ERIA Research Project Report 2011, No. 3

DYNAMICS OF FIRM SELECTION PROCESS IN GLOBALIZED ECONOMIES

Edited by
CHIN HEE HAHN
DIONISIUS A. NARJOKO

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May 2012

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EXECUTIVE SUMMARY

This research project examines firm- or plant-level adjustments in response to globalization, or trade and investment liberalization, utilizing micro data on seven East Asian countries. The primary goal of this project is to enhance our understanding of the various dimensions of the causes, as well as the consequences, of the international trade and investment flows. It is our view that a better understanding of these issues is important not only for maintaining the current momentum toward a closer economic integration among countries but also for strengthening its linkage with economic growth and development of each country.

Since the 1990s, research in international trade has shifted its focus from country- or industry-level analysis to firm- or product-level analysis, and the accumulation of both theoretical and empirical research along the latter line has provided us with new insights into the causes and consequences of the aggregate trade and investment flows. This shift was first triggered by some new empirical regularities put forward by several pioneering studies, which could not be reconciled with traditional Hecscher-Ohlin theories or the new trade theories based on monopolistic competition and horizontally-differentiated products. Motivated by the these findings as well as the earlier research on industry dynamics that emphasized the important role of resource reallocation in the aggregate productivity growth, Melitz (2003) theoretically showed that trade liberalization can improve aggregate productivity by triggering selection and reallocation among heterogeneous firms even when firm-level productivity is fixed. Taking the implications of the Metitz' paper as a theoretical framework, various authors further examined micro data and came up with new empirical findings. Having growing this fast, yet this literature has not exhausted all issues relevant to the theory and trade literature in general. This report attempts to make some contributions along this line, addressing the current and some of the remaining issues using the experiences of seven East Asian countries: Japan, China, Korea, Indonesia, Malaysia, Philippines, and Vietnam.

The topics addressed in each paper are diverse, but all papers try to empirically assess the causes and/or the effects of international trade and investment and clarify the adjustment mechanism of firms or plants along various dimensions. The nine papers can be classified into the following three groups: (1) Export Market Dynamics, Finance, and Intermediaries, (2) FDI Spillovers and Adjustment of Production Network, and (3) Plant Exit, Mark-up and Labor Market.

The first group of papers addresses the role of finance in determining the dynamics of firms in export markets. These chapters show that banks, or other financial intermediaries, are institutions that are able to support participation of a firm in exporting. The study on Chinese exporters reveals that the extent of a firm's financial constraint matter in determining the increase in the number of exported product as well as wider export destination. The other study that examines Japanese exporters underlines the important role of banks as a conduit for information about export markets. As a result of dealing with exporters, over the time these kind of banks build a pool of knowledge about export markets which in turn can be shared to firms which are about to start exporting. This study indeed finds evidence of this, and the marginal benefit seems to be the largest for new exporters, not for the existing one. The finding on the role of banks as provider of information is consistent with the view of expensive cost in exporting, especially for the new ones. The study using the data of Vietnamese small and medium enterprises (SMEs) shows that because of the costly efforts to penetrate export markets, many of the Vietnamese SMEs initially use the services of other firms to sell their products overseas before directly doing so.

The second group of papers addresses the issues related to foreign firms. The study on Indonesian manufacturing finds evidence on the existence of positive spillovers from the presence of multinationals through forward linkages. This study further finds that the effects are stronger for firms at the downstream that source input locally. Underlying this analysis is the presumption that foreign firms operating locally produce higher-quality, lower-cost inputs than imported inputs, and/or increase the availability of inputs. Under these conditions, the downstream firms that source inputs locally are more likely to benefit from them. The other study examines the decision to shut down overseas affiliates of a multinationals, using a case study of Japanese multinationals. It finds that affiliates located in a country small numbers of agglomerations are likely to be shut down. This is true regardless the level of development of the host countries. This finding however also finds that multiple (i.e., too many affiliates) in one country lead to higher probability of any affiliate to be shut down. This study overall sends a message that a consolidation of MNE's affiliates is expected as countries' markets are more integrated with each other.

The last group of papers addresses the differential impact of trade liberalization on firms. The paper using the data of Philippines manufacturing plants finds that trade liberalization has a differential effects on firm exit probability depending on the level of productivity, which is broadly consistent with the theoretical prediction. One paper, which uses Korean data, examines the effect of exporting on markup and total factor productivity (TFP). A particular attention is given to the effect of export intensity rather than export participation. Utilizing a generalized propensity score matching methodology, this study finds that the pro-competitive effect and the productivity-enhancing effect from exporting are found for a subset of firms. In particular, it finds an inversely U-shaped relationship between export intensity on the one hand and markup and TFP on the other. Meanwhile, another paper that utilizes Korean plant-level data reveals that exporting firms experience much faster skill upgrading than non-exporters, and this is accentuated if the exporting activities is complemented by more intensive innovation activities.

The findings of the studies covered by this project provide useful suggestions for policy makers. In general, what seems to have emerged from these studies is a direction of policies that is able to give just a 'right' balance between, first, policies to maximize the benefit from liberalization in trade and investment regime and, second, policies to minimize the adverse impact from the losers of the more opened economy. The studies conducted in this project also highlight the importance to focus on detailed and targeted policies, either those of services sectors or those which are rather specifically targeted to a group of firms.

More specific policy suggestions coming out from these studies are the following. First, it is important to develop financial sector, at the same time when a country liberalize its investment and trade regime. This is especially for banking sector, for the role it plays as a financial intermediary to support export. Two papers in this project further suggest the idea that banks, or other financial institutions, need to put more efforts in supporting services for the firms that are capable to export. Second, it is also important to keep promoting policy to encourage export, for the reason it facilitates firms to increase their productivity. As noted, one of the studies show that exporting firms experience much faster skill upgrading than non-exporters. Third, policy to invite foreign direct investment (FDI) could be designed to be rather specifically, with an intention to tackle some unique or narrowly targeted objective. The studies in this project suggest the importance of foreign investment in upstream industries and of creating more agglomeration in order to improve the chance of survival of affiliates. Lastly, clear and measured strategies, or policies, are needed to mitigate the adverse impact of trade and liberalization. One study in this project confirms the policy approach to facilitate adjustments rather than providing measures to protect in addressing some immediate adverse impact from liberalization. This study further suggests a modification of traditional trade adjustment assistance (TAA) in which it needs to take individual worker as the target and the basic unit of the TAA program. This is for the reason that trade liberalization may cause different impact even among the winners (i.e., exporters in this case), which is not suitable with the traditional TAA program that is usually designed to be triggered by an adverse impact in output of the affected firm.

CHAPTER 1

Introduction and Overview

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1. Background and Objective

This report consists of the nine papers that were submitted to the ERIA's research project "Dynamics of Firm Selection Process in Globalization" in fiscal year 2010. This project aims to examine firm- or plant-level adjustments in response to globalization, or trade and investment liberalization, utilizing micro data on seven East Asian countries. As in the previous microdata projects carried by out ERIA since 2008, the primary goal of this project is to enhance our understanding of the various dimensions of the causes, as well as the consequences, of the international trade and investment flows. It is our view that a better understanding of these issues is important not only for maintaining the current momentum toward a closer economic integration among countries but also for strengthening its linkage with economic growth and development of each country.

Since the 1990s, research in international trade has shifted its focus from country- or industry-level analysis to firm- or product-level analysis, and the accumulation of both theoretical and empirical research along the latter line has provided us with new insights into the causes and consequences of the aggregate trade and investment flows. This shift was first triggered by some new empirical regularities put forward by several pioneering studies[1], which could not be reconciled with traditional Hecscher-Ohlin theories or the new trade theories based on monopolistic competition and horizontally-differentiated products. For example, there were tremendous amounts of heterogeneity among firms or plants in productivity and other characteristics, even within narrowly-defined industries. Firms engaged in international trade were found to be superior to domestically-oriented firms in terms of productivity and many other economic performance measures. Furthermore, some of the important phenomenon at the aggregate level, such as rising disparity between skilled and unskilled workers, were found to be associated with between-plant reallocation of resources, and these between-plant reallocation was associated with international trade (Bernard & Jensen 1995 and 1999).

[1] Pioneering research in this regard includes Bernard & Jensen (1995, 1999).

Motivated by the above empirical findings as well as the earlier research on industry dynamics that emphasized the important role of resource reallocation in the aggregate productivity growth, Melitz (2003) theoretically showed that trade liberalization can improve aggregate productivity by triggering selection and reallocation among heterogeneous firms even when firm-level productivity is fixed. Taking the implications of the Metitz' paper as a theoretical framework, various authors further examined micro data and came up with new empirical findings, which further fueled back into the efforts to extend theoretically original Melitz' paper along various dimensions.

Bernard *et al.* (2011) review the development of empirical research on topics, such as extensive and intensive margin of trade, multi-product firms, firm-importing, product quality, trade intermediaries, foreign direct investment, intra-firm trade, labor markets, and firm export market dynamics. They summarize what these new empirical literature have found as well as what important, remaining issues are as follows.

> *"… Aggregate economic relationships such as the gravity equation are largely driven by the extensive margins of firm and products rather than the intensive margin of average exports per firm-product. Reductions in trade costs induce endogenous changes in internal firm organization as firms adjust their range of products, their decisions about whether to serve foreign markets through trade or overseas production, and their choices about whether to organize foreign production within or beyond the boundaries of the firm. To the extent that wages vary with firm revenue and only some firms export, firm heterogeneity provides a new mechanism for trade to affect wage inequality.*
>
> *… There remain many fundamental issues ahead, such as the microfoundations of trade costs, further exploration of the boundaries of the firm, and further consideration of the relationship between findings from disaggregated data and the economy's aggregate response to trade." (Bernard et al. 2011. p. 25)*

Against this backdrop, this report is a contribution to this growing literature based on experiences of seven East Asian countries: Japan, China, Korea, Indonesia, Malaysia, Philippines, and Vietnam. Analyses based on East Asia experience on the causes and consequences of trade and investment might be particularly revealing, not only because East Asia is a region that was most successful in terms of economic growth and development, but also because the process of economic integration within East Asian region and between East Asia and other regions have been one of the most rapid for the past decades. Furthermore, the diversity of countries included in this reports particularly in terms of the level of development allows us to examine and understand issues from both developing and developed country's perspectives.

The topics addressed in each paper are diverse, but all papers try to empirically assess the causes and/or the effects of international trade and investment and clarify the adjustment mechanism of firms or plants along various dimensions. While some papers employ explicit measures of trade liberalization policies and others leave these aspects in the background, the results from all papers are appropriate for understanding the causes and/or the effects of trade and investment liberalization. We believe that while all papers are addressing new issues at least in the context of each country, some papers are probably one of the early attempts to examine the issue from a global perspective.

Below, we provide a synopsis of what follows and summarize main policy implications that arise out of this report.

2. Summary of Country Studies

We classify the nine papers into the following three groups: 1) *Export Market Dynamics, Finance, and Intermediaries*, 2) *FDI Spillovers and Adjustment of Production Network*, and 3) *Plant Exit, Mark-up and Labor Market*.

2.1. Export Market Dynamics, Finance, and Intermediaries

The first two chapters examine export market dynamics focusing on the role of finance. Recent studies based on transaction-level customs data often matched with firm-level data have found an important role of the extensive margins of trade in explaining aggregate trade pattern: the cross-sectional variation in bilateral trade flows or the long run changes in aggregate trade over time. Meanwhile, the contraction of trade credit in many countries was believed to be one of the main reasons for the collapse of global trade flows in the aftermath of the recent global financial crisis. Against this background, there has been a growing attention to the potential role of finance in explaining the variations or changes in the aggregate trade flow.

Tang and Zhang's paper, "Exporting Behavior and Financial Constraint of Chinese Firms" examines the role of financial constraint in explaining changes in extensive margins of trade, by matching the firm-level dataset and the HS 8-digit level customs datasets. If there are various fixed costs involved to enter export market, financial constraint could matter for changes in firm-product-country extensive margins. They find that financial constraints, proxied by liquidity and leverage ratios, do matter for firm's export participation and country extensive margin, but not for product extensive margin. The results are indicative of the existence of distinct fixed costs at various margins, although the authors do not provide a detailed discussion in this regard. However, as the authors argue, a better understanding of the linkage between extensive margins of trade and financial constraint improves our knowledge on how the aggregate economy responds to trade liberalization or other macroeconomic shocks, contributing to a better policy response to such events or shocks.

Inui, Ito, Miyakawa, and Shoji's paper, "Export Dynamics and Information Spillovers through the Main Bank", also examines the linkage between finance and export market dynamics (i.e., changes in extensive and intensive margins of exports). However, they focus on a somewhat new aspect of the role of finance: information provision role of banks. The authors' view is that in the case of Japanese main bank system, banks not only perform a loan-provision role but also an information-provision role. They explain the incentive of Japanese lender banks to provide information to client firms. In so far as the Japanese main banks can work as a conduit of information related to export markets, banks' previous exposure to client's export markets is possibly related to the changes in various margins of trade.

Consistent with this hypothesis, they find that the measure of bank's information on export market is positively related to firm's export participation. However, they do not find a clear evidence that such information has a positive effect on the intensive margins. These results suggest that bank's information provision to client firms probably reduces the fixed cost of export market entry. Based on these results, the authors argue that it may be effective to involve banks in the export promotion campaigns or business matching events supported by the Japanese government.

Chuc, Anh, Anh, and Mai's paper, "Innovation and Choice of Exporting Modes under Globalization", examines the export mode choice (direct versus indirect exporting) as well as export participation, utilizing Vietnam's firm level panel data. For many developing countries including Vietnam, how to make SMEs participate in exporting is an important issue. In the literature, it has been reported that trade intermediaries play an important role in export market participation particularly for developing countries. Empirical examination of firms' choice between direct and indirect exporting shed light on this issue. In the descriptive analysis of their paper, the authors report several interesting findings. First, there is a significant share of indirect exporters among Vietnamese SME exporters although the share of direct exporters are the largest. Second, firms tend to make a transition from indirect to direct exporters over time, rather than the other way around. Third, firms that choose direct exporting tend to use imported materials and equipment more frequently and employ more skilled workers. Finally, exporters in general and direct exporters in particular face more difficulties in credit access. The authors provide various policy suggestions to promote SME export participation.

2.2. FDI Spillovers and Adjustment of Production Network

For many developing countries, attracting FDI has always been a key policy agenda. Accordingly, many Asian developing countries liberalized their foreign investment regime and used various "carrots". One key rationale for the existence of such carrots was that FDI has a positive spillover effects. A large amount of literature has found evidence in favor of the backward spillovers, but evidence in favor of the forward spillovers is scarce. Under this context, Takii and Narjoko's paper, “FDI Forward Linkage Effect and Local Input Procurement”, examines whether FDI has forward spillover effects and whether these effects are stronger for firms at the downstream that source input locally. Underlying this analysis is the presumption that foreign firms operating locally produce higher-quality, lower-cost inputs than imported inputs, and/or increase the availability of inputs. Under these conditions, the downstream firms that source inputs locally are more likely to benefit from them. Utilizing Indonesian plant-level dataset, the authors find evidence supportive of their hypothesis. In addition, the authors find a strong evidence for a backward spillover effects.

Hayakawa and Matsuura’s paper, “Interdependence in Multinational Production Networks: Evidence from Exit of Overseas Affiliates”, examines Japanese MNE’s decision to shut down their overseas affiliates. As well known, international production networks by multinational corporations have rapidly been formed for the past two decades or so, including those by large Japanese corporations in East Asian countries. A growing attention is paid to the issue of what role the global or regional production networks play in influencing the response of an economy to the macroeconomic shocks or trade liberalization. The distinctive and important role of international production networks has been often supported by many empirical studies which find that intra-firm trade accounts for a large and growing share of trade and that these types of trade flows are more resilient to macroeconomic shocks, such as the recent global financial crisis. The key finding in this paper is that MNEs are more likely to shut down affiliates which could potentially be more easily replaced by other affiliates. One implication from this study is that a consolidation of MNE’s affiliates is expected as countries’ markets are more integrated with each other.

2.3. Plant Exit, Mark-up, and Labor Market

Trade liberalization has differential effects on firms. As shown in Melitz (2003), trade liberalization creates winners and losers. The winners are current exporters and highly productive non-exporters, and the losers are least productive non-exporters. This reallocation process following trade liberalization brings about aggregate improvement in productivity. Aldaba's paper, "Surviving Trade Liberalization in Philippine Manufacturing", takes Melitz's paper as a broad theoretical framework and empirically examines one aspect of Melitz' theoretical prediction: the effect of the changes in actual trade policy measures on firm exits. As measures of trade policy, she uses MFN tariff rates, effective measures of protection, and ASEAN tariff rates. She finds that trade liberalization has a differential effects on firm exit probability depending on the level of productivity, which is broadly consistent with the theoretical prediction.

Lee and Choi's paper, "Export Intensity, Markup and Productivity: Micro-evidence from the Korean Manufacturing", examines the effect of exporting on markup and TFP. A particular attention is given to the effect of export intensity rather than export participation. Utilizing a generalized propensity score matching methodology, the authors find that the pro-competitive effect and the productivity-enhancing effect from exporting are found for a subset of firms. In particular, they find an inversely U-shaped relationship between export intensity on the one hand and markup and TFP on the other. Based on these results, the authors questions the plausibility of the hypothesis that exporters with higher export intensity experiences faster productivity growth than exporters with lower export intensity.

Hahn and Park's paper, "Skill Upgrading, Technology Choice, and the Role of Exporting in Korean Manufacturing Sector", examines the effects of exporting as well as R&D on the within-firm skill intensity utilizing plant-level data. While the causes of the rising disparity between skilled and unskilled workers in terms of wages and employment has traditionally been attributed to skill-biased technical progress rather than trade, a growing attention is paid to the possibility that trade and skill-biased technical progress are not competing, but complementary explanations for the growing labor market disparity. The authors show that during the 1990s both exporting and R&D contributed to within-plant skill upgrading. They further show that there exists a bi-directional causal relationship between exporting and R&D particularly at their extensive margins.

Finally, Lee's paper, "Exporting, Productivity, Innovation and Organization: Evidence from Malaysian Manufacturing", examines various relationships exiting among exporting, productivity, innovation, and measures of organization. He finds evidence that exporting causes innovation: process innovation in particular. In addition, he also finds evidence indicating that there are organizational changes, such as decentralized decision making, associated with exporting.

3. Implications for Policy

The results of the studies provide useful input for policy makers. In general, what seems to have emerged from these studies is a direction of policies that is able to give just a 'right' balance between, first, policies to maximize the benefit from liberalization in trade and investment regime and, second, policies to minimize the adverse impact from the losers of the more opened economy. The studies conducted in this project also highlight the importance to focus on detailed and targeted policies, either those of services sectors or those which are rather specifically targeted to a group of firms. The following elaborate the more detailed policy suggestions coming out from the results of the studies.

First, it is important to develop financial sector, at the same time when a country liberalize its investment and trade regime. This is especially for banking sector, for the role it plays as a financial intermediary to support export. Tang and Zhang (Chapter 2) found the dependency of exporters in China to increase their exporting country destinations. Tang and Zhang further suggest that re-examination of the functions of banks to support exports is needed, for the reason that many 'capable' firms (i.e., high productivity firms) are not able to export simply because they do not have sufficient funds to pay the (expensive) upfront fixed cost for exporting. This seems to be a general basic, not only in China as Tang and Zhang report it, but also in Japan as reported by Inui et al. (Chapter 3). The main topic and results of the study by Inui et al. suggests that banks could play more important role rather than just institutions of financial intermediary; banks could also be a conduit of information about export markets. Policy implication from this is clear, that is, governments need to take banks on board to its export promotion policy. Further, and this supports the idea of realigning the function of banks to be the intermediaries of exporters, Inui *et al*. suggest that banks need to put more efforts in supporting services for the firms that are capable to export.

The idea to steer banks, or other financial institutions, to support firms to export is warranted for the reason that it is very expensive for a firm to start its export. Furthermore, and perhaps more importantly, much of this expensive cost is due to information asymmetry associated with uncertainty about costs and profitability from exporting (Greenaway and Kneller 2004). In other words, some realignment in the functions of banks or other financial institutions to support export can be put in the perspective to reduce the information asymmetry. More support for this policy is given by findings of the other chapters in this project. Lee and Choi in Chapter 8 find the cost to export is expensive not only because of some exporting fixed-cost component a company has to pay, but also because of high coordination and control costs. Meanwhile, and as summarized earlier, Nguyen et al. (Chapter 4) highlight the large extent of the information asymmetry by their finding that SMEs in Vietnam firstly use the services of other firms to indirectly export before switching to be direct exporters after a couple of years.

Second, it is also important to keep promoting policy to encourage export, for the reason it facilitates firms to increase their productivity. Hahn and Park in Chapter 9 demonstrate this. They find that exporting firms experience much faster skill upgrading than non-exporters and this process is accelerated when the firms' export participation is accompanied by more intensive innovation activities.

Third, policy to invite foreign direct investment (FDI) could be designed to be rather specifically, with an intention to tackle some unique or narrowly targeted objective. This is inferred by the results of the studies conducted by Takii and Narjoko (Chapter 5) and Hayakawa and Matsuura (Chapter 6). Takii and Narjoko suggest a FDI policy approach that specifically target firms in upstream industries. As summarized, this is based on their finding of FDI spillover through forward linkages that gives more availability of high quality inputs locally, which in turn helps local firms to procured these inputs at much lower costs. Based on their findings on the pattern and determinants of the disappearance of Japanese firms' affiliates, Hayakawa and Matsuura indicate that a country should encourage the creation of more industrial agglomerations in order to increase the survival chance of affiliates in setting of regional production networks.

Fourth, clear and measured strategies, or policies, are needed to mitigate the adverse impact of trade and liberalization. Policy makers, in practice, tend to focus on policy actions to protect the loser of the adverse impact. However, what seems to have appeared from the experience of many countries indicate that policy to ‘protect’ the loser tend to be unfavorable for the welfare of the whole economy, that is, very costly, often prolong the adjustment period, and distort competition (Noland & Peck 2003). At the same time, many studies suggest that the benefit of liberalization usually occur only in medium or longer term. Evidence confirms this, where policies are better directed at facilitating adjustments, especially adjustments in labor market, and addressing information asymmetry as well as market entry that may inhibit the creation of new firms and growth (Hoekman & Javorcik 2004). Policy suggestions coming out from some studies in this project are either reflect this policy this framework and therefore suggest policies to be clearly defined and targeted in order to mitigate the adverse impact of the liberalization.

Aldaba in Chapter 7 suggests that policy need to enhance productivity and to foster domestic firms to have a link with foreign firms. In the context of her study, this implies that government should not protect firms that have low productivity from disappearing/going bankrupt. How to match local to foreign firms to form joint-venture firms are also implied, as one way to increase productivity and hence, survival. In Chapter 9, based on their findings that the skill upgrading because of firm’s export activities benefit more the skill workers rather the unskilled ones, Hahn and Park support the what so-called trade adjustment assistance (TAA). Hahn and Park, however, suggest a modification of traditional TAA in which it needs to take individual worker as the target and the basic unit of the TAA program. This is for the reason that, as they also find in their studies, trade liberalization may cause different impact even among the winners (i.e., exporters), which is not suitable with the traditional TAA program that is usually designed to be triggered by an adverse impact in output of the affected firm.

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CHAPTER 2

Exporting Behavior and Financial Constraint of Chinese Firms

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Using comprehensive firm-level panel datasets, we examine a two-way relationship between exporting behavior and financial constraint of Chinese firms. We find that for state-owned and foreign-owned firms, financial constraint reduces firm's probability to start exporting, but there is no such effect for private firms. Regarding the reverse causality, our propensity score matching estimation finds no evidence that exporting helps improve firm's financial condition. We also find that financial constraint affects destination country add and drop, but not product add and drop.

Key words: Financial Constraint, Exporter, China

JEL Classification: F14, G32

1. Introduction

Why do some firms export while other firms in the same industry don't? According to heterogeneous firm theory based on Melitz (2003), high productivity firms are more likely to export. This is because only high productivity firms can overcome fixed export costs such as researching foreign markets and establishing trade networks with foreign buyers. However, in the real world, even in a narrowly defined industry, many exporting firms are less productive than non-exporters (Eaton, Kortum and Kramarz, 2004). Recent research (e.g., Chaney, 2005; Manova, 2010) has extended the Melitz model and emphasized the role of financial constraint in determining firm's export status. With the assumption of imperfect capital market, these theories argue that even high productivity firms may not be able to export if they face financial constraint. For example, liquidity constraint makes it difficult for high productivity firms to cover the upfront fixed costs, even though expected future profits from exporting are sufficiently large.

On the other hand, exporting may also help firms overcome financial constraint. Firms often cite financial constraints as one of their primary obstacles to investment and growth. This is especially true in developing countries since financial markets are less developed in these countries, which makes external financing relatively expensive for firms. As a result, firms will have to rely on internally-generated funds to make future investment. In this case, exporting itself may be an important mechanism for firms from developing countries to overcome their financial constraint (constant cash flow, reputation, financing from foreign countries), and become an engine for firm growth.

The purpose of this paper is to examine the two-way relationship between exporting and financial constraint of Chinese firms. China is an interesting case to study not only because China is the largest exporter in the world, but also because many Chinese private firms face serious financial constraint. Due to the government interference in Chinese banks — especially the requirement that banks must favor the state-owned enterprises — Chinese banking system deprives the emerging private firms of access to bank credit (Huang *et al*., 2011). Such political pecking order also exists in the equity market. According to Chinese government policy on initial public offering, private firms were almost denied the access to stock market. It has been a puzzle that despite the discrimination and severe credit constraint, Chinese private firms have managed to grow quickly. One explanation in the literature hinges on informal finance (Allen, *et al.* 2005). We want to explore another possible channel — exporting provides alternative source of financing for credit-constrained private firms.

In this study, we use two comprehensive firm panel datasets. The first dataset from the National Bureau of Statistics (NBS) covers all state-owned firms and all non-state firms with sales above 5 million Yuan. This dataset is complemented with a transaction-level dataset from China Customs which includes the universe of Chinese importers and exporters during 2000-2006.

To examine how financial constraint affects firm export, we first estimate a probit model of new exporters. Our estimation results suggest that financial constraint does affect firm's export decision, and it matters more for state-owned firms and foreign invested firms than for private firms. In searching for causal links between exporting and financial constraint, we use propensity score matching and difference-in-difference techniques developed in microeconometrics (e.g., Heckman, *et al.* 1997). Propensity score matching allows us to construct a reasonable counterfactual and determine the changes in firm's financial condition that can be reliably attributed to exporting. Our propensity score matching results show that exporting does not alleviate firm's financial constraint, and this finding holds for all ownership categories.

To further explore the extensive margins, we study the effect of financial constraint on product and destination country add/drop of continuing exporters. We find that financial constraint matters for country add/drop, but not for product add/drop.

The rest of the paper is organized as follows. Section 2 provides a brief literature review.

Section 3 describes our data source and measurement issues. Section 4 presents the empirical strategy and reports the estimation results. The last section concludes with policy recommendations.

2. Literature Review

Recent literature in international trade, best represented by the heterogeneous-firm framework by Melitz (2003), has taken an important step towards the understanding of the adjustment process in an open economy. In Meltiz's framework, firms differ in productivity and need to incur various types of fixed costs to export. Since not all firms expect to receive sufficient operating profits to overcome the fixed export costs, only the relatively more productive firms would find it profitable to export. While the main goal of Melitz (2003) is to analyze welfare and reallocation impact of trade liberalization at the steady state, recent theoretical work has extended this line of research and examined another aspect of firm heterogeneity – financial constraint. Chaney (2005) shows that liquidity constraints affect entry in a Melitz type heterogeneous firm framework. Low productivity aside, in imperfect capital markets, a financially-strapped firm may not be able to borrow enough to afford the fixed export costs, even though it expects to receive a revenue stream from foreign sales sufficient to recover those costs. Based on this framework, it has been shown that a country's level of financial market development is an important source of comparative advantage (Beck, 2002; Manova, 2010). Specifically, in a world where sectors differ substantially in their dependence on external finance for production, nations with better financial institutions would specialize in financially vulnerable sectors.

In addition to sectoral level evidence, there are also increasing number of studies that use firm-level data. Greenaway *et al*. (2007) find a positive correlation between exporting status and financial health. However, they show that such positive correlation appears to be driven mostly by the positive effects of export participation on financial constraint relaxation, rather than the other way around as is postulated by the theoretical literature. Berman & Hericourt (2009) examine both productivity and financial constraint as determinants of export participation (extensive margin). They find that higher productivity and lower financial constraint both enhance export participation. Importantly, they find that these two effects reinforce each other (i.e., productivity effects are stronger when financial constraints are lower). Moreover, they find evidence consistent with a large sunk cost paid for exporting for the first time.

Conditional on exporting, they do not find evidence that financial constraint affects the probability of remaining as exporters nor the intensive margin. They speculate that the fixed costs required to continue the exporting status are substantially lower than the initial start-up cost for exporting. Amiti & Weinstein (2009) study the financial situations of the major banks providing trade finance to the exporters, and find that financial distress is associated with lower exports of the exporters. They argue that this evidence highlights the importance of external finance to exporters.

Our project is closely related to a recent study by Manova, *et al.* (2009). They use Chinese customs dataset to show that foreign invested firms are associated with better export performance compared with domestic private firms. Their argument is that foreign invested affiliates have access to internal capital from their parents, and rely less on borrowing from the domestic capital markets in China. To provide further support to this argument, they show robust evidence that these differences in export performance are larger in financially vulnerable sectors. There are three main differences between their work and ours. First, while they use ownership as a proxy for financial constraint, we use more direct measures of financial constraint from firm financial statements. Second, they mainly examine the impact of financial constraint on trade volume (the intensive margin); we focus on the effects on firms' export participation (the extensive margin). Third, since we do not use ownership types to proxy the financial constraint, we can further study the effects of credit market imperfections on trade across firm ownership types.

Using firm-level data from China, Du & Girma (2007) find that better access to bank loans boost firm exports, especially for politically unaffiliated firms. They also look at FDI as a source of external finance, and how different types of FDI (horizontal, vertical, export-oriented and market-seeking) are associated with firms' export performances. They find that export-oriented FDI enhances exports, especially in labor-intensive sectors, and that market-seeking FDI has a negative impact on firm exports.

3. Data and Measurement

3.1. Data Description

Our main dataset is the above-scale firm dataset (1998-2007) from the National Bureau of Statistics. The dataset contains annual survey data of all state-owned firms and those non-state firms with sales in excess of 5 million Yuan. The number of firms each year grew from about 160,000 firms in 1998 to over 310,000 firms in 2007. This dataset covers about 85-90% of total value-added of the manufacturing industries. It contains firm-level accounting and financial information, such as ownership type, debt, account receivables, and short-term and long-term assets. These firm-level data were used by the NBS to compute gross domestic product and other key macroeconomic variables, which are then reported in the China Statistical Yearbook.

We use unique numerical IDs to link firms of different years in the sample over time. Firms sometimes receive a new ID as a result of restructuring, merger, or acquisition. Where possible, we track firms as their boundaries or ownership structures change, using information on the firm name, industry, address, etc., to link them.

Since our focus is manufacturing industry, mining and utility industries are excluded from our sample. In addition, we drop those observations with missing values for key variables and those that fail to satisfy some basic error checks. Following Jefferson, *et al.* (2008), we delete all firms with less than 8 employees as they fall under a different legal regime (self-employed individual business). Consequently, about 17% of firms in the original dataset are dropped from the sample in 1998, but the fraction drops to less than 6% after 2001. After the clean-up process, we have an unbalanced panel of firms that increases in coverage from 148,685 firms in 1998 to 313,048 in 2007.

A firm's real output and value added are deflated by a sector-specific ex-factory price index. Ex-factory price refers to the price at the factory, and does not include any other charges, such as delivery or subsequent taxes. The capital stock is calculated using the perpetual inventory methods in Brandt, *et al.* (2012). To deal with the biases arising from endogenous input choices (Griliches & Mairesse, 1998), we adopt the Levinsohn & Petrin (2003) procedure that uses intermediate inputs as a proxy for unobservable productivity shocks. The Levinsohn-Petrin procedure is implemented in this paper using the Stata module "levpet" developed by Petrin, *et al.* (2004).

In our paper, a non-exporter is a firm that never exported up to and including the reporting year. New exporters are firms that did not export in the previous years but started exporting in the year of analysis. Their pre-export characteristics can therefore be matched with those of the non-exporters (see Section 4 for details about the matching approach). Existing exporters are firms that have export records in both current year and previous year. Table 1 reports summary statistics of all exporters, new exporters and non-exporters.

Table 1: Summary Statistics

	All Exporters			New Exporters			Non-Exporters		
Variable	No. Obs.	Mean	Std. Dev	No. Obs.	Mean	Std. Dev	No. Obs.	Mean	Std. Dev
Liquidity 1	536.603	0,052	0,296	56.555	0,051	0,654	1.417.609	0,022	0,313
Liquidity 2	538.090	0,422	0,262	56.555	0,425	0,302	1.416.122	0,403	0,284
Leverage1	541.539	1,035	0,793	56.329	1,152	0,894	1.423.473	1,215	0,976
Leverage2	538.090	0,578	0,262	56.555	0,463	0,354	1.416.122	0,597	0,284
ln(fixed asset)	543.953	8,756	1,83	56.304	8,411	1,722	1.440.000	8,215	1,647
ln(worker)	546.198	5,282	1,174	56.643	4,949	1,083	1.454.253	4,567	1,046
ln(age)	546.198	1,894	0,89	56.304	1,706	0,943	1.454.253	1,921	1,019
ln(TFP)	533.946	2,540	0,991	53.579	2,565	1,014	1.395.685	2,578	1,194

Source: NBS above-scale dataset.

The second dataset we will use is from China customs. It covers the universe of all Chinese firms that import or export over the period of 2000 to 2006. This dataset reports firms’ export and import values in US dollars of over 7000 products in the HS 8-digit classification (example of a product: 61124100 - Women's or girls' swimwear of synthetic fibers, knitted or crocheted), from and to over 200 destinations around the world, by type of enterprise (out of 9 types, e.g. state owned, wholly foreign owned, sino-foreign joint venture), region or city in China where the product was exported from or imported to (out of around 700 locations), customs regime (out of 18 regimes, e.g. process and assembling, process with imported materials). The data also reports quantity, quantity units, customs offices (ports) where the transaction was processed (97 in total), and transportation modes.

3.2. Measuring Financial Constraint

Following the literature, we examine two aspects of financial constraint: liquidity and leverage. A firm with a high liquidity ratio may have sufficient internal funds to pay the fixed costs for exporting, even though it has no access to external finance; whereas a firm with a higher ratio of leverage will find it more difficult to borrow from the financial market. In short, the first measure captures the need to use external finance, while the second one captures the ability to borrow externally. In particular, we measure liquidity and leverage in the following ways.

<u>Liquidity:</u>

- Liquidity 1 = (Short-term asset – Short-term liabilities)/ Total asset (Greenaway *et al*., 2007)
- Liquidity 2 = (Total asset – Total liabilities)/ Total asset (Berman & Hericourt, 2009; Muuls, 2009)

<u>Leverage:</u>

- Leverage 1 = Short-term liabilities/ Short-term asset (Greenaway *et al*., 2007)
- Leverage 2 = Total liabilities/Equity (Minetti & Zhu, 2010)

Figure 1 shows the average values of “liquidity 1” over 1999-2007 by four exporting types. In almost all years, always exporters have highest liquidity, followed by new exporters, export stoppers and never exporters. Same things can be said for “leverage 1”. Figure 2 shows the same pattern.

Figure 1: Liquidity 1 Across Exporting Types

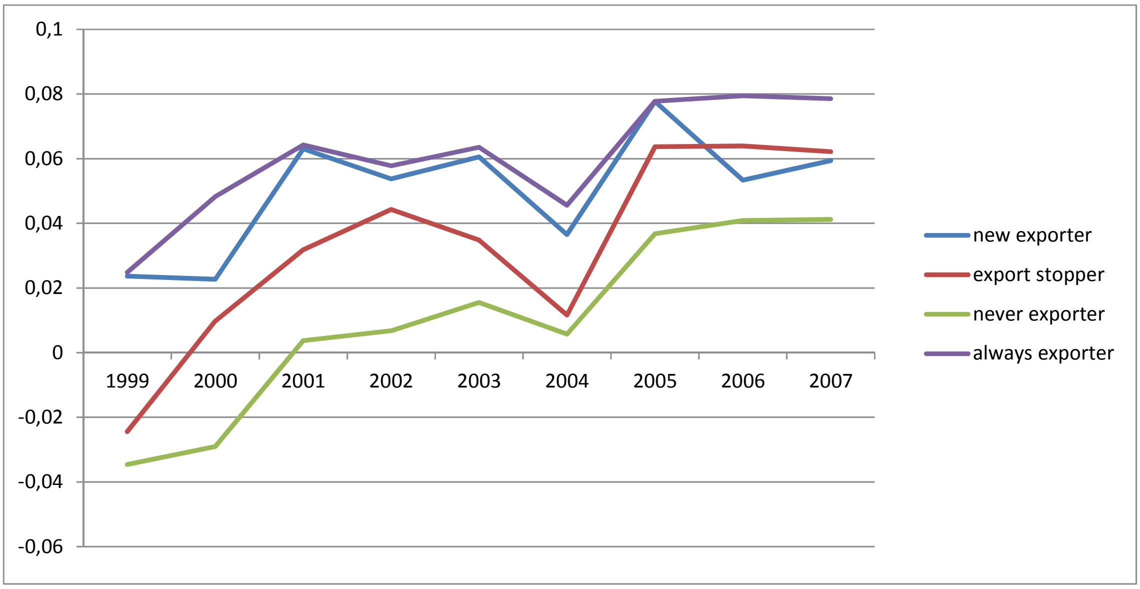
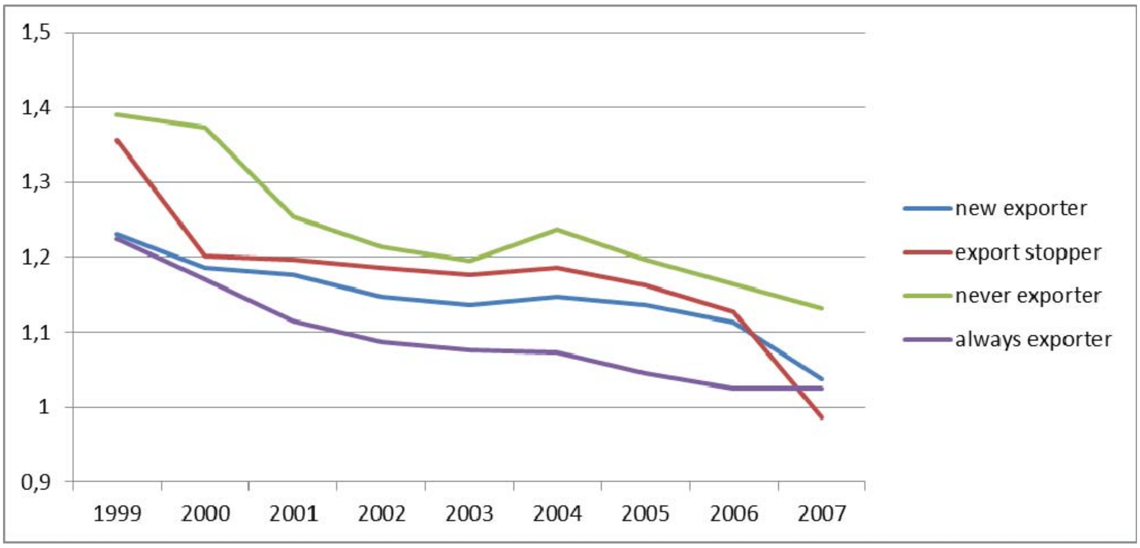


Figure 2: Leverage 1 Across Exporting Types



4. Econometrics Analyses

4.1. Financial Constraint and Firm Export Decision

One would expect that the fixed cost argument of financial constraint theory should better apply to new exporters. Following Bellone *et al*. (2010), we test the self-selection hypothesis that firms with less financial constraint are more likely to *start* exporting. In this context, initial financial constraint would be important to explain why some firms begin to export while others only sell in the domestic markets.

