ERIA Discussion Paper Series

Constraints, Determinants of SME Innovation, and the Role of Government Support

Sothea OUM
Economic Research Institute for ASEAN and East Asia (ERIA)

Dionisius NARJOKO
Economic Research Institute for ASEAN and East Asia (ERIA)

Charles HARVIE
Centre for Small Business and Regional Research,
School of Economics, University of Wollongong

May 2014

Abstract: *This paper provides an empirical analysis of potential constraints to SMEs upgrading their capability to innovate, and assesses the effectiveness of government support in overcoming these constraints. The justification for government support is that market failures can hinder SMEs' access to information, finance, technology, and human resources. This paper focuses on the impact of the perceived effectiveness of government support through business development services in terms of providing: (i) training; (ii) counselling and advice; (iii) technology development and transfer; (iv) information; (v) business linkages; (vi) financing; and (vii) a conducive business environment. The effectiveness of this support is evaluated against the ability of SMEs to innovate.*

Keywords: SMEs, constraints, innovation, government support, and developing Asia.
JEL Classification: L20, L25

1. Introduction

There are many sources of motivation for firms to innovate, including firms' rational, profit-driven investment and efficiency-seeking behaviour to improve their competitiveness, and in order to facilitate their entrance into new markets, so that they are able not only to maintain their current market shares but to expand as argued by Shefer and Frenkel (2005) and Webster (2004). The capability of firms to innovate is found to be an important determinant of the participation of small- and medium-sized enterprises (SMEs) in production networks (Harvie, *et al*., 2010). Therefore, a better understanding of factors that are likely to facilitate an enhancement of this capability is worth exploring. Teece (2010) and Souitaris (2003) provide a review of determinants of technological innovation. Mairesse and Mohnen (2010) also discuss the usage of innovation surveys for econometric analyses.

Many studies have been conducted to examine the determinants of innovation by SMEs, for example, Baldwin, *et al*. (2001) and Raymond and St-Pierre (2010) for Canada; Romijn and Albaladejo (2002) for England; Vega-Jurado, *et al*. (2008) and Guadalupe, *et al*. (2010) for Spain; de Jong and Vermeulen (2004) for the Netherlands; Bertschek (1995) for Germany; and Lee, *et al*. (2010) for South Korea. Other studies on innovation in ASEAN and other East Asian economies have been conducted by Hahn and Narjoko (2011), Intarakumnerd (2011), Intarakumnerd and Ueki (2010), and many papers have also been published in the *Asian Journal of Technology Innovation*.

It is well recognised in the literature, such as in Lall (2003) that, in most circumstances, the success of overcoming internal constraints of SMEs requires some strategic support measures from governments. The justification for the support to SMEs is the fact that SMEs are the backbone of every economy but, at the same time,

they face many constraints in an increasingly competitive and complex international business environment. These constraints are the results of market failures that hinder their access to information, finance, technology, and human resources.

The focus of this paper is to provide empirical evidence of potential constraints and determinants of SMEs' capability to innovate and to assess the impacts of effective support by governments to overcome these constraints through business development services.

As discussed by Abonyi (2005), national governments, in general, tend to provide support in six areas: (1) training in general business management, entrepreneurship, and particular business skills such as marketing, accounting, finance; (2) counselling and advice, often on a 'firm-by-firm' basis, and where particularly effective, as a follow-up to training; (3) technology development and transfer, involving the adaptation, design and development of technologies and their dissemination to SMEs; (4) information on markets, buyers, technology, increasingly available through information and communications technology (ICT)-based facilities, as well as through traditional mechanisms such as trade fairs, exhibitions and visits/tours; (5) business linkages involving the development and strengthening of commercial linkages between SMEs and large firms (e.g. subcontracting) and among SMEs (e.g. development of 'enterprise clusters'); and (6) financing aimed at channelling funds to SMEs either directly (e.g. special purpose financial institutions such as 'SME banks') or indirectly (e.g. through special 'windows' of commercial banks), perhaps at preferential rates. Another factor is also considered, number (7), which is whether the government's efforts to make an overall improvement in the business climate (e.g. political and macroeconomic stability; laws, regulations, and dispute resolutions; reduced corruption and bureaucratic barriers; fair competition, infrastructure, etc.) is

favourable to SMEs' innovation efforts. The perceived effectiveness of this support is evaluated against the ability of SMEs to innovate.

The rest of this paper is organized as follows. Section 2 discusses pertinent literature to provide a framework for our analysis and to establish some testable hypotheses. Section 3 presents the methodology for the empirical exercises. Section 4 presents the results of the empirical exercises and Section 5 summarises the key findings and presents the key conclusions from these findings.

2. Analytical Framework and Testable Hypotheses

The definitions of types of innovation used in this analysis follow the Oslo Manual (OECD/Eurostat, 2005). Three categories of innovation are considered: (1) business process or organisational innovation, which is defined as the introduction of significantly changed organisational structures, advanced management techniques, and corporate strategic orientations; (2) production process innovation: the implementation/adoption of new or significantly improved production or delivery methods; and (3) product innovation: the implementation/commercialisation of a product with improved performance characteristics, such as to deliver new or improved services to the consumer. We examine factors that hinder or contribute to the firms' likelihood to upgrade their capability to innovate. This then provides information relating to what variables are important overall, and how businesses, processes, and product innovators differ in their dominant characteristics and determinants.

In identifying constraints to, and determinants of, innovation by SMEs, we assume that SMEs need to overcome any internal resource constraints that may be related to their size, and to develop capacities enabling them to become more innovative. Their constraints or barriers that particularly affect innovation can be resource-based or capability-related, such as access to: skilled labour, finance, and market information. In addition to these internal factors, external environment factors, such as ICT infrastructure and protection of intellectual property rights (IPR) can also be hindrances to SME innovation. We also rely on existing literature to take into account the importance of the exposure to foreign trade and ownership in technological transfers and spillover effects.

We then investigate the significance of institutional support from government to help firms mitigate and overcome these constraints. Specifically, we test whether each of the reported comprehensive support services provided by governments or other sources in the area of (i) training, (ii) counselling and advice, (iii) technology development and transfer, (iv) information, (v) business linkages, (vi) financing, and (vii) conducive business environment, would enhance firms' capability to innovate.

Selected literature as discussed in the next section provides the basis for the empirical analysis, hypotheses testing and profiling aimed at highlighting the key characteristics of SMEs that are successful or unsuccessful in upgrading their capability to innovate.

2.1. Hypotheses relating to Firm Characteristics of SMEs

2.1.1. Size

Relatively large firms are assumed to have greater access to the resources needed for investment in, or adoption of, a new technology. Larger firms are more likely to

have the financial resources required for purchasing and installing new technology and may be better able to attract the necessary human capital and other resources. In support of this hypothesis, surveys of empirical studies by Cohen and Levin (1989) and Hall and Khan (2002) suggest that large firms can capture economies of scale from production and can spread the fixed costs associated with adoption across a larger number of units.

2.1.2. Age

There could be a positive relationship between an SME's age and its capability to innovate, as older firms would be expected to have accumulated more experience in learning how to improve their efficiency than younger firms. However, a negative relationship involving firm age and the capability to innovate might also be observed, as shown, for example, in the paper by Shefer and Frenkel (2005), who examined 209 industrial firms in the northern part of Israel and found that younger firms were more inclined to invest in research and development than the older, more established firms. We can also assume that adjustment is likely to be more difficult, in general, for older firms to achieve than it is for younger firms, as the new and younger SMEs are expected to have greater flexibility in taking advantage of breakthroughs in technology, be it through start-ups or spin-offs from technology research or incubating centres, compared with older SMEs.

