Gain potential
Taiwan		23	26	298	-19	-34	-57	5	-2	-9	-17
Japan	14		-28	91	-31	-59	-66	-8	-30	-34	-40
Korea	134	32		1,373	59	8	-12	86	11	65	51
China	5,619	443	6,872		387	230	102	260	253	298	265
Indonesia	90	4	37	80		306	340	381	86	193	169
Malaysia	40	37	-23	91	167		-41	39	27	-6	-14
Singapore	29	115	289	204	170	-41		39	33	7	-2
Thailand	118	110	50	271	792	52	-16		113	72	58
Philippines	181	72	81	964	278	36	25	546		135	115
Column Sum	61	127	23	180	43	-21	-28	32	7	9	
Give-out potential	48	108	13	157	31	-28	-34	21	-2		

Source: Asian International Input-Output Table, 1990 - 2005, IDE-JETRO.

Figure 1:
Spatial Economic Interdependence in East Asia, 1990 and 2005

Figure 2:
GDP Gain/Give-out Potentials of a Unit Increase

Figure 3: Cross-border transfer of value-added creation effect in East Asia: 1990-2005 (at the absolute level, thousand US\$)

Figure 4: Cross-border transfer of value-added creation effect in East Asia: 1990-2005 (at the industrial level, %)