To examine the empirical validity of this hypothesis, we focus on those firms that do not export initially, which can be further classified into two groups: those that start exporting in the next year and those that stay as non-exporters. Since our data span 1998-2007, we have 9 cohorts of export starters and non-exporters: 1998-1999, 1999-2000, …, and 2006-2007. Pooling these cohorts results in data for 56,555 export starters and 871,990 non-exporters. We estimate the probability of exporting as a function of ex-ante firm performance. In this framework, a negative relationship between ex-ante financial constraint and probability of exporting would support the self-selection hypothesis.

Our probit model is specified as follows:

$$Prob(NEWEXP_{i,t+1}=1) = \Phi(\ F_{i,t}\ ,X_{i,t},,\ Province,\ Industry,\ Ownership,\ Year) \quad (1)$$

where Φ is the normal cumulative distribution function. *NEWEXP* is an dummy variable of whether the firm started exporting. *F* denotes our measures for financial constraint. *X* is a vector of firm characteristics that affect the probability of exporting, including the logarithms of TFP, fixed assets, employment and firm age, all lagged by one year. We also include a full set of ownership, three-digit industry, year and provincial dummies.

The results reported in Table 2 support the self-selection hypothesis. The estimates, which correspond to the marginal effects, show that the probability of starting to export is, as expected, increasing in liquidity and decreasing in leverage. estimation results also indicate that those firms that are initially more productive, bigger, younger, and with foreign ownership, are more likely to be export starters.

Table 2: New Exporter Probit Estimation

Dependent Variable: New Exporter Dummy

	Liquidity 1	Liquidity 2	Leverage 1	Leverage 2
Financial Factors	0.043***	0.048***	-0.032***	-0.059***
	(0,010)	(0,012)	(0,009)	(0,012)
ln(TFP)	0.018***	0.016***	0.019***	0.016***
	(0,004)	(0,005)	(0,005)	(0,005)
ln(fixed assets)	0.012**	0.009*	0.012**	0.009*
	(0,004)	(0,004)	(0,004)	(0,004)
ln(worker)	0.180***	0.180***	0.180***	0.180***
	(0,006)	(0,006)	(0,006)	(0,006)
ln(age)	-0.063***	-0.062***	-0.063***	-0.062***
	(0,004)	(0,004)	(0,004)	(0,004)
State	-0.423***	-0.415***	-0.421***	-0.415***
	(0,016)	(0,016)	(0,016)	(0,016)
Foreign	0.468***	0.465***	0.468***	0.465***
	(0,013)	(0,013)	(0,013)	(0,013)
Collective	-0.334***	-0.334***	-0.335***	-0.334***
	(0,013)	(0,013)	(0,013)	(0,013)
N	927.154	928.545	928.921	928.321

Notes: Marginal Effects are reported. Standard errors (clustered at the industry-year level) in parentheses. All regressors, besides fixed effects, are lagged. Year, sector and province fixed effects are always included. Private owership is the omitted category. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

To investigate the heterogeneous effects across ownership types, we split the sample according to firms' ownership. We re-run the probit regressions for each ownership type. The estimation results are reported in Table 3. In general, the financial constraint factors have stronger effects for state-owned firms and foreign invested firms.

For private firms, liquidity and leverage do not seem to affect firm's probability to start exporting. It is well known that in China private firms have difficulty borrowing from state-owned banks. However, private firms had higher growth rate of exports than all other firms despite facing severe financial constraint. Our explanation is that for private firms, productivity and other factors become more important than financial constraint as determinants of exports.

Table 3: New Exporter Probit Estimation by Ownership

Dependent Variable: New Exporter Dummy

	Liquidity 1	Liquidity 2	Leverage 1	Leverage 2
Panel A: All Firms				
	0.043***	0.048***	-0.032***	-0.059***
	(0,010)	(0,012)	(0,009)	(0,012)
Panel B: State Ownerhsip				
	0.046***	0.059***	-0.051**	-0.071***
	(0,011)	(0,018)	(0,019)	(0,018)
Panel C: Foreign Ownerhsip				
	0.047*	0.068*	-0.049**	-0.064*
	(0,025)	(0,029)	(0,025)	(0,028)
Panel D: Collective Ownership				
	0.041**	-0,002	-0.041*	0,002
	(0,020)	(0,022)	(0,024)	(0,031)
Panel E: Private Ownership				
	-0,004	0,009	-0,004	0,007
	(0,015)	(0,022)	(0,019)	(0,025)

Notes: Marginal Effects are reported. Standard errors (clustered at the industry-year level) in parentheses. All regressors, besides fixed effects, are lagged. Year, sector and province fixed effects are always included. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

4.2. Does Exporting Improve Firms' Financial Health?

Our study finds that the Chinese new exporters (except private firms) tend to be less financially constrained than the non-exporters. However, the relation between financial factors and exporting can go either way. To study if exporting improves firms' financial health, we apply a matching estimator developed in the program evaluation literature by Heckman, *et al.* 1997). We construct a control group with exporting ('treated') firms that are matched to a comparison group of non-exporting ('control') firms. The two groups are matched as close as possible at the time before exporting based on their propensity score. Difference in financial factors before and after exporting and between the treatment group and the matched control group may then be attributed to the effect of exporting on financial condition. This is the difference-in-differences (DID) matching estimator. The use of matching approach to search for causal effects of starting to export has been widely used in the literature (e.g., De Loecker, 2007). In this study, we use nearest neighbor matching combined with difference-in-differences, which is implemented with Stata module "psmatch2" developed by Leuven & Sianesi (2003).

Panel A of Table 4 reports propensity score matching results of all firms. For all our measures of financial factors, none of them is statistically significant. In panel B-E, we do the same estimation with a subset of firms based on their ownership types. Again, regardless of firm ownership, exporting does not seem to improve firms' financial condition. It seems that exporting cannot be an alternative source of funding to overcome financial constraint for Chinese firms (including private firms).

Table 4: New Exporters' Financial Factors - Propensity Score Matching

	Liquidity 1	Liquidity 2	Leverage 1	Leverage 2
Panel A: All Firms				
	0,001	0,001	-0,012	-0,002
	(0,005)	(0,002)	(0,101)	(0,002)
Panel B: State Ownerhsip				
	0,002	0,003	-0,051	-0.021**
	(0,010)	(0,010)	(0,136)	(0,010)
Panel C: Foreign Ownerhsip				
	0,002	0,082	-0,098	0,002
	(0,006)	(0,008)	(0,231)	(0,005)
Panel D: Collective Ownership				
	0,009	-0,002	0,038	0,002
	(0,009)	(0,007)	(0,134)	(0,007)
Panel E: Private Ownership				
	-0,004	0,001	0,047	-0,001
	(0,004)	(0,003)	(0,241)	(0,003)

Notes: This table examines the impact of exporting on financial factors, using propensity score matching method, combined with difference-in-difference. Standard errors in parenthese.*, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Appendix Table 1 reports the balancing test results of the propensity score matching for variable "liquidity 1".[1] Our matching procedure has passed the *t*-tests for equality of the means that are reported in the last two columns. For the matched firms, we cannot reject the null hypothesis that these variables are identical for new exporters and non-exporters, before the former start exporting.

4.3. More extensive Margin – Product and Country

The financial constraint may also affect the ability to add or drop product and destination country for continuing exporters. In this regard, our paper relates to the theoretical literature that highlights the importance of the extensive margin at the product level (e.g., Chaney, 2008; Arkolakis & Muendler, 2010). Based on a multi-

[1] The balancing tests results for other financial constraint variables are available upon request.

product model extension of Melitz (2003), Bernard, *et al.* (2009) find that in the short run, the intensive margin is the dominant driving force of export growth, while the extensive margin, which consists of both net firm entry and net product addition, plays a more significant role in the long run.

In order to study the effect of financial constraint on product/country churning, we merge the NBS firm data with the transaction-level customs data based on firm names and other contact information. Depending on the year, 37%-48% of export value in the customs dataset is successfully merged to the NBS firm dataset. About 70% of exporters in NBS were merged. Statistics about the merging are reported in Appendix Table 2.

We use the merged data and regress the logarithms of number of products or countries on financial factor variables lagged by one year. The sample includes all exporters in our merged dataset. Tables 5 and 6 report the estimation results. Panel A reports estimation results with the whole sample, while Panel B shows the results with the subsample of private firms. We do not find any pattern for the number of products, but financial constraint consistently affects the number of export destination countries.

Table 5: Effect on the Number of Products

Dependent Variable: ln(number of products)

	Liquidity 1	Liquidity 2	Leverage 1	Leverage 2
Panel A: All Firms				
Financial Factors	-0,0084	-0,0144	-0,0055	0.0019***
	(0,011)	(0,014)	(0,004)	(0,001)
Controls	ln_TFP, ln_k, ln_worker, ln_age, state, foreign, collective fixed effects			
N	185.797	186.478	186.841	186.181
Panel B: Private Firms Only				
Financial Factors	-0,0149	-0,0215	-0,0019	0.0024***
	(0,013)	(0,016)	(0,007)	(0,001)
Controls	ln_TFP, ln_k, ln_worker, ln_age, state, foreign, collective fixed effects			

N	178.450	179.095	179.710	179.239

Notes: Standard errors (clustered at the industry-year level) in parentheses. All regressors, besides fixed effects, are lagged. Year, sector and province fixed effects are always included. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 6: Effect on the Number of Countries

	Dependent Variable: ln(number of countries)			
	Liquidity 1	Liquidity 2	Leverage 1	Leverage 2
Panel A: All Firms				
Financial Factors	-0.110***	-0.1970***	0.0219***	0.0067***
	(0,013)	(0,015)	(0,004)	(0,001)
Controls	ln_TFP, ln_k, ln_worker, ln_age, state, foreign, collective fixed effects			
N	185.797	186.478	186.841	186.181
Panel B: Private Fims only				
Financial Factors	-0.1220***	-0.2190***	0.0289***	0.0076***
	(0,021)	(0,025)	(0,007)	(0,002)
Controls	ln_TFP, ln_k, ln_worker, ln_age, state, foreign, collective fixed effects			
N	68.864	68.604	68.698	68.594

Notes: Standard errors (clustered at the industry-year level) in parentheses. All regressors, besides fixed effects, are lagged. Year, sector and province fixed effects are always included. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

To further explore the extensive margin, we focus on the continuing exporters and study how financial constraint affects the entry and exit of their product/country. To do this, we run probit regressions with all observations of firm-product or firm-country for continuing exporters. In Panel A of Table 7, we report the marginal effects from our probit estimation of product add Panel B deals with product drop. We can see that in most cases, financial constraint does not impact firm's product add/drop decision. Table 8 shows the estimation results with export destination country add and drop. Panel A suggests significant effect of financial factors on country add. But in the country drop regressions such effect is only found for "liquidity 1" and "leverage 1".

Our product/country level estimation suggests that financial constraint mainly affects country add and drop. According to theoretical literature, financial constraint reduces firms' ability to cover the upfront fixed export cost. It seems that adding a new country to existing products involves larger fixed cost than adding a new product to existing destination countries. In fact, much of the fixed export costs for continuing exporters are country-specific costs such as researching foreign market information and setting up distribution network.

Table 7: Probit Estimation Product Add and Drop

	Liquidity 1	Liquidity 2	Leverage 1	Leverage 2
Panel A: Dependent Variable: New Firm-Product Add Dummy				
	0.008	0.001	-0.004	-0.038***
	(0,008)	(0,010)	(0,021)	(0,013)
Controls	ln_TFP, ln_k, ln_worker, ln_age, state, foreign, collective fixed effects			
	845.164	845.484	845.882	845.631
Panel B: Dependent Variable: Old Firm-Product Drop Dummy				
	-0.019**	-0.014	0.001	-0.006
	(0,009)	(0,013)	(0,014)	(0,012)
Controls	ln_TFP, ln_k, ln_worker, ln_age, state, foreign, collective fixed effects			
N	789.784	789.657	790.324	789.358

Notes: Marginal Effects are reported. Standard errors (clustered at the industry-year level) in parentheses. All regressors, besides fixed effects, are lagged. Year, sector and province fixed effects are always included. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 8: Probit Estimation of Country Add and Drop

	Liquidity 1	Liquidity 2	Leverage 1	Leverage 2
Panel A: Dependent Variable: New Firm-Product Add Dummy				
	0.032***	0.024**	-0.031*	-0.028***
	(0,006)	(0,012)	(0,019)	(0,013)
Controls	ln_TFP, ln_k, ln_worker, ln_age, state, foreign, collective fixed effects			
	719.327	721.238	720.641	720.673
Panel B: Dependent Variable: Old Firm-Product Drop Dummy				
	-0.026***	0,005	0.034**	0,004
	(0,008)	(0,011)	(0,017)	(0,015)
Controls	ln_TFP, ln_k, ln_worker, ln_age, state, foreign, collective fixed effects			
N	678.346	680.661	679.437	679.214

Notes: Marginal Effects are reported. Standard errors (clustered at the industry-year level) in parentheses. All regressors, besides fixed effects, are lagged. Year, sector and province fixed effects are always included. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

5. Conclusions and Policy Implications

In this paper, we find that higher liquidity or lower leverage is associated with higher likelihood of starting to export. But we also find that financial constraint is not a determinant of new exporters for private firms. Using propensity score matching, we find that reverse causality does not appear to be a main issue. In other words, there is no evidence that exporting helps improve firm’s financial condition. Regarding the extensive margin of product and country, higher financial constraint is associated with fewer destination countries per exporting firm. No such relation is found with the number of products exported. Similarly, our probit estimation suggests that financial constraint affect country add and drop, but not product add and drop.

Understanding the relation between financial constraint and export has important policy implications. Such understandings not only enhance our knowledge about the welfare and distributional effects of trade liberalization, but also shed light on economic policies for better managing the economy in the future. For example, the sharp contraction in trade credits is considered one of the main reasons for the collapse in global trade flows during the early phase of the recent global financial crisis (e.g., Chor & Manova, 2009; Freund & Klapper, 2009).

In the Chinese context, exports play a critical role in driving the economic growth. Our results suggest that in addition to productivity, financial constraint matters in an important way for firm exports. Chinese government policies that target export promotion should pay more attention to financial factors. Many high productivity firms cannot export simply because they do not have funds to pay the upfront fixed export costs. This calls upon the re-examination of the functions of the banks and other financial intermediaries in supporting exporting firms. At the same time, government may want to increase its support of trade credit in order to help those potential exporters.

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CHAPTER3

Exporter Dynamics and Information Spilloversthrough the Main Bank*

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This paper examines how firms' decision to start exporting is affected by the availability of information on export markets. Unlike existing studies which focus on information sharing among firms, we are interested in the information provided by firms' main bank. Specifically, using a unique dataset containing information on both Japanese firms' export activities and their main banks' experience in transacting with other exporting firms, we examine whether main banks act as a conduit of information on export markets. We find that information spillovers through main banks positively affect client firms' decision to start exporting (extensive margin), implying that information on foreign markets provided by banks substantially reduces the fixed entry cost of exporting. On the other hand, we do not find any evidence that information provided by banks has an effect on the export volume or on the growth rate of exports (intensive margin). Our results highlight that channels of information spillovers other than those examined in the literature so far may be of considerable importance.

Key words: Export Decision; Lender Bank; Information Spillover; General and Specific Information.

JEL Classification: F10, F14, G21, L25

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* This research was conducted as part of the project entitled "Dynamics of Firm Selection Process in Globalization" for the Economic Research Institute for ASEAN and East Asia (ERIA). The authors would like to thank ShujiroUrata, Chin Hee Hahn, Dionisius Narjoko, Yifan Zhang, and other participants of the ERIA workshops for the Microdata Project FY2011 for their helpful comments.

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1. Introduction

The relationship between globalization and firms' performance has been the subject of numerous studies and there is growing evidence that there is a positive relationship between the two. Yet, researchers' understanding of the dynamic behavior of firms in a globalized economy is still far from sufficient to propose specific policies that help firms to grow in such an environment. For instance, micro-data analyses on various countries confirm that the international performance of a countrytends to hinge on a handful of high-performing firms (Mayer &Ottaviano 2008), suggesting that increasing the number of firms involved in international activities is important for the successful internationalization of a country. However, both theoretical and empirical research to date has not produced an adequate answer to the question of how to increase the number of firms involved in international activities. For example, although there is wide empirical support for the theoretical prediction that firms with higher productivity are more likely to become exporters, a growing number of studies is producing results suggesting thatproductivity advantages alone do not sufficiently explain the self-selection of firms into exporting. Such studies (see, e.g., Bernard *et al*. 2003; Mayer &Ottaviano 2008; and Todo 2011) point out that while such productivity advantages certainly do appear to exist, their impactis economically negligible.This implies that our knowledge about the determinants of the export decision remains very limited and no conclusive answer has yet been found as to what factors are important for firms to become an exporter and grow through exporting.

The international trade literature suggests that to start exporting firms incur sunk fixed costs, since initially they are uncertain about their export profitability and they have to collect a considerable amount of relevant information on export markets.

Moreover, firms need to modify products to suit local tastes and set up distribution networks. Developing a theoretical model, Melitz (2003) therefore suggests that only firms which are sufficiently productive to cover such fixed costs can be exporters. The above-mentioned empirical studies examining this hypothesis, however, indicate that there must be other important factors which affect firms' decision to export. In other words, they suggest that even when their productivity is not very high firms can be exporters as long as other critical conditions are satisfied.

The extant literature has focused on a number of conditions or factors that may affect firms' export decision. One important research strand in this context concentrates on export spillovers. The idea is that information exchange with other exporting firms reduces the individual fixed costs associated with exporting, and that such information exchange therefore increases the probability that a firm will export (see, e.g., Krautheim(2007) for a theoretical investigation).[1] Having access to information on foreign markets, the hypothesis goes, substantially reduces uncertainty and encourages firms to engage in export activities. Empirical work by Koenig *et al*. (2010) confirms this hypothesis by finding that the presence of other exporters has a positive effect on the export decision of other firms. Although Koenig *et al*. (2010) find evidence of positive export spillovers, the evidence produced by other empirical studieson such export spillovers is at best weak (e.g., Aitken *et al*. 1997, Barrios *et al*. 2003, Bernard & Jensen 2004), which means that the search for possible channels of

[1] *Other strands in the literature examine the relationship between firms' export status and their innovative capacity, the price and/or quality of their product, various country characteristics, and institutional factors such as free trade agreements, economic diplomacy, and so on. Moreover, especially since the 2008 global financial crisis, the impact of credit constraints on firms' export decision has gained growing attention among researchers and policy makers. Because exporting involves higher entry costs than selling in the domestic market and most entry costs must be paid up front, only firms with sufficient liquidity can meet them. Based on this line of reasoning, Chaney (2005) augmented a Melitz-type model with liquidity constraints and suggests that financial frictions affect the selection of firms into exporting. Several studies, such as Bellone et al. (2010), Muûls (2008), Manova et al. (2011), Feenstra et al. (2011), and Minetti and Zhu (2011), have produced evidence indicating that credit constraints severely restrict firms' export capacity.*

information spillovers continues.

Against this background, this paper focuses on information provided by lender banks as one potential channel of information spillovers. Most existing empirical studies examining information spillovers from other exporting firms assume that firms in the same region and/or industry are likely to exchange information with each other; however, such studies do not explicitly discuss the channel through which such information exchange takes place.The hypothesis we examine here is that lender banks work as a conduit for such information.In the case of Japan, lender banks provide not only financial support but also business consulting services utilizing extensive knowledge collected through their lending transaction relationships and from various information sources. Since the monitoring of borrower firms is important for banks, banks in general should accumulate information on borrower firms and related parties. Thus, if we assume that a particular bank is very knowledgeable about overseas business opportunities either through its own banking activities or transactions with client firms with experience in exporting, potential exporter firms would find it helpful to consult with such a bank. That financial institutions may indeed play an important role in determining client firms' export activities has recently been highlighted in studies by Amiti& Weinstein (2011) and Paravisini*et al.* (2011), which indicate that banks' financial health plays animportant role in determining firms' export behavior. Inui *et al*. (2011), on the other hand, focus on banks' ability to screen, monitor, and advise client firms as a determinant of export behavior. Specifically, using a measure of banks' efficiency as a proxy for their ability to screen, monitor, and advise client firms, they find that bank efficiency has a positive effect on the export decision and overseas sales ratio of client firms.

The aim of this paper is to explore the role of banks as information providers by explicitly quantifying banks' ability to provide information on export markets using aunique panel dataset for Japan in which firms are matched to lender banks.In fact, Japanese Bankers Association (2011) provides various examples of how banks provide supporting services to firmswhen the firms start exporting to a new foreign market and/or open affiliates or branches overseas. According to the report, banks not only provide financial support to firms but also actively introduce them to foreign firms that are potential business partners or providers of business supporting services.[2]We therefore conjecture that banks play a crucial role in substantially reducing the fixed entry costs incurred by client firms when starting to export. Specifically, we hypothesize that the provision of information by lender banks helps firms to start exporting based on the same mechanismsthat information exchange with other exporting firms helps potential export starters. To examine this hypothesis, we focus on firms' main bank which, in line with previous studies, we define as the top lender bank of a firm and investigate the importance of information flows from the main bank to client firms as a source of spillovers.[3]

This paper contributes to the existing literature in at least two ways. First, it is the first study to examine the export decision by using a dataset that makes it possible to link firm-level information with information on the major lender banks of each firm. The paper explores the impact of information spillovers through main banks on both firms' decision to start exporting (*the extensive margin*) and on the volume exported by each firm (*the intensive margin*). Second, the paper investigates whether the

[2]We also interviewed an assistant general manager at the international business support office at a regional bank and found that not only large (city) banksbut also many regional banks have been making strong efforts to support client firms trying to expand international transactions and business. Examples of such support services are summarized in Box 1.

[3] Of course, there are several other sources from which firms obtain information on export markets. Economic diplomacy and chambers of commerce in destination countries (Creusen&Lejour 2011) are another source of information on foreign markets, although we do not address the role of economic diplomacy here due to data constraints. As described below, information on the destination of exports is only available at the broad region level (e.g., North America or Asia) and not at the country level. Yet another potentially important conduit for information on export markets is trading companies and wholesalers. Unfortunately, we cannot identify transaction relationships between exporter firms and trading companies.

importance of information provided by banks differs across export destination regions and examines what type of information – that is, general information on overseas markets regardless of the destination or destination-specific information – is more relevant for firms' export decision.

Our results show that information on overseas markets provided by a main bank substantially reduces the fixed costs of starting exporting for a firm and thereby increases the probability that the firm will start exporting. However, the effect of such information on the volume of exports is not very clear.

The organization of this paper is as follows. Section 2 briefly explains the roles that main banks play in Japan and presents the empirical strategy. Section 3 describes the dataset used in this paper and provides some descriptive statistics on our sample firms. Next, Section 4 presents our estimation results. Finally, Section 5 discusses the policy implications and concludes.

2. Empirical Strategy

2.1 The Main Bank System in Japan

The "main bank system" has been a key feature of Japan's economic system that can be traced back as far as the early post-war period.[4]In this system, a firm's "main bank" usually is the bank from which it has borrowed the most and with which it typically has a long-term relationships. In addition, it is widely argued that main banks not only provide loans to client firms but also play a consulting role by providing relevant business information. In addition, main banks may get involved in the management of a firm in times of distress. Although the extent and form of main banks' involvement in firms' managementin times of financial difficulties have been

[4]For an overview of the origins of the main bank system, see, e.g., Hoshi &Kashyap (2001).

changing over time, main banks are still perceived to play an important role as providers of both funds and information to their client firms.

Trying to provide a theoretical underpinning for such long-term relationships between main banks and borrower firms, Patrick (1994) argues that such relationships enable banks to gain access to “soft information” on borrower firms, which helps to raise the efficiency of loan screening and borrower monitoring. The argument that repeated bank loan transactions lead to the accumulation of soft information on client firms has also been voiced in more recent studies such as Degryse*et al*. (2009).

Such soft information on borrower firms and banks’ own ability to collect information on industry-, region-, and nation-wide businesses has been helping Japanese main banks to provide effective and useful financial and consulting services to their client firms, and thereby has been contributing both to main banks’ profits and the growth of their client firms’ business.Particularly in recent years, aware of the fact that the growth prospects for Japan’s domestic market are not very promising and domestic manufacturing production has in fact been shrinking, banks have been promoting various services to support client firms’ international activities. With more and more Japanese large firms relocating production overseas, smaller domestic firms are forced to reduce their output, resulting in falling demand of funds, which in turn reduces business opportunities for banks in Japan. Moreover, if banks’existing client firm went out of business, banks would not only lose current business but also future business in which to utilize the firm-specific soft information they have accumulated.Thus, faced with a potentially shrinking market at home, many banks in recent years haveput greater emphasis on providing support services to client firms seeking to exploit growth opportunities overseas.

Concrete examples of the kind of support services that banks provide to their borrowers to help them with regard to international activities are provided by a

Japanese Bankers Association (JBA) report (Japanese Bankers Association 2011). According to the report, other than traditional banking services such as the usual loan business, deposit services, payment services, lease and leaseback deals, or the issue of stand-by letters of credit, main banks often provide client firms with information on potential business partners in foreign countries as well as advice on recruiting employees, advertising, tax systems, and administrative issues such as accounting systems and laws and regulations. These examples indicate that banks provide not only financial transactions but also information services, and in the report, the JBA cites a survey it conducted according to which 38 out of 43 Japanese banks with activities in Asia say they provide services other than loan, deposit, and payment services.Specifically, 32 out of the 38 banks with activities in Asia say they provide information related to investment (i.e., tax and accounting systems, etc.), while 31 banks provide opportunities for business matching (e.g., organizing business matching events for Japanese firms and potential local partners). In addition, many banks provide information on firms located in destination regions (14 banks), loan guarantees (12 banks), and support with export and import procedure (8 banks).[5]

2.2 Empirical Model

This section explains the empirical strategy we employto investigate the determinants of the export decision and of the export volume. We are particularly interested in the impact of information provided by main banks on the probability that a firm starts exporting (i.e., the extensive margin) and on the export volume (i.e., the intensive margin). Following previous empirical studies on the determinants of the extensive and intensive margin (e.g., Koenig *et al*. 2010, Minetti& Zhu 2011), we assume that firm *i* starts exporting if its profits are larger when exporting than when not exporting. Let π_{ijt}^* represent the difference between the profits of firm *i* when it

[5]For further details and examples of such support services, see Box 1.

starts exporting to destination j at time t and its profits when it does not start exporting to destination j at time t. The difference is determined by firm characteristics (e.g., size, productivity, and the skill level of workers), the firm's financial conditions (e.g., the leverage ratio, liquidity ratio, and short-term loan ratio), and the amount of information on the export market available to the firm. The availability of information on the export market is assumed to substantially lower the uncertainty of profits from exporting and hence, to lower either the variable or the fixed cost of exporting. While export spillovers are also taken into account, we are particularly interested in information provided through the main bank of the firm. Therefore, we parameterize π_{ijt}^{*} as:

$$\pi_{ijt}^{*} = \alpha_1 + Z_{it}\beta_1 + I_{ijt}\gamma_1 + \varepsilon_{ijt}$$

where Z_{it} is a vector of controls for firm characteristics and the firm's financial conditions which may affect firm i's differential profits π_{ijt}^{*}; $I_{ijt}$is a vector of variables representing information available to the firm; and ε_{ijt}captures unobserved firm characteristics and other unknown factors that may also affect differential profits.

We assume that firm i starts exporting if the differential profits $\pi_{ijt}^{*}>0$. Under the assumption that ε_{ijt} is a normally distributed random error with zero mean and unit variance, the probability that firm i starts exporting can be written as:

$$\mathrm{Prob}_{ijt} = \mathrm{Prob}\left(\alpha_1 + Z_{it}\beta_1 + I_{ijt}\gamma_1 + \varepsilon_{ijt} > 0\right) \qquad (1)$$

In the first instance, we estimate Equation (1) with a random effect panel probit approach. In order to take any potential endogeneity into account, we lag all right-hand side variables by one year.[6]The dependent variable $Prob_{ijt}$ denotes the

[6]As we will detail later, in order to address the endogeneity problem, we use a limited sample restricted to firms which maintained a relationship with their top lender (i.e., main bank) during the three years prior to the observation period. By doing so,we exclude cases where firms possibly changed their main bank in preparing to start exporting, i.e., cases where the bank and

change in export status at the firm- or firm-destination level and takes a value of 1 if a firm exports for the first time (overall) or the first time to destination *j* at time *t.*We define a firm as an export starter if the firm did not export over the last three years from *t-3* to *t-1* and exports at time *t*. $Prob_{ijt}$ takes a value of 0 if a firm did not export to destination *j* for the last three years prior to year *t* and does not export in year *t*. Firms which always export to destination *j* are not included in our analysis.Regarding control variables for firm characteristics and the firm's financial conditions (Z_{it}), we include firm size (the log of the number of employees of firm *i*), the TFP level of the firm, and the average wage rate of the firm as a proxy for the skill level of workers. Based on the results of both theoretical and empirical studies, we expect these variables to be positively correlated with firms' export decision. Further, to take the impact of liquidity constraints on firms' export behavior into account, we include variables representing firms' financial situation, such as their leverage ratio, their liquidity ratio, and the share of short-term loan in their total loans outstanding. The reason for including these variables is that, as highlighted by, e.g., Manova *et al.* (2011), Feenstra *et al*. (2011), and Minetti& Zhu (2011), financial constraints are likely to prevent firms from exporting because firms need sufficient liquidity in order to meet the entry costs associated with starting exporting. Therefore, we expect that firms with more liquidity are more likely to start exporting.

Regarding information available to the firm (I_{ijt}), we include variables representing the amount of information on export markets accumulated by a main bank and by a firm itself. The explanatory variable of main interest is the amount of information on export markets potentially available to the firm through its main bank, which is a proxy for the amount of information firm *i*'s main bank has accumulated on destination *j*.Specifically, we measure this variableas the ratio of the number of the main bank's client firms that are exporting to destination *j* to the total number of the

the firm are not randomly matched.

main bank's client firms, i.e., the intensity of each main bank's dealings with exporting firms. In addition, in order to take into account the information accumulated by firms themselves through their own international activities, we also include variables representing their overseas activities, such as the share of overseas employees in a firm's total number of employees and the share of overseas investment in a firm's total investment.[7] Industry dummies (for fifteen manufacturing industries) and time dummies are also included in order to control for industry-specific and time-specific fixed effects.

While Equation (1) focuses on the extensive margin, i.e., whether firms start exporting, we also examine the role of information spillovers through the main bank on the intensive margin, i.e., the export volume after firms start exporting. To do so, we adapt Equation (1) above as follows:

$$\mathrm{EXP}_{\mathrm{ijt}} = \alpha_2 + \mathrm{Z}_{\mathrm{it}}\beta_2 + \mathrm{I}_{\mathrm{ijt}}\gamma_2 + \varepsilon_{\mathrm{ijt}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

where EXP_{ijt} is the log of firm *i'*sexports to destination *j* at time *t*.We also use the first-difference of the log of exports (i.e., the growth rate of exports) as a dependent variable for an alternative specification. The variables on the right-hand side are the same as those in Equation (1) and we again lag all variables by one year. As above, the variable we are most interested in is the amount of information on export markets potentially available to the firm through its main bank.

That the provision of information by the main bank may affect not only the extensive margin but also the intensive margin is suggested by the theoretical analysis

[7] In addition, as highlighted in previous studies, there may be some spillovers from nearby exporters. In order to examine whether this is the case, we included dummies for the region in which firms' headquarters are located in order to control for export spillovers and other region-specific factors. However, we found that the region dummies were not significant and including them did not increase the explanatory power of our results, so that we decided to omit them here.A possible reason is that the headquarters of most firms in our sample are concentrated in a small number of prefectures (Tokyo, Osaka, and Hyogo).

by Rauch & Watson (2003), who examine the relationship between the search costs for establishing new partnerships and export volumes. They suggest that the higher the costs of searching for a new supplier, the smaller tend to be the orders a buyer places with a supplier. In addition, buyers tend to place larger orders with suppliers once they know that the latter is able to fulfill larger orders. Based on this idea, if banks help in matching businesses in overseas markets and provide information to both the buyer and the supplier on their respective counterpart, this should substantially reduce uncertainty and possibly result in higher transaction volumes. We test this hypothesis by examining whether information spillovers through the main bank have a positive effect on the intensive margin or not.

We should note that in the estimation of Equation (2) non-exporters are excluded from the sample used for analysis.In cases such as here, where there is a risk of a selection bias, a typical solution employed often is to use a Heckman selection model. However, we do not employ the Heckman model and estimate Equations (1) and (2) separately, since it is difficult to find a variable which strongly affects the selection process (Equation (1)) but not the outcome (Equation (2)).[8] Therefore, we estimate Equation (2) separately from Equation (1), employingthe fixed-effect panel estimation method.

[8]Although some previous studies employ a Heckman model to deal with selection bias (e.g., Bellone *et al.* 2010), not all do (see, e.g., Koenig *et al.* 2010, Paravisini *et al.* 2011,Manova *et al.* 2011). Moreover, for our data, finding an exogenous variable that is excluded from the export volume equation is extremely difficult. Although variables representing entry barriers to each export destination may be promising candidates for such an exogenous variable, we did not employ this approach here. The reason is that our information on export destinations is limited to destination regions (eight broad regions in the world), so that we do not have sufficient variation in entry barriers (see footnote 9).

3. Data and Descriptive Statistics

3.1 Data Description

The data used in this study are the firm-level panel data from the *Basic Survey on Business Structure and Activities (BSBSA)* collected annually by Ministry of Economy, Trade and Industry (METI) for the period 1997-2008. The survey is compulsory and covers all firms with at least 50 employees or 30 million yen of paid-in capital in the Japanese manufacturing, mining, and wholesale and retail sectors and several other service sectors. The survey contains detailed information on firm-level business activities such as the 3-digit industry in which the firm operates, its number of employees, sales, purchases, exports, and imports (including a breakdown of the destination of sales and exports and the origin of purchases and imports).[9,10] It also contains R&D expenditures and patents owned, the number of domestic and overseas subsidiaries, and various other financial data such as costs, profits, investment, debt and assets.

The key aim of our analysis, as mentioned above, is to investigate the importance of information on destination markets and advice provided by main banks to their client firms. To do so, we combine the firm-level data with information on firms' main bank and examine the relationships between firm characteristics, main banks' ability to provide advice, and firms' export status. We augment the firm-level panel data taken from the BSBSA with information on firm characteristics stored in the Development Bank of Japan Corporate Financial Databank. We then merge the dataset with information on the main bank for each firm using the loan relation

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[9]The survey asks for the amount as well as the destination or origin of exports and imports broken down into seven regions (Asia, Middle East, Europe, North America, Latin America, Africa, and Oceania). Unfortunately, more detailed information on the destination of exports and origin of imports is not available.

[10] Although the survey also asks non-manufacturing firms for information on exports and imports, they are required to provide the amount of trade in goods only. The survey does not cover international transactions in services.

information stored in the NEEDS Financial Quest database. This database also includes various types of information on main banks.

Although the BSBSA includes a large number of unlisted firms, we have to restrict our sample to listed firms because the information on firms' bank loan relationships is available for listed firms only. Yet, even though we limit our sample to listed companies so that we can match firms to their main bank, our dataset nevertheless includes a considerable number of relatively small firms, which are listed on the stock exchange markets for start-up companies, and some of them are first-time exporters. Moreover, once firms have started exporting, many of them expand the range of destinations to which they export, so that when we examine the determinants of whether firms start exporting to a new destination, we can include more observations in our analysis.

Our unbalanced panel data contain approximately 300–400 listed firms per year, approximately 5 percent of which are identified as export starters.[11] Although the number of pure first-time exporters is limited, there are a substantial number of exporters that expanded or reduced the number of destinations to which they exported during our observation period.

3.2 Variables

Let us now describe the variables for our estimation in detail. Basic statistics of all variables are provided in Table 1. Starting with the dependent variable, to estimate the extensive margin we construct three kinds of dummy variables. The

[11] We were able to match the BSBSA data with the other two databases for approximately 9,300 observations in the manufacturing sector. However, the sample size for our analysis is at most 3,000 observations. The reasons are as follows. First, we exclude firms which have positive exports throughout our observation period ("always" exporters), since our focus is on the decision to start exporting. Second, firms for which data on bank loan transactions are not available are excluded from our dataset. Third, as we employ a three-year window for identifying first-time exporters, firms which frequently changed their export status are excluded from our dataset. Namely, in our analysis, export starters are defined as firms that started exporting in year t but did not export in years$t-3$ to $t-1$.

first of these is *NEW_EXP*, which takes a value of 1 if the firm did not export to any of the regions considered in our analysis (i.e., Asia, North America, Central and South America, Africa, and Oceania) in years*t-3* to *t-1* but exported in year *t*.[12] The aim of using this three-year window is to identify export starters as unambiguously as possible. While employing this definition means that export starters still include firms that have past export experience and therefore are not pure first-time exporters, using a three-year window should reduce any possible biases arising from the misidentification of new exporters.[13] The second, alternative dependent variable we use is *NEW_EXP_REGION*, which takes a value of 1 if the firm did not export to one of the regions we focus on (i.e., Asia, North America, Central and South America, Africa, and Oceania) in years*t-3* to *t-1*but did export to one of those regions in year *t*.The third dependent variable is defined by region. Thus, *NEW_EXP_ASIA* takes a value of 1 if the firm did not export to Asia in years*t-3* to *t-1* but did export to Asia in year *t*. In the same manner, we define *NEW_EXP_NA*, *NEW_EXP_CSA*, *NEW_EXP_AFR*, and*NEW_EXP_OCE,* for the decision to export to North America, Central and South America, Africa, and Oceania, respectively.

Next, we turn to our explanatory variables. The variable we are particularly interested in is the variable measuring the potential information spillovers through a main bank, *BANKINFO*. In order to construct the *BANKINFO* variable, we first construct the variable*NUM_EXPORTER*, which denotes the number of each bank's exporting client firms. We should note that for the *NUM_EXPORTER* variable, exporting firms for which a bank is not the main bank (i.e., not the top lender) are

[12]The BSBSA also specifies other destination regions such as the Middle East and Europe. We ignore these regions due to the small number of export starters to those regions.