2.1.3. Foreign ownership

Foreign ownership is hypothesized as being positively related to an SME's capability to innovate, as foreign-owned firms can employ assets owned by the foreign partners, thus providing advantages, for example, in terms of accessing financial

support or technological know-how. The significance of foreign ownership, however, may depend on the share of the ownership. Parent companies may restrict the transfer of firm-specific assets to companies operating in another country if they do not hold a significant controlling interest over those firms. Guadalupe, *et al*. (2010) found that the parent companies of multinational firms acquire firms in foreign countries that they consider to be more conducive to conducting product and process innovation and adopting new technologies.

2.1.4. Skilled labour

The skill level of workers is found to be one of the most important determinants of a firm's ability to absorb and make use of new technology in the survey by Hall and Khan (2002), who argued that the successful implementation of a technology requires complex new skills, and it can be time consuming or costly to acquire the required level of competence. Dewar and Dutton (1986) found that investment in human capital in the form of technical specialists appears to be a major facilitator in the adoption of new technical processes. Therefore, firms with a high number of educated and technically qualified staff will be more responsive and capable of building up the capacity to innovate.

2.1.5. Access to finance

SMEs that have relatively plentiful internal financial resources or access to external sources of finance are hypothesized as having a higher chance of engaging in innovative activities than those that do not. The relationship between the use of

external finance in particular, and the extent of firm innovation is expected to be significant and positive. Access to external funds to improve existing, or acquire new, machinery and equipment is important to every firm, because as argued by Hall and Khan (2002), together with skilled workers, capital goods are crucial for successful implementation and operation of a new invention.

2.1.6. Exposure to foreign trade

Exposure to foreign trade is hypothesized as enhancing firms' innovation capability through both export and import channels, in addition to foreign acquisition through foreign direct investment (FDI). Keller (2009), in his extensive survey of theoretical and empirical studies, found that technology spillovers are positively associated with imports and firms' inward and outward FDI, but mixed for exports. Love and Ganotakis (2013) found a positive link between exporting and SMEs' ability to overcome hurdles and innovate for a sample of high-technology SMEs in the UK. Their finding is consistent with the learning-by-exporting hypothesis that when countries engage in trade, knowledge is exchanged between the companies in each of the trading partners. Knowledge is transferred internationally, both embodied in the flow of traded goods, services and skilled labour, and also through technology transfers between firms. Moreover, Hall and Khan (2002) argued that imports of high technology products from developed countries are generally coupled with a high level of knowledge transfer and knowledge spillover.

2.1.7 Access to information

Lack of information is found to be one of the most important constraints facing companies in our surveyed sample. Up-to-date information that is of key importance to business activities includes that relating to customer behaviour/tastes, new competitors, price development, availability of new technologies and materials, new

market opportunities, business advisory services, training opportunities, financing sources, taxation, government regulations on trade, customs, investment, etc. Information on all of those aspects of business is crucial for all enterprises to enhance their business sustainability, production and productivity, and to facilitate market access, as well as informing their decisions on whether to embark on investment in innovation activities.

2.1.8. ICT infrastructure

The adoption of new, and improvement of existing, ICT infrastructure can enhance firms' efficiency, reduce costs, and broaden market reach. It can be used by firms to replace traditional means of communication, to manage business documentation and information (databases), to perform usual business operations (inventory control) and to engage in business transactions or e-commerce (business to business or business to consumer).

While testing the hypothesis that ICT can act as an enabler of innovation by speeding up the diffusion of information, enabling closer links between businesses and customers, reducing geographic limitations and increasing efficiency in communication, Spiezia (2011) looked at firms in eight OECD countries and found that ICT enables firms to adopt new processes and practices, particularly resulting from product and marketing innovation, but not the capability to develop those new products and processes. Machikita, *et al*. (2010) also found positive correlations between ICT and business performance, especially with regard to the development of export markets and improvement of production management (product quality and cost reduction). Therefore, we expect that access to ICT infrastructure is an enabling factor for firms to innovate.

2.1.9. Enforcement of intellectual property rights

An efficient and effective intellectual property rights (IPR) system is assumed to be positively correlated with firms' innovation efforts. Hall and Lerner (2009) in their review of literature on firms' R&D finance suggested that a loose enforcement of IPR protection would hinder the firm undertaking the investment to secure the returns from the investment in knowledge/innovation, and therefore, such firms will be reluctant to invest. Allred and Park (2007) also found a strong positive influence of patent rights and changes in patent rights on a firm's propensity to invest in innovation in their study of data for 706 firms in 29 countries.

2.2. Hypotheses relating to Government Supports

Lall (2003) argued that it may be necessary for governments to take a proactive role in order to overcome market failures that may hinder firms building their capabilities that are required for industrial development. Smallbone and Welter (2001) discussed the role of government in SME development in transition economies. They argued that a stable macroeconomic environment, legislation and regulations (easy registration, compliance to tax, social security etc.), support policies and programmes, and institutional arrangements (business support infrastructure, banks, and other financial intermediaries) have direct (positive) impacts on SME development. Kim and Lee (2011) in their study of firms in South Korea found that government funding generally had a positive effect on firms' production processes and product innovation (new-to-the-firm), but found it to be statistically insignificant in its effect on achieving high innovativeness (new-to-the-market processes and product innovation). Intarakumnerd and Virasa (2004) discussed government policies and measures that would support firms' development of technological expertise and access to advances in technology, many of which are proposed below.

In order to assess the effectiveness of government support to SMEs, we examine whether the provision of (i) training; (ii) counselling and advice, (iii) technology development and transfer; (iv) information; (v) business linkages; (vi) financing; and (vii) a conducive business environment, are positively correlated with the capability of SMEs to innovate.

3. Methodology

3.1. Model

The analysis in this paper does not only identify the constraints and determinants of the capability of SMEs to innovate, but it also establishes how each constraint and determinant will impact upon the build-up of SMEs' capability to engage simultaneously in a number of innovation activities.

The capability is then measured within a range from zero to four where a value of four is the maximum value for business process innovation, three is the maximum for production process innovation, and three for product innovation. More detailed information on how each number is assigned is given in Section 3.2 and Table 1.

We utilize the ordered probit model to provide estimates for each firm/SME of its level of capability to innovate. Thus, the following general form of a statistical model is estimated:

$$INNO_{ij} = \alpha_0 + \beta_i X_i + \varepsilon_i \quad (1)$$

where $INNO_{ij}$ is a discrete choice variable for each factor relating to the firms' capability to innovate. The term i represents firm i, and j denotes categories of innovation and takes a value from 1-4. The term $INNO_{i1}$ takes a value of 0-4 to represent whether an SME is engaged in any number of business process innovation activities from zero to four; $INNO_{i2}$ takes a value of 0-3 to represent whether an SME is engaged in any number of production process innovation activities from zero to three; and $INNO_{i3}$ takes a value of 0-3 to represent whether an SME is engaged in any number of product innovations from zero to three. The term $INNO_{i4}$ takes a value of 0-3 to represent whether an SME is engaged in the maximum number of activities in zero, one, two or three of the categories of innovation. The term X_i is a set of explanatory variables that captures firm characteristics and ε_i is an error term. Estimations include a control by including dummy variables for industries and country groups. The industry dummy variables identify whether firms are in the following sectors: garments; auto parts and components; electronics, including electronics parts and components; or other sectors. The country-group dummy variables identify whether a firm operates in the group of developed ASEAN countries (i.e. Thailand, Malaysia, Indonesia and the Philippines) and China, or the group of new ASEAN member countries (i.e. Cambodia, Lao PDR and Viet Nam).

3.2. Measurement and Summary of Variables

Similar to the approach taken by Machikita and Ueki (2010) in their measurement and classification of innovation, in order to measure a firm's business process innovation efforts four dummy variables were created to identify whether a firm: (1) meets international quality standards, (2) has introduced ICT, (3) has established new divisions or plants, and (4) is involved in business networking activities (e.g. business association membership, cooperation with other firms, R&D networks, etc.). In order

to measure the extent of a firm's production-process innovation efforts, three dummy variables were created to identify whether a firm: (1) has bought new machines, (2) has improved its existing machinery, and (3) has introduced new know-how or knowledge into its production. For a firm's product innovation efforts three dummy variables were created to identify whether a firm: (1) has introduced new products or services onto the market, (2) has introduced new products or services using new technology, and (3) has introduced new products or services to the market. We sum all dummy variables for each innovation category to get the total number of innovation activities for each category, $INNO_{i1} - INNO_{i4}$ (see Table 1).