[13] Identifying pure first-time exporters is not straightforward. In fact, Koenig *et al.* (2010) consider that a firm is an export starter if it did not export in the previous year, while other studies such as Greenaway *et al*. (2007) and Bellone *et al.* (2010) simply look at whether a firm exports or not in each year. On the other hand, studies such as De Loecker (2007) define a firm as an export starter the first time it exported in the dataset. However, even with this definition, researchers are often likely to misidentify export starters when the time dimension of the dataset is not sufficiently long.

included. In this sense, we implicitly assume that all loan exposures to firms potentially contribute to the accumulation of overseas information at banks.[14] Therefore, the *NUM_EXPORTER*variable measures how many firms that could serve as a source of overseas information a firm's main bank transacts with. Given that *NUM_EXPORTER* is highly correlated with banks' size, we define *BANKINFO*as the ratio of *NUM_EXPORTER* to the total number of the bank's client firms (*NUM_CLIENT*). Through this metric, we intend to measure the intensity of each bank's exposure to exporting firms.[15] Since we have information regardingwhich regions each firm exports to, we can also define *NUM_EXPORTER*and *BANKINFO*by region. We assume that *BANKINFO* measured regardless of destination regions is a proxy for information held by banks on foreign markets in general, while *BANKINFO* measured for each destination region is a proxy for region-specific information held by banks. For each firm, we use the *BANKINFO* variable in order to capture the amount of information provided by the main bank. In order to control for the size of the main bank, we also include *NUM_CLIENT* in our explanatory variables.

It could be argued that firms which are thinking of expanding their business

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[14]Precisely speaking, we add the information about export dynamics stored in the BSBSA to the firm-bank-matched data constructed from the Financial Quest database. Then, summing up the total number of firms as well as the number of exporting firms to which each bank provides loans in each year, we construct *NUM_CLIENT* and *NUM_EXPORTER*. An alternative way to construct *BANKINFO* would be to focus on top lender relationships only. We prefer the former approach since it much better reflects the large variation across banks in terms of the extent to which they dealwith exporting firms.

[15] Whether a bank has branches or subsidiaries abroad and how long these overseas branches or subsidiaries have been in operation are alternative measures for banks' stock of information on overseas markets. However, in this paper, we focus on banks' transaction relationships with exporters, for the following reasons. First, Japanese banks drastically reduced the number of overseas branches at the end of the 1990s when the banking sector took drastic restructuring measures to dispose of bad debts. Instead, they increasingly engage in business tie-ups with other domestic and/or foreign banks to provide international business support services to their client firms. Therefore, we do not consider the number of banks' overseas branches to be a good proxy for the amount of information on overseas markets accumulated by banks. Second, the number of overseas branches by country or region for each bank is not readily available in the database, while the total number of overseas branches for each bank is available. We have to compile the data using various data sources. Nevertheless, considering alternative measures for information spillovers through banks in the future would be a worthwhile exercise.

overseas might try to establish a transaction relationship with a bank which is more likely to have a lot of overseas information. Given that such reverse causality could generate simultaneous equation bias in our estimation, we limit the sample to firms who had the same main bank throughout year *t-3* to year *t*. This allows us to focus on firm-bank pairs where the relationship is independent of the firm's decision to start exporting in year *t*.[16]

As for firm-specific variables, we include variables representing firms' size, labor quality, financial constraints, own overseas activities, and productivity. For firm size we use the (logarithm of) the number of employees (*LN_NUMWORKER*) and for labor quality the average wage (WAGE). Regarding financial constraints, we construct a number of variables: the leverage of a firm (ratio of total liabilities to total assets, *FLEV*), the ratio of bank loans to total liabilities (*FBDEP*), the ratio of liquidity assets to liquidity liabilities (*FLIQ*), and the short-term loan ratio (ratio of short-term bank borrowing to total bank borrowing, *STLOAN*). We construct a number of variables representing firms' own overseas activities: the share of overseas establishments (*FOR_BRANCH*), measured as the ratio of a firm's number of overseas branches or offices (not including overseas subsidiaries or affiliates) to the firm's total number of establishments, branches, or offices, including both domestic and overseas ones;the share of overseas employees (*FOR_EMP*), measured as the ratio of a firm's number of workers employed in overseas branches or offices (not including overseas subsidiaries or affiliates) to the firm's total number of workers employed in all establishments, branches, or offices; the overseas investment share (*FOR_INV*), measured as the ratio of a firm's overseas investment, including portfolio investment,to the firm's total investment; and the overseas lending share

[16] In order to rule out any endogeneity bias more rigorously, we could restrict our analysis to firms whose relationship with their main bank has been established even longer, or we could employ appropriate instruments for *BANKINFO*. Trying these alternative ways to address the endogeneity issue are tasks we leave for future research.

(*FOR_LOAN*), measured as the ratio of a firm's lending to affiliated firms overseas to the firm's total lending to affiliated firms at home and abroad.[17]

As for firm productivity, which, as mentioned above, is widely considered to be an important determinant of the export decision, we use the firm-level TFP data provided in the East Asian Listed Companies Database (EALC) 2010.[18] The firm-level TFP in the database is calculated using the multilateral TFP index method developed by Good *et al.* (1997).[19] Details on the TFP measure are provided in the Appendix.

Table 1: Summary Statistics

Variable	Definition	Obs	Mean	Std. Dev.	Min	Max
FRESH_EXP	1 if export in the year and not export in the previous three years	3.220	0,02	0,15	0	1
FRESH_EXP_somewhere	1 if in some region export in the year and not export in the previous three years	3.220	0,15	0,36	0	1
FRESH_EXP_ASIA	1 if export to ASIA in the year not in the previous three years	3.220	0,03	0,17	0	1
FRESH_EXP_NA	1 if export to the Northern America in the year not in the previous three years	3.220	0,03	0,17	0	1
FRESH_EXP_CSA	1 if export to Central and South America in the year not in the previous three years	3.220	0,07	0,25	0	1
FRESH_EXP_OCE	1 if export to Oceania in the year not in the previous three years	3.220	0,04	0,2	0	1
LN_NUMWORKER	Log of the number of workers	2.914	7,02	1,11	4,03	10,59
FLEV	Total liability / Total Asset	3.205	0,52	0,18	0,05	0,96
FBDEP	Borrowing from Bank / Total Liability	3.209	0,31	0,21	0	0,89
FLIQ	Liquidity asset / Liquidity liability	3.215	1,56	0,85	0,26	8,46
STLOAN	Short-term bank borrowing / Total bank borrowing	2.948	0,53	0,32	0	1
WAGE	Total wage payment / Total number of workers	2.903	6,49	1,78	0,46	12,72
FOR_BRANCH	Number of overseas cites / Total cites	3.206	0,05	0,11	0	0,68
FOR_EMP	Number of overseas employees / Total employees	3.206	0	0,01	0	0,07
FOR_INV	Total overseas investment / Total investment	3.201	0,25	0,44	0	3,36
FOR_LOAN	Total overseas lending / Total lending	3.220	0,11	0,26	0	1
TFP	TFP standardized by using the industry average in Japan	2.780	0,02	0,11	-0,97	0,59
NUM_EXPORTER	Number of exporter clients for the top lender for firm	3.190	182,9	92,41	1	371
NUM_CLIENT	Number of clients for the top lender for firm	3.190	353,06	183,63	8	759
BANKINFO	NUM_EXPORTER / NUM_CLIENT	3.190	0,52	0,07	0,08	0,78

Our firm-bank matched data cover the period from fiscal 1997 to 2008. In order

[17] The reason why the number of workers employed by overseas subsidiaries is not included is that the BSBSA does not contain such information. Similarly, the reason for using the ratio of overseas investment including portfolio investment is that the BSBSA does not allow us to distinguish between direct and portfolio overseas investment.

[18] The EALC is jointly compiled by the Japan Center for Economic Research, the Center for Economic Institutions (Hitotsubashi University), the Center for China and Asian Studies (Nihon University), and the Center for National Competitiveness (Seoul National University).

[19] For details on the TFP calculation, also see Fukao *et al*. (2011).

to control for the potential influence of outliers, we excluded observations in the tails for each variable.[20] Table 2 presents the correlation matrix for the variables used in our empirical analysis, while Table 3 shows the distribution of our sample firms by industry and year. As can be seen from Table 3, sample firms are concentrated in a limited number of industries (e.g., food and kindred products, chemicals, non-electrical machinery, electrical and electronic machinery, motor vehicles, transportation equipment and ordnance).

[20]We drop firms for which the absolute level of any of the explanatory variables falls into the 1st or the 99th percentile.

Table 2: Correlation Matrix

(obs=2242)

	FRESH_EXP	FRESH_EXP_somewhere	FRESH_EXP_ASIA	FRESH_EXP_NA	FRESH_EXP_CSA	FRESH_EXP_OCE	LN_NUMWORKER	FLEV	FBDEP	FLIQ	STLOAN	WAGE	FOR_BRANCH	FOR_EMP	FOR_INV	FOR_LOAN	TFP	NUM_EXPORTER	NUM_CLIENT	BANKINFO	TFP×BANKINFO
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
(1)	1,00																				
(2)	0,35	1,00																			
(3)	0,82	0,38	1,00																		
(4)	0,35	0,40	0,35	1,00																	
(5)	0,10	0,64	0,10	0,13	1,00																
(6)	0,12	0,48	0,12	0,15	0,20	1,00															
(7)	-0,02	0,05	0,00	0,05	0,04	0,06	1,00														
(8)	0,01	0,03	0,01	0,02	0,03	0,04	0,00	1,00													
(9)	0,01	-0,02	0,01	-0,01	-0,02	0,00	-0,26	0,47	1,00												
(10)	-0,01	0,00	-0,01	-0,01	0,03	-0,03	-0,02	-0,68	-0,45	1,00											
(11)	0,01	0,04	0,01	0,02	-0,01	0,00	-0,12	-0,03	-0,01	-0,07	1,00										
(12)	-0,04	0,04	-0,02	0,00	0,04	0,06	0,18	0,02	-0,10	-0,01	-0,02	1,00									
(13)	-0,01	0,03	0,01	0,03	0,03	0,03	0,16	-0,02	-0,06	0,05	0,01	0,12	1,00								
(14)	-0,01	0,01	0,00	0,02	0,02	0,02	0,03	-0,06	-0,08	0,05	0,04	0,08	0,68	1,00							
(15)	-0,02	0,04	-0,03	0,02	0,01	0,03	0,13	-0,12	-0,06	0,06	-0,05	0,08	0,14	0,18	1,00						
(16)	0,00	0,00	0,00	-0,02	0,01	0,04	0,16	-0,09	-0,04	0,07	-0,05	0,05	0,06	0,07	0,19	1,00					
(17)	0,00	-0,03	0,00	-0,01	-0,03	0,00	-0,01	-0,21	-0,21	0,22	-0,04	0,13	0,04	0,04	0,20	0,04	1,00				
(18)	0,05	0,01	0,05	0,01	0,00	0,00	0,10	-0,06	-0,06	0,03	-0,01	0,08	0,05	0,04	0,01	0,02	0,11	1,00			
(19)	0,04	0,00	0,04	0,01	-0,01	-0,01	0,09	-0,06	-0,06	0,03	-0,02	0,06	0,05	0,03	0,02	0,02	0,14	0,98	1,00		
(20)	0,01	0,07	0,04	0,03	0,03	0,07	0,10	-0,01	-0,05	0,06	0,05	0,14	0,05	0,04	0,00	0,06	-0,07	0,04	-0,09	1,00	
(21)	0,00	-0,03	0,00	0,00	-0,03	0,00	-0,01	-0,22	-0,22	0,22	-0,04	0,13	0,04	0,04	0,19	0,03	0,99	0,10	0,13	-0,06	1,00

Table 3: Distribution of the Sample Firms by Industry and Year

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Food and kindred products	43	41	40	32	32	34	44	44	52	362
Textile mill products, Apparel	18	23	20	17	13	18	22	24	22	177
Lumber and wood products, Furniture and fixtures	2	2	0	0	0	0	1	1	1	7
Paper and allied products	9	9	9	9	10	8	13	13	12	92
Printing publishing and allied products	7	5	6	5	4	5	9	9	10	60
Chemicals	31	30	31	25	36	41	49	47	51	341
Petroleum and coal products	2	1	3	2	0	0	2	1	1	12
Rubber and miscellaneous plastics	6	4	7	5	5	5	4	7	10	53
Stone, clay and glass products	13	13	16	15	17	16	18	21	21	150
Metal	10	12	14	9	11	9	21	21	23	130
Nonmetallic mining	11	8	7	6	5	6	12	12	15	82
Fabricated metal	15	15	14	9	11	10	20	19	19	132
Non-electical machinery	18	15	13	12	19	24	26	35	32	194
Electrical and electronic machinery	52	45	51	39	49	62	65	75	77	515
Motor vehicles, Transportation equipment and ordnance	28	36	31	28	36	43	44	46	46	338
Instruments	7	8	5	3	4	3	3	7	8	48
Miscellaneous manufacturing	19	18	17	19	16	17	20	21	22	169
Total	291	285	284	235	268	301	373	403	422	2.862

4. Estimation Results

4.1 The decision to enter specific markets

We first examine the determinants of firms' decision to participate in a new export market by estimating Equation (1). The estimation is conducted using observations for firms which did not exportduringthe years *t-3*to*t* ("never" exporters) and observations for firms which did not export duringthe years*t-3* to *t-1* but exported in year *t* (first-time exporters). Thus, observations for firms which exported in at least one year during*t-3*to*t-1 as well as t* are excluded in the estimation. The results of the random effect probit estimation (average marginal effects) and the panel logit estimation (odds ratios)are shown inTables4 and 5, respectively.The first two columns in Table 4 show the results when we use *NEW_EXP*as the dependent variable and including (Column (1)) or excluding (Column (2)) *TFP*×*BANKINFO* among the explanatory variables. Columns (3) and (4) repeat the same regressions but using *NEW_EXP_REGION* as the dependent variable. In Columns (1) to (4) in Table 4, we do not distinguish between destination regions and the *BANKINFO* variable is simply the ratio of the number of a firm's main bank's exporting clients – regardless of the destination region – to the total number of the bank's client firms. *BANKINFO* here therefore captures the main bank's general exposure (not specific to a destination region) to client firms with export activities. The same applies to Columns (1) to (3) in Table 5. However, in the last column of Tables 4 and 5, we use the region-specific *BANKINFO* variable corresponding to the region to which a firm starts exporting.[21] In the case where a firm starts exporting to more than one region at a time, we randomly assign the region-specific *BANKINFO*. Finally, it should be noted that Columns (1) to (3) in Table 5 show the results using the same variables but different models for the panel logit estimation; that is, a population average model (PA), a fixed effect model (FE), and a random effect model (RE).

Looking at the results shown in Table 4 and focusing on our variable of main interest, *BANKINFO*, we find that the coefficient is positive and significant in all estimations. Similarly, Table 5, which shows the results based on the panel logit estimation, suggests that main banks with greater exposure to firms with overseas business raise the likelihood that their client firms start exporting, hinting at the presence of information spillovers from the main bank, which is consistent with our prediction. Further, the results in Column (4) in Table 5 indicate that when we take account of destination region-specific information, *BANKINFO* has a significant positive effect on firms' export decision even when we control for firm-specific

[21] In the case where firms start exporting to more than one region at a time, we randomly assign the region-specific *BANKINFO*. An alternative way would be to use the average of *BANKINFO* among those regions.

fixedeffects.[22]

As for the other explanatory variables, firms' own overseas activities (e.g., the overseas employee ratio) have a positive effect on firms' decision to start exporting in many of the cases. On the other hand, for firm size, leverage, and liquidity the results vary depending on the estimation procedure and these variables are associated with a higher probability of starting exporting only in some cases.

A notable result is that the TFP level has almost no impact on the export decision. Given that the correlation between TFP and the interaction term between TFP and *BANKINFO* (*TFPxBANKINFO*) is very high for the whole sample, we run the same regressions without the interaction term (i.e., Columns (2) and (4) in Table4). The results remain unchanged. This result is consistent with the finding in previous studies such as Todo (2011) that TFP is not a sufficiently strong factor to explain the export decision of Japanese firms.

Next, in order to examine whether the effect of region-specific information spillovers differs depending on the destination region we split the sample by export destination region. The estimation results for the sub-samples by destination region are shown in Table6. The results suggest that *BANKINFO* has a significant positive effect on firms' export decision when they start exporting to Asia (Column (1)), but that this is not the case for other regions. These results may reflect the fact that most Japanese banks have been increasingly putting efforts into their business in Asia by expanding service networks there while restructuring services in other regions, particularly in developed regions. Moreover, because first-time exporters to Asia tend to be smaller firms than those to other regions, the result may imply that information accumulated in main banks is more important for smaller firms, which do

[22]Precisely speaking, the result of the likelihood ratio test presented in Column (5) in Table 4 implies that it is not necessary to employ the model with panel-level individual effects once we include the *BANKINFO* variable measured for each destination region (i.e., rho0=0 is not rejected even at the 10% significance level).

not have adequate capabilities to collect overseas information by themselves. This line of reasoning is supported by the fact that in Table 6 firm size has a significantly positive effect on the export decision in all cases except Asia.

Table 4:Random-effect Panel ProbitEstimation Results for Extensive Margin

	(1)	(2)	(3)	(4)	(5)
	FRESH_EXP	FRESH_EXP	FRESH_EXP_somewhere	FRESH_EXP_somewhere	FRESH_EXP_somewhere_POOL
Extensive Margin	dy/dx	dy/dx	dy/dx	dy/dx	dy/dx
LN_NUMWORKER	0,0594	0,0612	0,0849 **	0,0853 **	0,0890 **
	(0,0675)	(0,0672)	(0,0374)	(0,0374)	(0,0369)
FLEV	0,3496	0,3010	0,3927	0,3858	0,3923
	(0,6523)	(0,6510)	(0,3297)	(0,3290)	(0,3237)
FBDEP	0,8656 *	0,7559 *	0,0266	0,0231	0,0250
	(0,4495)	(0,4435)	(0,2334)	(0,2332)	(0,2290)
FLIQ	0,3966 ***	0,3785 ***	-0,0478	-0,0484	-0,0456
	(0,1466)	(0,1473)	(0,0734)	(0,0733)	(0,0725)
STLOAN	0,2612	0,3073	0,0411	0,0447	0,0383
	(0,2383)	(0,2377)	(0,1133)	(0,1129)	(0,1117)
WAGE	-0,0330	-0,0349	0,0068	0,0066	0,0111
	(0,0416)	(0,0416)	(0,0218)	(0,0218)	(0,0216)
FOR_BRANCH	0,5277	0,5627	-0,6871	-0,6884	-0,6460
	(1,1716)	(1,1886)	(0,4553)	(0,4552)	(0,4491)
FOR_EMP	24,5621	21,5684	16,4349 **	16,4852 **	15,5256 **
	(15,5615)	(16,1527)	(6,5394)	(6,5388)	(6,4744)
FOR_INV	0,2521	0,2648	-0,0238	-0,0251	-0,0140
	(0,2245)	(0,2179)	(0,0889)	(0,0888)	(0,0869)
FOR_LOAN	-0,5484 *	-0,5297	0,0226	0,0215	0,0315
	(0,3287)	(0,3291)	(0,1218)	(0,1217)	(0,1203)
TFP	-10,8578 **	-0,4327	-1,2803	0,2251	-0,0084
	(5,3428)	(0,8626)	(3,3607)	(0,4695)	(0,4941)
BANKINFO†	2,7098 ***	2,0666 **	1,5565 **	1,5628 **	0,4764 **
	(0,9117)	(0,8510)	(0,6591)	(0,6597)	(0,2028)
TFP×BANKINFO†	19,4209 **		2,8644		3,3046
	(9,7683)		(6,3235)		(2,2393)
NUM_CLIENT	0,0008 *	0,0007	0,0001	0,0001	0,0001
	(0,0005)	(0,0005)	(0,0002)	(0,0002)	(0,0002)
# Obs	1.178	1.178	2.589	2.589	2.570
# Groups	304	304	562	562	561
Obs per group: min	1	1	1	1	4
avg	3,9	3,9	4,6	4,6	4,6
max	10	10	9	9	9
Wald chi2	56,62	54,74	232,58	232,48	239,03
Prob > chi2	0,0265	0,0303	0,0000	0,0000	0,0000
Log likelihood	-313,15	-315,27	-942,19	-942,29	-933,58
Likelihood ratio test of rho0=0	5,23	5,53	1,83	1,8	0,61
Prob >= chibar2	0,011	0,009	0,088	0,09	0,217
Year dummies	yes	yes	yes	yes	yes
Industry dummies	yes	yes	yes	yes	no

Notes: Standard errors are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent level, respectively.

† The BANKINFO variable for the columns (1) - (4) is measured regardless of destination regions, while the BANKINFO variable in column (5) is measured for each destination region.

Table 5: Panel Logit Estimation Results for Extensive Margin

	(1)		(2)		(3)		(4)	
	(PA) FRESH_EXP_somewhere		(FE) FRESH_EXP_somewhere		(RE) FRESH_EXP_somewhere		(FE) FRESH_EXP_somewhere_POOL	
Extensive Margin	Odds Ratio		Odds Ratio		Odds Ratio		Odds Ratio	
LN_NUMWORKER	1,1232	*	1,2843		1,1346	*	1,2746	
	(0,0714)		(0,3007)		(0,0779)		(0,2972)	
FLEV	4,3200	***	8,0844		4,5162	***	11,0653	
	(2,3778)		(15,5052)		(2,6429)		(21,3757)	
FBDEP	0,9486		3,1914		0,9595		3,5039	
	(0,3790)		(3,3545)		(0,4077)		(3,6864)	
FLIQ	1,1388		1,0604		1,1401		1,0357	
	(0,1368)		(0,2999)		(0,1446)		(0,2969)	
STLOAN	1,2091		1,4647		1,2230		1,4673	
	(0,2364)		(0,6397)		(0,2520)		(0,6461)	
WAGE	1,0447		0,9916		1,0486		1,0125	
	(0,0387)		(0,0635)		(0,0411)		(0,0662)	
FOR_BRANCH	0,4969		0,0572	**	0,4478		0,0847	*
	(0,3790)		(0,0759)		(0,3644)		(0,1128)	
FOR_EMP	4,15E+09	**	3,12E+29	***	5,16E+10	**	4,03E+27	***
	(4,40E+10)		(5,75E+30)		(5,95E+11)		(7,38E+28)	
FOR_INV	1,0870		0,7765		1,0813		0,8321	
	(0,1633)		(0,2759)		(0,1713)		(0,2890)	
FOR_LOAN	1,1376		1,3147		1,1477		1,2993	
	(0,2333)		(0,4694)		(0,2505)		(0,4673)	
TFP	0,1079		0,0076		0,1224		2,3192	
	(0,6546)		(0,0712)		(0,7748)		(3,6080)	
BANKINFO†	20,8130	***	8,9001	**	23,5516	**	0,3393	**
	(24,6440)		(17,1476)		(29,2406)		(0,1519)	
TFP×BANKINFO†	296,1543		3,66E+05		272,8471		3,16E+04	**
	(3373,71)		(6,50E+06)		(3250,91)		(1,59E+05)	
NUM_CLIENT	1,0000		1,0006		1,0000		1,0003	
	(0,0004)		(0,0006)		(0,0004)		(0,0006)	
# Obs	2.589		1.413		2.589		1.396	
# Groups	562		252		562		251	
Obs per group: min	1		2		1		2	
avg	4,6		5,6		4,6		5,6	
max	9		9		9		9	
Wald chi2	229,99		204,65		205,27		208,51	
Prob > chi2	0		0		0,0000		0,0000	
Log likelihood	-		-383,54		-964,05		-375,10	
Likelihood ratio test of rho0=0	-		-		4,72		-	
Prob >= chibar2	-		-		0,015		-	
Year dummies	yes		yes		yes		yes	
Industry dummies	no		no		no		no	

Notes: Standard errors are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent level, respectively.

† The BANKINFO variable for the columns (1) - (3) is measured regardless of destination regions, while the BANKINFO variable in column (4) is measured for each destination region.

Table 6: Random-effect Panel Probit Estimation Results for Extensive Margin by Destination Region

	(1)	(2)	(3)	(4)	(5)
	FRESH_EXP_ASIA	FRESH_EXP_NA	FRESH_EXP_CSA	FRESH_EXP_AFR	FRESH_EXP_OCE
Extensive Margin	dy/dx	dy/dx	dy/dx	dy/dx	dy/dx
LN_NUMWORKER	0,0581	0,4464 ***	0,1009 *	0,1576 *	0,1499 **
	(0,0823)	(0,1621)	(0,0545)	(0,0843)	(0,0763)
FLEV	0,7978	1,2477	1,0709 **	1,4298 *	0,2956
	(0,7941)	(1,1094)	(0,5092)	(0,7510)	(0,6552)
FBDEP	0,4545	1,8494 **	-0,2969	-0,3514	-0,3018
	(0,5209)	(0,9449)	(0,3508)	(0,5145)	(0,4636)
FLIQ	0,3822 **	0,3905	0,1073	0,1339	-0,2702 *
	(0,1888)	(0,2378)	(0,1112)	(0,1625)	(0,1526)
STLOAN	0,3607	0,4460	0,0302	-0,0789	-0,0437
	(0,2663)	(0,3702)	(0,1705)	(0,2536)	(0,2199)
WAGE	-0,0798	-0,0997	0,0268	0,1146 **	0,0641
	(0,0511)	(0,0658)	(0,0327)	(0,0456)	(0,0410)
FOR_BRANCH	0,0332	-2,4972	-0,3675	0,8157	0,2359
	(1,5995)	(2,1615)	(0,7125)	(0,8552)	(0,8553)
FOR_EMP	42,2748 **	77,6527 **	17,8788 *	-2,6105	6,7518
	(21,2118)	(31,7772)	(9,4868)	(12,4718)	(11,3327)
FOR_INV	-0,5063	0,5267	-0,0772	0,1686	0,2356
	(0,3865)	(0,3795)	(0,1476)	(0,1818)	(0,1624)
FOR_LOAN	0,0485	-0,7049	0,3178 *	-0,0421	0,0036
	(0,3312)	(0,5758)	(0,1718)	(0,2431)	(0,2387)
TFP	-0,5318	-5,0289	-1,1761	0,3440	1,2884
	(7,3806)	(5,7492)	(2,3737)	(0,9744)	(2,3621)
BANKINFO†	2,8382 **	0,6886	1,4655	-0,0336	1,0355
	(1,4160)	(1,5599)	(1,1103)	(0,2954)	(1,0289)
TFP×BANKINFO†	1,7274	14,4149	8,8588	-3,6875	-6,3045
	(13,7284)	(13,6617)	(9,3470)	(14,2688)	(9,1479)
NUM_CLIENT	0,0008	0,0004	0,0001	0,0000	0,0002
	(0,0006)	(0,0007)	(0,0004)	(0,0006)	(0,0004)
# Obs	815	1.143	1.910	1.649	1.969
# Groups	213	275	483	434	454
Obs per group: min	1	1	1	1	1
avg	3,8	4,2	4	3,8	4,3
max	9	9	9	9	9
Wald chi2	41,33	22,84	164,84	82,65	40,6
Prob > chi2	0,249	0,9672	0,0000	0,0000	0,3147
Log likelihood	-157,3956	-197,99	-453,62	-323,76	-346,42
Likelihood ratio test of rho0=0	0	7,25	1,46	9,2	4,39
Prob >= chibar2	1	0,004	0,113	0,001	0,018
Year dummies	yes	yes	yes	yes	yes
Industry dummies	yes	yes	yes	yes	yes

Notes: Standard errors are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent level, respectively.

† The BANKINFO variable is measured for each destination region.

4.2. Export Volume and Export Growth

Table7 reports the fixed-effect panel estimation results of Equation (2). In the estimation, we only include observations of first-time exporters, and we examine whether information spillovers through main banks affect the export volume (the value of exports in logarithm) or the growth rate of exports from year *t* to year *t+1* after the firm started exporting. Beginning with the results in Panel (a) in Table 7, we find that the coefficient on *BANKINFO* is not significant, implying that information spillovers do not have a clear effect on the volume of exports (i.e., the intensive margin). Whilefirms' own international activities (the overseas investment ratio in Column (1)) tend to have a positive effect on the intensive margin, most of the other explanatory variables do not have a significant coefficient. Althoughit is possible that the results partly reflect the small sample size, they suggest that the export volume is mainly explained by firm fixed effects.

Next, we further split the sample by destination region and estimate the same equations as in Panel (a) for each destination region. Panel (b) shows the estimated coefficient on *BANKINFO* for each destination region. As can be seen, the coefficient is not significant in most cases and the impact of *BANKINFO* is ambiguous. Although we find a negative and significant coefficient on *BANKINFO* for the cases of North America, Africa, and Oceania, we should note that the number of observations is small, particularly in the latter two cases, for which we could not calculate F-values. Therefore, we do not obtain clear and robust results for the impact of information spillovers on the intensive margin. This is in line with Koenig *et al.* (2010), whoalso do not find a significant impact of export spillovers on the intensive margin. Although our results are consistent with their results, which factors affect the intensive margin of exports is an issue that deserves further scrutiny.

Table 7: Fixed-effect Panel Estimation Results for Intensive Margin

	(1)	(2)
	LN_EXPORT	ΔLN_EXPORT
Intensive Margin	Coefficient	Coefficient
LN_NUMWORKER	0,1596	-0,4597 ***
	(0,2083)	(0,1744)
FLEV	-0,3610	-1,0596 *
	(0,6445)	(0,5894)
FBDEP	-0,2657	0,0972
	(0,3539)	(0,3608)
FLIQ	-0,0557	0,0253
	(0,1307)	(0,1336)
STLOAN	-0,0966	0,0247
	(0,1408)	(0,1402)
WAGE	0,0192	-0,0129
	(0,0271)	(0,0275)
FOR_BRANCH	0,7586	0,1181
	(0,4661)	(0,4290)
FOR_EMP	7,4139	-0,1965
	(5,5907)	(5,6848)
FOR_INV	0,4138 **	0,0531
	(0,1917)	(0,1541)
FOR_LOAN	0,0486	0,0039
	(0,0874)	(0,0798)
TFP	0,1745	-3,1451
	(2,2030)	(2,0943)
BANKINFO	-0,3234	-0,5169
	(0,4680)	(0,6068)
TFP×BANKINFO	-0,5957	6,9974 *
	(4,3403)	(4,2042)
NUM_CLIENT	0,0001	0,0000
	(0,0003)	(0,0003)
_cons	7,2424 ***	4,0855 ***
	(1,7397)	(1,4323)
# Obs	1.656	1.328
# Groups	426	389
Obs per group: min	1	1
avg	3,9	3,4
max	9	9
F	4,7	1,91
Prob > F	0	0,011
R-sq: within	0,0872	0,03
between	0,3209	0,0169
overall	0,247	0,0028
corr(u_i, Xb)	0,3668	-0,7657
Year dummies	yes	yes
Industry dummies	no	no

Notes: Standard errors clustered within a firm are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent level, respectively.

Table 7: Fixed-effect Panel Estimation Results for Intensive Margin-- continued --

	(1)	(2)	(3)	(4)	(5)
	ASIA	North America	Central and South America	Africa	Oceania
Intensive Margin	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Dependent variable: LN_EXPORT					
BANKINFO	-0,4527	-0,4859	-2,3443	0,1132	-2,3285
	(0,5260)	(0,5162)	(2,6461)	(0,7668)	(1,3063)
# Obs	1.600	1.172	504	229	447
# Groups	415	348	261	147	199
Obs per group: min	1	1	1	1	1
avg	3,9	3,4	1,9	1,6	2,2
max	9	9	8	7	8
F	5,39	6,15	3,8	3,03	2,73
Prob > F	0	0	0	0	0,0002
R-sq: within	0,1024	0,37	0,29	0,33	0,16
between	0,2539	0,1355	0,1507	0,0185	0,0965
overall	0,1877	0,1298	0,1466	0,0468	0,1346
corr(u_i, Xb)	0,2644	0,0265	-0,1877	-0,3475	-0,035
Dependent variable: ΔLN_EXPORT					
BANKINFO	-0,1269	-1,1411 *	-2,0576	-2,8330 **	-6,1500 ***
	(0,7294)	(0,6456)	(2,6331)	(1,4032)	(1,7790)
# Obs	1.281	861	232	80	251
# Groups	381	291	103	48	117
Obs per group: min	1	1	1	1	1
avg	3,4	3	2,3	1,7	2,1
max	9	9	7	6	7
F	1,26	6,16	7,82	.	.
Prob > F	0,2057	0	0	.	.
R-sq: within	0,0225	0,49	0,40	0,67	0,17
between	0,002	0,3065	0,0167	0,0119	0,0267
overall	0,0008	0,3797	0,0729	0,02	0,0286
corr(u_i, Xb)	-0,7252	-0,3769	-0,6869	-0,9978	-0,6516
Year dummies	yes	yes	yes	yes	yes
Industry dummies	no	no	no	no	no

Notes: Standard errors clustered within a firm are in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent level,Although the estimated coefficients for other explanatory variables are not shown in the table, most of coefficients are not statistically significant.

4.3. Robustness Checks

To check the robustness of our results, we also estimated Equation (1) using a logit estimator, for which the standard errors are corrected for clustering. Taking into account that observations within the same firm are not independent, standard errors are corrected for clustering across firms. Alternatively, standard errors are corrected for clustering across main banks, taking into consideration the possibility that observations of firms which have a transaction relationship with the same bank are not independent. In both cases, the logit estimation results with clustered standard errors are consistent with the results in Table 5 and *BANKINFO* has a significant positive effect on firms' export decision.[23]

In addition, bank characteristics may affect firms' export decision. For example, the Japan Bank for International Corporation (JBIC, the former Export-Import Bank of Japan) is a government financial institution which was originally established to promote cross-border trade and foreign investment. Therefore, JBIC may be particularly active in helping firms to start exporting. On the other hand, major commercial banks may differ from regional banks or local banks in terms of their scope of business and hence in the characteristics of information accumulated by them. In order to control for differences in bank characteristics, we include a JBIC dummy and a dummy for major commercial banks in the export decision estimation. However, neither dummy variable has a significant coefficient, and including these dummy variables does not change the significance of the *BANKINFO* variable.

Finally, there may be several alternative ways to measure the amount of information on export markets available to a firm. While our main variable, *BANKINFO*, measures the intensity of banks' exposure to exporting firms, the absolute number of a bank's export client firms, *NUM_EXPORTER* may be a better way to measure the amount of information on export markets. However, when we replace *BANKINFO* with *NUM_EXPORTER*, we find that the coefficient on *NUM_EXPORTER* is not statistically significant. A possible reason is that *NUM_EXPORTER* is highly correlated with the total number of a bank's client firms (*NUM_CLIENT*), which we use as a proxy for the size of banks. As there are several other possible alternative specifications (e.g., using bank assets instead of

[23] The estimation results are available upon request from the authors.

NUM_CLIENT), it might be worthwhile to conduct further robustness checks in the future.[24]

5. Concluding Remarks

In this paper, we study whether the information spillovers through main banks affect client firms' export behavior (i.e., the extensive and intensive margins). We find that information spillovers through main banks positively affect client firms' decision to start exporting. This implies that information on destination markets provided by main banks substantially reduce the fixed entry cost of exporting and encourage firms to become exporters. On the other hand, we did not find evidence that information spillovers through main banks have an effect on the export volume or on the growth rate of exports. This is more or less consistent with the finding obtained by Koenig *et al*. (2010).

A key contribution of this paper is that it proposes an additional channel of information spillovers ignored in previous studies. While existing studies, such as Koenig *et al.* (2010), concentrate on information spillovers from other exporting firms in the same region and/or industry, this study focuses on the importance of

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[24] In addition, we may need to control for shocks to banks' balance sheets as well as for firms' credit constraints. Other tasks left for the future are as follows. First, the results in Paravisini *et al.* (2011) imply that firms match with banks that have developed an expertise on certain export destinations, which other lenders may not have. Firms and banks are not randomly matched. We address this endogeneity issue by restricting our sample to firms which did not change their main bank during the three years prior to starting exporting. However, there may be some alternative ways to address this issue more rigorously. Second, the loan share of the main bank for each firm can be taken into account when constructing the *BANKINFO*. By doing this, we can measure not only the information accumulated in a main bank but also how smoothly or frequently the information could be transmitted to client firms. The closer the relationships that a non-exporting firm has with banks that have a large exposure to exporting firms, the more the non-exporting firm would benefit from the information accumulated by the banks. Third, we could take into account information accumulated by the second or third lender banks for each firm. However, according to an interview we conducted with a bank, firms usually consult their main bank (i.e., top lender) first on various issues related to their business. Firms ask their second or third, etc., lender bank for help only in cases where the main bank cannot provide satisfactory support to the client firm. Therefore, focusing only on main banks appears to be an appropriate and reasonable strategy.

information provided directly by main lender banks through transaction relationships. If we look at our results in terms of the argument put forward by Chaney (2008) that a change in fixed costs only affects the extensive margin, while a change in variable costs affects both the intensive and the extensive margin, they suggest that information provided by banks contributes to a reduction in the fixed costs but not in the variable costs associated with exporting. On the other hand, Paravisini *et al.* (2011) suggest that credit frictions, by affecting the cost of working capital, affect the variable costs of exporting and hence the volume of exports. This result suggests that banks may play an important role in affecting the intensive marginas suppliers of funds. Thus, banks' role as suppliers of funds and as providers of information may affect fixed and variable costs and hence the extensive and the intensive margin differently. Untangling these two roles of banks and their impact on firms' export behavior is a topic we aim to further address in future research.

This paper also provides an important policy implication. As mentioned in introduction, our knowledge regarding what factors are important for firms to become an exporter remains very limited, even though export promotion has been an important policy issue in many countries. With regard to Japan, studies such as Wakasugi *et al.* (2008) and Ito (2011) argue that there are still many firms which do not export even though their performance is good or they actively invest in research and development. Promoting exports by these firms is an urgent policy issues for Japan, which has been facing population decline and sluggish domestic demand for a prolonged period. This paper showed the importance of banks' role as an information provider for potential exporters, implying that the government should proactively involve banks in its export promotion policies. Regional banks – seeing their client firms face declining domestic demand and therefore worried that their own business may shrink – may also be interested in providing more support services for firms trying to expand their business abroad. Helping such banks to build international service networks and building on the banks' support services may allow the government to implement its export promotion policies more effectively. Moreover, as banks have accumulated a lot of information on their client firms' business, they may have useful knowledge on what type of firms should receive support from the government and on what type of support is most effective. Of course, government and non-profit organizations already provide various support services for firms' international business and for trading companies. Information provided by such organizations or trading companies is complementary to information collected by banks through lending relationships, and it is important for the government to effectively utilize these various information sources for export promotion policies. According to the banker we interviewed, the advantage that banks have is that they possess detailed and wide-ranging information on individual firms' management, financial health, and business activities.

To conclude, we highlight tseveral issues for future research. The first of these concerns the type of information provided by banks. While the information we considered was destination-specific information, it would be possible to take other, more detailed types of information additionally into account, such as industry-specific information. Second, our relatively long-panel dataset allows us to conduct a survival analysis-type of study on the status of exporting firms. This, in turn, allows us to examine how the duration of staying in export markets is determined, which is another important dimension discussed in the theoretical international trade literature (e.g., Schröder and Sørensen 2012). Although there area fair number of empirical studies analyzing the determinants of the duration of imports, studies on the determinants of what kind of firms are "always" exporters so far have all been only at an aggregate level(e.g., Besedeš and Prusa 2006a, 2006b, Nitsch 2009, Besedeš and

Blyde 2010). Third, although the expansion of export destinations,particularly in the case of larger listed firms, often involves the establishment of new subsidiaries or affiliates abroad, this paper, partly because of data constraints, only focused on exporting and did not explicitly deal with foreign direct investment in a new location. As banks provide a wide range of support services for firms which try to open a foreign affiliate, investigating banks' role in firms' FDI decision is another promising research topic. Lastly, our results imply that information spillovers through main banks may be more important for smaller firms, which are more likely to choose Asia as their first export destination. Therefore, further investigation focusing on smaller firms would be a worthwhile exercise, if data for small firms were available. We believe that all of these extensions would provide further evidence for a better understanding of firms' overseas activities and the role of banks.