A number of variables are employed to account for the hypothesized firm characteristics. The first six of these are as follows and described in turn: firm size, firm age, firm ownership, skill level, exposure to foreign trade, and access to finance.

Firm size is proxied by the number of employees. Meanwhile, the age of the firm is proxied by the number of years the plant has been in commercial production. These two variables are in logarithmic form.

We distinguish between foreign- and locally-owned firms by assigning a value of one for firms with more than 50 percent of the share owned by foreigners and zero for locally-owned firms. A skill intensity variable is also included in the estimation, which is defined as the ratio of employees with tertiary or vocational education to the total number of employees.

The firm's level of exposure to foreign trade is proxied by a dummy variable when the firm is engaged in both importing and exporting at the same time.

For the finance variable, we have two dummies variables. One is for SMEs that are reported to face a shortage of working capital to finance new business plans, so those SMEs are considered to be financially constrained. Another dummy variable is

for SMEs that are reported to have access to external sources of finance to fund their capital expansion.

Four other variables to capture critical constraints faced by SMEs affecting their capability to innovate are: (1) limited information to locate and/or analyse markets and/or business partners, (2) insufficient quantity of personnel, or insufficiently trained personnel required for the firm's expansion, (3) inadequacy of ICT infrastructure, and (4) inadequate protection of IPR.

Finally, seven dummy variables were assigned to reflect the perceived effectiveness of the government support services to SMEs, for (i) training; (ii) counselling and advice, (iii) technology development and transfer; (iv) information; (v) business linkages; (vi) financing; and (vii) a conducive business environment.

The summary of statistics is shown in Tables 1 and 2. Table 1 shows the summary of key dependent variables, and Table 2 shows all 18 variables using the Likert scale, where a value of one implies 'very significant' and a value of five means 'not significant'. The key constraint variables are numbered (1) to (5); determinants and firm characteristics are numbered (6), (7) and (15) to (18); and the seven variables for the perceived effectiveness of government support and the business environment are numbered (8) to (14) where a value of one implies 'very ineffective' and a value of five means 'very effective'.

Table 1: Summary Statistics of Dependent Variables

	Mean	Std dev.	Min.	Max.
Business process innovation - $INNO_{i1}$	1.372	1.237	0	4
Adopted an international standard (ISO or others)?	0.375	0.484	0	1
Introduced ICT and reorganized business processes?	0.338	0.473	0	1
Introduced other internal activities to respond to changes in the market?	0.199	0.400	0	1
Involved in business networking activities (e.g. business association membership, cooperation with other firms, R&D networks, etc.)?	0.460	0.499	0	1
Production process innovation - $INNO_{i2}$	1.517	1.164	0	3
Bought new machines	0.493	0.500	0	1
Improved existing machines	0.615	0.487	0	1
Introduced new know-how on production methods	0.409	0.492	0	1
Product innovation - $INNO_{i3}$	0.902	1.071	0	3
Introduction of new good	0.496	0.500	0	1
Introduction of new good to new market	0.213	0.410	0	1
Introduction of new good with new technology	0.193	0.395	0	1
Combined innovation capabilities $INNO_{i4}$	0.445	0.666	0	3
Business process innovations ($1\ if\ INNO_{i1} = 4, 0$ otherwise)	0.055	0.227	0	1
Production process innovations ($1\ if\ INNO_{i2} = 3, 0$ otherwise)	0.268	0.443	0	1
Product innovations ($1\ if\ INNO_{i3} = 3, 0$ otherwise)	0.122	0.327	0	1

In Table 1, the summary statistics suggest that firms are reported to have conducted business process innovation, primarily through business networking activities (mean value at 0.46, or 46 percent), followed by the adoption of international standards (37 percent) and third most significant was the introduction of ICT (34 percent). However, most SMEs showed very little response to changes in market conditions (20 percent).

Firms that have been engaged in production process innovation have done so predominantly by improving existing machines (mean value at 61 percent) or buying new machines (49 percent) and, to a lesser degree, by introducing new know-how to the production process (41 percent).

Firms' capacity with regard to product innovation is shown to take a mean value of 0.496, or 50 percent in the table. However, a significant proportion of them (with

very low mean value for using new technology at 19 percent) have been able to introduce new goods to the market that are made using old technologies and sold to existing markets (mean value for new market at 21 percent). For the combined innovation capabilities, about 27 percent (mean value at 0.27) of them are able to engage in all activities in production process innovation, 12 percent in product innovation, and about 5 percent in business process innovation.

In Table 2, the mean value of each constraint variable (1) to (5) is between 2.7 to 3.3, suggesting that many firms face significant constraints, because a value of 1.0 implies the most significant constraint. Around 11 percent of SMEs are able to access external sources of finance and around 22 percent of them are exposed to foreign trade. A mean value lower than 3.0 for perceived effectiveness of government support suggests some degree of ineffectiveness, since a value of 5.0 implies the most effective.

Table 2: Summary Statistics of Independent and Control Variables

	Variables	Mean	Std dev.	Min.	Max.		Variables	Mean	Std dev.	Min.	Max.
(1)	Limited information to locate/analyse markets/business partners	2.801	1.271	1	5	(10)	Technology development and transfer	2.211	1.823	0	1
(2)	Insufficient quantity of and/or untrained personnel for market expansion	2.944	1.280	1	5	(11)	Information	2.781	1.806	0	1
(3)	Shortage of working capital to finance new business plan	2.741	1.337	1	5	(12)	Business linkages	2.661	1.895	0	1
(4)	Inadequacy of basic and ICT infrastructure	3.219	1.228	1	5	(13)	Financing supports	2.282	1.831	0	1
(5)	Inadequate protection of intellectual property rights	3.290	1.441	1	5	(14)	Conducive business environment	2.478	1.793	0	1
(6)	Access to external sources of finance to fund their capital expansion	0.108	0.311	0	1	(15)	Age	2.238	0.858	0	4.220
(7)	Exposure to foreign trade	0.221	0.415	0	1	(16)	Size	3.302	1.186	0	5.298
(8)	Received training	2.631	1.790	0	5	(17)	Foreign ownership	0.099	0.299	0	1
(9)	Counselling and advice	2.431	1.760	0	5	(18)	Skill intensity	0.398	0.365	0	1

The logarithmic mean of firm age is 2.2 (normal mean age is 12 years) and firm size is 3.3 (normal mean size is 49 employees), respectively. Less than 10 percent of the firms are owned by foreigners and the average ratio of the workforce with university and vocational training is around 40 percent.

4. Results and Analyses

4.1. Constraints and Determinants of Innovation by SMEs

SMEs are asked to rank barriers to firms' ability to initiate, develop or sustain business operations. Limited information to locate and/or analyse markets and/or business partners, difficulty faced by a firm to access to insufficient quantity of, and/or untrained, personnel for market expansion, shortage of working capital to finance new business plan, inadequacy of ICT infrastructure, and inadequate protection of IPR are found to be major constraints to all firms in the sample. We estimate the significance of these constraints with regard to the ability of firms to upgrade their capability to innovate.

Table 3 reports the results of a maximum likelihood estimation of Equation (1). The table reports the final specifications that give the best results. The Wald test of overall significance in all specifications passes at the 1 percent level. The table reports robust standard errors for the reason of heteroscedastic variance.

Table 3: Constraints and Determinants of SME Innovation

Independent variable	Dependent variable			
	$INNO_{i1}$ (1)	$INNO_{i2}$ (2)	$INNO_{i3}$ (3)	$INNO_{i4}$ (4)
Ln(age)	-0.126**	-0.0791	-0.0804	-0.182***
	(0.0559)	(0.0559)	(0.0590)	(0.0596)
Ln(size)	0.502***	0.209***	0.243***	0.220***
	(0.0421)	(0.0398)	(0.0395)	(0.0426)
Foreign ownership	-0.0653	-0.0575	-0.00353	-0.0282
	(0.147)	(0.143)	(0.132)	(0.166)
Skill intensity	1.071***	0.644***	0.324***	0.492***
	(0.123)	(0.128)	(0.124)	(0.133)
Constraint and determinant variables				
Limited information to locate and/or analyse markets and/or business partners	-0.0636*	-0.0357	-0.0515	-0.0475
	(0.0345)	(0.0336)	(0.0374)	(0.0385)
Insufficient quantity of personnel and/or untrained personnel for market expansion	-0.0770**	-0.119***	-0.112***	-0.114***
	(0.0355)	(0.0357)	(0.0378)	(0.0381)
Shortage of working capital to finance new business plan	-0.0599*	-0.0743**	-0.0281	-0.0820**
	(0.0321)	(0.0321)	(0.0336)	(0.0351)
Inadequacy of basic and ICT infrastructure	-0.0444	0.00636	-0.0982***	-0.0569
	(0.0351)	(0.0374)	(0.0380)	(0.0405)
Inadequate protection of intellectual property rights	-0.0436	-0.0115	-0.114***	-0.0743**
	(0.0302)	(0.0299)	(0.0308)	(0.0322)
Dummy variable for access to external sources of finance to fund capital expansion	0.427***	0.476***	0.368***	0.383**
	(0.127)	(0.138)	(0.139)	(0.152)
Dummy variable for exposure to foreign trade	0.451***	0.315***	-3.16e-05	0.0511
	(0.124)	(0.121)	(0.117)	(0.137)
Control variables				
Dummy variable for garment sector	-0.663***	-0.264**	-0.0500	-0.230*
	(0.121)	(0.120)	(0.127)	(0.129)
Dummy variable for auto parts and components	-0.131	0.116	0.0697	-0.0810
	(0.123)	(0.128)	(0.135)	(0.142)
Dummy variable for electronics, and electronics parts and component	-0.0556	0.0731	0.147	-0.205
	(0.132)	(0.139)	(0.124)	(0.152)
Dummy variable for country group	-0.00198	0.644***	0.164	-0.0138
	(0.100)	(0.107)	(0.107)	(0.117)
Observations	715	715	715	715

Notes: 1. Robust z statistics in parentheses

2. ***significant at 1%; **significant at 5%; *significant at 10%.

3. To avoid potential multicollinearity between independent variables, we introduce constraint and determinant variables separately, with little effect on the base models, although we present the coefficients here in a single column.

Results from the regression shown in Table 3 indicate that there are some common constraints and determinants affecting the capability of SMEs to innovate and also some that are specific to certain SMEs.

The common features with robust findings, statistically significant at the 1 percent level, for all categories of innovation are: larger firm size, higher skill intensity, overcoming the shortage in human resources, and being able to access external sources of finance to fund capital expansion. These are key determinant factors for SMEs to upgrade their capability to innovate. These findings are in accordance with our hypotheses.

However, younger firms appear to be more innovative in terms of improving business processes and amongst the most capable SMEs. Foreign ownership seems to be a relatively unimportant factor in technological transfers and upgrading of technology.

Specific to business process innovation $INNO_{i1}$ in addition to the above-mentioned characteristics, limited access to information and a shortage of working capital appear to be major constraints. Moreover, exposure to trade is one of the significant channels of improvement in business processes.

Similar to the case of business-process innovation, overcoming shortages in working capital and exposure to foreign trade, are additional constraints and determinants for SMEs in successfully upgrading their capability in production processes $INNO_{i2}$, while access to information is not a significant constraint. ICT infrastructure and protection of IPR are also found not to be major problem areas for both innovation categories.

The high impact of foreign trade for both business- and production-process innovation indicates that SMEs are able to achieve significant marginal benefits from interacting with their foreign counterparts or from participation in product networks, confirming the learning-by-export hypothesis. Moreover, they must innovate to meet strict product requirements and international standards for their product exports, and this is likely to require the adoption of advanced technology. They can improve their production process by simply importing

machinery and equipment to replace their obsolete technologies, with little linkages through foreign ownership.

For SMEs to be successful in product innovation $INNO_{i3}$, it seems that they must have access to information and financial resources, and not be too reliant on foreign trade—possibly by concentrating on making new products for domestic markets, although the coefficient for exposure to foreign trade is not statistically significant. ICT infrastructure and the protection of IPR are also found to be significant factors for SME product innovation. The importance of ICT underscores the growing importance of ICT infrastructure, such as broadband, in stimulating innovation. Moreover, since conducting product innovation may incur risks and significant investment costs, loose enforcement of IPR protection would undermine returns on investment in R&D. These results are also consistent with our hypotheses.

Finally, in order that SMEs become more innovative $INNO_{i4}$, beyond factors such as being younger, processing on a larger scale, employing labour with a higher skill intensity, overcoming the shortage in human resources, and being able to access external sources of finance to fund capital expansion, they must have healthy internal finances and demand a good IPR protection regime.

4.2. Perceived Effectiveness of Government Support

SMEs were asked to report the perceived effectiveness of the assistance from government or non-governmental organisations (NGOs). On average, between 32 and 48 percent of SMEs reported having received assistance and rated the effectiveness of support in training; counselling and advice; technology development and transfer; access to information; business linkages and networking; financial support; and the importance of a conducive business environment.

In terms of the effectiveness of the assistance, for all receiving firms, financing and technology development and transfer ranked first and second, on average, followed by

counselling and advice, business environment, business linkages and networking, training, and lastly information.

When asked what assistance they needed the most, the logical answers would be in the areas with lower ranks of perceived effectiveness. Therefore, information should be the highest priority, but was consistently ranked second after financing, which could suggest that access to finance is one of the most important problems faced by SMEs. This was followed by the need for further provision of support in business linkages and networking, improving business environment, training, technology development and transfer, and counselling and advice services.

We further investigate whether the perceived effectiveness of the support services would stimulate innovation activities of the firms by conducting the ordered probit regression analysis for each of the innovation categories, following the same procedures as in Section 4.1 to ensure the robustness of the results.

Table 4 Effectiveness of Government Support and SME Innovation

Independent variable	Dependent variable			
	$INNO_{i1}$ (1)	$INNO_{i2}$ (2)	$INNO_{i3}$ (3)	$INNO_{i4}$ (4)
Ln(age)	-0.126**	-0.0791	-0.0804	-0.182***
	(0.0559)	(0.0559)	(0.0590)	(0.0596)
Ln(size)	0.502***	0.209***	0.243***	0.220***
	(0.0421)	(0.0398)	(0.0395)	(0.0426)
Foreign ownership	-0.0653	-0.0575	-0.00353	-0.0282
	(0.147)	(0.143)	(0.132)	(0.166)
Skill intensity	1.071***	0.644***	0.324***	0.492***
	(0.123)	(0.128)	(0.124)	(0.133)
Government support				
Training	0.0735**	0.0492	0.0171	0.0311
	(0.0354)	(0.0349)	(0.0393)	(0.0382)
Counselling and advice	0.0794**	0.0548	0.00823	0.0719*
	(0.0364)	(0.0365)	(0.0410)	(0.0405)
Technology development and transfer	0.136***	0.125***	0.0413	0.0661*
	(0.0357)	(0.0357)	(0.0416)	(0.0385)
Information	0.166***	0.103***	0.0791**	0.0623*
	(0.0360)	(0.0323)	(0.0361)	(0.0356)
Business linkages	0.152***	0.128***	0.0444	0.0627*
	(0.0344)	(0.0342)	(0.0353)	(0.0357)
Financing	0.0280	0.0383	0.0307	0.0116
	(0.0389)	(0.0380)	(0.0434)	(0.0403)
Conducive business environment	0.125***	0.103***	0.0353	0.00472
	(0.0386)	(0.0343)	(0.0396)	(0.0382)
Control variables				
Dummy variable for garment sector	-0.663***	-0.264**	-0.0500	-0.230*
	(0.121)	(0.120)	(0.127)	(0.129)
Dummy variable for auto parts and components	-0.131	0.116	0.0697	-0.0810
	(0.123)	(0.128)	(0.135)	(0.142)
Dummy variable for electronics, and electronics parts and component	-0.0556	0.0731	0.147	-0.205
	(0.132)	(0.139)	(0.124)	(0.152)
Dummy variable for country group	-0.00198	0.644***	0.164	-0.0138
	(0.100)	(0.107)	(0.107)	(0.117)
Observations	715	715	715	715

Notes: 1. Robust z statistics in parentheses

2. ***significant at 1%; **significant at 5%; *significant at 10%.