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Appendix

The multilateral TFP index

As detailed in Fukao*et al.* (2011), the TFP level of firm *i*, industry *j* in year *t*, $TFP_{i,j,t}$ is defined in comparison with the TFP level of a hypothetical representative firm in the benchmark year t_0 in industry *j*.In the EALC 2010 Database, the firm-level TFP level is calculated as follows, using the multilateral TFP index method developed by Good *et al.* (1997).In the EALC 2010 Database, the benchmark year $t_0$is set at year 2000.

$$\mathrm{LN}(\mathrm{TFP}_{i,j,t}) = \left\{\mathrm{LN}(Q_{i,j,t}) - \overline{\mathrm{LN}(Q_{j,t})}\right\} - \sum_{k=1}^{n}\left(S_{i,k,j,t} + \overline{S_{k,j,t}}\right)\left\{\mathrm{LN}(X_{i,k,j,t}) - \overline{\mathrm{LN}(X_{k,j,t})}\right\}$$

fort $= t_0$

$$\mathrm{LN}(\mathrm{TFP}_{i,j,t}) = \left\{\mathrm{LN}(Q_{i,j,t}) - \overline{\mathrm{LN}(Q_{j,t})}\right\} - \frac{1}{2}\sum_{k=1}^{n}\left(S_{i,k,j,t} + \overline{S_{k,j,t}}\right)\left\{\mathrm{LN}(X_{i,k,j,t}) - \overline{\mathrm{LN}(X_{k,j,t})}\right\}$$
$$+ \sum_{s=t_0+1}^{t}\left\{\overline{\mathrm{LN}(Q_{j,s})} - \overline{\mathrm{LN}(Q_{j,s-1})}\right\}$$
$$- \sum_{s=t_0+1}^{t}\sum_{k=1}^{n}\frac{1}{2}\left(\overline{S_{k,j,s}} + \overline{S_{k,j,s-1}}\right)\left\{\overline{\mathrm{LN}(X_{k,j,s})} - \overline{\mathrm{LN}(X_{k,j,s-1})}\right\}$$

fort $> t_0$

$$\mathrm{LN}(\mathrm{TFP}_{i,j,t}) = \left\{\mathrm{LN}(Q_{i,j,t}) - \overline{\mathrm{LN}(Q_{j,t})}\right\} - \frac{1}{2}\sum_{k=1}^{n}\left(S_{i,k,j,t} + \overline{S_{k,j,t}}\right)\left\{\mathrm{LN}(X_{i,k,j,t}) - \overline{\mathrm{LN}(X_{k,j,t})}\right\}$$
$$- \sum_{s=t+1}^{t_0}\left\{\overline{\mathrm{LN}(Q_{j,s})} - \overline{\mathrm{LN}(Q_{j,s-1})}\right\} + \sum_{s=t+1}^{t_0}\sum_{k=1}^{n}\frac{1}{2}\left(\overline{S_{k,j,s}} + \overline{S_{k,j,s-1}}\right)\left\{\overline{\mathrm{LN}(X_{k,j,s})} - \overline{\mathrm{LN}(X_{k,j,s-1})}\right\}$$

fort $< t_0$

where $Q_{i,j,t}$ stands for the real output (real sales) of firm *i* (in industry *j*) in year *t*,

$X_{i,k,j,t}$represents the real input of production factor k of firm i (in industry j)in year t, and $S_{i,j,k,t}$is the cost share of production factor k at firm i(in industry j)in year t. $\overline{LN(Q_{J,t})}$ denotes the arithmetic average of the log value of the output, in year t, of all firms in industry j to which firm i belongs, while $\overline{LN(X_{k,J,t})}$ stands for the arithmetic average of the log value of the input of production factor k, in year t, of all firms in industry j to which firm i belongs. Finally, $\overline{S_{k,J,t}}$ is the arithmetic average of the cost share of the input of production factor k, in year t, of all firms in industry j to which firm i belongs.

CHAPTER 4

Innovation and Choice of Exporting Modes under Globalization*

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Theoretical model by Melitz (2003) suggests that most productive enterprises export. But empirical evidences show that not highly productive enterprises export also. These enterprises resort to intermediaries to access foreign markets and avoid burdensome fixed cost of exporting. There is hence more than one mode of exporting used by enterprises under the globalization process. A unique feature of this paper is to consider SMEs' decision both on export involvement and export modes at the same time, i.e. export directly, indirectly or both. The relevant of this approach is carefully tested by applying the test of pooling states (Cramer and Ridder, 1991). By applying the test the paper avoids bias due to miss-specification committed by previous studies which include only two choices of exporting in analysis. The paper shows that innovation by its all types influences significantly probability to choose different exporting modes. Therefore to promote exports by SMEs, the government can use indirect approach by supporting not only product innovation, process innovation but also product modification.

Keywords: international trade, intermediation, innovation, exporting modes

JEL: D21, L23, O31, O32

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* Comments are welcome. The authors are solely responsible for the opinions expressed in this paper. We would like to thank Chin Hee Hahn (Kyungwon University), Dionisius A. Narjoko (ERIA), Kazunobu Hayakawa (IDE, JETRO), Siwook Lee (Myungji University), Cassey Lee (Wollongong University) for their comments and suggestions. Financial support from ERIA is gratefully acknowledged.

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1. Introduction

Since its economic reform known as “doi moi” in 1986, Vietnam economy has become one of the fastest growing economies in the world with the average GDP growth rate of over 7 percent per annum. During its transition to a more market-based economy, Vietnam has achieved a rapid economic growth and the expansion of the external sector (Belser 2000, Dollar & Kraay 2004). The growth rate of the export sector is about 20 percent per year.

Vietnam's development strategy aims to achieve an effective economic growth. Its success depends to a large degree on the development of the private sector, which consists mainly of small and medium enterprises (SMEs) and given the importance of export growth, a key question naturally faced by policy makers is how to improve the competitiveness of these SMEs in order to sustain its export growth.

In the face of Vietnam's increased integration into the world market and particularly after the country's entry into the WTO by the end of 2006, the SMEs are having a great opportunity to expand by exporting to other markets and at the same time they are also facing tough competition at their door step. The major problem is that the Vietnamese private enterprises are mostly of small and medium sizes and therefore may not be sufficiently competitive to enter foreign markets. Vietnamese exporters (mostly small and medium size) may find the start-up challenges to be too formidable, because they involve nontrivial up-front costs of establishing in-house channels and developing a knowledge base of overseas markets. This is not to mention the costs associated with writing contracts and developing trust and credibility with foreign customers.

There is an option for SMEs in Vietnam to access foreign markets that is to use intermediaries. They can involve in both direct export and using intermediaries at the same time. In such interdependent world due to the globalization, an important question to ask is what are the strategies available for Vietnamese SMEs to deal with the increased competition and complexity of doing international business. This study will explore the question what are determinants of exporting strategies that Vietnamese SMEs utilize. Moreover, the paper examines the role of innovation as a determinant of exporting strategies applied by SMEs.

The practice of resorting to export intermediaries is quite common in some countries. According to Peng & Illinitch (1998) export intermediaries in Korea and handle about half of total exports. Through export intermediaries, exporters gain access to international markets while not having to incur the up-front costs associated with searching for new markets, negotiating contracts, and monitoring those contracts to ensure performance. Given the large number of SMEs in Vietnam and their roles in the economy, in this research, we would like to investigate the dynamics involved in the decision made by the SMEs in their decision to export in the face of increased competition as a result of globalization process undertaken by the government of Vietnam.

2. Literature Review

The seminal paper by Melitz (2003) enlightens that the main determinant of exporting activities by enterprises is productivity. In Melitz model, enterprises choosing to serve only domestic market are least productive, while foreign markets are served by the most productive ones. The literature on international trade has mostly focused on productivity and firm characteristics, and hence on differences between exporting and non-exporting firms. (e.g. Bernard & Jensen (1995, 1999); Roberts & Tybout (1997), and the large literature has grown). However, empirical studies show that not highly productive enterprises also export. Most productive enterprises have to overcome the fixed cost and variable cost of exporting, while not highly productive enterprises pay for exporting fee to intermediaries. The intermediaries are seen to lower the average fixed cost of exporting by exercising their activities across many goods for pooled enterprises in a specific country or industry.

According to Schroder *et al*. (2005), the theory of trade intermediation is still in the early stage of development. It was only recently that attention shifted to the differences existing among trading firms and the role of intermediaries as an important institution in economic systems, helping to match buyers and sellers indirectly (Bernard *et al.* 2010; Ahn *et al.* 2011).[1] These papers point out that there exist both manufacturers that organize the production and distribution of their goods abroad as well as intermediaries that specialize in distribution. According to Spulber (1998), intermediaries can gain advantages over direct exchange in a number of ways, especially by pooling and diversifying risk, reducing transaction costs, and lowering costs of matching and searching.

There has been a growing literature (international business studies) on the role as well as performance of trade intermediaries. For example, Peng & York (2001) investigated the determinants of performance of intermediaries in export trade. They argued that export intermediaries assist inexperienced exporters in breaking into overseas markets and experienced exporters (including multinational corporations) in entering unfamiliar countries. Indirect paths to internationalization are those "whereby small firms are involved in exporting, sourcing or distribution agreements with intermediary companies who manage, on their behalf, the transaction, sale or service with overseas companies" (Fletcher, 2004). Export intermediaries play an important "middleman" role in international trade, "linking individuals and organizations that would otherwise not have been connected" (Peng & York, 2001).

This emerging literature relies on the so-called Resource-Based Theory, which suggests that a firm's competitive advantage is a function of its valuable, rare, and inimitable resources (Barney, 1991, 1997). Such resources are often intangible, embedded, and knowledge-based. In the case of export intermediaries, such skills as market knowledge and negotiation ability may play an important role in minimizing the search and negotiation costs associated with export transactions. Additionally, some firms may have unique financial resources which allow them to more successfully bond clients by taking title to goods and thus reducing client risk. On the other hand, firms may hire export intermediaries because they perform certain functions related to exporting better or at lower costs than the firm itself could, for example because they possess country-specific knowledge that the firm lacks (Li, 2004). In summary, this theory suggests that the performance of export intermediaries depends on whether they can acquire and deploy resources in a way that cannot be easily imitated. Otherwise, manufacturers may attempt to develop export capabilities in-house. In comparison to large multinational firms, small and medium sized

[1] Such indirect matching may be required for transactions to take place or to be successful (Trabold, 2002).

enterprises (SMEs) are typically regarded as resource-constrained, lacking the market power, knowledge and resources to operate viably in international markets (Fujita, 1995; Coviello & McAuley, 1999; Knight, 2000; Hollenstein, 2005). As a consequence, export intermediaries may prove to be a good choice available for the exporting SMEs.

Antras & Costinot (2010) argue that the benefit of economic integration may differ under the presence of trade intermediaries. They analyze the effect of intermediaries on welfare in a highly stylized Ricardian model of trade and find that Walrasian integration between centralized markets improves welfare. However the degree of market integration arising from the use of intermediaries may reduce welfare and has the potential for adverse effects on the aggregate level of trade (arising from the relocation of traders and the resulting imperfect loss in rents as a result of imperfect bargaining arrangements).

In a multi-agent, multi-country environment with transaction costs, there are a number of factors that still provide strong motivations for both firms and intermediaries to seek new opportunities and markets. There is a growing body of literature on the determinants of the decision to engage intermediaries. In a study for the US firms Felbermayr & Jung (2011) relate the relative prevalence of trade intermediaries to destination country characteristics as well as to the dispersion of firm size across industries. They find that industries with firms of many different sizes exhibit a significantly lower relative prevalence of trade intermediaries. In a study for the Chinese firms, Ahn *et al*. (2011) report an inverted U-shaped relationship between firm size and the fraction of indirect exports in total sales for a sample of both exporters and purely domestic firm.

Analyzing survey data of German and British firms, Fryges (2007) identifies the factors that drive firms to switch between different export modes and finds that firm size has a significantly positive effect on the probability to change from indirect exports to direct exports. Most recently, there is a study by Dung & Janssen (2011) on the mode of exporting for Vietnamese firms. This study focuses on the choices made by firms between (i) exporting directly and (ii) exporting indirectly (i.e. through intermediary) conditional on having decided to export. Although this is interesting, the paper (as are a number of previous studies reviewed above) is limited in such a way that the choice set is focused to two or three choices while in reality it may consist of more than that. Our data for analysis show that the choice set may include four alternatives: (i) not exporting; (ii) exporting directly only; (iii) exporting directly and indirectly; and (iv) exporting indirectly only.[2] Instead of limiting the choice set to only two alternatives (three in Dung & Janssen (2011)), our study employs a statistical technique to identify the appropriate choice set that an exporting firm faces (i.e the test for pooling states in the multinomial logit model as proposed by Cramer and Ridder 1991).

Before conducting our analysis of the four modes in the Vietnam context, the following section surveys findings from various empirical studies. The first mode considers the critical juncture for most firms, asking what conditions are necessary for a firm to choose to enter new markets. There is strong evidence concludes that exporters are larger, more productive, more capital- and technology-intensive. However, this does not automatically imply the absence of these characteristics is what necessarily withholds firms from export. More specifically, we must distinguish whether these characteristics are necessary conditions for firms to export or whether these advantages are acquired only as a consequence of exporting.

Unsurprisingly, Bernard & Jensen (1995) find that high-performing firms (those who satisfy the above characteristics ex-ante) will export but they did not find conclusive results for causality. Export activity may not necessarily improve outcomes for the firm with productivity gains no faster and at times, slower than that of non-exporters. This suggests that there may be considerable downside risk for firms and policy that encourage firms into foreign markets if they are not export ready. This is supported by results that show firms transitioning in and out of exporting over a longer timeframe. Their US results conform to similar studies in Morocco, Mexico and Columbia.

Psychic Distance Theory supposes that the distance of a market, both psychologically (education system, complicated market structure, unfamiliar experiences) or geographically determines the extent to which firms will pursue opportunities there directly. Firms would transfer what are perceived to be large transactional costs to an intermediary for whom these costs are considerably less. The Theory of Planned Behaviour can also be applied to predict choice of export mode. The real (actual) and perceived (confidence in soft skills) resources that entrepreneurs

[2] See the section on data for analysis for more detailed discussion and description of the exporting modes used by Vietnamese SMEs.

have to operate in a new environment is believed to influence the inclination to engage in direct exports.

Dung & Janssen (2011) study of Vietnam enterprises contradicts the propositions of both theories mentioned above. They do not find that psychic distance is a major influence on the decision to take up overseas opportunities and that international experience is not significant in determining the use of an indirect export mode. Dow (2000) and Dow & Larimo (2009) find that as a firms' international experience the impact of psychic distance on the firm's mode choice diminishes. They do find that younger entrepreneurs more comfortable with the advantages of technological connectivity, are more inclined to export directly and take risks.

In addition to the use of facilitating intermediaries, indirect entry modes could also include firms partnering more directly with a company in the host country. Though a more capital-intensive option, this strategy could be a better fit with the firm's corporate structure or investment strategy, or help mitigate the risks in entry to markets that demonstrate more challenging country, industrial characteristics. Hayakawa *et al*. (2010) surveyed a range of empirical studies that considered firm entry into foreign markets through wholly owned greenfield investments, joint ventures or other collaborative operational structures. They found given the range of approaches taken it was difficult to conclude precisely what conditions need to be met to determine particular choice of entry for multinational corporations.

The literature on export determinants includes also the studies on the influence of innovation to propensity to export. Using a sample of UK firms, controlling for firm size Wakelin (1998) concludes that non-innovative firms are more likely to export than innovative firms. However past innovation has positive impact on the probability of an innovative firm exporting. Other studies on innovation and firm performance document positive and significant influence of innovation and productivity of firms (e.g. Huergo & Jaumadreu, 2004, Griffth, *et al.*, 2010). As productivity is the main determinant of export, innovation thus is the root of self-selection of more productive firm into exports (Roper & Love, 2002, Casiman & Golovko, 2010). The literature therefore is splited on the association of innovation and export. The issue will be explored in this paper.

3. Econometric Modeling and Estimation Strategy

SMEs may pursue a variety of foreign market entry modes which vary significantly with respect to benefits and costs (Sharma & Erramilli, 2004). When deciding whether to engage in a foreign market, manufacturers essentially have a number of options: (1) no export; (2) indirect export through intermediaries, (3) both indirect and direct export and (4) direct export. Following Robert & Tybout (1997) and Bernard & Jensen (1999), we assume that the decision to export is made by rational and profit maximizing firm.

$$U_{ij} = V_{ij} + \varepsilon_{ij} = \mathbf{x}_i'\boldsymbol{\beta}_j + \varepsilon_{ij} \qquad (1)$$

With profit maximization andindividual firm facing J mutually exclusive alternatives (indexed $j=0,...,J$), the alternative that yields the highest profit is chosen. The probability that an individual exporter will choose alternative k is:

$$\begin{aligned}\Pr(y = k) &= \Pr(U_k > U_j \;\; for\, all\; j \neq k) \qquad (2)\\ &= \Pr(\varepsilon_{ik} - \varepsilon_{ij} < V_{ij} - V_{ik})\end{aligned}$$

A very popular model which results from this model is the familiar multinomial logit model. McFadden (1976) noted that the multinomial logit model is particularly appealing in two aspects. First is the computational ease of the multinomial logit model. Secondly, the model is derived from the random utility model which makes it consistent with the classical theory of profit maximization.[3] McFadden (1976) shows that the multinomial logit model results if we assume all the ε_{ij} of the J choices are independent and identically distributed with the extreme value distribution of the form $F(\varepsilon) = \exp[-\exp(-\varepsilon)]$. The probability of alternative k being chosen can then be written as:

$$\Pr(y_i = k) = \frac{\exp(\mathbf{x}_i'\boldsymbol{\beta}_k)}{\sum_{j=0}^{J}\exp(\mathbf{x}_i'\boldsymbol{\beta}_j)} \qquad (3)$$

The multinomial logit model can be estimated using standard maximum likelihood estimation procedure. The model can be estimated by:

[3] It is well known that the estimates from the multinomial logit model are difficult to interpret. An alternative to the interpretationof the odds ratios is to calculate the marginal effects associated with the covariates as suggested by Greene (2003).

$$y^* = \beta_0 + \beta_1 I_i + \beta_2 X_i + \beta_2 N_i + \beta_3 K_i + \varepsilon_i \qquad (4)$$

with *Ii*, the measure for innovation activities (product/process introduction, product modification), X_i is a vector of firm-specific characteristics (age of firm, firm's productivity, firm's capital intensive product, type of product), N_i is a vector of the owner characteristics (age and gender of manager/director), K_i, a vector of environmental factors (difficulty in getting a loan and location).[4] [5] The error term ε_i is assumed to be *iid*~N(0; σ_u). The export measure *y** cannot be observed completely. The observed model is given by:

$$y = \begin{cases} 0 & NO\ EXPORT \\ 1 & EXPORT\ \ DIRECTLY\ ONLY \\ 2 & EXPORT\ INDIRECTLY\ ONLY \\ 3 & EXPORTING\ \ DIRECTLY\ \&\ INDIRECTLY \end{cases} \qquad (5)$$

As discussed above, the previous literature often specifies a binary choice logit model (i.e. exporting directly and exporting indirectly) and hence runs the risk of model misspecification. In our study, instead of arbitrarily specifying a particular model, we will test for the most appropriate model specification. This can be made possible by using the pooling states specification test proposed by Cramer & Ridder (1991). The issue of pooling states/alternatives arises when two alternatives *j* and *k* are indistinguishable with respect to explanatory variables in the model (e.g. whether choice 2 and choice 3 in equation (1) above are distinguishable). That is, the vector of explanatory variables $\mathbf{x}_i$ does not affect the odds of outcome *j* versus alternative *k* (Long, 1997). Therefore when two alternatives are indistinguishable it may be appropriate to re-group them as one alternative. This can also be seen as an informal test of exporting mode model.

The test of pooling states of the multinomial logit model proposed by Cramer & Ridder (1991) is basically a test of the difference between the likelihood of an

[4] For the list of variables used in the empirical analysis, please see table 3 in the Appendix.

[5] To account for the dynamic impact of exporting modes in the previous year to the choice of exporting mode in the year of analysis, lagged variables are used which are exporting modes of the enterprise in the previous survey.

aggregated model in which different states are pooled together and a disaggregated model in which different states are modelled separately.[6] The test statistic is given by

$$LR = 2\{Log\,L_U - Log\,L_R\}$$

where $Log\,L_U$ is the maximum loglikelihood of the full model and $Log\,L_R$ the maximum log-likelihood of the restricted model where the estimates are constrained to satisfy the null hypothesis that the full model and the restricted model 'have the same regressor coefficients apart from the intercept' (Cramer & Ridder 1991, p. 269). This test is then shown asymptotically to have a chi-squared distribution with *k* degrees of freedom where *k* is the number of restrictions. The $Log\,L_U$ is obtained directly from the full model. But the $Log\,L_R$ is obtained by

$$LogL_R = \sum_j n_{sj} Logn_{sj} - n_s Logn_s + LogL_A$$

where $Log\,L_A$ is the unconstrained maximum log-likelihood of the pooled model, *s* refers to the pooled state, *j* refers to the separate states within *s*, n_s is the number of sample observations in the pooled state *s*, n_{sj} is the number of the sample observations in each of the separate states *j*, and the sum of the number of observations in all separate states equal the number of observations in the pooled state, i.e. $\sum_j n_{sj} = n_s$.

To take into account the endogeneity of exporting and innovation decisions we consider an instrumental variable (IV) approach in the line of previous studies (Zhao & Li, 1997 and Smith *et al*., 2002). In particular our empirical strategy consists of a two-stage procedure. In the first stage we estimate the following innovation equation:

$$I_i^* = \gamma_0 + \gamma_1 X_i + \gamma_2 Z_i + \gamma_3 N_i + \gamma_4 K_i + \upsilon_i \qquad (6)$$

$$I_i = 1 \text{ if } I_i^* > 0;\ I_i = 0 \text{ if } I_i^* \leq 0$$

where Z is the vector of instruments, i.e. variables that are strongly correlated with innovation but uncorrelated with the error term in the export equation (4); and X, N and K is a set of exogenous variables.

[6] The multinomial logit model is well known for its proliferation of parameters, in empirical analysis we usually attempt to search for a more parsimonious specification.

To identify the model, the vector Z_i in the innovation equation (6) must contain at least one variable not included in equation (4). In this study, the excluded variables reflect the businesses' investment strategy, which include investment for raising capacity, investment for replacing old equipment, investment for improving productivity, investment for improving quality, investment for producing new product and investment for other purposes). The key element in this identification strategy is the availability of valid instruments (Z_i), i.e. variables that influence innovation and its effect on the export decision must operate solely through its indirect effect on innovation. The instruments in this study were chosen on the basis that they were strongly related to innovation activities (as shown in the first stage estimates presented) but not significant in determining whether the business exported.

In the second stage, the innovation variable (I_i) in the export equation (4) is then replaced with the predicted probabilities from the estimation of model (6) (see Maddala, 1983). This generates unbiased estimates of the impact of innovation on exports (Wooldridge, 2002). Similar simultaneous approaches have been employed in several empirical studies treating innovation and exports as inextricably interdependent (Hughes, 1986; Zhao & Li, 1997; Smith *et al.*, 2002; Cassiman & Martinez-Ros, 2006; Lachenmaier & Wößmann, 2006 and Nguyen *et al.*, 2008).

4. Dataset and Analysis

In this study we use the Small and Medium Scale Enterprise (SME) Survey in Vietnam that has been conducted consistently since 2005 through 2007 and 2009 by the Ministry of Labour, Invalid and Social Affairs (MOLISA) and the Stockholm School of Economics. The surveys focused on medium and small enterprises in Vietnam. The surveys provide rich information about private sector SMEs. They focused on non-state and manufacturing SMEs, while conducted in various provinces and cities. Sample of surveys was stratified according to industries, ownership, sizes and other characteristics to present the structure of SMEs in Vietnam. This dataset is designed and implemented to track firms a number years. The study will employ the unique longitudinal SME survey data to look at the dynamic of exporting choice behavior.

Table 1 below shows the evolution of exporting behavior for Vietnamese SMEs during the last three surveys from 2005 to 2007 and 2009. Interestingly, the practice of using export intermediaries is quite common among Vietnamese SME exporters. Among exporting enterprises, the number of enterprises indirectly exporting accounts for 32 percent in 2005, reduced to 13 percent in 2007 and recovering to 18.7% in 2009.

Table 1: Export Choice and Export Modes for SMEs

	2005	**2007**	**2009**
Not export	2,640	2,481	2,504
	93.6%	94.2%	94.2%
Export	181	154	155
	6.4%	5.8%	5.8%
Directly	72	91	78
	39.8%	59.1%	50.3%
Indirectly	58	20	29
	32.0%	13.0%	18.7%
Both	51	43	48
	28.2%	27.9%	31.0%

Source: Vietnam SME survey 2005, 2007 and 2009

The table 2 below presents some of the characteristics of enterprises that involve in different exporting modes.[7] It shows that over the years enterprises accessed to foreign markets have consistently higher ratios of innovation activities. Exporting enterprises are also more capital intensive compared to non-exporting ones, with the exception of enterprises that do both indirect and direct exporting. As documented in the literature the dataset shows that labour productivity of exporting enterprises is significantly higher than non-exporting ones. Another characteristics of exporting enterprises is that they are younger than non-exporting enterprises and the youngest ones commit in direct export, why older ones use safer approach resorting to intermediaries. The statistics shows that enterprises involve in exporting activities report higher level of difficulty in accessing to credit. It may be the fact that to overcome higher capital requirement of exporting activities they are more active in finding credit and therefore expose more to credit requirements and issues. The table 2 also shows that owner of exporting enterprises is little younger than non-exporting

[7] More summary statistics of varibles used in analysis are presented in table 13 and 14 in the Appendix.

enterprise owner and the ratio that a female owns an exporting enterprises is very much the same as the one owning a non-exporting enterprise.

Table 2: Summary Statistics of Enterprises in Different Modes of Export

	NO EXPORT	INDIRECT EXPORT	BOTH EXPORT	DIRECT EXPORT
2005				
New product innovation (yes/no)	0.38	0.69	0.71	0.62
New process innovation (yes/no)	0.28	0.52	0.75	0.45
Product modification innovation (yes/no)	0.58	0.86	0.80	0.78
Capital – labour ratio (thousand VND per labour)	132,276	229,430	112,909	179,808
Labour productivity (thousand VND)	25,034	41,880	32,721	29,093
Firm age (year)	11.72	9.37	8.57	8.93
Difficulty in accessing credit (yes/no)	0.07	0.11	0.16	0.09
Owner is female (yes/no)	0.31	0.31	0.27	0.31
Age of SMEs owner (year)	44.77	43.97	43.71	43.72
2007				
New product innovation (yes/no)	0.41	0.63	0.90	0.73
New process innovation (yes/no)	0.14	0.26	0.40	0.35
Product modification innovation (yes/no)	0.42	0.67	0.65	0.71
Capital – labour ratio (thousand VND per labour)	222,612	273,143	201,916	562,104
Labour productivity (thousand VND)	32,391	80,208	59,402	66,974
Firm age (year)	13.61	14.23	9.40	9.31
Difficulty in accessing credit (yes/no)	0.07	0.19	0.20	0.25
Owner is female (yes/no)	0.33	0.30	0.35	0.40
Age of SMEs owner (year)	45.33	46.58	49.65	43.05
2009				
New product innovation (yes/no)	0.34	0.58	0.72	0.65
New process innovation (yes/no)	0.13	0.31	0.55	0.31
Product modification innovation (yes/no)	0.39	0.71	0.72	0.64
Capital – labour ratio (thousand VND per labour)	294,427	385,415	256,409	405,397
Labour productivity (thousand VND)	57,612	72,821	84,109	98,090
Firm age (year)	14.70	12.38	11.76	10.92
Difficulty in accessing credit (yes/no)	0.08	0.17	0.21	0.19
Owner is female (yes/no)	0.34	0.35	0.41	0.42
Age of SMEs owner (year)	45.80	42.63	43.48	44.95

Source: Vietnam SME survey 2005, 2007 and 2009.

The dynamics of changing exporting modes is shown in the table 3 below. It presents that percentage of enterprises joining exporting sector increasing over time. Of non-exporting enterprises in 2005, by 2007 only 2,35 percent enters exporting sectors with different exporting modes. The figure increases in the period 2007-2009, where nearly 3 percent of non-exporting enterprises in 2007 enter exporting sectors by 2009. The matrices also show that the most frequent mode of exporting used by Vietnamese SMEs when they export for the first time is indirect export. In 2007, among SMEs newly entering exporting sector, 61.1 percent chooses to start with indirect exporting, 7.3 percent with both direct and indirect exporting and 31.6 percent with direct export. In 2009, 40.4 percent of enterprises entering exporting sector starts by indirect exporting, 25 percent by both direct and indirect exporting, and 34.6 percent with direct export.

Table 3. Transition Matrices

(%)	**2007**			
	No export	***Direct export***	***Direct and indirect export***	***Indirect export***
2005				
No export	97.65	0.74	0.17	1.43
Direct export	28.12	65.62	6.25	0
Direct and indirect export	33.33	40	20	6.67
Indirect export	73.68	5.26	5.26	15.79
	2009			
	No export	***Direct export***	***Direct and indirect export***	***Indirect export***
2007				
No export	97.03	1.03	0.74	1.2
Direct export	27.08	52.08	16.67	4.17
Direct and indirect export	30.77	38.46	23.08	7.69
Indirect export	66.67	6.06	0	27.27

Source: Vietnam SME survey 2005, 2007 and 2009.

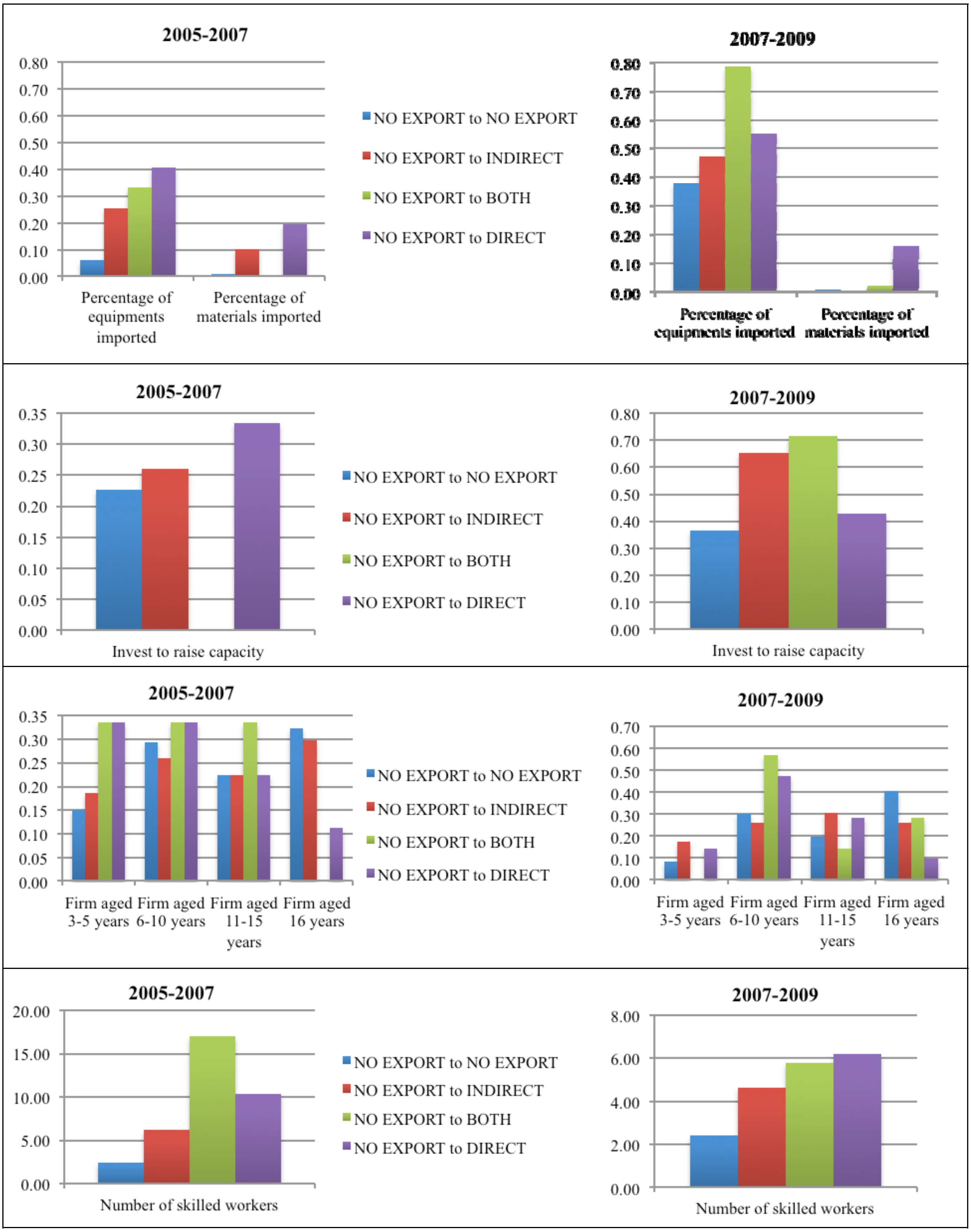
The transition matrices gives clear result over the two periods that more SMEs conducting direct exporting remained in their mode of export than others. The figure shows that of direct exporting enterprises in 2005, by 2007 65.6 percent remained in direct exporting mode; 28 percent was out of exporting sector; 6.25 percent added indirect exporting modes as a method of internationalization; and zero percent moved to indirect export. By 2009, the situation for direct exporting enterprises worsens with only 52 percent enterprises remained direct exporting mode. However, the percentage of direct exporting enterprises in 2007 quit exporting activities remained the same in 2009 (27 percent compared with 28.1 percent in 2007). Mostly enterprises moved to use both direct and indirect exporting mode (16.6 percent). Interestingly, percentage of enterprises move from direct exporting to indirect exporting increased to 4.1 percent. This might be explained by the fact that the countries on over the world were affected by the global financial crisis.

The two most unstable modes of exporting are indirect and both indirect and direct exporting. As expected, the number of enterprises quit exporting activities is most observed in indirect exporting mode. The percentage of enterprises moved from indirect exporting mode to using both direct and indirect exporting mode was reducing over time and reached zero percent in the period 2007-2009, while percentage of indirect exporting enterprises remained in their exporting mode increased over time.

Characteristics of enterprises involved in changing from non-exporting to exporting of different modes as showed below points to some policy implications. The figure 1 shows that among transitional enterprises from non-exporting mode during the period 2005-2007 and 2007-2009, enterprises moving to direct exporting have highest percentage of imported materials. It is also clear that enterprises start to export import higher percentage of equipment why enterprises remain as non-exporting do not invested in imported capital as much.

This is consistent with the figure on investment by transitional enterprises. In both periods, there are more enterprises transitioning to exporting spending to raise their production capacity while the number of enterprises remaining in their no-exporting mode invest to raise their capacity is lower. Figures on ages of transitional enterprises show that enterprises that are active in moving from non-exporting to direct exporting and combining mode of exporting directly and indirectly are less than 10 years of age. The percentage of enterprises staying in non-exporting mode is higher when they are more than 10 years of age. Another characteristics of enterprises that change to exporting mode is that they have more skilled workers (see figure 1 for details).

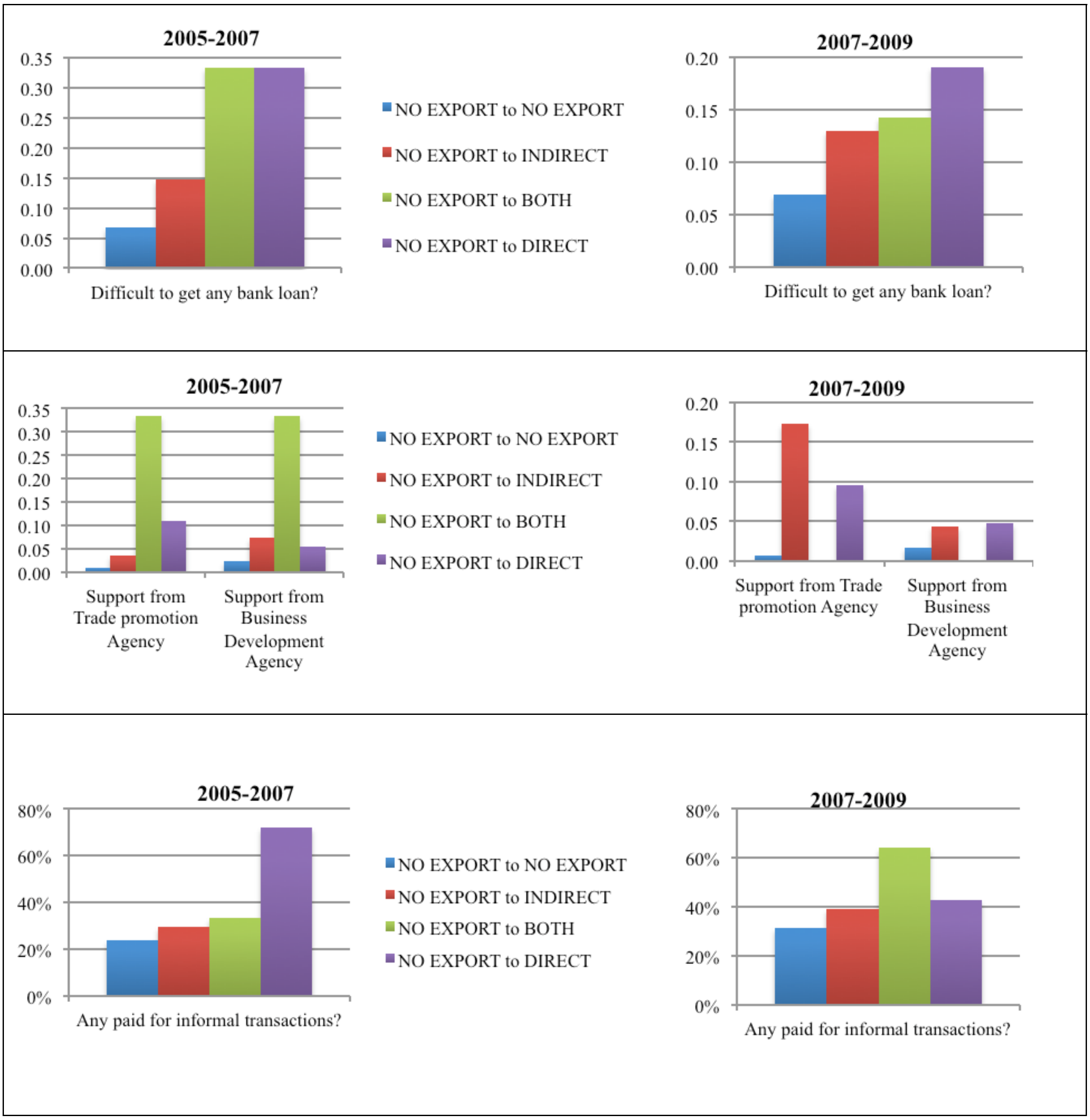
Figure 1: Transition from Non-exporting Mode: Enterprise Characteristics



Source: Vietnam SME survey 2005, 2007 and 2009

The SMEs surveys include questions related to government policies which enable the discussion on policy issues in connection with transitional enterprises. Figure 2 below shows the fact that enterprises that change from non-exporting to exporting modes more often to face difficulties accessing credit in comparison with enterprises that remain non-exporting. These enterprises also often pay for informal payment to authorities. It does not surprise that transitional enterprises are often supported by trade promotion agency and business development agency (see figure 2 for details).

Figure 2: Transition from Non-exporting Mode: Policy Issues



Source: Vietnam SME survey 2005, 2007 and 2009

The above descriptive analysis of the dataset shows some interesting characteristics of Vietnamese SMEs and their strategies as well as determinants of their transition from non-exporting to exporting mode. Regression analysis in the following section will provide more understanding of the behaviour of Vietnamese SMEs in choosing their modes of export.

5. Estimation Results

A specification issue that must be addressed is the pooling of export modes in the multinomial logit model. This issue arises since an obvious question is whether our specification of a four-way multinomial logit model is justified or whether a more parsimonious specification is adequate. In this paper we use the pooling states test developed by Cramer & Ridder (1991) to classify the possibility to combine export modes in analysis. Table 5 presents test statistics for pooling states in our four-way multinomial logit model. We report all groupings of choices, including a binary logit model and a three-way multinomial logit model, which are the standard ones found in the literature. Almost these poolings are rejected at one percent significant level in favour of our unrestricted four-way multinomial logit model, except for the case combining both export and direct export in each individual years. Pooling sample gives more significant test results and enables us to analyze the full choices of exporting mode. The test shows that previous regression studies that use only two choices of exporting and are not aware of different choices face the risk of miss specification.

The results of multinomial logit regressions of equation (4) are presented in table 6, 7, and 8 where coefficient, marginal effects, and odds ratio forms of regression are reported. The baseline comparison in all multinomial logit regressions are "no export". The results show that among the more fundamental determinants of the probability of choosing export modes in Vietnamese SMEs is the decision to undertake product innovation. In comparison with the baseline, other factors kept unchanged, the application to product innovation increases the exportation probability, whatever direct exports or via intermediates. Specifically, given product innovation being taken, the probability of choosing "indirect export" would be 2.05 times more likely than when other factors are held constant. Product innovation is also associated significantly with higher probability to choose of direct export, or both indirect and direct export. The probability of choosing direct export or both indirect and direct export mode will increase by 4.56 and 2.41 times more likely if enterprises pursue product innovation (*ceteris paribus*).

Regarding other controls, an enterprise experienced direct and/or indirect export in the past tends to increase their exportation probability. The export mode transition can be recognized via the previous exportation experience. For example, a SME experienced indirect export is more likely to be involved in indirect export while a SME experienced both direct and indirect export is more prone to continue with this type of export. *Ceteris paribus,* higher productivity increases the exportation probability. Meanwhile enterprises which are capital intensive are less likely to export using indirect mode or using both indirect and direct mode. The impact on direct export mode is not clear in this case. Also if enterprises are older than 15 years of age they are less likely to take direct exporting mode.

Table 7 and 8 replicates the analysis presented in Table 6, but focuses on process innovation and product improvement. Again, process innovation and product improvement is strongly related to exporting, across all the export models. Table 7 and 8 highlight the existence of important complementarities regarding the innovation activities of Vietnamese SMEs. Particularly, it was observed that the majority of companies undertaking product innovation were simultaneously introducing new processes and/or improving products. Given this, and the fact that the innovation variable is dichotomous, it is possible that the results presented in Tables 7 for process innovation and/or Table 8 for product improvement could be picking up the effect of these complementarities, and in particular the impact of product innovation on exporting.

We, therefore, extend the analysis presented in Tables 7 and 8, by determining the relative importance of product and process innovation/improvement in explaining the probability of a firm being an exporter. These results, presented in Table 9, suggest that once one controls for the effect of product innovation, there is no or very small significant additional effect for process innovation. The effect of product improvement is more important in the cases of indirect export and direct export. This again provides important information for policy makers. In addition to the introduction of new products into the market, it is clear that variables that are highly correlated with success, such as use of new technology, well-qualified management and a competitive environment, are also correlated with exporting. This highlights the types of firms that could be targeted for interventions in terms of boosting exporting in small firms.

Multinomial logit estimations rely on the assumption of identical independent error terms. If these assumptions are not meet in the data, a violation of the independence of irrelevant alternatives (IIA) property will lead to biased estimates. IIA implies that adding another alternative does not affect the relative odds between two alternatives considered. IIA holds when the estimated coefficients of the full model are statistically similar to those of the restricted one. If the test statistic is significant, the assumption of IIA is rejected, and the conclusion is that the multinomial logit model is inappropriate. The most commonly used tests are Suest-based Hausman test, Hausman test, and Small-Hsiao test, which are frequently discussed in econometrics texts (e.g., Greene 2003) and can be easily computed using standard software (Zhang & Hoffman 1993). Model-based tests are computed by estimating a more general model that does not impose the IIA assumption and testing constraints that lead to IIA. The robustness of our results depends upon the appropriateness of the IIA assumption.

The results of these tests of IIA are set out in Table 10. The HM test shows very small or negative chi-squared test statistics. Such negative test statistics are common (Long & Freese, 2006, p. 244-5) and indicate that the IIA property is not violated (Hausman & McFadden 1984, p. 1226). The results are further supported by the Suest-based Hausman tests, where all the test statistics are insignificant, giving further evidence that the IIA property holds.[8] The results of Small-Hsiao test are very contradictory. However, this test, in particular, produces different results every time this test is run, as it is based on splitting the sample into two halves (Long & Freese 2006, pp. 243-246).

The tests results suggest no IIA problem, indicating that the MNL model suits the data in hand. The tests also indicate that the unobserved factors can be assumed to be independent across alternatives, implying that the alternatives are dissimilar (Amemiya, 1985, p. 298).

An important issue that should be taken into consideration is the simultaneity of exporting and innovation decisions. As outlined in the section on estimation strategy,

[8] Hausman test also produces different results depending on what category is the base category and often doesn't work either. Therefore, Suest-based Hausman test should be applied when evaluating this assumption (Long and Freese, 2001).

it is avoided by using IV regression in which probabilities to conduct innovation predicted from the estimation of model (6) will be used in the IV estimation of equation (6). The results of probit regressions for predicted probabilities of innovation are presented in table 12. Tables 11 reports the simultaneous estimation results for the exporting and product and process innovation respectively. Columns (2), (4) and (6) in Table 11 present the results from the simultaneous IV equations while Table 11 includes the results for the first-stage innovation equation. Comparing the IV results with the results from Table 6, 7, 8 shows that the changes in the estimated coefficients are very small and the significance is unaffected.

6. Conclusion and Policy Implications

In this paper, we use Cramer & Ridder (1991) test to arrive the proper model of analysis on determinants of exporting modes. Our result show that previous studies that based on only two choices of exporting mode will face the risk of miss-specification problem. Our test confirms that all the four modes of exporting, i.e. (i) not exporting; (ii) exporting directly only; (iii) exporting directly and indirectly; and (iv) exporting indirectly only, should be used in analysis of possible choices of exporting.

Also, in this paper we use three measures of innovation, namely product innovation, process innovation and product modification of existing product in examining the impact of innovation on the probability of choosing different exporting modes. This is new analysis in the literature of trade intermediation. To deal with the endogeneity of innovation and exporting modes we employ instrumental variable approach. Our results indicate that all three measures of innovation significantly influence the probability to choose different exporting modes.

Our analysis of the enterprises in the sample shows that policies should be taken into consideration to promote international trade involvement by SMEs. Given the commitments by WTO, direct supports for export promotion are prohibited. Our analysis shows that by applying innovation promotion strategy, exporting activities by SMEs will be beneficial. More importantly the government can consider to support not only a strict type of innovation but also product modification. The analysis on transition from non-exporting to exporting mode also suggests several policy options to promote export by SMEs. Import of equipment should definitely be eased with the fact that more SMEs which transit from non-exporting mode to exporting mode involve in importing of equipment. Credit access by SMEs should also be facilitated since enterprises that do exporting of all types are more likely to face difficulties in getting bank loan. At the same time they are investing more to raise their capacity in response to exporting requirement.

Business environment are also need to be improve since there are more SMEs transforming from being non-exporter to exporter report about informal fee they have to pay for authority agencies and officials. Education and training is another strategy which the government should support. In average enterprises that export employ more skilled worker. Operation of business and trade promotion agencies should be strengthened since it is clear from the analysis that more exporting transitional enterprises resort to the supports by these agencies. Last but not least, supports for SMEs to promote export should aim at young SMEs. These enterprises are relatively more active in looking for the chance to access foreign markets than older ones.

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Appendix

Table 4:Variable description

Variable name	Descriptions
exportmode	= 0 if no export, = 1 if indirect export, = 2 if both indirect and direct export, = 3 if direct export
newproduct	Introduced/plan to introduce new products
newprocess	Applied new production process/technology
modiproduct	Significantly improved firm's products
indirectexport_1	= 1 if firm experienced indirect export last 2 years.
bothexport_1	= 1 if firm experienced both indirect and direct export last 2 years
directexport_1	= 1 if firm experienced direct export in last 2 years
lklratio_1	Ln (total asset/number of full-time employees) in the previous year
lnprodt_1	Ln(Value added/number of full-time employees) in the previous year
year16	= 1 if Firm's age is above 15 years
creditdif	=1 if Firm faced difficulties to get a loan
female	= 1 if Firm's manager/director is female
lownerage	Ln(age of firm's manager/director)
textile	=1 if Firm's main product is textile
HCM	= 1 if firm is located in HCM City
d_2007	= 1 if year = 2007

Table 5.: Pooling LR Tests

Export Mode	2007			2009			2007_2009		
	chi2	df	p	chi2	df	p	chi2	df	p
Product introduction									
0/1,2/3	30.99	12	0.002	21.91	12	0.038	39.55	13	0.000
0/1,3/2	56.03	12	0.000	41.24	12	0.000	83.25	13	0.000
0,1/2/3	62.60	12	0.000	79.95	12	0.000	133.78	13	0.000
0/1/2,3	22.38	12	0.033	17.10	12	0.146	29.59	13	0.005
0,2/1/3	133.22	12	0.000	100.88	12	0.000	223.24	13	0.000
0,3/1/2	379.71	12	0.000	262.68	12	0.000	637.65	13	0.000
0/1/2,3	505.65	24	0.000	175.32	24	0.000	663.27	24	0.000
0/1/3,2	332.72	24	0.000	333.33	24	0.000	653.60	24	0.000
0/2/3,1	513.85	24	0.000	338.74	24	0.000	838.08	26	0.000
0,1/2/3	141.85	26	0.000	55.84	26	0.000	174.81	26	0.000
Process introduction									
0/1,2/3	28.49	12	0.005	24.48	12	0.017	40.13	13	0.000
0/1,3/2	55.46	12	0.000	41.32	12	0.000	82.76	13	0.000
0,1/2/3	61.08	12	0.000	80.06	12	0.000	133.47	13	0.000
0/1/2,3	20.04	12	0.066	21.55	12	0.043	31.66	13	0.003
0,2/1/3	128.12	12	0.000	112.51	12	0.000	227.36	13	0.000
0,3/1/2	378.20	12	0.000	259.73	12	0.000	633.40	13	0.000
0/1/2,3	499.04	24	0.000	186.32	24	0.000	665.66	24	0.000
0/1/3,2	329.62	24	0.000	330.85	24	0.000	649.00	24	0.000
0/2/3,1	507.44	24	0.000	347.14	24	0.000	837.48	26	0.000
0,1/2/3	138.04	26	0.000	60.63	26	0.000	176.00	26	0.000
Product improvement									
0/1,2/3	27.52	12	0.006	21.46	12	0.044	36.63	13	0.000
0/1,3/2	56.33	12	0.000	42.03	12	0.000	83.69	13	0.000
0,1/2/3	66.07	12	0.000	82.17	12	0.000	140.94	13	0.000
0/1/2,3	19.21	12	0.084	17.11	12	0.146	27.16	13	0.012
0,2/1/3	123.83	12	0.000	101.07	12	0.000	213.68	13	0.000
0,3/1/2	378.92	12	0.000	263.12	12	0.000	638.05	13	0.000
0/1/2,3	500.04	24	0.000	177.72	24	0.000	330.26	24	0.000
0/1/3,2	335.72	24	0.000	335.93	24	0.000	436.70	24	0.000
0/2/3,1	505.44	24	0.000	339.14	24	0.000	524.68	26	0.000
0,1/2/3	137.84	26	0.000	56.23	26	0.000	-415.3	26	-

Note: a) LR tests for combining outcome categories: 0 = No export; 1 = Indirect export; 2 = Both indirect and direct export, 3 = Direct export

b) Ho: All coefficients except intercepts associated with a given pair of outcomes are zero (i.e., categories can be collapsed)

c) “,”: Pool. Eg, 1/2: pool 1 with 2.

Table 6: The Effect of Product Innovation on Export Modes: Multinomial Logit Regression

	Coefficient	Marginal effects	Odds ratio	Coefficient	Marginal effects	Odds ratio	Coefficient	Marginal effects	Odds ratio
		Indirect Export			Direct and Indirect Export			Direct Export	
newproduct	0.717***	0.00806***	2.049	1.519***	0.00396***	4.567	0.880***	0.00711***	2.411
indirectexport_1	2.801***	0.122***	16.45	2.360***	0.0147	10.59	2.371***	0.0532**	10.71
bothexport_1	2.625***	0.0529*	13.80	5.007***	0.127***	149.4	4.776***	0.359***	118.7
directexport_1	1.731***	0.0175	5.647	4.218***	0.0587***	67.89	4.936***	0.430***	139.2
lklratio_1	-0.151	-0.00156	0.860	-0.368**	-0.000748**	0.692	0.0583	0.000439	1.060
lnprodt_1	0.753***	0.00774***	2.123	1.214***	0.00245***	3.368	0.634***	0.00451***	1.885
year16	-0.0228	-0.000173	0.977	-0.621	-0.00116	0.537	-0.734**	-0.00486***	0.480
creditdif	0.845***	0.0124*	2.328	0.590	0.00147	1.804	1.107***	0.0130**	3.026
female	-0.201	-0.00201	0.818	-0.299	-0.000578	0.741	-0.0378	-0.000253	0.963
lownerage	0.118	0.00119	1.126	0.451	0.000910	1.570	0.421	0.00303	1.524
textile	0.960***	0.0151**	2.611	1.278***	0.00462*	3.589	0.400	0.00323	1.492
HCM	0.0662	0.000646	1.068	-0.455	-0.000838	0.634	0.651***	0.00569**	1.918
d_2007	-0.0222	-0.000218	0.978	-0.698*	-0.00147*	0.498	0.0456	0.000343	1.047
N	4392								
ll	-780.5								
chi2	909.2								
p	0.000								
r2_p	0.368								

* *p*< 0.105, ** *p*< 0.055, *** *p*< 0.015

Note: Not showing constant
Baseline comparison: “No export”

Table 7: The Effect of Process Innovation on Export Modes: Multinomial Logit Regression

	Coefficient	Marginal effects	Odds ratio	Coefficient	Marginal effects	Odds ratio	Coefficient	Marginal effects	Odds ratio
		Indirect Export			**Direct and Indirect Export**			**Direct Export**	
newproduct	0.767***	0.0105**	2.153	1.584***	0.00680**	4.876	0.792***	0.00792**	2.207
indirectexport_1	2.793***	0.122***	16.34	2.201***	0.0135	9.033	2.408***	0.0580**	11.11
bothexport_1	2.646***	0.0527*	14.10	4.938***	0.126***	139.5	4.810***	0.377***	122.8
directexport_1	1.746***	0.0170	5.731	4.201***	0.0613***	66.74	4.965***	0.446***	143.3
lklratio_1	-0.160	-0.00169	0.852	-0.396**	-0.000892**	0.673	0.0534	0.000427	1.055
lnprodt_1	0.781***	0.00816***	2.183	1.219***	0.00272***	3.384	0.665***	0.00499***	1.945
year16	-0.0502	-0.000455	0.951	-0.692	-0.00142	0.501	-0.749**	-0.00521***	0.473
creditdif	0.936***	0.0146**	2.551	0.747*	0.00222	2.111	1.205***	0.0156***	3.337
female	-0.197	-0.00201	0.821	-0.193	-0.000418	0.824	-0.0346	-0.000243	0.966
lownerage	0.105	0.00106	1.110	0.400	0.000892	1.491	0.408	0.00309	1.504
textile	1.013***	0.0165**	2.753	1.421***	0.00612**	4.142	0.447	0.00387	1.563
HCM	0.00454	0.00000694	1.005	-0.568	-0.00112	0.567	0.550**	0.00492*	1.733
d_2007	0.0148	0.000159	1.015	-0.561	-0.00130	0.571	0.125	0.000960	1.133
N	4392								
ll	-781.5								
chi2	907.4								
p	4.80e-165								
r2_p	0.367								

* $p< 0.105$, ** $p< 0.055$, *** $p< 0.015$

Note: Not showing constant

Baseline comparison: "No export"

Table 8: The Effect of Product Modification on Export Modes: Multinomial Logit Regression

	Coefficient	Marginal effects	Odds ratio	Coefficient	Marginal effects	Odds ratio	Coefficient	Marginal effects	Odds ratio
		Indirect Export			Direct and Indirect Export			Direct Export	
newproduct	1.003***	0.0109***	2.728	0.923***	0.00247**	2.518	0.883***	0.00674***	2.419
indirectexport_1	2.835***	0.118***	17.04	2.428***	0.0190	11.34	2.461***	0.0566**	11.71
bothexport_1	2.590***	0.0467	13.33	5.031***	0.154***	153.1	4.789***	0.346***	120.2
directexport_1	1.820***	0.0175	6.169	4.282***	0.0721***	72.38	5.033***	0.437***	153.4
lklratio_1	-0.139	-0.00135	0.870	-0.323**	-0.000790*	0.724	0.0880	0.000633	1.092
lnprodt_1	0.738***	0.00713***	2.092	1.226***	0.00298***	3.407	0.649***	0.00448***	1.913
year16	-0.0625	-0.000537	0.939	-0.721	-0.00161*	0.486	-0.815***	-0.00519***	0.443
creditdif	0.911***	0.0130**	2.488	0.754*	0.00246	2.124	1.212***	0.0145***	3.361
female	-0.166	-0.00157	0.847	-0.214	-0.000505	0.807	0.0116	0.0000966	1.012
lownerage	0.167	0.00158	1.182	0.512	0.00124	1.669	0.494	0.00345	1.639
textile	0.854***	0.0120*	2.349	1.220***	0.00518*	3.386	0.339	0.00258	1.403
HCM	0.0126	0.0000885	1.013	-0.574	-0.00123	0.563	0.571**	0.00473**	1.770
d_2007	-0.00602	-0.0000484	0.994	-0.601*	-0.00152	0.548	0.0676	0.000485	1.070
N	4392								
ll	-781.0								
chi2	908.4								
p	3.00e-165								
r2_p	0.368								

* *p*< 0.105, ** *p*< 0.055, *** *p*< 0.015

Note: Not showing constant

Baseline comparison: "No export"

Table 9: The Effect of Innovation on Export Modes

	Marginal effects	Standard errors
	No_export	
newproduct	-0.0115***	(0.00396)
newprocess	-0.0112**	(0.00523)
modiproduct	-0.0129***	(0.00402)
	Indirect_export	
newproduct	0.00440	(0.00286)
newprocess	0.00435	(0.00361)
modiproduct	0.00815***	(0.00318)
	Direct_and_indirect_export	
newproduct	0.00254**	(0.00119)
newprocess	0.00364*	(0.00199)
modiproduct	0.000436	(0.000759)
	Direct_export	
newproduct	0.00452**	(0.00213)
newprocess	0.00317	(0.00252)
modiproduct	0.00430**	(0.00203)

Standard errors in parentheses
* $p< 0.105$, ** $p< 0.055$, *** $p< 0.015$

Table 10: IIA test

Omitted catergories	Suest-based Hausman			Hausman			Small-Hsiao		
	chi2	df	p	chi2	df	p	chi2	df	p
				2007					
				Product innovation					
indirect	9.70	26	0.998	-3.56	26	-	32.50	26	0.177
both	10.75	26	0.996	0.37	26	1.000	91.96	26	0.000
direct	14.80	26	0.961	6.10	26	1.000	90.91	26	0.000
				Process innovation					
indirect	9.69	26	0.998	-6.64	26	-	19.88	26	0.797
both	10.98	26	0.996	-0.82	26	-	63.31	26	0.000
direct	14.23	26	0.970	0.22	25	1.000	65.87	26	0.000
				Product modification					
indirect	10.23	26	0.998	2.76	25	1.000	205.6	26	0.000
both	11.29	26	0.995	-0.68	26	-	217.3	26	0.000
direct	11.60	26	0.993	-1.17	25	-	381.8	26	0.000
				2009					
				Product innovation					
indirect	17.52	26	0.892	4.21	25	1.000	246.8	26	0.000
both	13.68	26	0.977	-2.04	26	-	114.7	26	0.000
direct	11.10	26	0.995	-10.25	26	-	152.5	26	0.000
				Process innovation					
indirect	19.20	26	0.828	-1.63	26	-	63.01	26	0.000
both	12.23	26	0.990	-0.21	26	-	77.03	26	0.000
direct	12.84	26	0.985	0.70	26	1.000	132.7	26	0.000
				Product modification					
indirect	15.48	26	0.948	7.94	26	1.000	300.8	26	0.000
both	11.11	26	0.995	-1.18	26	-	337.9	26	0.000
direct	13.48	26	0.979	1.20	26	1.000	80.09	26	0.000
				2007-2009					
				Product innovation					
indirect	16.67	28	0.955	0.12	28	1.000	16.90	28	0.950
both	22.52	28	0.757	1.35	27	1.000	19.69	28	0.875
direct	16.99	28	0.949	3.58	27	1.000	23.60	28	0.702
				Process innovation					
indirect	16.50	28	0.958	-1.32	28	-	52.98	28	0.003
both	19.61	28	0.878	-4.91	28	-	44.37	28	0.026
direct	16.42	28	0.959	2.98	28	1.000	63.06	28	0.000
				Product modification					
indirect	17.14	28	0.946	4.37	28	1.000	33.64	28	0.213
both	21.21	28	0.816	6.21	28	1.000	20.43	28	0.848
direct	15.87	28	0.968	9.98	28	0.999	30.61	28	0.335

Table 11: IV Multinomial Logit models -Marginal effects

	Product innovation	Product Innovation - IV	Process innovation	Process innovation - IV	Product Improvement	Product Improvement - IV
	(1)	(2)	(3)	(4)	(5)	(6)
			No_export			
newproduct	-0.0191***	-0.0180***	-0.0253***	-0.0229***	-0.0201***	-0.0184***
	(0.00448)	(0.00446)	(0.00718)	(0.00702)	(0.00425)	(0.00419)
			Indirect_export			
newproduct	0.00806***	0.00784**	0.0105**	0.00940**	0.0109***	0.0101***
	(0.00323)	(0.00327)	(0.00495)	(0.00484)	(0.00323)	(0.00324)
			Direct_and_indirect_export			
newproduct	0.00396***	0.00302**	0.00680**	0.00541**	0.00247**	0.00120
	(0.00149)	(0.00127)	(0.00284)	(0.00246)	(0.00119)	(0.000868)
			Direct_export			
newproduct	0.00711***	0.00709***	0.00792**	0.00813**	0.00674***	0.00716***
	(0.00238)	(0.00244)	(0.00348)	(0.00361)	(0.00214)	(0.00224)

Standard errors in parentheses
* $p < 0.105$, ** $p < 0.055$, *** $p < 0.015$

Table 12: Probit models -Marginal Effects

	Product innovation	**Process innovation**	**Product Improvement**
	(1)	(2)	(3)
inv_cap	0.195***	0.191***	0.177***
	(0.0189)	(0.0159)	(0.0188)
inv_rep	0.149***	0.157***	0.212***
	(0.0287)	(0.0276)	(0.0276)
inv_prod	0.280***	0.221***	0.136***
	(0.0413)	(0.0440)	(0.0430)
inv_qua	0.182***	0.427***	0.312***
	(0.0622)	(0.0630)	(0.0541)
inv_new	0.364***	0.346***	0.196***
	(0.0547)	(0.0675)	(0.0624)
inv_othr	0.224***	0.0963***	0.00492
	(0.0370)	(0.0339)	(0.0376)
indirectexport_1	0.170***	0.135***	0.0902
	(0.0572)	(0.0459)	(0.0564)
bothexport_1	0.226***	0.129**	0.237***
	(0.0710)	(0.0548)	(0.0687)
directexport_1	0.147***	0.0664*	0.0232
	(0.0515)	(0.0350)	(0.0496)
lklratio_1	0.0131*	0.0153***	0.00756
	(0.00691)	(0.00445)	(0.00696)
lnprodt_1	0.0963***	0.0327***	0.0981***
	(0.0117)	(0.00727)	(0.0118)
year16	-0.0872***	-0.0289***	-0.0396**
	(0.0166)	(0.0104)	(0.0170)
creditdif	0.142***	0.0122	0.0567**
	(0.0298)	(0.0170)	(0.0293)
female	-0.0467***	-0.00411	-0.0849***
	(0.0164)	(0.0103)	(0.0163)
lownerage	-0.120***	-0.0289	-0.152***
	(0.0349)	(0.0215)	(0.0352)
textile	0.0522*	-0.00803	0.140***
	(0.0290)	(0.0167)	(0.0290)
HCM	-0.0811***	0.0368***	0.0221
	(0.0194)	(0.0138)	(0.0204)
d_2007	0.153***	0.0667***	0.0911***
	(0.0159)	(0.0100)	(0.0161)
N	4392	4392	4392
ll	-2636.8	-1562.6	-2755.1
chi2	590.0	450.4	456.5
p	1.11e-113	2.62e-84	1.41e-85
r2_p	0.101	0.126	0.0765

Standard errors in parentheses
* $p< 0.105$, ** $p< 0.055$, *** $p< 0.015$

Table 13: Means of Variables

Variable	2007	2009
newprocess	0.155	0.126
newproduct	0.427	0.345
modiproduct	0.434	0.399
inv_cap	0.236	0.378
inv_rep	0.096	0.083
inv_prod	0.025	0.044
inv_qua	0.016	0.016
inv_new	0.012	0.018
inv_othr	0.042	0.054
indirectex~1	0.022	0.018
bothexport_1	0.020	0.007
directexpo~1	0.022	0.028
lklratio_1	11.515	11.895
lnprodt_1	10.093	10.462
year16	0.309	0.394
creditdif	0.079	0.076
female	0.331	0.333
lownerage	3.791	3.814
textile	0.081	0.080
HCM	0.236	0.226
Observations	2283	2109

Table 14: Exports and Innovations

Export modes	Innovation	2007	2009
No_export	Product Innovation	0.145	0.110
	Process Innovation	0.409	0.325
	Product Improvement	0.417	0.383
Indirect_export	Product Innovation	0.263	0.361
	Process Innovation	0.632	0.639
	Product Improvement	0.711	0.722
Direct_and_indirect_export	Product Innovation	0.421	0.577
	Process Innovation	0.895	0.731
	Product Improvement	0.684	0.731
Direct_export	Product Innovation	0.325	0.328
	Process Innovation	0.714	0.639
	Product Improvement	0.701	0.590

CHAPTER 5

FDI Forward Linkage Effect and Local Input Procurement - Evidence from Indonesian Manufacturing -

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This paper examines FDI spillovers through forward linkages using the case study of Indonesian manufacturing over the period 2000-08. It examines whether productivity of a plant in the industry is correlated with the presence of MNEs in upstream industry. An exercise of dynamic panel data model econometric is undertaken to examine the forward linkage effect. The study includes a descriptive analysis that provides some basic facts about forward linkage and its pattern over the time and across industries. The econometric results provide evidence on the positive spillovers impact through forward linkages. The impact, however, is found to depend on the extent, or share, of locally procured inputs. The dependency of the forward linkage effect suggests that the availability of cheaper, but at the same time, high quality inputs produced by MNEs in local economy may encourage firms to switch from importing the inputs to procure locally. This study underlines the strategic importance of FDI policy to direct and/or promote FDI in upstream industries.

Keywords: FDI, Forward Linkages, Indonesian manufacturing, Panel Data

JEL classification: F23, D24, O24

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1. Introduction

Developing countries always consider establishment of foreign firms as a high priority in their policy agenda. Providing evidence to this, history has witnessed investment liberalizations and an increasing foreign direct investment (FDI) in many developing Asian countries since early of the 1990s. Policy makers in these countries are interested not only in the efficient technology brought by the FDI but also in positive productivity impact for local firms through technological spillovers to them (Saggi, 2006).

Channels of FDI therefore play an important role in order to materialize the positive productivity impact. One of these channels is linkage; that is, the linkage between multinationals (MNEs) with other firms within an industry (horizontal linkage) or with firms in other industries (vertical linkage). FDI spillovers through backward linkage occur when MNEs establish an inter-firm relationship with firms in downstream industries with a purpose to supply intermediate inputs for the MNEs. The backward spillovers effect then takes place through direct knowledge transfer, requirement for higher quality input, and increased demand that allows firms in downstream industries to gain from economies of scale (Javorcik 2004). Meanwhile, the spillovers through FDI in upstream industries, (forward linkages), occur when domestic firms in downstream industries benefit from high quality and less costly intermediate inputs produced by MNEs operating in the upstream industries. The analytic of FDI spillovers put forward a hypothesis that the vertical linkages, either through backward or forward linkages, are relatively more importantly than the horizontal FDI linking MNEs with other firms within the same industry. MNEs are likely to protect their knowledge from possible use by their competitors, whereas this is unlikely in the case of vertical linkage, and this is because there is no competition threat from sharing knowledge to firms in other industries.[1] A number of recent empirical works, such as Javorcik (2004), Blalock &Gertler (2008), Havranek & Irsova (2011), and Xu & Sheng (2011) support this hypothesis.

Evidence on vertical linkages however, has been skewed toward backward linkages. As Saggi (2006) wrote, "a voluminous informal and empirical literature exists on backward linkages". Reflecting this, Javorcik (2004) found strong evidence for the spillovers coming through backward linkages but she only found a weak evidence for the spillovers coming through forward linkages. The skewed evidence may have been, to some extent, affected by the nature of FDI going in to developing countries which usually promote export oriented industries or experience a rapidly growing demand from

[1]See Blalock & Gertler (2008) for the conceptual framework that explains the behavior of MNEs in sharing their knowledge and technology with firms in other industries vis-à-vis with firms within the same industry.

population growth. In other words, much of this FDI is located in downstream industries; hence, it is not surprising if the evidence of backward linkage effect appears more frequently.

This paper focuses on forward linkages. It examines whether the productivity of a plant is correlated with the presence of MNEs in upstream industries, using the case study of Indonesian manufacturing. This study, in other words, tests the existence of FDI spillovers coming through forward linkages.

This study essentially extends the work previously done by Blalock & Gertler (2008) which only considered backward linkage effect. Examining FDI spillovers through forward linkages, particularly in the context of industrialization in Indonesia, is important at least for three reasons. First, over more than two decades of industrialization with relatively opened trade and investment regime, FDI in to the country has gone not only to downstream industries but also to the upstream ones, even though in terms of magnitude it may have been lower than the one went to downstream industries as argued by Blalock & Gertler. As described in Section 3 (see Table 1), FDI coming in to the group of capital-intensive sectors of the Indonesian manufacturing, such as resource-based capital intensive (RCI), electronics (ELE), and footloose capital intensive (FCI), had increased over time since 1990s.[2] Moreover, the

[2]The five categories are based on the following ISIC groups (and corresponding SITC

spillovers through forward linkages – if any –should arguably have been much stronger more recently, after a rather long-term engagement of FDI in upstream industries in the country.

Second, the large size and resource abundance of Indonesia support the establishment of a relatively complete supply chain. As indicated by Blalock & Gertler (2008), these characteristics could provide more incentive to foreign firms to establish not only in the downstream but also in upstream industries.

Third, for policy-making purpose, inviting FDI to upstream industries not only brings new knowledge or technology but also introduces competitive pressure for incumbents, which, in some developing countries, are dominated by state-owned enterprises (SOEs). SOEs in upstream industries are likely inefficient and tend to be 'protected'; hence, directing FDI to upstream industries may pose credible treat of competitive pressure which eventually could improve efficiency in upstream industries.

In examining the forward linkages, this study further test whether the benefit stemming from forward linkages depends on the extent of locally

groups for export statistics). Unskilled labour-intensive: ISIC 32 (textiles and garments), 332 (furniture), 342 (printing and publishing), and 39 (other manufacturing). Resource based, labour-intensive: ISIC 31 (food and beverages) and 331 (wood products). Resource based, capital-intensive: ISIC 341 (paper and paper products), 35 (chemicals, rubber, and plastics), 36 (non-metallic minerals), and 37 (basic metals). Electronics: ISIC 383 (electrical machinery). Footloose capital-intensive: ISIC 381 (metal products), 382 (non-electrical machinery), 384 (transport equipment), and 385 (professional and scientific equipment).

procured inputs. The conjecture is that, the productivity-enhancing effect because of forward linkage should be higher for a firm that sources locally many of its intermediate inputs. The availability of high quality inputs produced locally by MNEs, but at relatively cheaper price/cost than imported inputs, allowing any firm to switch, from sourcing low quality locally produced inputs to procuring the high quality ones.

The rest of this paper is organized as follows. Section 2 provides presents the methodology of our study, outlining the empirical model and the testable hypotheses as well as describing the dataset and variables used by the study. Section 3presents and discusses our empirical results, and Section 4offers the policy implication coming out from the analysis.

2. Data and Methodology

2.1.Specification and Hypotheses

Previous studies of technology spillovers through vertical linkages typically estimate the following function (Javorcik 2004; Blalock &Gertler 2008):

$$\Delta\omega_{ijt} = \beta_{ijt} + \beta_F Forw_{jt} + \beta_H Horz_{jt} + \beta_B Bacw_{jt} + \varepsilon_{it},$$

where ω_{ijt}, $Forw_{jt}$, $Horz_{jt}$, and $Bacw_{jt}$ are the natural logarithm of total factor productivity of plant i in year t, and the proxies for forward, horizontal and backward spillover effects in industry $j$ofyear t, respectively. The Δstands for difference operator. The linkage variables are measured as output shares of foreign-owned plants in upstream (forward effect), own (horizontal effect) and downstream (backward effect) industries, respectively. The *Horz* variable is calculated as the output share produced by foreign owned plants in industry j and the *Forw* and *Bacw* variables are calculated as weighted average of*Horz* variables for upstream and downstream industries of industry $j$with weights taken from Input-Output (IO) tables.[3]

In our current analysis, we extend the basic model focusing on the spillovers through forward linkages, which was not examined in a previous study on the Indonesian manufacturing conducted by Blalock &Gertler (2008).In our empirical analysis, thefollowing equation is estimated:

$$\omega_{ijt} = \beta_{ijt} + \beta_{\omega}\omega_{ijt-1} + \beta_F Forw_{jt} + \beta_{F*Rdm} Forw_{jt} * Rdm_{it} \\ + \beta_H Horz_{jt} + \beta_B Bacw_{jt} + \varepsilon_{it}. \quad (1)$$

This specification is consistent with an assumption that productivity is dependent on its lagged variables in an estimation techniqueused in our analysis (see section 2.2),and is different from that of previous studies.First,

[3]Exactly speaking, the coefficients used as weights are not weight because the sum of the weight is not equal to one. The *Horz* variable was calculated as a 3-years moving average.

Javorcik (2004) regressed the growth of productivity ($\Delta\omega_{ijt}$) on the linkage variables assuming that the coefficient β_{ω}in our estimated model is one; second, Blalock &Gertler (2008) regressed the level of productivity on the backward linkage variable assuming that the coefficient β_{ω} is zero. In our analysis, the coefficient and thus the lag structure is to be estimated in more general specification with a lagged dependent variable on the right-hand side. Second, we hypothesis that the magnitude of forward linkage effect vary among benefiting plants depending on the extent that plants procure inputs locally or by importing them. The variable Rdm is share of material inputs procured locally in total material inputs. If the coefficient β_{F*Rdm} is positive, it suggests thatplants procuring more material inputs locally can benefit more from forward linkage effects. The hypotheses of our interest can be written as:

$$\mathrm{H}_0: \beta_F = 0, \quad \mathrm{H}_1: \beta_F > 0$$

and

$$\mathrm{H}_0: \beta_{F*Rdm} = 0, \quad \mathrm{H}_1: \beta_{F*Rdm} > 0.$$

2.2. Variables and Estimation Issues

The previous studies estimated the productivity variable $\omega_{ijt}$with a technique suggested by Olley & Pakes (1996) in order to account for endogeneity of input choiceusing investment as a proxy for unobservable productivity shocks in production function.[4] However, the technique requires that investment responds to the productivity shocks smoothly and that positive (nonzero) investment was reported by plants in sample observations. In our analysis, the productivity is estimated with a technique suggested by Levinsohn & Petrin (2003) using material inputs as a proxy for unobservable productivity shocks. The methodology is more appropriate for the Indonesian manufacturing where the number of plants reporting positivematerial inputs is greater than plants reporting positive investment. Furthermore, Olley & Pakes'(OP) method avoids selection bias by taking exit decision of plants into account, while Levinsohn and Petrin's (LP)method does not.However, the latter is more appropriate for our analysis because there is relatively large number of plants that did not report capital stock, resulting to missing value of the variable. In the OP method, capital stock is a key determinant of the plant exit decision. In the case where dataset contains many missing values of capital stock for existing plants, we cannot properly estimate the probability of exit.

In the estimation process, we set up a following production function:

$$y_{it} = \alpha_0 + \alpha_l l_{jt} + \alpha_l k_{it} + \alpha_m m_{it} + \omega_{it} + \eta_{it},$$

Where$y_{it}$is the logarithm of output calculated as the sum of value added and

[4]Another related previous study on Indonesian manufacturing by Negara & Firdausy (2011) does not take account for the endogeneity.

expenses for material inputs or revenue minus the expenses for energy and fuel, assuming additive separability of energy and fuel inputs in production function. l_{it}, k_{it} and m_{it} are the logarithm of the number of workers, capital stock and material input. The output, capital stock and material inputs are deflated values.[5] Similarly with the OP and LP methods, the productivity ω_{it} is presumed to follow a first-order Markov process (in the estimation process of the productivity), and it is also assumed that material inputs is a strictly monotone function of the productivity and responds to productivity shocks smoothly. Under these assumptions, the total factor productivity ω_{it} is estimated by applying LP method for each industry at a two-digit ISIClevel.