3. To avoid potential multicollinearity between independent variables, we introduce government support variables separately, with little effect on the base models, although we present the coefficients here in a single column.

Results from the regressions in Table 4 show that although all receiving firms reported relative effectiveness of government finance, it is not statistically significant and this may suggest that it is less effective in helping firms to innovate across all categories. This result reconfirms the previous finding in the case of joining production networks, namely that overcoming an internal shortage of working capital by accessing external finance is more important than government financial support. This may suggest that being able to access external finance is in itself a sign of competency to earn trust or a 'seal of approval' from financial institutions.

Effective measures with statistical significance across innovation categories are: access to information, promotion of business linkages and networking, and support measures in technology development and transfer. It is interesting to note that most government support in our sample firms is found to be relatively more significant only for business- and production-process innovation, and less so for the product and the ability to conduct a combination of business, production process, and product innovation.

For business-process innovation, except for government finance, the rest of the support is found to be effective in enhancing SMEs' capabilities, especially access to information, business linkages and networking, technology development and transfer, with higher coefficients and significance at 1 percent level, followed by a conducive business environment, counselling and advice, and training.

The most effective measures to help upgrade SMEs in terms of production-process innovation are found to be: business linkages and networking, technology development and transfer, followed by access to information and a conducive business environment, with all coefficients significant at the 1 percent level.

However, only access to information is found to be significant and the rest of the government support appears to be totally ineffective in raising SMEs' product innovation capabilities. This result suggests that more difficult challenges remain for the government to

address amongst the external constraints, which are quite distinctive for this group (better ICT infrastructure and an effective IPR regime), and for SMEs themselves to build up their internal capacity, especially human capital as shown in Section 4.1.

Finally, at the 10 percent level of statistical significance, the firms that have the greatest ability to innovate appear to consider that the most effective support is: receiving counselling and advisory services, business linkages and networking, information, and technology development and transfer, followed by access to information and a conducive business environment. However, the coefficients of these statistically significant variables are similar to each other.

5. Summary and Conclusion

This paper provides empirical evidence of key constraints and firm characteristic determinants of SMEs upgrading their capability to innovate. It also contributes to the literature on the assessment of effective government support measures for surveyed SMEs in Thailand, Indonesia, Malaysia, the Philippines, Viet Nam, Cambodia, Lao PDR and China.

Results from the regression have shown that larger firm size, higher skill intensity of labour, ability to overcome shortages in human resources, and being able to access external sources of finance to fund capital expansion, are common key determinants for SMEs in upgrading their capability to innovate for all three categories of innovation. Foreign ownership seems to be the least important among the factors in the survey in terms of SMEs' capability to upgrade technology and in technological transfers.

Another important result is that exposure to foreign trade is important for both business- and production-process innovation, through interacting with their foreign counterparts or from participation in product networks, confirming the learning-by-export hypothesis, and through

importing technologies, while linkages through foreign ownership tend to have a much less significant influence. For product innovation, the two most important factors for SMEs to upgrade their capabilities are ICT infrastructure and the protection of IPR.

With regard to the effectiveness of government policy measures, although all receiving firms reported the relative effectiveness of government financial support, it was found to be ineffective in helping firms to be more innovative in all categories in comparison to overcoming internal shortages of working capital by accessing external finance. This may suggest that being able to access external finance is in itself a sign of competency to earn trust or a 'seal of approval' from financial institutions. Effective measures that appear to be significant across innovation categories are: access to information, promotion of business linkages and networking, and support measures in technology development and transfer.

Effective measures to help upgrade SMEs' ability to innovate in the production process are found to be: business linkages and networking, and technology development and transfer, followed by access to information, and a conducive business environment. However, only access to information is found to be significant in raising SMEs' capability in terms of product innovation. The firms that have the greatest ability to innovate appear to attach relative importance of effective support to receiving counselling and advisory services, business linkages and networking, information, and technology development and transfer, followed by access to information and a conducive business environment.

Empirical findings from our analyses suggest that more difficult challenges remain for the government to address amongst the external constraints, and for SMEs themselves to build up their internal capacity. Rather than concentrating on assisting SMEs directly through financial contributions, the government should focus on investing in skills upgrading, human capital development, and supporting measures for internationalisation of SMEs, together with the improvement in ICT infrastructure, such as broadband networks, and the protection of IPR.

Three other specific support measures that should be given priority are: provision of access to information, promotion of business linkages and networking, and support measures in technology development and transfer.

References

Abonyi, G. (2005), 'Transformation of Global Production, Trade and Investment: Global Value Chains and International Production Networks.' paper presented to the Expert Group Meeting on SMEs' Participation in Global and Regional Supply Chains, UNESCAP, Bangkok, November.

Allred, P. and W. Park (2007), 'The Influence of Patent Protection on Firm Innovation Investment in Manufacturing Industries', *Journal of International Management*, 13(2007): 91–109.

Baldwin, J. R., P. Hanel and D. Sabourin (2001), 'Determinants of Innovative Activity in Canadian Manufacturing Firms', in Kleinknecht, A. and P. Mohnen (eds.), *Innovation and Firm Performance*, London and Basingstoke: Palgrave.

Bertschek, I. (1995) ,'Product and Process Innovation as a Response to Increasing Imports and Foreign Direct Investment', *The Journal of Industrial Economics*, 43(4), pp.341-357.

Cohen, W. and R. Levin (1989), 'Empirical Studies of Innovation and Market Structure,' *Handbook of Industrial Organization*, Vol. 2, Ch. 18.

Dahlman, C., B. Ross-Larson and L. Westphal (1987), 'Managing Technological Development: Lessons from the Newly Industrializing Countries', *World Development*, 15(6): 759–75.

De Jong, J. and P. Vermeulen (2004), 'Determinants of Product Innovation in Small Firms: a Comparison across Industries', SCALES paper N200410, EIM, Zoetermeer, the Netherlands.

Dewar, R. D. and J. E. Dutton (1986), 'The Adoption of Radical and Incremental Innovations: An Empirical Analysis', *Management Science*, 32(11), pp.1422-33.

Guadalupe, M., O. Kuzmina, and C. Thomas (2010), 'Innovation and Foreign Ownership', NBER Working Paper Series, Working Paper No. 16573.

Hall, B. and B. Khan (2002), 'Adoption of New Technology', in *New Economy Handboo: Hall and Khan.* Available at: http://elsa.berkeley.edu/~bhhall/papers/HallKhan03%20diffusion.pdf

Hall, B. and J. Lerner (2009), 'The Financing of R&D and Innovation, NBER Working Paper Series, Working Paper No. 15325.

Hahn, C. H. and D. Narjoko (eds.) (2011), *Globalization and Innovation in East Asia*. ERIA Research Project Report 2010-4. Jakarta: ERIA.