The horizontal effect variable, *Horz*, is calculated as:

$Horz_{jt}$

Conceptually, this effect captures mainly demonstration effect (and competition effect) of productivity spillovers within own industry. However, it should be noted that thisvariable also captures forward and backward

[5]Output is deflated by the wholesale price index, which appears to be appropriate for each 3-digit ISIC classification. Deflated capital stock is calculated by following steps. Buildings, machinery and equipment, vehicles and other fixed capital are respectively deflated using wholesale indices for construction materials of buildings, imported machinery, transport machinery, and the general wholesale price index, respectively and then the sum of the four categories is calculated as the measure of deflated capital stock for each plant. Because of lack of sufficient information on prices, intermediate input is deflated by corresponding wholesale price index of output.

linkage effects within the own industry. Backward linkage effect variable, *Bacw*, measures the presence of foreign owned plants in the downstream industriesprocuringfrom industry j, and it is calculated as the following:

$$Bacw_{jt} = \sum_{k=1}^{K} \alpha_{jk}\, Horz_{kt},$$

where the coefficient α_{jk} is the proportion of output in industry j supplied to industry k and is taken/calculated from Indonesia's Input-Output (IO) tables for 2000 and 2005.[6] Similarly, the forward linkage effect variable, *Forw*, is defined as:

$$Forw_{jt} = \sum_{k=1}^{K} \alpha_{kj}\, Horz_{kt}.$$

These two variables capture vertical linkage effects include not only inter-industry but also intra-industry effects, because in the definition of these variables, there is a term of foreign presence in own industry ($\alpha_{jj} Horz_{jt}$).Therefore, the estimated model based on these definitionshas a limitation in estimating the magnitude of spillovers through backward and forward linkage and through horizontal separately for the reason that backward and forward linkage effects *within* the own industry has been captured by both the *Bacw/Forw* and *Horz* variables. Javorcik (2004)

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[6]This variable corresponds to the Downstream_FDI in Blalock & Gertler (2008).

useddifferent definitions of the backward and forward variables wherebyα_{jj} is set to zero. This means thereis no backward/forward linkage effect*within* the own industry.[7] However, this is not a well-grounded solution because it is unrealisticto assume no intra-industry linkage effect even if we use a highly aggregated industrial classification. Therefore, we do not impose $\alpha_{jj} = 0$ in the definitions of the *Bacw/Forw* variable.

Using these definitions, equation (1) is estimated together with the other control variables including capital intensity, ratio of non-production workers in total employment, and plant size measured by output in previous year. When we estimate the model, another estimation issue arises because the model is a dynamic panel data model that requires strict exogeneity of independent variables in order to be estimated by OLS/DVLS consistently. A generalized method of moment (GMM) estimator for a dynamic panel data model with endogenous/predetermined variables was developed by Arellano & Bond (1991) and Blundel & Bond (1998). We apply the estimator suggested by Blundel & Bond (1998) assuming that the spillover variables are exogenous while plant size is predetermined and the ratio of material input procured domestically, capital intensity, and the ratio of non-production workers are endogenous as well as the lagged dependent variable. In this estimation method, two-year and further lags of the independent and

[7]Another purpose of setting to zero is to avoid colinearity with the horizontal variable.

dependent variables can be used as instruments for (orthogonal) differenceequation, and one-year and further lag of differenced dependent variables can be used as instrument for level equation. When we seek for a set of valid instrumental variables, the possibility of the presence of measurement errors in variables is taken into account by excluding/including two-year lags of instruments for difference equation and one-year lag for level equation, as suggested by Bond (2002).[8]

2.3. Data and Sample

This study uses and utilizes a plant-level panel dataset of Indonesian manufacturing. The dataset was constructed collecting data for relatively large manufacturing plants with 50 or more workers from annual surveys conducted by the Indonesia's statistical agency since 1975. The study considers the period 2000-2008 as the period forthe analysis and therefore a panel dataset for this period was constructed. It contains useful information related to both locally and foreign-owned plants, including value added, employment, capital stock, intermediate inputs and other variables that are necessary for the calculation of TFP. However, there are several outliers and apparently incorrect data entries in the original dataset. In order to avoid misleading results, data that appeared to be outliers or contain measurement

[8]For the estimation, xtabond2 command was used in stata program. "Forward orthogonal deviations" was used instead of first difference because the dataset is an unbalanced panel with "gap," as suggested by Roodman (2009).

errors were modified/eliminated from the panel dataset.

The data modification process took following steps. First, incorrect data entries were modified. For example, a plant reported 100 percent foreign ownership share in a year but it reported the share of 0 percent in previous and subsequent years. In this case, the data entry of the 100 percent foreign ownership share was replaced with 0 percent. Second, the dataset contains estimates by the statistical agency for non-responds to the surveys. In general, the agency does not provide information on whether data entries were original replies from plants or were estimated by the agency because the plants did not respond. However, in some cases, we can speculate it. For example, original datasets for 2001-2005 contain data entries indicating that labor productivity (value added divided by the number of workers) is exactly the same for several plants within a 5-digit ISIC level.[9] Observations for these plants were totally excluded from our sample because the data entries appear to be estimates by the agency. Third, before estimating a production function by the LP method, it was estimated by OLS and residual was calculated. If observations with the residual whose absolute value were 2.5 times greater than estimated standard error, then the observations were excluded from sample for the LP estimation. This step eliminated outliers

[9]For example, calculated labor productivity is exactly the same for 497 plants in industry 18101 in 2001. For these plants, the value of calculated labor productivity is integer, which is usually non-integer. The number of such data entries decreased year by year and disappeared in dataset for 2006.

and incorrect entries in value added, and other production factor variables.

Another data used in this analysis is IO tables for 2000 and 2005. The Indonesia's statistical agency has published four types of IO tables every 5 years. In our analysis, a table for domestic transaction at producers' prices is used to calculate the *Forw/Bacw*variables.[10] For 2000 and 2005, α_{jk}s are calculated from the tables. α_{jk}s for 2001-2004 and 2006-2008 are inter or extrapolated using α_{jk}s for 2000 and 2005.

3. Results and analysis

3.1. Descriptive Analysis

Indonesia has been adopted, and it continues to adopt, a policy to attract FDI for the development of its manufacturing sector. In the late 1980s and during the first half of 1990s before the 1997/98 economic crisis, the government consistently introduced measures to liberalize the country's investment regime.[11] The policy direction to attract FDI continues after the crisis; in fact, the emphasis was greater in this period because of the perceived decline in the extent of FDI entering Indonesia after the 1997/98 crisis. Reflecting the greater emphasis, the government introduced a new investment

[10]Other options are (1) total transaction including imports and (2) at consumers' prices. Thus, there are four combinations of these options.

[11] See, for example Pangestu (1996) and Aswicahyono *et al*. (2010) for the detail of foreign direct investment policy in Indonesia over the before and after the 1997/98 economic crisis, respectively.

law in 2007 in an effort to increase FDI flow in to the country.

The picture about foreign ownership in the Indonesian manufacturing points to a rising pattern over the period 1990–2008 (Table 1). The share of manufacturing output produced by firms with foreign equity rose from 22 per cent in 1990 to 47 per cent in 2008. It rose more or less continuously throughout the period, but particularly immediately before and after the crisis, 1993–1999. It is important to note a jump in 2008, which may have been the result of an immediate impact of the new investment law introduced in early 2007. Overall ,the crisis had no major impact on this secular trend of rising foreign ownership. The increase in foreign ownership is evident in most industries, except for paper and chemical products, where local firms have become more active. As expected, foreign presence is greatest in the two most multinational enterprise (MNE)-intensive industries, automotive products and electronics, as well as in the resource-based capital intensive (RCI) and footloose capital intensive industry (FCI). Recalling the definition of *Forw*, the increase in the presence of MNEs in an industry indicates an increase in the share of intermediates produced by MNEs. If the MNEs in upstream industries produce similar products with imported inputs, therefore there should be a higher chance for plants in the downstream industry to procure inputs locally.

Table 1: Foreign Ownership Share, Indonesian Manufacturing, 2000-2008

Foreign ownership (share, in %)

		1990	**1993**	**1996**	**1999**	**2002**	**2005**	**2008**
31	Food, beverages, and tobacco.	8.5	9.7	14.0	15.8	9.4	24.9	24.4
32	Textile, clothes and leather industry.	17.8	21.8	29.3	37.4	32.1	32.8	44.5
33	Wood and wood products	10.1	11.7	22.9	15.8	11.6	11.2	19.1
34	Paper and paper products	30.2	14.9	33.8	23.5	46.4	29.0	27.3
35	Chemicals and chemical products	33.1	36.6	43.0	44.8	29.7	26.3	53.5
36	Non metalic mineral products	18.0	23.3	33.4	34.6	28.3	35.9	39.2
37	Basic metal industries.	24.8	35.3	24.3	43.1	29.4	30.5	28.2
38	Fabricated metal , machinerie, and eq.	46.1	36.4	42.4	58.0	67.6	68.3	77.9
39	Other manufacturing industries.	19.5	44.4	51.9	56.1	33.7	46.9	71.2
1-ULI	Unskilled Labour Intensive	16.2	21.1	27.3	35.4	28.8	30.0	42.2
2-RLI	Resource Based, Labour Intensive	9.0	10.2	16.8	15.9	9.8	22.8	24.4
3-RCI	Resource Based, Capital Intensive	29.5	32.5	35.9	40.0	34.9	29.9	45.6
4-ELE	Electronics	41.7	43.0	48.7	82.4	71.5	68.9	76.0
5-FCI	Footloose Capital Intensive	47.2	34.7	39.5	44.0	66.0	68.1	78.5
	Non-Oil and Gas Manufacturing	**21.9**	**23.4**	**30.9**	**35.5**	**33.5**	**37.2**	47.6

Source: StatistikIndustri (SI), various years.

Table 2 presents the average value of *Forw* and *Bacw* for the period 2000-08 for the whole and by industry groups of Indonesian manufacturing. The table shows that for the whole manufacturing, the value of *Bacw* is higher than that of *Forw*. This reflects large extent of FDI in Indonesian manufacturing went to downstream industries, which is consistent with export orientation and large domestic demand of the Indonesian economy.

Table 2: Forward and Backward, Indonesian Manufacturing, 2000-08

ISIC 2 Digit	Sectors	Forward	Backward
15	Food products and beverages	19.72	33.63
16	Tobacco	22.79	21.81
17	Textiles	26.35	33.41
18	Wearing apparel	37.46	36.40
19	Leather products and footwear	31.34	22.39
20	Wood products	32.08	28.70
21	Paper	27.03	11.74
22	Publishing	31.32	38.36
23	Petroleum products	41.21	30.47
24	Chemicals	32.01	37.00
25	Rubber and plastics products	45.25	42.87
26	Non-metallic mineral products	35.04	32.49
27	Basic metals	33.10	45.90
28	Fabricated metals	34.98	40.53
29	General machinery	31.44	62.44
30	Electrical machinery	58.71	70.94
31	Office and computing machinery	52.91	57.26
32	Radio, TV and communication	68.27	78.30

33	Precision machinery	49.93	75.11
34	Motor vehicles	45.38	82.28
35	Other transport equipment	43.20	65.92
36	Furniture and miscellaneous	33.03	40.08
37	Recycling	23.36	26.54
	Manufacturing	36.67	43.43

Another important observation is that, there is variation in the *Forw*value across industries, ranges from the lowest 19.7 percent in food products and beverages (ISIC 15) to radio, TV and communication (ISIC 32). But more importantly, there is rather skewed pattern in the distribution of *Forw*, with many capital intensive industries, such as electrical machinery, office and computing, radio, TV and communication, precision machinery, and motor vehicles (ISIC 30, 31, 32, 33, and 34, respectively), record a value well above the average value for the whole manufacturing. All of these industries are the industries where MNEs are likely to locate. It is interesting to note that the value of *Forw*in apparel (ISIC 18) is slightly above the whole manufacturing average. This is interesting because this industry is labor-intensive in nature, deviating from the skewness pattern the table has just revealed. The cross-section pattern of the *Bacw* seems to resemble closely the one of *Forw*, including the concentration of the value above whole-industry average in capital-intensive industries. Moreover, it is observed that the values of*Bacw* are significantly high for motor vehicle (the highest), precision machinery, radio-TV and communication, and electrical machinery (ISIC 34, 33, 32, and 30, respectively).

The cross-section variation in the value of *Forw* and *Bacw* also varies over the time, as it is shown by the changes over the 2000-08 period graphed in Figure 1 and 2. Consider the pattern of *Forw* (see Figure 1), there are about half of two-digit ISIC industries that registered positive change over this period, while the other half recorded a negative change in the value. Assuming the technical coefficient does not change substantially over the period, the positive change therefore suggests an increase in the foreign share of output produced by upstream industries. Observing Figure 1, industries that significantly increased their foreign-shared output are capital intensive industries, such as motor vehicle, fabricated metal products, and general machinery. The pattern is similar for *Bacw* (see Figure 2), where there is wide cross-section variation over the time. Most of the industries that gain the increase are those coming from the group of capital-intensive industries.

Figure 1: Change in Forward between 2008 and 2000, Indonesian Manufacturing

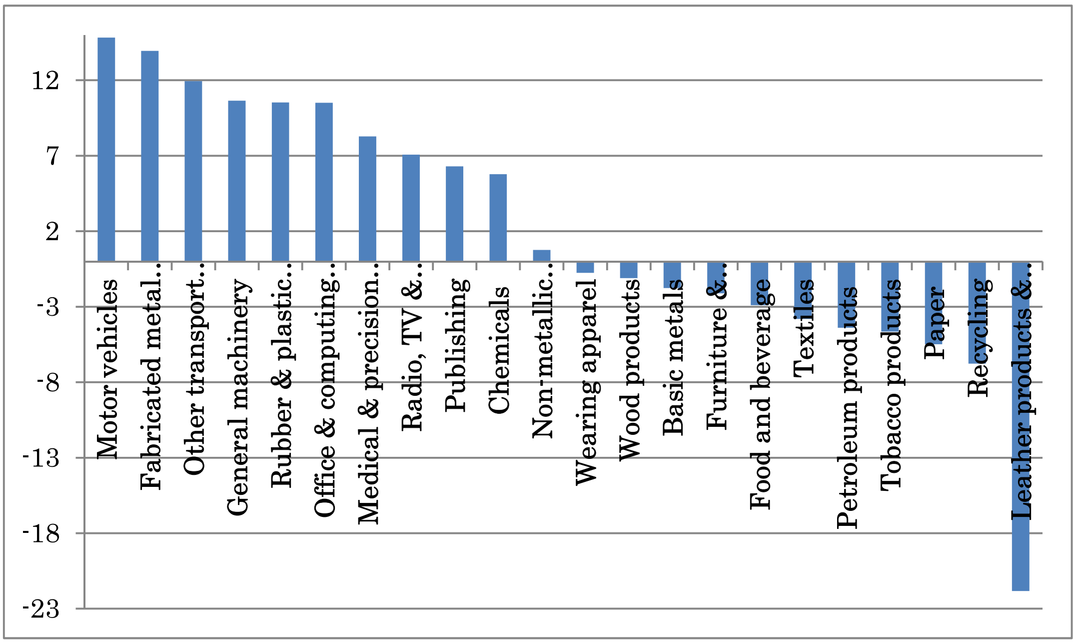
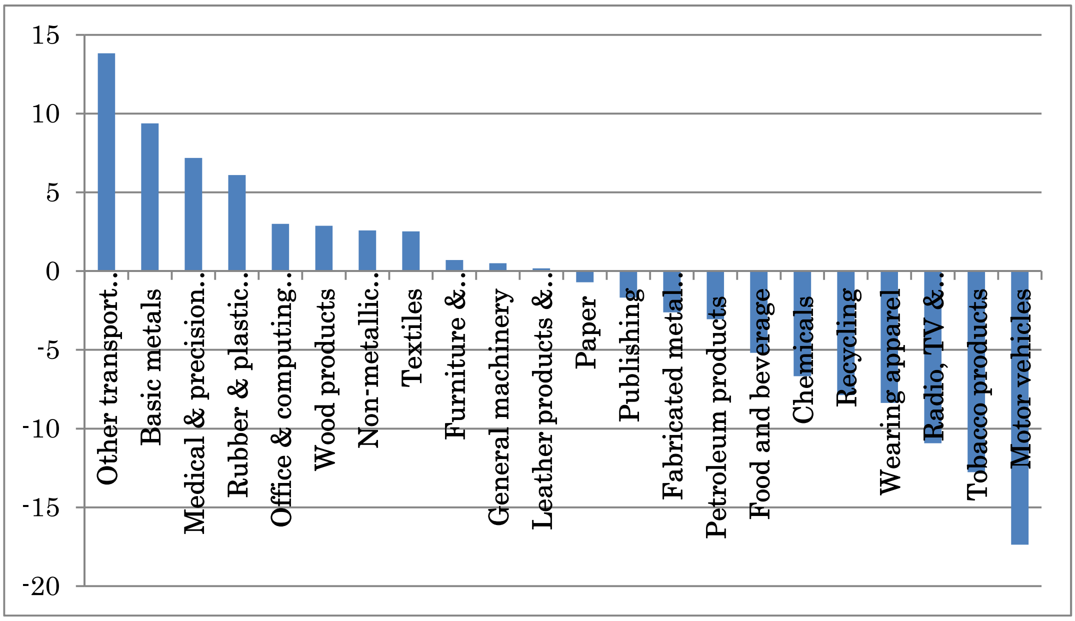


Figure 2: Change in Backward between 2008 and 2000, Indonesian Manufacturing



There is an indication of a decline in the use of imported input over the time, suggesting a higher use of locally produced inputs. This is derived from observing the cross-section and overtime pattern of imported input ratio over the period 2000-08presentedin Table 3. Observing the average of imported input, there is a declining pattern in the use of imported input from 7.1 percent in 2000-04 to 6.5 percent in 2005-08. This is observed in almost all groups of broader industry groups, with large decline occurred in electrical machinery (ISIC 31), precision machinery (ISIC 33), and to some extent in basic metal (ISIC 27) and motor vehicles (ISIC 34). Notwithstanding this decline, there are eight industries that experienced an increase in their average ratio of imported input; however, the increase was marginally, except the one recorded for other transportation equipment industry (ISIC 35), increasing from 8 to 14 percent.

The change in average ratio of imported input can be decomposed into two factors: one is the change in average imported input in importing plants (an average after excluding plants not importing) (columns 3 and 4) and the other one is the change in the number of importers (columns 4 and 5). Consider, first, the former, the average of importers' average imported input increased only in three industries (i.e., wood products (ISIC 20), paper (ISIC 21), and radio, TV and communication (ISIC 32)). The average for the whole manufacturing decreased from 47 to 44 percent over the period 2000-04 and 2005-08, respectively. Meanwhile, for the change in the number of importers, importing plants decreased, albeit slightly, by one percentage-point over these two sub periods.

To sum up, and to reiterate, all figures described by Table 3 show that plants in the Indonesian manufacturing tend to have lowered their purchase of imported input, suggesting, at the same time, that they may have procured input locally. This is somewhat inconsistent with a fact that Indonesia has liberalized international trade since the mid 1980s; it is however consistent, and provides some support, to the idea of the development that happened in the upstream industries.

Table 3: Imported input ratio, Indonesian Manufacturing, 2000-08

	Average of imported input ratio (%)		Average of imported input ratio only for importers (%)		Percentage of # of Importers (%)	
Period	2000-2004	2005-2008	2000-2004	2005-2008	2000-2004	2005-2008
Column	[1]	[2]	[3]	[4]	[5]	[6]
15 Food products and	2	2	28	25	8	8
16 Tobacco	1	1	18	16	4	5
17 Textiles	12	9	50	46	23	18
18 Wearing apparel	11	11	63	61	15	16
19 Leather products and	9	6	38	37	23	17
20 Wood products	1	1	16	17	7	8
21 Paper	8	8	35	38	22	21
22 Publishing	5	3	28	17	16	17
23 Petroleum products	10	11	65	43	15	25
24 Chemicals	24	23	57	56	42	40
25 Rubber and plastics	11	10	48	45	22	20
26 Non-metallic mineral	3	3	41	37	8	8
27 Basic metals	28	26	57	52	48	47
28 Fabricated metals	12	12	58	56	20	21

29 General machinery	15	16	56	56	26	28
30 Office and computing	-	-	-	-	-	-
31 Electrical machinery	32	29	61	58	50	47
32 Radio, TV and	59	58	85	87	62	54
33 Precision machinery	34	27	66	55	48	43
34 Motor vehicles	15	13	59	54	25	24
35 Other transport	8	14	52	50	15	26
36 Furniture and	4	4	38	35	10	10
37 Recycling	-	-	-	-	-	-
Manufacturing	7.1	6.5	47	44	15	14

3.2. Estimation results and analysis

This subsection reports the estimation results to address the hypothesis of this study. Table 4 presents these, for all continuing plants in our dataset which cover the period 2000-08. Consider, first, the results of specification [1] and [2], which follow the modeling strategy of Blalock &Gertler (2008) and Javorcik (2004), respectively, in treating the lag of natural logarithm of total factor productivity (see the discussion in subsection 2.1). It turns out that there is no support for the impact of forward linkage effect on productivity if we consider these modeling strategies; the estimated coefficient of Forw is very statistically insignificant and, in the case of the results of specification [2], it shows a negative sign, which is not expected based on the theory.

Turning to the next column, which shows the result from the specification that includes the lag of dependent variable (i.e., specification [3]), there is a hint for a positive impact of forward linkage on productivity. The estimated coefficient of *Forw* is positive although it is not statistically significant. Examining further, it turns out that the result is not reliable; the p-value of Hansen test rejects the null of valid overidentifying restrictions. In the dynamic panel GMM estimation, rejecting the null means higher chance for the estimates although efficiency of the estimator at the same time also increases (Baltagi, 2008).

Specification [4] specifies the hypothesis that the impact of forward linkage depends on the extent of locally procured inputs. The estimation result of this specification supports this hypothesis; the estimated coefficient of the interactive variable *Forw* and *Rdm* is positive and statistically significant, albeit only at 10 percent level. The overall, or net, impact of forward linkage on productivity is also positive, although the estimated coefficient of *Forw* is negative when it enters the specification individually. The result is likely to be robust, given that the specification [4] passes the Hansen test where the p-value of the Hansen statistics fail to reject the null of overidentifying restrictions.

The finding on the positive effect of the interactive *Forw* and *Rdm* variable supports the argument that the availability of cheaper – but high quality – intermediate inputs produced by MNEs in local economy is capable to make a firm to switch, from importing the inputs to source them locally. It

Table 4: Productivity Estimation Results

Column	[1]	[2]	[3]	[4]	[5]	[6]
Dependent var.	w_t	Δw_t	w_t	w_t	w_t	w_t
Estimation	DVLS	DVLS	Sys-GMM	Sys-GMM	Sys-GMM	Sys-GMM
w_{t-1}			0.144	0.145	0.147	0.146
			[0.040]***	[0.039]***	[0.039]***	[0.039]***
Forw	0.291	-0.101	0.146	-5.281	-5.843	-4.413
	[0.226]	[0.283]	[0.278]	[3.172]*	[3.678]	[2.334]*
*Rdm*Forw*				6.643	7.294	5.291
				[3.799]*	[4.424]*	[2.859]*
Horz	0.168	0.254	0.009	0.044	0.086	0.005
	[0.084]**	[0.107]**	[0.096]	[0.097]	[0.121]	[0.096]
Bacw	1.049	0.914	0.934	1.027	1.127	0.872
	[0.216]***	[0.257]***	[0.261]***	[0.253]***	[0.297]***	[0.235]***
HI	0.095	0.019	0.116	0.106	0.091	0.118
	[0.113]	[0.145]	[0.109]	[0.112]	[0.116]	[0.110]
Rmd	0.002	-0.054	-0.668	-0.673	-0.572	-0.722
	[0.040]	[0.054]	[0.353]*	[0.368]*	[0.369]	[0.373]*
Rln	0.014	0.023	-0.018	-0.014	-0.002	-0.043
	[0.007]**	[0.010]**	[0.074]	[0.076]	[0.075]	[0.075]
Rlk	0.029	0.026	0.137	0.123	0.122	0.121
	[0.004]***	[0.006]***	[0.054]**	[0.053]**	[0.053]**	[0.053]**
Plants	7,673	5,311	5,311	5,311	5,311	5,311
Observations	32,749	24,462	24,462	24,462	24,462	24,462
F-value	0.000	0.000	0.000	0.000	0.000	0.000
AR1 (p-value)			0.000	0.000	0.000	0.000
AR2 (p-value)			0.969	0.905	0.899	0.958
Hansen (p-val.)			0.012	0.113	0.105	0.118
Instruments			64	75	75	75

Notes: In Sys-GMM estimation, w_{t-2}, w_{t-3}, Rmd_{t-3}, Rmd_{t-4}, Rln_{t-3}, Rln_{t-4}, Rlk_{t-3}, Rlk_{t-4}, $Rdm*Forw_{t-3}$ and $Rdm*Forw_{t-4}$ (for difference equation) and Δw_{t-2} (for level equation) were used as instruments. The results of two-step estimation with Windmeijer's (2005) finite-sample correction of standard errors are reported. "***", "**", "*" indicate statistically significant at 1 percent, 5 percent, or 10 percent level, respectively. Year dummies are included in all models.

is important to note, however, that the coefficient of the interactive term does not reflect the extent of the switching; it just gives a suggestion that such a switching behavior may occur.

Specification [5] and [6] are estimated to test the robustness of the key finding on the impact of forward linkage. First, in specification [5], and following Javorcik (2004), the output produced by foreign plant in the formula to compute horizontal linkage is adjusted by the foreign share in the plant; that is, by multiplying it with the foreign ownership share, or

$$Horz_{j,t} = \frac{\sum_{i \in j} (\text{foreign share})_{i,t} \times (\text{output})_{i,t}}{\sum_{i \in j} (\text{output})_{i,t}}$$

Thus, now, unlike the *Horz* variable used by specification [4], *Horz* adopted by specification [5] reflect the extent of output from foreign plants more precisely, because it reflects the share of foreign ownership in an industry. The value of *Bacw* and *Forw* is adjusted accordingly. Looking at the estimation result of this specification, it turns out that the key finding is robust even with the alternative measurement of horizontal, forward, and backward linkage; that is, the impact of forward linkage is positive but dependent on the extent of locally procured input.

Another robustness test considers the value of *Forw* and *Bacw* that excludes the 'within-industry' effect. Recalling the explanation in section 2.2, this means the definition of *Forw* and *Bacw* imposes a restriction of $\alpha_{jj} = 0$. This is done by specification [6]. The key message from the results accords the one derived by previous estimation where the forward and backward effect within an industry is included. However, the dependency of the forward linkage effect on the extent of locally procured inputs appears to be lower than the dependency when the ‘within industry’ effect is assumed. The estimated coefficient of interactive term *Rdm*Forw* in specification [6] is higher than the one produced by the estimation of specification [4] and [5].

Table 5 reports our experiment that focuses on testing the hypothesis on the group of local plants. This extends the exercise reported in the Table 4 and is motivated both by a more policy-oriented argument and cleaner/more-convincing test to detect the presence of spillovers from the presence of multinationals. While it does not necessary applyonly to domestic/local firms, FDI spillovers is analytically, and commonly, referred to an increase in productivity of domestic firms as a consequence of the presence of foreign firms in the domestic economy. Looking at from the perspective of policy, policy makers usually are interested to know the extent of knowledge transferred from multinationals to local firms.

Table 5: Productivity Estimation Results: Focusing on Local Plants

Column	[7]	[8]	[9]	[10]	[11]	[12]
Subsample	Local plants	Local plants	Non-importing local plants	Importing local plants	Non-Importing plans including foreign plants	Importing plants including foreign plants
Estimation	Sys-GMM	Sys-GMM	Sys-GMM	Sys-GMM	Sys-GMM	Sys-GMM
w_{t-1}	0.127	0.133	0.182	0.141	0.197	0.113
	[0.041]***	[0.040]***	[0.047]***	[0.070]**	[0.045]***	[0.060]*
Forw	0.363	-2.378	0.659	-2.45	0.659	-3.71
	[0.277]	[2.527]	[0.308]**	[1.306]*	[0.299]**	[1.575]**
*Rdm*Forw*		3.208		4.241		6.165
		[2.945]		[2.230]*		[2.693]**
Horz	-0.063	-0.06	-0.021	-0.114	0.009	0.039
	[0.094]	[0.094]	[0.116]	[0.136]	[0.112]	[0.143]
Bacw	1.049	1.138	1.345	0.197	1.286	0.644
	[0.276]***	[0.268]***	[0.311]***	[0.463]	[0.298]***	[0.428]
HI	-0.001	-0.014	0.04	-0.091	0.037	0.094
	[0.095]	[0.095]	[0.118]	[0.138]	[0.115]	[0.169]
Rmd	-0.491	-0.509		-0.564		-0.658
	[0.419]	[0.392]		[0.344]		[0.366]*
Rln	-0.053	-0.06	0.005	0.197	0.017	0.244
	[0.080]	[0.078]	[0.087]	[0.120]	[0.079]	[0.124]**
Rlk	0.088	0.075	0.121	0.059	0.13	0.089
	[0.057]	[0.056]	[0.061]**	[0.113]	[0.057]**	[0.081]
Plants	4,645	4,645	4,099	1,132	4,414	1,617
Observations	21,065	21,065	16,727	4,338	17,954	6,508
F-value	0.000	0.000	0.000	0.012	0.000	0.011
AR1 (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
AR2 (p-value)	0.761	0.720	0.243	0.649	0.175	0.780
Hansen (p-val.)	0.003	0.021	0.015	0.653	0.009	0.816
Instruments	64	75	53	75	53	75

Notes: In Sys-GMM estimation, w_{t-2}, w_{t-3}, Rmd_{t-3}, Rmd_{t-4}, Rln_{t-3}, Rln_{t-4}, Rlk_{t-3}, Rlk_{t-4}, $Rdm*Forw_{t-3}$ and $Rdm*Forw_{t-4}$ (for difference equation) and Δw_{t-2} (for level equation) were used as instruments. The results of two-step estimation with Windmeijer's (2005) finite-sample correction of standard errors are reported. "***", "**", "*" indicate statistically significant at 1 percent, 5 percent, or 10 percent level, respectively. Year dummies are included in all models.

In an attempt to make a careful examination of the impact on this group of plant, the experiment is conducted three more specific groups of local-plants, that is: (i) the whole local plants, (ii) groups of local plants differentiated by whether or not they procured inputs from importing, and (iii) the groups defined by (ii) but with addition of plants that have some share of foreign ownership. Two specifications, that is, with and without the interacted *Forw*-and-*Rdm* variable, are applied/estimated on each of these more specific groups..

Consider, first, the estimation results for the group of the whole local plants (see the results of specification [7] and [8] in Table 5), there is no evidence for the impact of forward linkage on productivity, shown by statistical insignificant of *Forw* and *Forw***Rdm* variable. The positive impact of forward linkage on productivity only appears in the results of estimations for the remaining more specific groups – see the results of specification [9] to [12]. Specifically, forward linkage positively affects productivity for the group of non-importing local plants (the results of specification [9]), indicated by the positive and statistically significant estimated coefficient of *Forw*. The productivity impact of forward linkage that depends on the extent of locally procured input is positive for the group of local plants that at the same time also import some of their inputs (the results of specification [10]). These findings persist even when plants with some foreign ownership are added to the sample groups, shown by the results of specification [11] and [12].

These findings presented support the inference produced by the results presented in Table 4, on the positive impact of forward linkage on productivity. This seems to further suggest that the impact of forward linkage is greater for local plants or firms that do have strong international linkage; here, in this context, international linkage isbroadly defined by how much a plant imports its inputs. Following a strand of literature in importing (and exporting), this could be explain by the theory that importing is costly, particularly for a plant/firm to pay the very costly/expensive sunk cost for importing.

So far this section focuses on the presentation and comments on the results for the question asked by this study. In addition to these, it is worth to also make some comments on the results of the other spillover-linkage variables (i.e., *Horz* and *Bacw*).Referring back to the results of specification [4] in Table 4, there is evidence of strong FDI spillovers through backward linkages. The estimated coefficient is positive and statistically significant at the very high level of confidence (at 1 percent level).Moreover, it is suggested that the impact through this channel is economically very important, owing to the very large estimated coefficient. This finding is consistent with numerous other studies which have demonstrated the existence of the backward-linkage spillovers. In particular, it supports the work of Blalock & Gertler (2008) that also found positive impact from backward linkages in Indonesian manufacturing. This finding also confirms the particular characteristic of inward FDI to developing countries that mostly targets downstream industries.

Turning to horizontal linkages, the results do not find evidence that FDI spillovers take place through horizontal linkages. The *Horz* estimated coefficient is very statistically insignificant. Moreover, the sign of the coefficient is negative, which appear to be indicating a possible adverse competition effect in the local market as an impact of MNE operation. This finding however is consistent with other studies (e.g. Aitken & Harrison (1997), Javorcik (2004) and Blalock & Gertler (2008)) in which the evidence for the presence of horizontal linkage spillovers can not be found.

It is also worth commenting that there is a rather strong the persistency in the outcome of productivity. The coefficient of ω_i is very statistically significant not only with the one-year lag of the variable (ω_{ijt-1}) but it is also for the two-years lag variable (ω_{ijt-2}). The impact of the two-years lag of the variable however is not so strong in terms of magnitude; the estimated coefficient of (ω_{ijt-2}) is about half of the estimated coefficient of (ω_{ijt-1}).

4. Summary and Policy Implications

This paper addresses the topic of FDI spillovers through forward linkages using the case study of Indonesian manufacturing over the period

2000-2008. It examines whether productivity of a plant in the industry is correlated with the presence of MNEs in upstream industry. In examining the forward linkage effect, it tests whether the benefit stemming from the forward linkages depends on the extent of inputs locally procured by a plant. An exercise of dynamic panel data model econometric is undertaken to examine the forward linkage effect. The study also includes a descriptive analysis that provides some basic facts about forward linkage and its pattern over the time and across industries. The descriptive analysis also provides a picture about some pattern or characteristics of input procurement of plants in the manufacturing sector.

The descriptive analysis shows some indication of an increase in presence of MNEs in upstream industries. The value of forward variable is recorded to have increased over the period 2000-08 in about half of the industries defined at two-digit ISIC level. More importantly, and more interestingly, almost all of these industries are capital-intensive industries where FDI is usually located. Consistent with this, many of the two-digit ISIC industries that record a well above the whole manufacturing average – in the value of forward variable – are capital-intensive industries. Another important finding from descriptive analysis is the indication that plants in the manufacturing sector tended to have lowered their purchase of imported inputs, which suggests that they should have procured more locally.

The econometric results provide evidence on the positive spillovers impact through forward linkages. The impact, however, seems to depend on the extent, or share, of locally procured inputs. This supports the hypothesis on the existence of spillovers effect through forward linkages. The dependency of the forward linkage effect suggests that the availability of cheaper, but at the same time, high quality inputs produced by MNEs in local economy may encourage firms to switch from importing the inputs to procure locally. The econometric analysis also found evidence of the existence of backward linkage effect, which appear to be quite strong.

There are at least two policy implications can be drawn from this study. First, this study underlines the importance of strategic investment policy for FDI. Usually, in many cases, government tends to direct FDI only to downstream industries. While this is proved to be beneficial, as shown in this study by the convincing results of the backward linkage effect, government could actually apply a more strategic FDI policy by directing, or promoting, FDI to be invested in upstream industries. As indicated by this study, the forward linkage effect is proved to be positive and it may actually trigger firms to switch from importing to procure their inputs locally. Procuring inputs locally definitely reduces costs and this means potential increase in the growth rate of many firms. Second, considering the positive impact of the vertical linkages in facilitating technology transfer from MNEs, it is important for policy to promote FDI in to the sectors that currently are still experiencing low level of the vertical linkage with MNEs. Recalling the insight from the descriptive analysis of this study, many of these industries at this moment are labor and some of resource intensive industries.

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CHAPTER 6

Interdependence in Multinational Production Networks: Evidence from Exit of Overseas Affiliates

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By setting up and shutting down their overseas affiliates, multinational enterprises (MNEs) have established their production and distribution networks in the world. The entry strategy of their affiliates has been investigated in the academic literature of location choice, but it has remained unknown how MNEs decide the shutdown of their overseas affiliates. In this paper, by exploiting data on Japanese foreign direct investment, we empirically examined the exit of MNEs' production affiliates. In particular, we explore not only the effects of affiliate or host country specific characteristics on the exit of affiliates but also how the exit of an affiliate is affected by the existence of the other affiliates belonging to the same parent firm. As a result, we found that affiliates in countries to which the other same-firm affiliates have better market access are more likely to be shut down.

Keywords: Multinational enterprises; Exit; Japan

JEL Classification: F21; F23

1. Introduction

By setting up and shutting down their overseas affiliates, multinational enterprises (MNEs) have established their production and distribution networks in the world. Every year, while some new overseas affiliates are established, some existing affiliates are shut down. For example, in the case of Japanese MNEs' overseas affiliates in 2009, while 82 manufacturing affiliates were newly advanced abroad, the number of manufacturing affiliates withdrawing from overseas markets was 305 (Basic Survey of Overseas Business Activities, Ministry of Economy, Trade and Industry). Since around 8,000 manufacturing affiliates exist in the world, about five percent of all manufacturing affiliates are new affiliates or exit from the overseas markets. Such entry and exit of overseas affiliates will be based on the global strategy of MNEs. MNEs have continuingly improved their production and distribution networks through the reallocation of their overseas affiliates.

The entry strategy of their affiliates has been investigated in the academic literature.[1] This literature is called location choice analysis and examines what kinds of firm and regional characteristics have influence on the location decision of overseas plants of MNEs. This literature includes two main topics. The first topic examines various kinds of location factor such as the agglomeration of firms belonging to the same firm group (e.g., Belderbos and Carree, 2002) or investment climate-related elements (free trade zones in the US, Head *et al*., 1999; special economic zones and opening coastal cities in China, Belderbos and Carree, 2002; Objective 1 structural

[1] Recent references are as follows: Head *at al.* (1999) for Japanese MNEs in the US; Belderbos and Carree (2002) for Japanese MNEs in China; Head and Mayer (2004) for Japanese MNEs in Europe; Disdier and Mayer (2004) for French MNEs in Europe; Castellani and Zanfei (2004) for large MNEs in the world; Mayer *et al.*(2010) for French MNEs in the world; Crozet *et al.* (2004) for MNEs in France; and Basile *et al.* (2008) for MNEs in Europe.

funds and cohesion funds in Europe, Basile *et al.*, 2008). The second topic explores the substitution of location by examining inclusive values in the nested logit model: Basile *et al*. (2009); Disdier and Mayer (2004); Mayer *et al.* (2010). For instance, Disdier and Mayer (2004) investigate the location choice of French multinational firms and found the differentiation between Eastern European countries and Western European countriesas a location. These studies contribute to uncovering how MNEs decide the location of their overseas affiliates.

On the other hand, the analysis on exit strategy of their affiliates has been limited to the comparison in exit between foreign-owned plants and indigenous plants. For example, following the pioneer study by Gibson and Harris (1996), which examine the exit of foreign-owned plants in New Zealand, Görg and Strobl (2003), Bernard and Jensen (2007), Bernard and Sjöholm (2003), Van Beveren (2007), Bandick (2010), and Kneller *et al.* (2012) look at evidence from Ireland, the United States, Indonesia, Belgium, Sweden, and Japan, respectively. Although the results are slightly different depending upon the country under inspection, most of the studies show that the survival rate of foreign plants is lower than that of domestic plants. These studies contribute to clarifying the differences in “foot-looseness” of MNEs’ overseas plants, but it has remained unknown how MNEs decide the shutdown of their overseas affiliates.