Harvie, C., D. Narjoko and S. Oum (2010), 'Firm Characteristic Determinants of SME Participation in Production Networks,' ERIA Working Papers DP-2010-11.

Intarakumnerd, P. (ed.) (2011), 'How to Enhance Innovation Capability with Internal and External Sources', ERIA Research Project Report 2010-9. Jakarta: ERIA.

Intarakumnerd, P. and T. Virasa (2004), 'Government Policies and Measures in Supporting Technological Capability Development of Latecomer Firms: A Tentative Taxonomy', *Asian Journal of Technology Innovation*, 12(2), pp.1-19.

Intarakumnerd, P. and Y. Ueki (eds.) (2010), 'Fostering Production and Science & Technology Linkages to Stimulate Innovation in ASEAN', ERIA Research Project Report 2009-7-4. Jakarta: ERIA.

Keller, W. (2009), 'International Trade, Foreign Direct Investment, and Technology Spillovers', NBER Working Paper Series, Working Paper No. 15442.

Kim, M. and S.Y. Lee (2011), 'The effects of government financial support on business innovation in South Korea', *Asian Journal of Technology Innovation*, 19(1), pp.67-83.

Lall, S. (2003), 'Reinventing Industrial Strategy: The Role of Government Policy in Building Industrial Competitiveness', Working Paper Number 111, QEH Working Paper Series – QEHWPS111.

Lee, S., G. Park, B. Yoon, B. and Park, J. (2010) 'Open innovation in SMEs-an intermediated network model', *Research Policy*, 39: 290-300.

Love, J. H. and P. Ganotakis (2013), 'Learning by Exporting: Lessons from High-technology SMEs', *International Business Review*, 22(1), pp.1–17.

Machikita, T., M. Tsuji and Y. Ueki (2010), 'How ICTs Raise Manufacturing Performance: Firm-level Evidence in Southeast Asia', ERIA Discussion Paper 2010-07.

Machikita, T. and Y. Ueki (2010), 'Innovation in Linked and Non-linked Firms: Effects of Variety of Linkages in East Asia', ERIA Discussion Paper 2010-03.

Mairesse, J., and P. Mohnen (2010), 'Using Innovations Surveys for Econometric Analysis', NBER Working Paper Series, Working Paper No. 15857.

OECD/Eurostat (2005), 'Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data,' 3rd Edition, The Measurement of Scientific and Technological Activities, OECD Publishing. doi: 10.1787/9789264013100-en.

Raymond, L. and J. St-Pierre (2010), 'R&D as a determinant of innovation in manufacturing SMEs: An Attempt at Empirical Clarification', *Technovation*, 30(1), pp.48–56.

Romijn, H. and M. Albaladejo (2002), 'Determinants of Innovation Capability in Small Electronics and Software Firms in Southeast England', *Research Policy*, 31(7), pp.1053-67.

Shefer, D. and A. Frenkel (2005), 'R&D, Firm Size and Innovation: An Empirical Analysis', *Technovation*, 25(1), pp.25-32.

Smallbone, D. and F. Welter (2001), 'The Role of Government in SME Development in Transition Economies', *International Small Business Journal*, 19(4), pp.63-77.

Souitaris, V. (2003), 'Determinants of Technological Innovation: Current Research Trends and Future Prospects' in Shavinina, L. (ed.), *International Handbook on Innovation*, Pergamon, pp.513-528.

Spiezia, V. (2011), 'Are ICT Users More Innovative? An Analysis of ICT-Enabled Innovation in OECD Firms', *OECD Journal: Economic Studies*, Vol. 2011/1.

Teece, D. (2010), 'Technological Innovation and the Theory of the Firm: The Role of Enterprise-Level Knowledge, Complementarities, and (Dynamic) Capabilities', *Handbook of The Economics of Innovation*, 1, pp.679–730.

Vega-Jurado, J., A. Gutiérrez-Gracia, I. Fernández-de-Lucio and L. Manjarrés-Henríquez (2008), 'The Effect of External and Internal Factors on Firms' Product Innovation', *Research Policy*, 37(4), pp.616-32.

Webster, E. (2004), 'Firms' Decisions to Innovate and Innovation Routines', Melbourne Institute Working Paper No.5/03.

ERIA Discussion Paper Series

No.	Author(s)	Title	Year
2014-10	Sothea OUM, Dionisius NARJOKO, and Charles HARVIE	Constraints, Determinants of SME Innovation, and the Role of Government Support	May 2014
2014-09	Christopher PARSONS and Pierre-Louis Vézina	Migrant Networks and Trade: The Vietnamese Boat People as a Natural Experiment	May 2014
2014-08	Kazunobu HAYAKAWA and Toshiyuki MATSUURA	Dynamic Tow-way Relationship between Exporting and Importing: Evidence from Japan	May 2014
2014-07	DOAN Thi Thanh Ha and Kozo KIYOTA	Firm-level Evidence on Productivity Differentials and Turnover in Vietnamese Manufacturing	Apr 2014
2014-06	Larry QIU and Miaojie YU	Multiproduct Firms, Export Product Scope, and Trade Liberalization: The Role of Managerial Efficiency	Apr 2014
2014-05	Han PHOUMIN and Shigeru KIMURA	Analysis on Price Elasticity of Energy Demand in East Asia: Empirical Evidence and Policy Implications for ASEAN and East Asia	Apr 2014
2014-04	Youngho CHANG and Yanfei LI	Non-renewable Resources in Asian Economies: Perspectives of Availability, Applicability, Acceptability, and Affordability	Feb 2014
2014-03	Yasuyuki SAWADA and Fauziah ZEN	Disaster Management in ASEAN	Jan 2014
2014-02	Cassey LEE	Competition Law Enforcement in Malaysia	Jan 2014
2014-01	Rizal SUKMA	ASEAN Beyond 2015: The Imperatives for Further Institutional Changes	Jan 2014
2013-38	Toshihiro OKUBO, Fukunari KIMURA, Nozomu TESHIMA	Asian Fragmentation in the Global Financial Crisis	Dec 2013
2013-37	Xunpeng SHI and Cecilya MALIK	Assessment of ASEAN Energy Cooperation within the ASEAN Economic Community	Dec 2013
2013-36	Tereso S. TULLAO, Jr. And Christopher James CABUAY	Eduction and Human Capital Development to Strengthen R&D Capacity in the ASEAN	Dec 2013
2013-35	Paul A. RASCHKY	Estimating the Effects of West Sumatra Public Asset Insurance Program on Short-Term	Dec 2013

No.	Author(s)	Title	Year
		Recovery after the September 2009 Earthquake	
2013-34	Nipon POAPONSAKORN and Pitsom MEETHOM	Impact of the 2011 Floods, and Food Management in Thailand	Nov 2013
2013-33	Mitsuyo ANDO	Development and Resructuring of Regional Production/Distribution Networks in East Asia	Nov 2013
2013-32	Mitsuyo ANDO and Fukunari KIMURA	Evolution of Machinery Production Networks: Linkage of North America with East Asia?	Nov 2013
2013-31	Mitsuyo ANDO and Fukunari KIMURA	What are the Opportunities and Challenges for ASEAN?	Nov 2013
2013-30	Simon PEETMAN	Standards Harmonisation in ASEAN: Progress, Challenges and Moving Beyond 2015	Nov 2013
2013-29	Jonathan KOH and Andrea Feldman MOWERMAN	Towards a Truly Seamless Single Windows and Trade Facilitation Regime in ASEAN Beyond 2015	Nov 2013
2013-28	Rajah RASIAH	Stimulating Innovation in ASEAN Institutional Support, R&D Activity and Intelletual Property Rights	Nov 2013
2013-27	Maria Monica WIHARDJA	Financial Integration Challenges in ASEAN beyond 2015	Nov 2013
2013-26	Tomohiro MACHIKITA and Yasushi UEKI	Who Disseminates Technology to Whom, How, and Why: Evidence from Buyer-Seller Business Networks	Nov 2013
2013-25	Fukunari KIMURA	Reconstructing the Concept of “Single Market a Production Base” for ASEAN beyond 2015	Oct 2013
2013-24	Olivier CADOT Ernawati MUNADI Lili Yan ING	Streamlining NTMs in ASEAN: The Way Forward	Oct 2013
2013-23	Charles HARVIE, Dionisius NARJOKO, Sothea OUM	Small and Medium Enterprises’ Access to Finance: Evidence from Selected Asian Economies	Oct 2013
2013-22	Alan Khee-Jin TAN	Toward a Single Aviation Market in ASEAN: Regulatory Reform and Industry Challenges	Oct 2013
2013-21	Hisanobu SHISHIDO,	Moving MPAC Forward: Strengthening	Oct

No.	Author(s)	Title	Year
	Shintaro SUGIYAMA, Fauziah ZEN	Public-Private Partnership, Improving Project Portfolio and in Search of Practical Financing Schemes	2013
2013-20	Barry DESKER, Mely CABALLERO-ANTHONY, Paul TENG	Thought/Issues Paper on ASEAN Food Security: Towards a more Comprehensive Framework	Oct 2013
2013-19	Toshihiro KUDO, Satoru KUMAGAI, So UMEZAKI	Making Myanmar the Star Growth Performer in ASEAN in the Next Decade: A Proposal of Five Growth Strategies	Sep 2013
2013-18	Ruperto MAJUCA	Managing Economic Shocks and Macroeconomic Coordination in an Integrated Region: ASEAN Beyond 2015	Sep 2013
2013-17	Cassy LEE and Yoshifumi FUKUNAGA	Competition Policy Challenges of Single Market and Production Base	Sep 2013
2013-16	Simon TAY	Growing an ASEAN Voice? : A Common Platform in Global and Regional Governance	Sep 2013
2013-15	Danilo C. ISRAEL and Roehlano M. BRIONES	Impacts of Natural Disasters on Agriculture, Food Security, and Natural Resources and Environment in the Philippines	Aug 2013
2013-14	Allen Yu-Hung LAI and Seck L. TAN	Impact of Disasters and Disaster Risk Management in Singapore: A Case Study of Singapore's Experience in Fighting the SARS Epidemic	Aug 2013
2013-13	Brent LAYTON	Impact of Natural Disasters on Production Networks and Urbanization in New Zealand	Aug 2013
2013-12	Mitsuyo ANDO	Impact of Recent Crises and Disasters on Regional Production/Distribution Networks and Trade in Japan	Aug 2013
2013-11	Le Dang TRUNG	Economic and Welfare Impacts of Disasters in East Asia and Policy Responses: The Case of Vietnam	Aug 2013
2013-10	Sann VATHANA, Sothea OUM, Ponhrith KAN, Colas CHERVIER	Impact of Disasters and Role of Social Protection in Natural Disaster Risk Management in Cambodia	Aug 2013
2013-09	Sommarat CHANTARAT, Krirk PANNANGPETCH,	Index-Based Risk Financing and Development of Natural Disaster Insurance Programs in Developing	Aug 2013

No.	Author(s)	Title	Year
	Nattapong PUTTANAPONG, Preesan RAKWATIN, and Thanasin TANOMPONGPHANDH	Asian Countries	
2013-08	Ikumo ISONO and Satoru KUMAGAI	Long-run Economic Impacts of Thai Flooding: Geographical Simulation Analysis	July 2013
2013-07	Yoshifumi FUKUNAGA and Hikaru ISHIDO	Assessing the Progress of Services Liberalization in the ASEAN-China Free Trade Area (ACFTA)	May 2013
2013-06	Ken ITAKURA, Yoshifumi FUKUNAGA, and Ikumo ISONO	A CGE Study of Economic Impact of Accession of Hong Kong to ASEAN-China Free Trade Agreement	May 2013
2013-05	Misa OKABE and Shujiro URATA	The Impact of AFTA on Intra-AFTA Trade	May 2013
2013-04	Kohei SHIINO	How Far Will Hong Kong's Accession to ACFTA will Impact on Trade in Goods?	May 2013
2013-03	Cassey LEE and Yoshifumi FUKUNAGA	ASEAN Regional Cooperation on Competition Policy	Apr 2013
2013-02	Yoshifumi FUKUNAGA and Ikumo ISONO	Taking ASEAN+1 FTAs towards the RCEP: A Mapping Study	Jan 2013
2013-01	Ken ITAKURA	Impact of Liberalization and Improved Connectivity and Facilitation in ASEAN for the ASEAN Economic Community	Jan 2013
2012-17	Sun XUEGONG, Guo LIYAN, Zeng ZHENG	Market Entry Barriers for FDI and Private Investors: Lessons from China's Electricity Market	Aug 2012
2012-16	Yanrui WU	Electricity Market Integration: Global Trends and Implications for the EAS Region	Aug 2012
2012-15	Youngho CHANG, Yanfei LI	Power Generation and Cross-border Grid Planning for the Integrated ASEAN Electricity Market: A Dynamic Linear Programming Model	Aug 2012
2012-14	Yanrui WU, Xunpeng SHI	Economic Development, Energy Market Integration and Energy Demand: Implications for East Asia	Aug 2012
2012-13	Joshua AIZENMAN, Minsoo LEE, and	The Relationship between Structural Change and Inequality: A Conceptual Overview with Special	July 2012

No.	Author(s)	Title	Year
	Donghyun PARK	Reference to Developing Asia	
2012-12	Hyun-Hoon LEE, Minsoo LEE, and Donghyun PARK	Growth Policy and Inequality in Developing Asia: Lessons from Korea	July 2012
2012-11	Cassey LEE	Knowledge Flows, Organization and Innovation: Firm-Level Evidence from Malaysia	June 2012
2012-10	Jacques MAIRESSE, Pierre MOHNEN, Yayun ZHAO, and Feng ZHEN	Globalization, Innovation and Productivity in Manufacturing Firms: A Study of Four Sectors of China	June 2012
2012-09	Ari KUNCORO	Globalization and Innovation in Indonesia: Evidence from Micro-Data on Medium and Large Manufacturing Establishments	June 2012
2012-08	Alfons PALANGKARAYA	The Link between Innovation and Export: Evidence from Australia's Small and Medium Enterprises	June 2012
2012-07	Chin Hee HAHN and Chang-Gyun PARK	Direction of Causality in Innovation-Exporting Linkage: Evidence on Korean Manufacturing	June 2012
2012-06	Keiko ITO	Source of Learning-by-Exporting Effects: Does Exporting Promote Innovation?	June 2012
2012-05	Rafaelita M. ALDABA	Trade Reforms, Competition, and Innovation in the Philippines	June 2012
2012-04	Toshiyuki MATSUURA and Kazunobu HAYAKAWA	The Role of Trade Costs in FDI Strategy of Heterogeneous Firms: Evidence from Japanese Firm-level Data	June 2012
2012-03	Kazunobu HAYAKAWA, Fukunari KIMURA, and Hyun-Hoon LEE	How Does Country Risk Matter for Foreign Direct Investment?	Feb 2012
2012-02	Ikumo ISONO, Satoru KUMAGAI, Fukunari KIMURA	Agglomeration and Dispersion in China and ASEAN: A Geographical Simulation Analysis	Jan 2012
2012-01	Mitsuyo ANDO and Fukunari KIMURA	How Did the Japanese Exports Respond to Two Crises in the International Production Network?: The Global Financial Crisis and the East Japan Earthquake	Jan 2012
2011-10	Tomohiro MACHIKITA and Yasushi UEKI	Interactive Learning-driven Innovation in Upstream-Downstream Relations: Evidence from	Dec 2011