In this paper, by exploiting data on Japanese foreign direct investment (FDI), we empirically examined the exit of MNEs’ production affiliates. In particular, our data enable us to differentiate purely exiting affiliates with those just stopping the response. With those data, we compare exit among MNEs’ affiliates, not between those and indigenous plants. In other words, rather than exploring how different the exit is between indigenous plants and foreign plants in a country, this paper investigates how different it is among MNEs' affiliates in the world. With this analysis, we can uncover the effects of affiliate or host country characteristics on the exit of affiliates. For example, due to the larger sunk costs, the relatively large-sized affiliate among affiliates within an MNE might be less likely to be shut down. Obviously, the rapid hike of local wage rates will encourage foreign affiliates to exit. This is the first paper that presents the evidences on the effects of these kinds of characteristics on the exit of MNEs' affiliates. Such analyses are important from the policy point of view because their existence is one of the most important drivers for economic growth in developing countries.

Furthermore, we take into account the existence of multiple affiliates within an MNE. In the analysis of plant exit, some papers examined how the exit of a domestic plant is affected by the existence of the other domestic plants belonging to the same firm, and found their significant interaction in plant exit (see, for example, Baden-Fuller, 1989; Deily, 1991; Dunne *et al*., 2005).[2] Similarly, in this paper, we examine the interaction of overseas affiliates in exit. In particular, we say that our paper is close to Chen (2011), which analyzes the effect of MNEs' existing-network on the location choice of a new affiliate. By using the data of French MNEs' affiliates,she examines how the entry of an affiliate is affected by the existence of the other affiliates in the same firm. This paper is also the first one that conducts the similar analysis in the context of exit of MNEs' affiliates. Namely, by using the data of Japanese MNEs' overseas affiliates, we examine how the exit of an affiliate is affected by the existence of the other affiliates in the same firm.

The existence of the other affiliates within the same MNE has an influence on the

[2] Stafford (1991), Kirkham and Watts (1997), Watts and Kirikham (1999), and Richbell and Watts (2000) are the examples of the descriptive analysis on plant exit in the case of multiple-plant firm.

exit decision on an affiliate in some ways. The one effect is through the mechanics of export platform FDI. Yeaple (2003) and Ekholm *et al.* (2007) explore theoretically the motives of the export platform FDI strategies that adopt one host country as a platform from which to serve third countries. This type of FDI becomes optimal for firms when the host country has good access to those third countries. The validity of this mechanics is confirmed by Blonigen *et al.* (2007) and Ekholm *et al.* (2007). In the context of overseas affiliates' exit, an affiliate will be more likely to be shut down if its MNE has other affiliates with the good access to countries to which that affiliate supplies. The other effect is through the mechanics of complex vertical FDI (VFDI). Blonigen *et al.* (2007) and Hayakawa and Matsuura (2011) examine the mechanics of this type of FDI, of which aim is to get engaged in production process-wise vertical division of labor among multiple overseas affiliates. This type of FDI becomes optimal if countries in which those overseas affiliates locate have large differences in location advantages (e.g. wages) and if trade costs among those countries are low enough. Therefore, in our context, an affiliate will be more likely to exit if its location is less desirable for conducting the vertical division of labor with the other affiliates, say, if the MNE does not have other affiliates with the good access to an affiliate's location. As a result, the direction of the network effects will show which kind of mechanics is stronger.[3]

During a few decades, MNEs have located a large number of overseas affiliates in the world. Hereafter, their exit based on the global reallocation strategy might show a significant increase. Therefore, it is becoming important to clarify the mechanics of exit of MNEs' overseas affiliates. The results on the effects through the existence of

[3] Unlike ours, Chen (2011) investigates these two mechanics separately by differentiating FDI types and affiliates' production process (i.e. finished goods production or intermediate goods production). Unfortunately, our dataset does not allow us to differentiate these.

the other affiliates within the same MNE will uncover the trend of affiliates' location. On the one hand, if MNEs intend to shut down affiliates with good access from the other affiliates, the distribution of overseas affiliates will be regionally dispersed. Then, affiliate or country characteristics become important in determining which affiliate within the region is shut down. On the other hand, if MNEs are more likely to shut down affiliates without good access from the other affiliates, MNEs concentrate their affiliates in a particular region, e.g. Asia, and then supply products to the world from those affiliates. In short, as in the analysis of location choice of MNEs' affiliates, our paper contributes to predicting the future trend of the location distribution of MNEs' affiliates.

The rest of this paper is organized as follows. The next section explains our empirical framework to investigate the exit of Japanese MNEs' affiliates in the world. In Section 3, we present some data issues including data sources and then take a brief look at the exit of Japanese MNEs' affiliates in the world. Section 4 reports our empirical results, and Section 5 concludes on this paper.

2. Empirical Framework

This section first provides the simple conceptual framework to motivate our empirical specification and then explains the detailed specification of our estimation equation. The framework provided here is invaluable to clarify under what kinds of decision problems the empirical equation for our analyses on plants' exit is specified.

2.1. Settings

We begin by specifying the current profit of a firm j's plant i in country r at year t.

Let π_{ijrt} ($\mathbf{x}_{it}$, $\mathbf{m}_{rt}$) be the maximum profits earned by this plant. The profit is a function of a set of plant specific elements $\mathbf{x}$ (e.g. plant's employment) and a set of country specific elements $\mathbf{m}$ (e.g. wages).$\mathbf{x}_{it}$and $\mathbf{m}_{rt}$ are row vectors.[4] These elements may be affected by some kinds of exogenous shocks. In the literature, it is assumed that a plant makes a decision to continue operating in a country at the start of each year prior to observing the values of $\mathbf{x}$and $\mathbf{m}$ for that year. Namely, the plant decides to produce in year $t + 1$ by comparing the expected discounted sum of profits from operating, E(V_{ijrt+1}), with scrap values F. We simply assume that F is identical across plants. The expected future profits are calculated based on the knowledge of the profit function π_{ijrt+1}, the observed state variables for year t (i.e. ($\mathbf{x}_{it}$, $\mathbf{m}_{rt}$)), and knowledge of the transition process for the state variables (though $\mathbf{m}_{rt}$ should be taken for each firm/plant as exogenous variables). If E(V_{ijrt+1}) – $F \geq 0$, the plant continues in the country and we observe discrete variable Y_{ijrt+1}= 0. Otherwise, we observe Y_{ijrt+1}= 1. As a result, the empirical model expresses the discrete exit variable in year t+1 as a function of state variables, i.e. Y_{ijrt+1}($\mathbf{x}_{it}$, $\mathbf{m}_{rt}$).[5]

The above-outlined framework is the basis for many of the empirical exit studies in the literature (see, for example, Dunne *et al*., 2005).[6] For our analysis, however, it is necessary to depart from this model in order to take into account the existence of multiple plants within the same firm. Indeed, it is natural that the decision of overseas affiliates' exit is made by not such affiliates themselves but their parent firm. Then, the parent makes the decision of affiliate's exit, based on the comparison of the joint

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[4] Firm specific elements are another kind of important elements. However, since data on parent firms are not available in this study, we do not consider firm specific elements.

[5] More precisely Y_{ijrt+1} is defined conditional on that $Y_{ijrt+1} = 0$, $k = 0, \ldots, K$. Time t-K is the entry year of this plant.

[6] The general theoretical framework for firms' entry and exit is provided in Ghemawat and Nalebuff (1985), Hopenhayn (1992), Ericson and Pakes (1995) and so on.

expected profits of all plants within the same firm according to affiliate's exit. In addition, we assume that firms need to pay some kind of fixed costs for shutting down their plants rather than get some amount of positive scrap values. In the case of MNEs' affiliates, it is rare that firms can obtain a positive value of revenue. Rather, their exit requires firms to incur some amount of costs when they shut down their affiliates particularly in developing countries.[7] If such costs are greater than the so-called scrap values, firms need to incur some amount of costs in net.

In order to simplify our analysis, we consider this decision problem under some assumptions. First, we assume that a firm does not shut down more than one plant at the same time. Second, firms do not make their decision on entry and exit simultaneously. Then, plant i continues if

$$\sum_{l \in R} \sum_{f \in \Omega_{jlt}} E\left(V_{fjlt+1} \mid \forall q \in R, \forall k \in \Omega_{jqt}, Y_{kjqt+1} = 0\right) \geq$$

$$\sum_{l \in R} \sum_{f \in \Omega_{jlt}-\{i\}} E\left(\begin{array}{c} V_{fjlt+1} \mid i \in \Omega_{jrt}, Y_{ijrt+1} = 1; \\ \forall q \in R, \forall k \in \Omega_{jqt} - \{i\}, Y_{kjqt+1} = 0 \end{array}\right) - F \qquad (1)$$

Ω_{jlt} denotes a set of affiliates in country l in firm j in year t. R is a set of countries. Due to the first assumption, we can explore plant i's exit under the condition that the other plants in the same firm remain alive. In other words, we do not examine the number of plants to be shut down. Also, the second assumption enables us to fix sets of affiliates within a firm, i.e. Ω_{jlt}. The left hand side indicates the joint expected profits of all plants within firm j under the condition that all plants including plant i survive in year t+1. The first term of the right hand side indicates the joint expected profits of all plants other than plant i under the condition that only plant i exits in year t+1. Namely, plant i continues if and only if the joint expected profits of all plants within the same

[7] For example, suppose that an affiliate obtains 5-year exemption of corporate tax from investment authorities in the host country as investment incentive schemes. If it exits in three year (i.e. less than five years), then it must pay three-year corporate tax to the government of host country as a penalty.

firm are greater than the joint expected profits of the other plants minus the fixed exit cost.

This equation can be rewritten as:

$$E\left(V_{ijrt+1} \middle| \forall q \in R, \forall k \in \Omega_{jqt}, Y_{kjqt+1} = 0\right) \geq -F + \sum_{l \in R} \sum_{f \in \Omega_{jlt}-\{i\}} \left\{ \begin{array}{c} E\left(V_{fjlt+1} \middle| i \in \Omega_{jrt}, Y_{ijrt+1} = 1;\ \forall q \in R, \forall k \in \Omega_{jqt} - \{i\}, Y_{kjqt+1} = 0\right) \\ -E\left(V_{fjlt+1} \middle| \forall q \in R, \forall k \in \Omega_{jqt}, Y_{kjqt+1} = 0\right) \end{array} \right\}. \quad (2)$$

The left hand side is the usual expected profits in plant *i*. The second term of the right hand side captures the difference of the expected profits in the other plants according to plant *i*'s exit, namely "expected exit effects" in the other plants. Plant *i* continues if the expected future profit of plant *i* is as large as or larger than the expected exit effect in the other plants (minus fixed exit cost). We call this expected exit effects "network effects" and discuss more closely later how the network effects affect plants' exit. Based on this framework, we formalize our estimation equation as follows:

$$\mathrm{Prob}\left(Y_{ijrt+1} = 1\right) = \Phi\left(\mathbf{x}_{it}, \mathbf{m}_{rt}, \mathbf{G}_{ijrt}\right), \quad (3)$$

where Φ (•) is the standard normal distribution function. $\mathbf{G}_{ijrt}$ is a set of elements capturing the network effects in the other plants (a row vector).

Although this framework is based on the above-mentioned two kinds of strong assumptions, its generalization and its more detailed examination are quite complicated. Indeed, the theoretical framework becomes quite complicated in the case of multiple plants and changes the results obtained in the case of single plant (see, for example, Whinston, 1988). For example, if the exit of only plant *i*is optimal, the right hand side of (2) should be less than so many kinds of the joint expected profits, depending on how many plants are shut down. Furthermore, even in the case of shutting down two plants, if a firm has a number of plants, there are so many combinations of two plants to be shut down. Such generalization and examination are beyond our scope here. The aim of this section is to relate the relative position of a plant among all plants within the same firm, with that plant's exit, i.e. network effects. T hus, our reduced-form empirical analysis in this paper does not take into account the number of exit plants and the simultaneous decision on entry and exit.

2.2. Variables

In our model, each kind of elements includes the following. The plant specific elements **x**include its number of employment (Employment), a share of parent's capital (Control Share), and its age (Age). The larger sized-plants are more likely to survive due to the larger operating profit. One may argue that since joint-venture affiliates (affiliates with the lower capital share of parents) are more likely to have been involved with local sales or procurement network, they are able to cope better with negative shocks in the domestic market. On the contrary, the higher capital share enables affiliates to obtain the larger share of operating profits. Thus, the effect of control share is ambiguous.The older plants may be more likely to survive because of much knowledge on international activities.[8]

Country specific elements **m** are GDP, GDP growth, GDP per capita, the number of Japanese affiliates with the same industry as a concerned affiliate, inflation, exchange rate volatility, regulation, and minimum efficient scale. First, the effect of GDP on exit will reflect the motivation of FDI. Namely, GDP is negatively related to affiliates' exit in the case of market-seeking FDI, but not related to that in the case of efficiency-seeking FDI.[9] Not only its level but also its growth will affect the exit

[8] Due to the data unavailability, we cannot examine the roles of affiliates' and their parents' productivity.

[9] Alfaro and Charlton (2009) propose the empirical method to identify FDI types, i.e. horizontal

decision of affiliates through the changes of expected profits. Second, we use GDP per capita as a proxy for general wages, which will be positively related to affiliates' exit. Third, affiliates enjoy various kinds of lower transaction costs in the location with the agglomeration of the same nationality and industry affiliates, resulting in a lower probability of exit. However, due to the fiercer competition among those affiliates, they may escape from such location. Fourth, the high inflation lowers the expected profits through, say, the rise of production cost in the transition process. Thus, the exit will be more likely to be observed in affiliates in higher inflation countries. Fifth, affiliates in countries with the higher volatility of exchange rates are less likely to survive due to the decrease of the expected profits through the more uncertainty. Sixth, affiliates in countries with the more regulated rules of credit, labor, and business may lower the operating profit. On the other hand, in such countries, the exit *per se* may be hard action. Thus, the effects of regulation on exit will be ambiguous. We also examine the role of entry barriers on affiliate exit by including the Minimum Efficient Scale measure; affiliates operating in industries with the higher entry barriers are more likely to survive.

We construct variables on the network effects in the other plants, based on the above discussion. In particular, we shed light on the network effects through trade costs. Specifically, a raw vector of $\mathbf{G}_{ijrt}$ is constructed as follows:

$$\mathbf{G}_{ijrt} = (\mathbf{E}_{jt}\mathbf{W'}_{\mathrm{D}rt} \quad \mathbf{E}_{jt}\mathbf{W'}_{\mathrm{T}rt}),$$

where $\mathbf{W}_{\mathrm{D}rt} = (d_{r1t} \quad \cdots \quad d_{rct}), \mathbf{W}_{\mathrm{T}rt} = (\tau_{r1t} \quad \cdots \quad \tau_{rct}), \mathbf{E}_{jt} = (e_{j1t} \quad \cdots \quad e_{jct})$.

c is a total number of sample countries. d_{rlt} and τ_{rlt} are the (naturally-logged) geographical distance between countries r and l in year t and tariff rates of country r

FDI or vertical FDI. However, our data do not allow us to examine the exit of market-seeking FDI and efficiency-seeking FDI separately because the available industrial identification in our dataset is too rough to o that method. Also see footnote 3.

for country l in year t, respectively. Both distance and tariff rates are normalized by the largest distance and highest tariff rates. Since the geographical distance is time-invariant,$d_{rlt} = d_{rl}$ for all t. e_{jlt} is an indicator variable taking unity if firm j has affiliates in country l in year t and zero otherwise. Also, e_{jlt} sets zero if $l = i$. For example, if firm j has other affiliates in countries 3 and 5, an element of $\mathbf{E}_{jt}\mathbf{W'}_{\mathrm{D}rt}$ becomes $(d_{i3} + d_{i5})$. Namely, this indicator measures how geographically close the other affiliates in firm j are to country r. Similarly, $\mathbf{E}_{jt}\mathbf{W'}_{\mathrm{T}rt}$measures how much tariff rates the other plants within the same plant need to pay in exporting to the country in which plant i locates. In order to avoid that the results of these network variables simply reflect the effects of the increase of affiliates, we introduce the number of firm's affiliates in the world as an independent variable.

In considering how the network effects affect plants' exit, it is invaluable to take into consideration two types of FDI, as in Chen (2011). The one is export platform FDI, in which MNEs' strategy is to adopt one host country as a platform to serve third countries (Ekholm *et al.,* 2007). In the case of this type of FDI, if plant i exits, the other plants will supply products to the markets where plant i used to do. Namely, it can be said that those effects are sensitive to how much the other plants substitute for a plant i. Thus, the better access to plant i the other plants have, the more likely plant $i$is to be shut down. This can be said as a substitutability perspective. The other is complex vertical FDI (complex VFDI), in which MNEs get engaged in production process-wise vertical division of labor among their *multiple* overseas plants (see, for example, Hayakawa and Matsuura, 2011). I n this case, if the other plants have better access to plant i, plant i is more likely to be involved into the production process-wise vertical division of labor and thus to survive. This can be said as a complimentary perspective. In sum, there are two countervailing forces. If the substitutability perspective works more strongly in firms' decision on plants' reallocation, the better access to plant *i* the other plants have, the more likely plant *i*is to be shut down.

3. Data Issues

In this section, we first provide our data sources for empirical analysis and then take a brief overview of Japanese overseas affiliates' exit.

Our data source of Japanese overseas affiliates' exit is the following. In Japan, there are two kinds of firm-level surveys on overseas activities. One is "Basic Survey of Oversea Business Activity" (hereafter we call BSOBA) annually compiled by Ministry of Economy, Trade and Industry (METI). The other is "Oversea Japanese Companies Data" (hereafter we call OJCD data) compiled by a private company, Toyo Keizai INC. The former survey contains the rich information on Japanese overseas affiliates' characteristics, such as affiliates' sales, profit, and cost structure. However, since the response rate is only around 60%, a significant fraction of"exiting" affiliates in BSOBA data is still active and but just stops responding the survey. On the other hand, OJCD data contain the list of exiting affiliates, which further provides us the information on exit form; withdrawal (including bankruptcy and liquidation) or decline in control share. As a result, since we can differentiate purely exiting affiliates with those stopping the response,we use OJCD data for Japanese overseas affiliates' exit. From the sample for estimation, we exclude the affiliates who disappear in the data by stopping responding the survey.

The data sources of each variable are as follows. As for host country characteristics, we obtain the data on GDP, GDP per capita, GDP deflator, and

Japanese affiliates (and country-level dataenough for our analyses). We restrict sample affiliates only to those in manufacturing industry. The industrial sectors include Food, Textile, Paper products, Printing products, Chemicalproducts, Petroleumproducts, Rubberproducts, Non-metallic mineral products, Iron and steel, Non-ferrous metal, Metal products, General machinery, Electric machinery, Transport equipment, Automobile, Precision machinery, and Other manufacturing industries. The basic statistics are provided in Table 1.

inflation from World Development Indicator (World Bank).[10] The index on the regulation of credit, labor, and business is drawn from the Economic Freedom of the World: 2010 Annual Report. The literature analyzing the impacts of exchange rate volatility on trade has applied various kinds of variables for exchange rate volatility.[11] In this paper, following Rose (2000), we use a widely-used indicator, the real exchange rate volatility, which is constructed as the standard deviation of the first-difference of the monthly natural logarithm of bilateral real exchange rates in the five years preceding period *t*. The necessary data for this variable are drawn from International Financial Statistics (International Monetary Fund). For industry attributes, it is desirable to control the differences in efficient scale of production by industries. Following the discussion by Lyons (1980), we use the average value of shipment, which is calculated using the 1995 Census of Manufacturer (METI), as a proxy for Minimum Efficient Scaleby industry. As for the proxy for trade cost, we use bilateral distance and tariff. The data on distance are from CEPII website.[12] Our data source for tariff rates is the World Integrated Trade Solution (WITS), particularly TRAINS raw data.[13]

The sample years of affiliates' exit are from 1991 to 2008. All of the independent variables are one year lagged. Sample host countries are 39 countries, which are listed in Appendix. These countries are selected as those having a relevant number of

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10 GDP and GDP per capita are deflated by GDP deflator.

11 In this literature, there are a large number of theoretical and empirical studies (see, for example, McKenzie, 1999; Clark *et al.*, 2004).

12 http://www.cepii.fr/

13 In addition, some other sources are used for identifying the best tariff scheme for individual trading partners. In particular, we need to make a list of member countries of the WTO and each RTA. Also, GSP beneficiaries are different across importers. Information on the WTO and RTAs is obtained from the WTO website. We use the "Regional Trade Agreements Information System" for obtaining the RTA member list. As for GSP beneficiaries, we used several documents available on the UNCTAD website in addition to official documents on the national custom's website of each country.

Table 1: Basic Statistics

	N	Mean	SD	p10	p90
Exit	82,630	0.014	0.117	0	0
Employment	82,630	4.836	1.546	2.890	6.745
Relative Employment	82,630	0.549	0.401	0.043	1
Control Share	82,630	0.724	0.279	0.320	1
Age	82,630	2.301	0.746	1.386	3.258
Numebr of affiliates in an MNE	82,630	7.678	11.022	0	21
GDP	82,630	27.041	1.568	25.179	29.711
GDP Growth	82,630	0.054	0.044	0.011	0.096
GDP per capita	82,630	8.424	1.406	6.718	10.311
Number of Japanese affiliates	82,630	5.940	1.150	4.26268	7.328437
Inflation	82,630	0.181	1.688	0.000	0.089
Volatility	82,630	0.049	0.084	0.024	0.056
Regulation	82,630	6.342	1.300	4.700	8.200
Minimum Efficient Scale	82,630	7.099	0.982	5.672359	8.404477
Number of affiliates in the same region	82,630	1.044	1.960	0.000	3.000
Number of affiliates in the same country	82,630	0.558	1.454	0	2
Network effects through distance	82,630	3.085	3.904	0.000	7.886
Network effects through distance (excl. Japan)	82,630	3.933	3.912	0.773465	8.715
Distance from Japan	82,630	8.384	0.724	7.649	9.292
Network effects through tariff	82,630	1.768	2.239	0.000	4.571
Network effects through tariff (excl. Japan)	82,630	2.268	2.245	0.475893	5.065
Tariff rates for Japan	82,630	1.351	2.282	0	5.132

Note: We take logs of Employment, GDP, GDP per capita, Number of Japanese affiliates, Minimum Efficient Scale, and Distance from Japan.

Next, we take a brief overview of Japanese overseas affiliates' exits. Table 2 reports those by regions. Most of the exits occurred in developed countries including North America, NIEs, and Western Europe, in the former half of the 1990s. On the other hand, in the period of Asian currency crisis (i.e. the latter half of the 1990s), the major exit of Japanese affiliates can be observed in Asian developing countries including China and ASEAN, in addition to developed countries. In the 2000s, most of the exits have occurred in China. Taking a look at the exit rate, which is defined as a share of the exit number in the next year in the total number of affiliates in the concurrent year, we can see that it is around 1%. Next, Table 3 reports Japanese overseas affiliates' exit by affiliates' industries. Most of the exits of Japanese overseas affiliates can be observed in textile, chemical, general machinery, electric machinery, and transport equipment industries. In particular, electric machinery industry shows relatively the large number and the high exit rate.

Table 2: Exit of Japanese Affiliates by Regions

	NAmerica		MSAmerica		ASEAN4		NIES		China		Other Asia		WEurope		EEurope		Oceania		Africa	
	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)
1990	12	2%	1	1%	5	1%	11	1%	0	0%	0	0%	3	1%	0	0%	1	2%		
1991	8	1%	4	2%	4	0%	16	2%	0	0%	0	0%	0	0%	0	0%	2	3%		
1992	7	1%	1	1%	3	0%	9	1%	0	0%	0	0%	6	2%	0	0%	2	3%		
1993	18	2%	3	1%	6	1%	13	1%	0	0%	1	2%	3	1%	0	0%	2	3%		
1994	9	1%	0	0%	3	0%	12	1%	1	0%	1	2%	4	1%	0	0%	1	1%		
1995	17	2%	3	1%	3	0%	13	1%	1	0%	1	2%	13	3%	0	0%	3	4%		
1996	13	2%	1	1%	7	1%	13	1%	0	0%	1	2%	7	2%	0	0%	2	3%		
1997	23	3%	2	1%	4	0%	16	2%	5	0%	0	0%	5	1%	0	0%	0	0%		
1998	21	3%	3	2%	12	1%	21	2%	14	1%	1	1%	8	2%	0	0%	0	0%		
1999	31	4%	3	2%	18	1%	17	2%	19	1%	3	3%	9	2%	1	7%	3	4%		
2000	21	3%	5	3%	9	1%	16	2%	9	1%	1	1%	7	2%	0	0%	0	0%		
2001	17	2%	3	2%	14	1%	16	2%	19	1%	2	2%	7	2%	1	6%	3	4%	0	0%
2002	31	4%	0	0%	16	1%	15	2%	16	1%	2	2%	12	3%	1	5%	1	2%	0	0%
2003	10	2%	2	1%	14	1%	10	1%	18	1%	2	1%	13	4%	0	0%	2	4%	0	0%
2004	13	2%	1	1%	15	1%	9	1%	18	1%	0	0%	9	3%	2	10%	0	0%	0	0%
2005	5	1%	1	1%	19	1%	8	1%	19	1%	1	1%	6	2%	0	0%	1	2%	0	0%
2006	5	1%	2	1%	16	1%	8	1%	26	1%	2	1%	7	2%	0	0%	0	0%	0	0%
2007	13	3%	2	2%	31	2%	31	5%	48	3%	1	0%	11	4%	0	0%	0	0%	1	13%

Source:Authors' calculation using "Oversea Japanese Companies Data" compiled by Toyo Keizai INC

Notes: Columns (I) and (II) report the number of exit and an exit rate, respectively. The exit rate is defined as a share of the exit number in the next year in the total number of affiliates in the concurrent year.NAmerica, MSAmerica, WEurope, and EEurope indicate North America, Middle and South America, Western Europe, and Eastern Europe, respectively.

Table 3: Exit of Japanese Affiliates by Industries

	Food		Textile		Wood		Paper and Paper products		Printing		Chemicals		Petroleum		Rubber		Non-Metalic Mineral products	
	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)
1990	2	1%	2	1%	0	0%	0	0%	0	0%	6	2%	0	0%	1	1%	3	4%
1991	1	1%	3	1%	0	0%	0	0%	1	3%	2	1%	0	0%	1	1%	0	0%
1992	1	1%	2	1%	0	0%	0	0%	0	0%	1	0%	0	0%	2	1%	0	0%
1993	0	0%	5	2%	2	4%	3	7%	1	3%	7	2%	0	0%	2	1%	1	1%
1994	3	1%	2	1%	3	5%	0	0%	0	0%	2	0%	0	0%	2	1%	1	1%
1995	4	2%	3	1%	0	0%	0	0%	0	0%	6	1%	0	0%	1	1%	0	0%
1996	2	1%	2	1%	1	2%	2	4%	0	0%	3	1%	0	0%	0	0%	1	1%
1997	3	1%	5	1%	1	2%	1	2%	0	0%	4	1%	0	0%	3	1%	2	1%
1998	7	2%	7	2%	2	3%	0	0%	4	9%	7	1%	0	0%	3	1%	1	1%
1999	8	3%	16	4%	0	0%	1	2%	1	2%	8	1%	0	0%	3	1%	6	3%
2000	3	1%	2	0%	1	2%	0	0%	0	0%	13	2%	0	0%	2	2%	2	1%
2001	7	2%	13	3%	0	0%	1	2%	2	5%	4	1%	4	1%	0	0%	1	1%
2002	6	2%	9	2%	2	3%	1	2%	1	2%	16	2%	0	0%	2	1%	1	1%
2003	5	2%	2	0%	2	3%	0	0%	0	0%	10	1%	0	0%	3	2%	2	1%
2004	3	1%	6	1%	0	0%	0	0%	0	0%	11	1%	0	0%	1	1%	1	1%
2005	1	0%	13	3%	3	6%	0	0%	0	0%	8	1%	0	0%	1	1%	0	0%
2006	1	0%	9	2%	2	5%	0	0%	2	6%	10	1%	0	0%	1	1%	5	4%
2007	5	2%	11	3%	1	3%	3	5%	2	7%	19	2%	0	0%	1	1%	7	5%

Table 3: Exit of Japanese Affiliates by Industries (Conti.)

	Iron and Steel		Non-ferrous Metal		Metal Products		General Machinery		Electric Machinery		Transport Equipment		Automobile		Precision Machinery		Other Manufacturing	
	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)
1990	2	2%	0	0%	1	1%	0	0%	13	2%	2	3%	0	0%	0	0%	1	1%
1991	3	3%	1	1%	3	2%	5	2%	7	1%	0	0%	5	2%	1	1%	1	1%
1992	0	0%	0	0%	1	1%	5	1%	8	1%	0	0%	4	1%	2	2%	2	1%
1993	2	2%	0	0%	3	2%	3	1%	9	1%	2	3%	1	0%	1	1%	4	2%
1994	0	0%	0	0%	1	1%	5	1%	6	1%	1	1%	0	0%	1	1%	4	2%
1995	1	1%	3	2%	3	2%	6	2%	17	2%	1	1%	6	1%	0	0%	3	1%
1996	0	0%	1	1%	2	1%	6	1%	13	1%	2	2%	6	1%	2	2%	1	0%
1997	1	1%	0	0%	0	0%	5	1%	16	2%	1	1%	6	1%	1	1%	6	3%
1998	3	2%	6	4%	5	2%	6	1%	16	2%	0	0%	7	1%	3	2%	3	1%
1999	2	1%	2	1%	4	2%	15	3%	18	2%	1	1%	12	2%	1	1%	6	2%
2000	0	0%	3	2%	5	2%	8	1%	17	2%	2	2%	8	1%	1	1%	1	0%
2001	2	2%	1	1%	3	1%	5	1%	25	3%	3	3%	7	1%	1	1%	3	2%
2002	1	1%	3	2%	7	3%	7	1%	22	2%	4	8%	4	1%	4	3%	4	3%
2003	3	3%	1	1%	2	1%	11	2%	16	2%	1	3%	6	1%	3	2%	4	4%
2004	0	0%	1	1%	1	0%	7	1%	23	2%	0	0%	9	1%	3	2%	1	1%
2005	0	0%	2	2%	1	0%	8	1%	18	2%	0	0%	2	0%	3	2%	0	0%
2006	0	0%	1	1%	1	0%	6	1%	21	2%	0	0%	3	0%	1	1%	3	2%
2007	3	2%	4	3%	9	3%	20	3%	31	4%	0	0%	11	1%	6	5%	5	3%

Source: Authors' calculation using "Oversea Japanese Companies Data" compiled by Toyo Keizai INC

Notes: Columns (I) and (II) report the number of exit and an exit rate, respectively. The exit rate is defined as a share of the exit number in the next year in the total number of affiliates in the concurrent year.

4. Empirical Result

This section reports the estimation results of our probit model on exit. We first report those for the model without the network effects in the other plants and then those for the model with such effects. We also conduct some other estimation.

4.1. Baseline Results

Our baseline results without the network effectsare provided in column (I) in Table 4. In this specification, we include only year dummy variables. Firstly, the results in affiliate characteristics are as follows. As is consistent with our expectation, the larger-sized affiliates are less likely to be shut down. This result is also consistent with the results obtained in the usual analysis on plants' exit listed in the introductory section. Specifically, affiliates with 10% larger size have 2% lower probability of exit. The less likely exit can be detected in affiliates with the higher capital share of parents, indicating that the larger share of operating profits is more dominant factor than the better knowledge on local markets acquired from the local partner firms. The coefficient for affiliates' age is estimated to be insignificant. In addition, the coefficient for the number of affiliates in each MNE, which can be taken as a parent characteristic, is estimated to be significantly positive, indicating that the affiliates in the MNEs with a larger number of affiliates in the world are more likely to be shut down.

Table 4: Probit Results (Marginal Effect)

	(I)	(II)	(III)	(IV)
Affiliate characteristics				
Employment	-0.002	-0.002		
	[0.0003]***	[0.0003]***		
Relative Employment			-0.006	-0.006
			[0.0010]***	[0.0010]***
Control Share	-0.007	-0.009	-0.007	-0.009
	[0.0013]***	[0.0013]***	[0.0014]***	[0.0013]***
Age	0.000	0.000	-0.001	-0.001
	[0.0006]	[0.0006]	[0.0005]*	[0.0005]**
Parent characteristics				
Number of affiliates in an MNE	0.00007	0.00005	-0.00007	-0.00010
	[0.0000]**	[0.0000]	[0.0000]*	[0.0000]**
Country characteristics				
GDP	0.0007	0.0008	0.0007	0.0008
	[0.0003]**	[0.0003]**	[0.0003]**	[0.0003]**
GDP Growth	0.02	0.02	0.02	0.02
	[0.0116]*	[0.0113]	[0.0117]*	[0.0115]
GDP per capita	0.003	0.003	0.004	0.003
	[0.0005]***	[0.0005]***	[0.0005]***	[0.0005]***
Number of Japanese affiliates	-0.0007	-0.0007	-0.0005	-0.0006
	[0.0004]	[0.0004]*	[0.0004]	[0.0004]
Inflation	-0.0002	-0.0001	-0.0002	-0.0002
	[0.0003]	[0.0003]	[0.0003]	[0.0003]
Volatility	0.002	0.003	0.002	0.003
	[0.0049]	[0.0047]	[0.0049]	[0.0048]
Regulation	0.0002	0.0006	0.0001	0.0005
	[0.0005]	[0.0005]	[0.0005]	[0.0005]
Minimum Efficient Scale	-0.002		-0.002	
	[0.0004]***		[0.0004]***	
Year dummy	Yes	Yes	Yes	Yes
Industry dummy	No	No	Yes	Yes
Log-likelihood	-5867	-5814	-5881	-5841
Number of observations	82,630	82,630	82,630	82,630
Pseudo R-squared	0.0348	0.0436	0.0326	0.0392

Notes: The dependent variable takes unity if an affiliate exits and zero otherwise. The parentheses are robust standard errors. *** and ** show 1% and 5% significance, respectively.

The results in host country characteristics are as follows. The coefficient for GDP is estimated to be positively significant, which is a result unfavorable for market-seeking

FDI.[14] As is consistent with this result, GDP growth has significantly positive effect on the exit. GDP per capita has significantly positive coefficient, indicating that Japanese MNEs are likely to shut down their affiliates in high wage countries. For example, affiliates in countries with 10% higher wages have 3% higher probability of exit. The coefficient for Number of Japanese affiliates is insignificant, indicating the benefits from the same-nationality plant agglomeration (lower transaction costs) are offset by its costs (tougher competition). Inflation and exchange rate volatility have insignificant coefficients, which imply no significant impacts on the expected profits of affiliates. We do not find a significant effect of regulation, indicating its neutral contribution to the exit of affiliates. The coefficient for Minimum Efficient Scale is estimated to be significantly negative. Namely, the higher entry barriers decrease the exit probability of the affiliate exit.

We also conduct some more estimation. In column (II), we introduce an industry dummy variable, which forces us to drop an industry-specific time-invariant variable, Minimum Efficient Scale. Except for GDP growth and the number of Japanese affiliates, the results are qualitatively unchanged. The affiliates in countries with the larger agglomeration of Japaneseaffiliates are less likely to be shut down. In columns (III) and (IV), we explore the relative employment size of an affiliate in same-firm's overseas affiliates, instead of its absolute size. Specifically, the relative employment size is a ratio of an affiliate's employment to the largest affiliate's employment (do not include the employment in Japan due to the data unavailability). Namely, this variable of the relative employment size includes information on not only an affiliate but also the other

[14] We also try to include industrial value-added instead of industry-invariant GDP, of which data are drawn from UNIDO Industrial database. We obtain insignificant coefficients for the industrial value-added.

affiliates in the same firm. In this sense, this variable may play a role of exploring not only affiliate characteristics but also the network effects. The coefficient for this new variable is estimated to be significantly negative, indicating that relatively large-sized affiliates among same firm's affiliates are less likely to be shut down. As mentioned just above, since this variable includes more information, we use this relative size variable in the following analyses. The noteworthy differences with the previous results are as follows. The coefficient for Age turns out to be significantly negative, implying that the older affiliates are less likely to be shut down, maybe due to the more knowledge on the local economy. Also, the coefficient for Number of affiliates in an MNE turns out to be significantly negative; the affiliates in the MNEs with a larger number of affiliates in the world are less likely to be shut down.

4.2. Network Effects

In this subsection, we examine the network effects on affiliates' exit. But before that, we simply examine the effects of existence of affiliates within the same region belonging to the same firm. Specifically, columns (II) and (III) include variables of "Number of affiliates in the same region" and of "Number of affiliates in the same country", which are the numbers of affiliates within the same region and country belonging to the same firm, respectively. Indeed, our network variables do not take the existence of same-firm's affiliates within the same country into account. Thus, "Number of affiliates in the same country" complements our network variables. Also, we examine the case of the same region, of which effects might be seen as the middle effects between those captured by the case of the same country and those captured by our network variables. The results in the previous variables are qualitatively unchanged. While the coefficient for Number of affiliates in the same region is estimated to be insignificant, that for Number of affiliates in the same country is significantly positive. Thus, MNEs are more likely to shut down some of affiliates if they have a larger number of affiliates within the same country.

Table 5: Probit Results on Network Effects (Marginal Effect)

	(I)	(II)	(III)	(IV)	(V)	(VI)
Affiliate characteristics						
Relative Employment	-0.006	-0.006	-0.007	-0.007	-0.007	-0.007
	[0.0010]***	[0.0010]***	[0.0010]***	[0.0010]***	[0.0010]***	[0.0010]***
Control Share	-0.009	-0.009	-0.008	-0.008	-0.008	-0.008
	[0.0013]***	[0.0013]***	[0.0013]***	[0.0013]***	[0.0013]***	[0.0013]***
Age	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	[0.0005]**	[0.0005]**	[0.0005]	[0.0005]	[0.0005]	[0.0005]
Parent characteristics						
Number of affiliates in an MNE	-0.00011	-0.00014	-0.00001	-0.00001	-0.00001	-0.00001
	[0.0000]**	[0.0000]***	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Country characteristics						
GDP	0.0008	0.0007	0.0007	0.0007	0.0009	0.0007
	[0.0003]**	[0.0003]**	[0.0003]**	[0.0003]**	[0.0004]**	[0.0003]**
GDP Growth	0.02	0.02	0.01	0.01	0.01	0.01
	[0.0115]	[0.0114]	[0.0113]	[0.0112]	[0.0114]	[0.0112]
GDP per capita	0.004	0.004	0.003	0.003	0.003	0.003
	[0.0005]***	[0.0005]***	[0.0005]***	[0.0005]***	[0.0006]***	[0.0005]***
Number of Japanese affiliates	-0.0006	-0.0008	-0.0012	-0.0012	-0.0014	-0.0012
	[0.0004]	[0.0004]*	[0.0004]***	[0.0004]***	[0.0005]***	[0.0004]***
Inflation	-0.0002	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
	[0.0003]	[0.0003]	[0.0003]	[0.0003]	[0.0003]	[0.0003]
Volatility	0.003	0.003	0.003	0.003	0.004	0.004
	[0.0048]	[0.0048]	[0.0047]	[0.0047]	[0.0048]	[0.0047]
Regulation	0.0005	0.0006	0.0006	0.0005	0.0009	0.0007
	[0.0005]	[0.0005]	[0.0005]	[0.0005]	[0.0007]	[0.0005]
Network effects						
Number of affiliates in the same region	0.0001					
	[0.0002]					
Number of affiliates in the same country		0.0008	0.0011	0.0011	0.0011	0.0011
		[0.0003]***	[0.0002]***	[0.0002]***	[0.0002]***	[0.0002]***
Network effects through distance			-0.0009			
			[0.0001]***			
Network effects through distance					-0.0009	
(excluding Japan)					[0.0001]***	
Distance from Japan					-0.001	
					[0.0010]	
Network effects through tariff				-0.0017		
				[0.0002]***		
Network effects through tariff						-0.0017
(excluding Japan)						[0.0002]***
Tariff rates for Japan						0.00094
						[0.0004]**
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
Log-likelihood	-5836	-5840	-5813	-5811	-5812	-5809
Number of observations	82,630	82,630	82,630	82,630	82,630	82,630
Pseudo R-squared	0.0400	0.0393	0.0438	0.0441	0.0439	0.0445

Notes: The dependent variable takes unity if an affiliate exits and zero otherwise. The parentheses are robust standard errors. *** and ** show 1% and 5% significance, respectively.