No.	Author(s)	Title	Year
		Mutual Exchanges of Engineers in Developing Economies	
2011-09	Joseph D. ALBA, Wai-Mun CHIA, and Donghyun PARK	Foreign Output Shocks and Monetary Policy Regimes in Small Open Economies: A DSGE Evaluation of East Asia	Dec 2011
2011-08	Tomohiro MACHIKITA and Yasushi UEKI	Impacts of Incoming Knowledge on Product Innovation: Econometric Case Studies of Technology Transfer of Auto-related Industries in Developing Economies	Nov 2011
2011-07	Yanrui WU	Gas Market Integration: Global Trends and Implications for the EAS Region	Nov 2011
2011-06	Philip Andrews-SPEED	Energy Market Integration in East Asia: A Regional Public Goods Approach	Nov 2011
2011-05	Yu SHENG, Xunpeng SHI	Energy Market Integration and Economic Convergence: Implications for East Asia	Oct 2011
2011-04	Sang-Hyop LEE, Andrew MASON, and Donghyun PARK	Why Does Population Aging Matter So Much for Asia? Population Aging, Economic Security and Economic Growth in Asia	Aug 2011
2011-03	Xunpeng SHI, Shinichi GOTO	Harmonizing Biodiesel Fuel Standards in East Asia: Current Status, Challenges and the Way Forward	May 2011
2011-02	Hikari ISHIDO	Liberalization of Trade in Services under ASEAN+n : A Mapping Exercise	May 2011
2011-01	Kuo-I CHANG, Kazunobu HAYAKAWA Toshiyuki MATSUURA	Location Choice of Multinational Enterprises in China: Comparison between Japan and Taiwan	Mar 2011
2010-11	Charles HARVIE, Dionisius NARJOKO, Sothea OUM	Firm Characteristic Determinants of SME Participation in Production Networks	Oct 2010
2010-10	Mitsuyo ANDO	Machinery Trade in East Asia, and the Global Financial Crisis	Oct 2010
2010-09	Fukunari KIMURA Ayako OBASHI	International Production Networks in Machinery Industries: Structure and Its Evolution	Sep 2010
2010-08	Tomohiro MACHIKITA, Shoichi MIYAHARA, Masatsugu TSUJI, and	Detecting Effective Knowledge Sources in Product Innovation: Evidence from Local Firms and MNCs/JVs in Southeast Asia	Aug 2010

No.	Author(s)	Title	Year
	Yasushi UEKI		
2010-07	Tomohiro MACHIKITA, Masatsugu TSUJI, and Yasushi UEKI	How ICTs Raise Manufacturing Performance: Firm-level Evidence in Southeast Asia	Aug 2010
2010-06	Xunpeng SHI	Carbon Footprint Labeling Activities in the East Asia Summit Region: Spillover Effects to Less Developed Countries	July 2010
2010-05	Kazunobu HAYAKAWA, Fukunari KIMURA, and Tomohiro MACHIKITA	Firm-level Analysis of Globalization: A Survey of the Eight Literatures	Mar 2010
2010-04	Tomohiro MACHIKITA and Yasushi UEKI	The Impacts of Face-to-face and Frequent Interactions on Innovation: Upstream-Downstream Relations	Feb 2010
2010-03	Tomohiro MACHIKITA and Yasushi UEKI	Innovation in Linked and Non-linked Firms: Effects of Variety of Linkages in East Asia	Feb 2010
2010-02	Tomohiro MACHIKITA and Yasushi UEKI	Search-theoretic Approach to Securing New Suppliers: Impacts of Geographic Proximity for Importer and Non-importer	Feb 2010
2010-01	Tomohiro MACHIKITA and Yasushi UEKI	Spatial Architecture of the Production Networks in Southeast Asia: Empirical Evidence from Firm-level Data	Feb 2010
2009-23	Dionisius NARJOKO	Foreign Presence Spillovers and Firms' Export Response: Evidence from the Indonesian Manufacturing	Nov 2009
2009-22	Kazunobu HAYAKAWA, Daisuke HIRATSUKA, Kohei SHIINO, and Seiya SUKEGAWA	Who Uses Free Trade Agreements?	Nov 2009
2009-21	Ayako OBASHI	Resiliency of Production Networks in Asia: Evidence from the Asian Crisis	Oct 2009
2009-20	Mitsuyo ANDO and Fukunari KIMURA	Fragmentation in East Asia: Further Evidence	Oct 2009

No.	Author(s)	Title	Year
2009-19	Xunpeng SHI	The Prospects for Coal: Global Experience and Implications for Energy Policy	Sept 2009
2009-18	Sothea OUM	Income Distribution and Poverty in a CGE Framework: A Proposed Methodology	Jun 2009
2009-17	Erlinda M. MEDALLA and Jenny BALBOA	ASEAN Rules of Origin: Lessons and Recommendations for the Best Practice	Jun 2009
2009-16	Masami ISHIDA	Special Economic Zones and Economic Corridors	Jun 2009
2009-15	Toshihiro KUDO	Border Area Development in the GMS: Turning the Periphery into the Center of Growth	May 2009
2009-14	Claire HOLLWEG and Marn-Heong WONG	Measuring Regulatory Restrictions in Logistics Services	Apr 2009
2009-13	Loreli C. De DIOS	Business View on Trade Facilitation	Apr 2009
2009-12	Patricia SOURDIN and Richard POMFRET	Monitoring Trade Costs in Southeast Asia	Apr 2009
2009-11	Philippa DEE and Huong DINH	Barriers to Trade in Health and Financial Services in ASEAN	Apr 2009
2009-10	Sayuri SHIRAI	The Impact of the US Subprime Mortgage Crisis on the World and East Asia: Through Analyses of Cross-border Capital Movements	Apr 2009
2009-09	Mitsuyo ANDO and Akie IRIYAMA	International Production Networks and Export/Import Responsiveness to Exchange Rates: The Case of Japanese Manufacturing Firms	Mar 2009
2009-08	Archanun KOHPAIBOON	Vertical and Horizontal FDI Technology Spillovers:Evidence from Thai Manufacturing	Mar 2009
2009-07	Kazunobu HAYAKAWA, Fukunari KIMURA, and Toshiyuki MATSUURA	Gains from Fragmentation at the Firm Level: Evidence from Japanese Multinationals in East Asia	Mar 2009
2009-06	Dionisius A. NARJOKO	Plant Entry in a More LiberalisedIndustrialisationProcess: An Experience of Indonesian Manufacturing during the 1990s	Mar 2009
2009-05	Kazunobu HAYAKAWA, Fukunari KIMURA, and	Firm-level Analysis of Globalization: A Survey	Mar 2009

No.	Author(s)	Title	Year
	Tomohiro MACHIKITA		
2009-04	Chin Hee HAHN and Chang-Gyun PARK	Learning-by-exporting in Korean Manufacturing: A Plant-level Analysis	Mar 2009
2009-03	Ayako OBASHI	Stability of Production Networks in East Asia: Duration and Survival of Trade	Mar 2009
2009-02	Fukunari KIMURA	The Spatial Structure of Production/Distribution Networks and Its Implication for Technology Transfers and Spillovers	Mar 2009
2009-01	Fukunari KIMURA and Ayako OBASHI	International Production Networks: Comparison between China and ASEAN	Jan 2009
2008-03	Kazunobu HAYAKAWA and Fukunari KIMURA	The Effect of Exchange Rate Volatility on International Trade in East Asia	Dec 2008
2008-02	Satoru KUMAGAI, Toshitaka GOKAN, Ikumo ISONO, and Souknilanh KEOLA	Predicting Long-Term Effects of Infrastructure Development Projects in Continental South East Asia: IDE Geographical Simulation Model	Dec 2008
2008-01	Kazunobu HAYAKAWA, Fukunari KIMURA, and Tomohiro MACHIKITA	Firm-level Analysis of Globalization: A Survey	Dec 2008