In columns (III) and (IV), we explore our variables of network effects through tariff rates and geographical distance. Due to the high correlation between those two kinds of variables (97%), we examine those separately. The number of Japanese affiliates has significantly negative coefficients. The coefficients for two kinds of network variables are estimated to be significantly negative. Due to the high correlation, we cannot interpret the roles of networks through distance and tariff rates separately. Thus, we safely interpretthis estimation result as indicating that affiliates in countries to which the other same-firm affiliates have better market access are more likely to be shut down. In other words, if the other affiliates within the same firm can substitute well for an affiliate, such an affiliate is less likely to survive. In this sense, we can say that the substitutability perspective works more strongly in Japanese MNEs' decision on their overseas affiliates' reallocation.

We also examine the network effects isolating the role of home production plants or headquarters, i.e. establishments in Japan. Specifically, in a vector of $\mathbf{E}_{jt}$, e_{jlt} sets zero not zero not only if $l = i$ but also if l = Japan. Instead, we introduce independent variables of geographical distance from Japan and tariff rates for products from Japan. The results are reported in columns (V) and (VI). The network variables excluding the elements of Japan have negatively significant coefficients. While the coefficient for distance from Japan is estimated to be insignificant, that for tariff rates for Japan is positively significant. The positive result in tariff rates for Japan indicates that affiliates in countries with better access from Japan in terms of tariff rates are more likely to survive maybe due to the lower trade costs for importing parts and components from Japan.

4.3. Some Other Estimation

We conduct some more kinds of estimation. Two of those are to focus on the typical

FDI conducting mostly the production process-wise vertical division of labor (see, for example, Kimura, 2006). Specifically, we first focus on the exit of affiliates in machinery industries (general machinery, electric machinery, transport equipment, automobile, and precision machinery), which are major industries for Japanese complex VFDI. The results are reported in columns (I) and (II) in Table 6 and are qualitatively unchanged with Table 5. The network variables have significantly negative coefficients. Our second focus goes to the exit of affiliates in Asia, which is again major destination for Japanese complex VFDI. The estimation results are provided in columns (III) and (IV). One noteworthy difference with Table 5 is that coefficients for GDP and Number of Japanese affiliates are estimated to be insignificant. Nevertheless, the results on the network variables do not change. In sum, it is interesting that, even in the case of Japanese FDI conducting mostly the production process-wise vertical division of labor, the substitutability perspective works more strongly in MNEs' decision on their overseas affiliates' reallocation.

Table 6: Estimation for FDI Conducting Active Vertical Division of Labor

	Machinery Industries		Asia	
	(I)	(II)	(III)	(IV)
Affiliate characteristics				
Relative Employment	-0.009	-0.009	-0.006	-0.006
	[0.0014]***	[0.0014]***	[0.0011]***	[0.0011]***
Control Share	-0.007	-0.007	-0.006	-0.006
	[0.0020]***	[0.0019]***	[0.0015]***	[0.0015]***
Age	-0.001	-0.001	0.001	0.001
	[0.0008]	[0.0008]	[0.0006]	[0.0006]
Parent characteristics				
Number of affiliates in an MNE	0.00009	0.00009	-0.00002	-0.00002
	[0.0001]	[0.0001]	[0.0001]	[0.0001]
Country characteristics				
GDP	0.0010	0.0010	0.0006	0.0006
	[0.0004]**	[0.0004]**	[0.0012]	[0.0012]
GDP Growth	0.018	0.017	0.009	0.008
	[0.0170]	[0.0169]	[0.0140]	[0.0139]
GDP per capita	0.003	0.003	0.003	0.003
	[0.0007]***	[0.0007]***	[0.0007]***	[0.0007]***
Number of Japanese affiliates	-0.0015	-0.0014	-0.0013	-0.0013
	[0.0006]**	[0.0006]**	[0.0011]	[0.0011]
Inflation	0.0001	0.0001	-0.0061	-0.0066
	[0.0004]	[0.0004]	[0.0085]	[0.0086]
Volatility	0.009	0.008	0.011	0.007
	[0.0059]	[0.0059]	[0.0348]	[0.0347]
Regulation	0.0009	0.0008	-0.0003	-0.0003
	[0.0007]	[0.0007]	[0.0012]	[0.0012]
Network effects				
Number of affiliates in the same country	0.0011	0.0011	0.0009	0.0009
	[0.0004]***	[0.0003]***	[0.0002]***	[0.0002]***
Network effects through distance	-0.0012		-0.0008	
	[0.0002]***		[0.0002]***	
Network effects through tariff		-0.0022		-0.0015
		[0.0003]***		[0.0003]***
Year dummy	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes
Log-likelihood	-2845	-2844	-3465	-3464
Number of observations	39,240	39,240	57,265	57,265
Pseudo R-squared	0.0514	0.0518	0.0450	0.0453

Notes: The dependent variable takes unity if an affiliate exits and zero otherwise. The parentheses are robust standard errors. *** and ** show 1% and 5% significance, respectively. Machinery industries include general machinery, electric machinery, transport equipment, automobile, and precision machinery. Asia consists of Thailand, Malaysia, Indonesia, Philippines, Taiwan, Korea, Singapore, China, India, Vietnam, Sri Lanka, and Bangladesh.

The other robustness checks are as follows. First, in order to increase the sample number of exit affiliates, in addition to those listed in exit list, we count the affiliates who stop responding, asexit affiliates. The results under this new definition are reported in columns (I) and (II). Second, in addition to industry dummy, we include host country dummy variables, which control not only host country-specific time-invariant elements but also time-invariant elements in the relationship between host country and Japan. The results are reported in columns (III) and (IV). Third, in order to avoid suffering from omitted variable-biases more seriously, we introduce affiliate fixed effect, estimated by linear probability model. Then, a variable of Age is dropped due to the perfect multi-colinearity. The results are reported in columns (V) and (VI). In sum, in all of these kinds of estimation, the results on the network variables are again unchanged. Thus, we conclude that affiliates in countries to which the other same-firm affiliates have better market access are more likely to be shut down. The substitutability perspective works more strongly in Japanese MNEs' decision on their overseas affiliates' reallocation.

Table 7: Some More Robustness Checks

	Other Definition of Exit		Host Country Dummy		Fixed Effect	
	(I)	(II)	(III)	(IV)	(V)	(VI)
Affiliate characteristics						
Relative Employment	-0.014	-0.014	-0.007	-0.007	-0.015	-0.015
	[0.0019]***	[0.0019]***	[0.0010]***	[0.0010]***	[0.0024]***	[0.0024]***
Control Share	-0.035	-0.035	-0.008	-0.008	-0.007	-0.007
	[0.0024]***	[0.0024]***	[0.0013]***	[0.0013]***	[0.0047]	[0.0047]
Age	-0.002	-0.002	-0.001	-0.001		
	[0.0010]**	[0.0010]**	[0.0005]*	[0.0005]		
Parent characteristics						
Number of affiliates in an MNE	0.0005	0.0005	0.000001	-0.000001	-0.0001	-0.0002
	[0.0001]***	[0.0001]***	[0.0000]	[0.0000]	[0.0001]	[0.0001]
Country characteristics						
GDP	0.003	0.003	0.020	0.020	-0.028	-0.027
	[0.0006]***	[0.0006]***	[0.0136]	[0.0136]	[0.0184]	[0.0184]
GDP Growth	0.013	0.013	0.006	0.006	0.005	0.005
	[0.0216]	[0.0216]	[0.0126]	[0.0126]	[0.0144]	[0.0144]
GDP per capita	0.007	0.007	-0.020	-0.020	0.059	0.059
	[0.0009]***	[0.0009]***	[0.0142]	[0.0141]	[0.0187]***	[0.0187]***
Number of Japanese affiliates	-0.0046	-0.0045	0.0096	0.0092	-0.0138	-0.0141
	[0.0008]***	[0.0008]***	[0.0024]***	[0.0024]***	[0.0026]***	[0.0026]***
Inflation	-0.00014	-0.00013	-0.00039	-0.00038	0.00005	0.00006
	[0.0005]	[0.0005]	[0.0003]	[0.0003]	[0.0003]	[0.0003]
Volatility	0.012	0.010	0.000	0.000	0.005	0.004
	[0.0087]	[0.0087]	[0.0056]	[0.0056]	[0.0076]	[0.0076]
Regulation	0.001	0.001	0.002	0.002	0.001	0.001
	[0.0009]*	[0.0009]	[0.0013]	[0.0013]	[0.0015]	[0.0015]
Network effects						
Number of affiliates in the same country	0.001	0.001	0.001	0.001	0.001	0.001
	[0.0005]	[0.0005]*	[0.0002]***	[0.0002]***	[0.0007]*	[0.0007]*
Network effects through distance	-0.003		-0.001		-0.001	
	[0.0002]***		[0.0001]***		[0.0003]***	
Network effects through tariff		-0.006		-0.002		-0.002
		[0.0004]***		[0.0002]***		[0.0006]***
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes	No	No
Country dummy	No	No	Yes	Yes	No	No
Affiliate dummy	No	No	No	No	Yes	Yes
Log-likelihood	-15049	-15043	-5760	-5759	72362	72361
Number of observations	85,338	85,338	82,129	82,129	82,630	82,630
Pseudo R-squared	0.0433	0.0437	0.0514	0.0515		
R-squared (Overall)					0.0012	0.0013

Notes: The dependent variable takes unity if an affiliate exits and zero otherwise. The parentheses are robust standard errors. *** and ** show 1% and 5% significance, respectively. In addition to affiliates listed in exit list, columns of "Other Definition of Exit" include the affiliates who stop responding, as exit affiliates. The column of "Host Country Dummy" reports the results of the estimation for equations with host country dummy variables. In columns of "Fixed Effect", we introduce affiliate dummy variables, estimated by linear probability model.

5. Implication

By setting up and shutting down their overseas affiliates, MNEs have established their production and distribution networks in the world. The entry strategy of their affiliates has been investigated in the academic literature of location choice, but it has remained unknown how MNEs decide the shutdown of their overseas affiliates. In this paper, by exploiting data on Japanese foreign direct investment, we empirically examined the exit of MNEs' production affiliates. In particular, we explore not only the effects of affiliate or host country specific characteristics on the exit of affiliates but also how the exit of an affiliate is affected by the existence of the other affiliates belonging to the same parent firm. As a result, we found that affiliates in countries to which the other same-firm affiliates have better market access are more likely to be shut down.

Our results imply that, as trade liberalization proceeds, the distribution of overseas affiliates in each MNE will be regionally dispersed. Then, country characteristics become important in determining which affiliate within each region will be shut down. The affiliates locating in countries without the large agglomeration of Japanese affiliates will be more likely to be shut down. The same is true for affiliates locating in the higher wage countries. Also, we found that the higher probability of affiliates' exit in countries with multiple affiliates within the same country. In this case, affiliate characteristics become important in determining which affiliate within each country will be shut down. One important element is affiliates' size. The relatively large-sized affiliates among same firm's affiliates are more likely to survive.

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Appendix

Sample Countries

Region	Countries
NAmerica	USA; CAN
MSAmerica	BRA; MEX; VEN; COL; ARG; CHL; PER
ASEAN	THA; MYS; IDN; PHL; VNM
NIES	TWN; KOR; SGP
China	CHN
Other Asia	IND; LKA; BGD
WEurope	GBR; DEU; FRA; ESP; ITA; NLD; IRL; PRT; SWE; AUT; DNK; GRC; NOR
EEurope	HUN; FIN
Oceania	AUS; NZL
Africa	ZAF

CHAPTER 7

Surviving Trade Liberalization in Philippine Manufacturing

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Firm entry and exit play a crucial role in spurring a reallocation of resources across firms as tariffs are reduced. In the light of the substantial trade reforms implemented in the Philippines over the last two decades, the paper examines the impact of trade reforms on the exit of domestic firms controlling for firm characteristics that may affect firm death likelihood. The results provide some evidence that tariffs have a highly significant negative impact on firm exit suggesting that trade liberalization increases the probability of exit of a given firm. These effects are, however, mitigated by the characteristics of individual firms, particularly by productivity. Firms with high productivity are more likely to survive as tariffs are reduced. This seems to be consistent with Melitz' (2003) finding that trade liberalization induces the exit of less productive firms. As the results show, exposure to trade forces the least efficient firms out of the industry. The results also show that apart from high productivity, other individual firm characteristics matter with larger, older, foreign-affiliated and export-oriented firms having a lower probability of exit. These indicate that in designing adjustment policies towards a more open trade regime, it is necessary to understand not only the process or mechanism of inter-firm reallocations taking place in the face of declining tariffs but also the factors hindering this process.

Keywords:firm entry, exit, survival, trade liberalization, Philippine manufacturing

JEL Classification:F10, D24

* In building the manufacturing dataset used in the paper, the author is thankful to the National Statistics Office led by Ms. Estrella de Guzman, Director of the Industry and Trade Statistics Department and Ms. DulceRegala, Chief of Industry Statistics Division. The invaluable research assistance of Mr. Donald Yasay and Ms. Jocelyn Almeda is also gratefully acknowledged.

1. Introduction

Trade policy has been the major policy tool for industrialization in the Philippines. After more than three decades of protection and import-substitution policy, the government implemented trade liberalization programs from the 1980s till the 1990s. While the trade reforms in the 1980s up to the early 1990s were unilateral, those carried out during the mid-1990s till 2000s were mostly in line with the country's commitments under the General Agreement on Tariffs and Trade-World Trade Organization (GATT-WTO) and the Association of South East Asian Nations Free Trade Area Common Effective Preferential Tariff Scheme (AFTA-CEPT).

With intense competitive pressures arising from the trade policy changes, understanding the impact on firm survival is crucial particularly since the death and birth of new firms and their survival in the market are often seen as closely intertwined with economic growth and competitiveness in a modern economy. The recent literature on trade liberalization and productivity shows that industries facing the greatest tariff reduction and import competition have faster productivity growth than relatively protected industries. As Melitz (2003) showed, the least productive firms will typically exit and resources will be reallocated to more productive firms leading to aggregate productivity increases. Resource reallocation drives the increase in productivity through the exit of inefficient plants and productivity improvements within existing plants (Pavcnik, 2000) for Chile; Amite & Konings, 2007 for Indonesia; and Fernandes, 2003 for Columbia). This implies that declining trade costs (usually defined as tariffs and transportation costs) raise the probability of exit. With the entry of imports, increased competition from foreign varieties will lead to reduction in market shares of domestic firms. The empirical literature suggests that lower trading cost and higher import competition increase exit (Bernard, *et al.* 2006, and Baggs 2004).

In the Philippines, the performance of the manufacturing industry shows that from the 1980s up to the 1990s, manufacturing growth was very slow; growing on the average by 1 percent in the 1980s and 2 percent in the 1990s. Growth picked up in the 2000s with manufacturing expanding by 3.4 percent on the average. However, its average share to total industrial output has remained stagnant and declined from 26 percent in the 1980s to 25 percent in the 1990s and to 24 percent in the 2000s.

In view of the manufacturing sector's weak performance and inability to contribute substantially to growth and employment creation as indicated by industry level indicators, the paper will examine the impact of trade liberalization on firm survival using micro level data. It will analyze the impact of trade reforms on the exit of domestic firms controlling for firm characteristics that may affect firm death likelihood. The study is relevant not only in the light of the substantial unilateral trade reforms implemented in the last two decades but also given the country's implementation of its liberalization commitments under the ASEAN Economic Community.

The paper is divided into four parts. After the introduction, section two focuses on the trade and investment reforms along with an analysis of the economic performance of the Philippine manufacturing industry based on industry level indicators. Section three presents the firm level manufacturing data along with the methodology and analysis of results. Section four concludes and discusses the implications of the paper.

2. Review of Economic Reforms and Performance Affecting Manufacturing

2.1 Trade policy reforms

After more than three decades of protectionism and import substitution from the 1950s up to the 1970s, the government started to liberalize the trade regime by removing tariff and non-tariff barriers in the 1980s. In 1982, the country's first tariff reform program (TRP 1) substantially reduced the average nominal tariff and the high rate of effective protection that characterized our industrial structure. TRP I also reduced the number of regulated products with the removal of import restrictions on 1,332 product lines between 1986 and 1989.

In 1991, the second phase of the tariff reform program (TRP II) further narrowed down the tariff range with the majority of tariff lines falling within the three to 30 percent tariff range. It also allowed the tariffication of quantitative restrictions for

153 agricultural products and tariff realignment for 48 commodities. As such, the number of regulated products declined to about three percent in 1996 and by 1998, most quantitative restrictions were removed except those for rice.

In 1995, the government initiated the third round of tariff reform (TRP III) as a first major step in its plan to adopt a uniform five percent tariff by 2005. This further narrowed down the tariff range for industrial products to within three and ten percent range. In June 1999, Executive Order 63was issued to increase the tariff rates on textiles, garments, petrochemicals, pulp and paper, and pocket lighters and at the same time, froze tariff rates at their 2000 levels.

In 2001, another legislation (TRP IV) was passed to adjust the tariff structure towards a uniform tariff rate of 5 percent by the year 2004, except for a few sensitive agricultural and manufactured items. However, this was not implemented, instead, in October and December 2003, the government issued Executive Orders 241 and 264 which modified the tariff structure to protect selected industries. The twin Executive Orders restructured tariffs such that the rates on products that were not locally produced were made as low as possible while the tariff rates on products that were locally produced were adjusted upward. This resulted in tariff increases on a group of agricultural and manufactured products and signaled the government's selective protection policy.

Table 1 presents the tariff rates from 1996 to 2004 for the country's major economic sectors. Note that since 2004, no major most favored nation (MFN) tariff changes have been implemented. The tariff changes pursued were mainly those arising from the ASEAN Free Trade Agreement. It is evident from the data that the country's overall level of tariff rates are already low. As of 2004, the average tariff rate for all industries is 6.82 percent. Among the sectors, agriculture has the highest average tariff rate of 11.3 percent. Manufacturing rates are almost the same as the total industry average with an average tariff rate of 6.76 percent. Fishing and forestry has an average rate of six percent while mining and quarrying is the lowest at 2.5 percent.

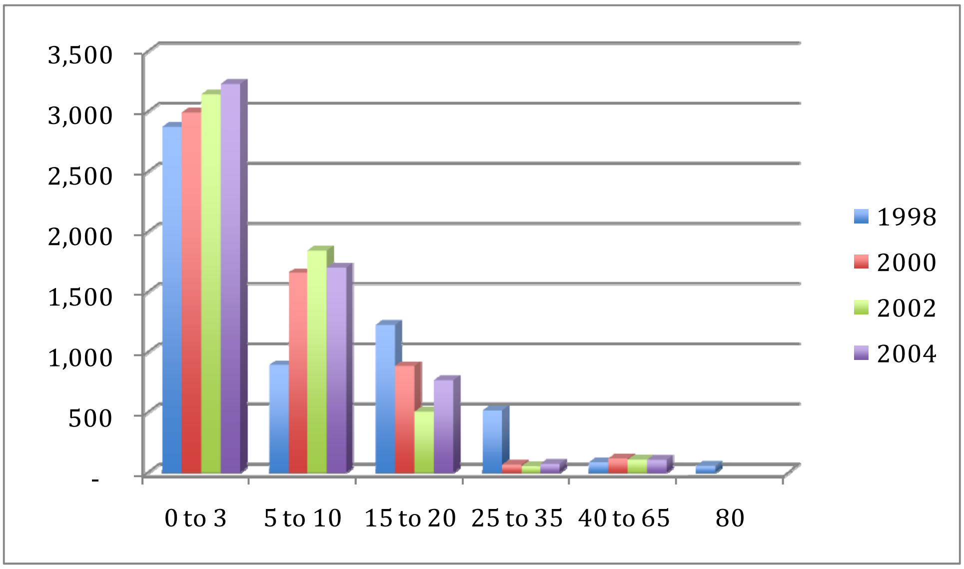
Table 1: MFN tariff structure

Implementation of Major Tariff Policy Changes								
Major Sectors	1996	1998	1999	2000	2001	2002	2003	2004
All Industries	25.5	11.32	10.25	8.47	8.28	6.45	6.6	6.82
CV	1.02	0.96	0.91	0.99	1.04	1.17	1.06	1.07
% of tariff peaks		2.24	2.24	2.48	2.5	2.69	2.53	2.71
Agriculture	29	15.9	13.2	11.5	12.3	10.4	10.4	11.3
CV	0.81	1.07	1.14	1.3	1.23	1.31	1.22	1.17
Fishing & forestry	22	9.4	8.9	6.7	6.7	5.8	5.7	6
CV	0.95	0.63	0.7	0.66	0.62	0.45	0.48	0.57
Mining & quarrying		3.3	3.3	3.1	3.2	2.8	2.7	2.5
CV		0.42	0.41	0.24	0.23	0.38	0.4	0.48
Manufacturing	28	11.38	10.35	8.5	8.28	6.39	6.57	6.76
CV	0.97	0.93	0.88	0.95	1	1.13	1.03	1.03

Note: CV coefficient of variation (ratio of SD to mean). Tariff peaks are represented by the proportion of products with tariffs exceeding 3x the mean tariff.
Source: Aldaba (2005).

In terms of frequency distribution, Figure 1 shows that in 2004, more than 50% of the total number of tariff lines were already clustered in the 0 to 3% tariff range while 29% were inthe 5 to 10% range. 13% were in the 15 to 20% tariff range, 1% in the 25 to 35% tariff range, and 2% in the 40 to 65% tariff range. Between 2002 and 2004, the number of lines in the 5 to 10% tariff range fell but those in the 15 to 20% range increased.

Figure 1: Frequency distribution of tariff rates



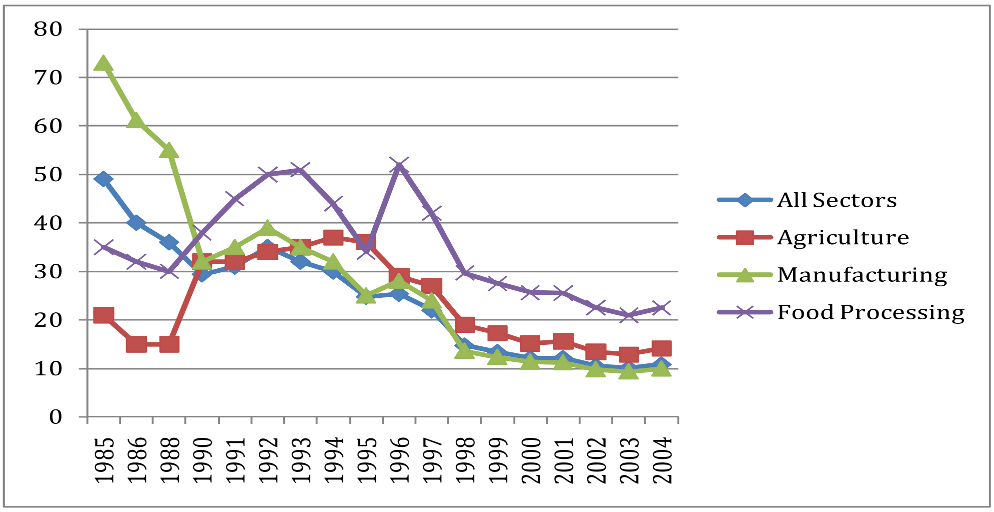
Source: Aldaba (2005)

Though average tariff rates seem to be low, tariff dispersion widened as the coefficient of variation went up from 0.96 to 1.07. The ad valorem tariffs for mining and quarrying as well as those for fishing and forestry show the most uniformity while those for agriculture and manufacturing exhibit the most dispersion. Table 1 also indicates an increase in the percentage of tariff peaks (tariffs that are greater than three times the mean tariff) from 2.24 in 1998 to 2.71 in 2004. The sectors with tariff peaks consisted mostly of agricultural products with in- and out- quota rates including sugarcane, sugar milling and refining, palay, corn, rice and corn milling, vegetables like onions, garlic, and cabbage, roots and tubers, hog, cattle and other livestock, chicken, other poultry and poultry products. Manufacturing sectors with high tariff peaks included slaughtering and meat packing, coffee roasting and processing, meat and meat processing, canning and preserving fruits and vegetables, manufacture of starch and starch products, manufacture of bakery products excluding noodles, manufacture of animal feeds, miscellaneous food products, manufacture of drugs and medicines, manufacture of chemical products, and manufacture and assembly of motor vehicles.

Compared to tariff rates, effective protection rates (EPRs) [1] provide a more meaningful indicator of the impact of the system of protection. EPRs measure the net protection received by domestic producers from the protection of their outputs and the penalty from the protection of their inputs. Figure 1 shows that average effective protection rates for all sectors declined from 49% in 1985 to 36% in 1988. In 1995, this further dropped to around 25%, to 15% in 1998 and to 10.9% in 2004. For manufacturing, EPR fell from 73% in 1985 to 55% in 1988 and to 28% in 1996. This further declined to 11.4% in 2000 to about 10% in 2004.

[1] EPRs are rates of protection of value added, are more meaningful than actual tariff rates and implicit tariff rates (representing excess of domestic price of a product over its international price) since it is value added rather than the value of the product that is contributed by the domestic activity being protected.

Figure 2: Effective protection rates (1985-2004)



Sources: Medalla (1990), Tan (1995), Manasan & Pineda (1999), and Aldaba (2005)

Table 2: Average effective protection rate

	1996	1998	1999	2000	2001	2002	2003	2004
All Sectors	**25.5**	**14.75**	**13.41**	**12.13**	**12.18**	**10.55**	**10.11**	**10.88**
CV	1.02	2.82	2.91	3.21	2.19	2.13	2.23	2.27
Agriculture, Fishing, & Forestry	**22**	**18.98**	**17.29**	**15.12**	**15.63**	**13.38**	**12.86**	**14.15**
CV	0.95	0.75	0.71	0.77	0.83	0.88	0.82	0.77
Mining	-	**2.52**	**2.6**	**2.65**	**2.67**	**2.41**	**2.36**	**2.28**
CV		0.79	0.76	0.68	0.66	0.68	0.69	0.69
Manufacturing	**28**	**13.61**	**12.34**	**11.37**	**11.23**	**9.79**	**9.36**	**9.96**
CV	0.97	3.27	3.4	3.68	2.54	2.45	2.58	2.64

Note: CV or coefficient of variation is the ratio of the standard deviation to the mean.

Source: Manasan & Pineda (1999), Aldaba (2005).

However, within manufacturing, wide disparities in effective protection have also been present due to the relatively high protection that the food processing has continued to enjoy in the last twenty years. Table 2 shows that the manufacturing industry exhibited the highest coefficient of variation, although it declined from 3.27 in 1999 to 2.45 in 2002, this went up again to 2.64 in 2004.

Note also that effective protection rates calculated at a more disaggregated level show relatively high effective protection for some manufacturing product sectors. For instance, in 2004, coffee roasting and processing and manufacture of pesticides and insecticides have very high EPRs. The manufacture and assembly of motor vehicles also has a relatively high protection with its EPR of 76%. Meat and meat processing and rice and corn milling have EPRs slightly above 40% (see Appendix 1).

2.2. Economic Performance the Manufacturing Industry: 1980s-2000s

The overall performance of the overall manufacturing industry in terms of output and employment generation has been weak. Table 3 shows that from the 1980s up to the 1990s, manufacturing growth was very slow; growing on the average by 1 percent in the 1980s and 2% in the 1990s. Growth picked up in the 2000s with manufacturing expanding by 3.4% on the average. However, there seems to be very little movement of resources in the manufacturing industry as its share to total industrial output declined from 26% in the 1980s to 25% in the 1990s and to about 24% in the 2000s. Like manufacturing, growth in the agriculture sector remained sluggish up to the 1990s posting an average growth rate of 4% during the most recent period. The services sector has been the best performer in all three decades. On the average, its growth rate went up from 2.3% in the 1980s to 5% in the 2000s.

Table 3: Average Value Added Growth Rates and Structure

	Average Growth Rate			Average Value Added Share		
Year	81-89	90-99	00-09	81-89	90-99	00-09
Agric, Fishery, &Forestry	1.3	1.5	3.5	23.5	21.6	19.2
Industry Sector	0.9	2.1	3.9	27.6	26.4	25.4
Manufacturing	0.9	2.3	3.4	25.9	25.1	23.8
Service Sector	2.3	3.7	5.2	48.9	52	55.4
TOTAL GDP	1.7	2.8	4.6	100	100	100

Source: National Statistical Coordination Board, National Income Accounts (NIAS), various years.

In terms of employment generation, the manufacturing industry failed in creating enough employment to absorb new entrants to the labor force. Table 4 indicates that its share to total employment remained stagnant at 10 percent in the 1980s till the 1990s and this dropped to 9.2% in the 2000-2009 period. The services sector is the most important provider of employment in the recent period with its average share increasing from 40% in the 1980s to 47% in the 1990s. Currently it accounts for an average share of almost 54 percent. Agriculture's share in total employment dropped continuously from 50% in the 1980s to 43% in the 1990s and to 37% in the current period.

Table 4: Employment Growth Rates and Structure

Economic Sector	Average Growth Rate			Average Share		
	81-89	90-99	00-09	81-89	90-99	00-09
Agriculture, Fishery, & Forestry	1.2	0.7	1.4	49.6	42.8	36.6
Industry	2.5	1.7	0.8	10.6	10.6	9.6
Manufacturing	2.5	2.1	0.6	9.9	10.2	9.2
Services	4.8	4.2	3.6	39.8	46.6	53.8
TOTAL EMPLOYED	2.7	2.5	2.5	100	100	100

Source: NIAS.

Table 5 shows the distribution of value added in the manufacturing industry. Consumer goods comprised the bulk of manufacturing value added, although its share declined from 57% to 50% between the eighties and the 1990s. In the current period, its share remained at 5%. Food manufacturing represented the most important subsector accounting for an average share of 39% of the total in the current period. Intermediate goods followed with a share of 27% in the 2000s, a decline from 35% in the 1990s and 31% in the 1980s. Petroleum and coal had the highest average share of 14% in the 2000s. With the growing importance of electrical machinery, the share of capital goods increased steadily from 10% in the 1980s to 13% in the 1990s and 19% in the 2000s. Electrical machinery posted an average growth rate of 3% in the 1980s, 6% in the 1990s, and 12 % in the 2000s.

Table 5: Manufacturing Value Added Structure and Growth Rate

	Average Growth Rate			Average Value Added Share		
Industry Group	1980-89	1990-99	2000-08	1981-89	1990-99	2000-08
Consumer Goods	**0**	**2**	**5**	**57**	**50**	**50**
Food manufactures	-1	2	6	44	36	39
Beverage industries	7	2	4	4	4	4
Tobacco manufacture:	1	1	-6	3	3	1
Footwear wearing app	6	2	2	5	6	5
Furniture and fixtures	2	2	7	1	1	1
Intermediate Goods	**2**	**2**	**2**	**31**	**35**	**27**
Textile manufactures	0	-5	0	4	3	2
Wood and cork produ	-5	-4	-4	2	2	1
Paper and paper produ	4	-1	2	1	1	1
Publishing and printin	3	1	0	1	2	1
Leather and leather pr	-3	5	0	0	0	0
Rubber products	1	-2	0	2	1	1
Chemical & chemical	-1	2	3	7	6	6
Petroleum & coal	6	4	3	12	17	14
Non-metallic mineral	2	2	3	2	3	2
Capital Goods	**2**	**6**	**6**	**10**	**13**	**19**
Basic metal industries	10	-2	13	3	2	2
Metal industries	4	0	7	2	2	2
Machinery ex. electric	0	6	2	1	1	2
Electrical machinery	7	13	6	3	6	12
Transport equipment	-5	2	5	1	1	1
Miscellaneous manufac	8	5	7	2	2	3
Total Manufacturing	1	2	4	100	100	100

Table 6 presents four-firm concentration ratio (CR4) calculations for the manufacturing industry adjusted for the presence of imports. In general, given the relatively low tariff rates in the manufacturing industry, the calculated ratios seem to indicate that the industry is already contestable. In most sectors, the concentration ratios are already below 35% such as in paper & paper products, rubber & plastic, medical & precision instruments, basic metals, and machinery and equipment nec. In the middle range are chemicals & chemical products, 41%; other transport equipment, 45%; and for motor vehicles, non-metallic and food products, the concentration ratios range from 54 to 57%. High ratios ranging from 60-82% are still prevalent in sectors such as refined petroleum, tobacco, beverages, and flat glass (non-metallic products).

Table 6: Four Firm Concentration Ratios (CR4)

Description	CR4
Coke, Refined Petroleum and other Fuel Products	79.8
Tobacco Products	72
Beverages	62.4
Other non-metallic: flat glass	82.4
Motor Vehicles, Trailers, and Semi-trailers	57.2
Food	55.7
Other Non-Metallic Mineral products	54.3
Other non-metallic: cement	52.7
Footwear	45.1
Manufacture of Other Transport Equipment	44.8
Chemicals and Chemical Products	40.6
Publishing, Printing and Reproduction of Recorded Media	36.3
Fabricated Metal Products, Except Machinery and Equipment	35.8
Machinery and Equipment, n.e.c.	34.5
Basic Metals	30.5
Clocks	29.4
Paper and Paper Products	29
Rubber and Plastic Products	28.3
Manufacture and Repair of Furniture	22.7
Wood, Wood Products, Cork, Ex Furniture; Articles of Bamboo, Cane, Rattan, Plaiting Materials	20.4
Textile	4.4

Note: CR4 = 4-firm concentration ratio calculated as the value of output by the four largest firms to total for each 5-digit industry level. The CR4 calculations are adjusted for import penetration (MPR), i.e., (1-MPR)*CR4. Import penetration shares are estimated as the ratio of imports to output plus imports less exports.

Table 7 presents price cost margin (PCM) estimates with an average of 29% for the manufacturing industry. In a number of sectors, PCMs are low ranging from 8 to 19% for sectors such as leather, fabricated metal, transport equipment, garments, machinery excluding electrical, and printing and publishing. Moderate PCMs that range from 22 to 38% are found in food, plastic, wood, rubber, and furniture products. Meanwhile, PCMs are high in beverages, tobacco, non-metallic products (including cement), and glass and glass products. In these sectors, PCMs range from 45 to 62%. These sectors are also the most highly concentrated within the manufacturing industry.

Table 7: Price Cost Margins

Description	PCM based on Roeger method	Standard Errors	PCM based on simple method
Beverages	0.62***	0.06	0.53
Tobacco	0.59***	0.04	0.47
Pottery, cement & other nonmetallic	0.60***	0.1	0.57
Glass and Glass Products	0.50***	0.04	0.52
Other chemicals	0.45***	0.04	0.37
Paper and Paper Products	0.38***	0.03	0.36
Industrial chemicals	0.38***	0.03	0.35
Rubber products	0.34***	0.05	0.28
Furniture including Metal Furniture	0.32***	0.03	0.22
Professional and Scientific equipment	0.31***	0.29	-0.06
Wood and Cork	0.31***	0.02	0.26
Nonferrous metal	0.31***	0.05	0.21
Miscellaneous manufactures	0.30***	0.04	0.2
Plastic products	0.30***	0.02	0.25
Petroleum refineries	0.29***	0.11	0.21
Electrical machinery	0.28***	0.01	0.25
Petroleum and Coal	0.27***	0.12	0.21
Textiles	0.26***	0.02	0.27
Food processing & manufacturing	0.24***	0.03	0.28
Iron and Steel	0.22***	0.01	0.26
Printing and Publishing	0.19**	0.11	0.16
Machinery except Electrical	0.18***	0.04	0.11
Wearing Apparel except Footwear	0.16**	0.12	-0.01
Transport equipment	0.12***	0.04	0.14
Fabricated metal	0.10**	0.04	0.17
Leather & leather footwear	0.08***	0.04	0.16
All manufacturing	*0.29****	*0.02*	*0.3*

Source: Aldaba (2008).

Table 8 presents estimates of TFP growth. The growth figures are normalized and interpreted as growth relative to 1996. From 1996 to 2006, aggregate productivity gains are evident in leather, textile, furniture, other manufacturing, and basic metals and fabricated metal sectors. Leather grew by 9.5%, textile by 2.4%, other manufacturing by 2.9%, furniture by 1.9% and basic metals by 1.3%. Meanwhile, six sectors covering food, beverages, and tobacco; garments; wood, paper, and publishing; coke, petroleum, chemicals and rubber; non-metallic products as well as machinery and equipment, motor vehicle and other transport registered negative productivity growth rates from 1996 to 2006. On the whole, the manufacturing sector's aggregate productivity declined by 3.4% from 1996 to 2006.

Table 8: 2006 Total Factor Productivity Growth

Sector	2006 TFP Growth relative to base year 1996
Food, beverages, & tobacco	-1.44
Textile	2.35
Garments	-0.99
Leather	9.54
Wood, paper, & publishing	-5.39
Coke, petroleum, chemicals & rubber	-4.76
Non-metallic products	-0.65
Basic metal & fabricated metal products	1.32
Machinery & equipment, motor vehicles & other transport	-0.86
Furniture	1.86
Other manufacturing	2.87
All Manufacturing	-3.37

Note: TFP growth figures are normalized and are interpreted as growth relative to base year 1996.
Source: Aldaba (2010)

2.3. A Summing up

Since the 1980s, the Philippines has made considerable progress in opening-up the economy to competition by removing tariff and non-tariff barriers in both the manufacturing and agriculture sectors. From the 1980s up to the mid-1990s, average nominal tariff rates were reduced substantially from a range of 70 to 100% to within a three to 30% range. Overall, average effective protection rates declined from 53% in 1983 to 36% in 1988. In 1995, this further dropped to around 25% to 8.59% in 1998 and to 6.8% in 2004.

As the preceding analysis indicated, the more than two decades of trade liberalization have not yet led to rapid industrial growth. From the 1980s up to the early 20s, manufacturing growth was very slow; growing on the average by 0.9% in the 1980s, by 2.3% in the 1990s, and by 3.4% in the 2000s. Its share to total industrial output remained unchanged during the same periods accounting for 26% in the 1980s; 25% in the 1990s and 24% in the 2000s. In terms of employment generation, the industry failed in creating enough employment to absorb new entrants to the labor force as its share to total employment dropped from about 10% in the 1980s and the 1990s to 9% in the current period. The industry's total factor productivity growth declined by 3.4% from 1996 to 2006.

In the light of the lackluster performance of the manufacturing industry as indicated by the industry level indicators, an analysis of the role of trade liberalization and its impact on manufacturing performance based on micro data is crucial in understanding the reallocation of resources, adjustment and restructuring process that have taken place in the manufacturing industry. The industry level indicators that were earlier presented might be masking or unable to fully capture the reallocation of activity across industries within manufacturing and across firms within industries. In the next section, the entry and exit of establishments will be examined to allow us a more in-depth analysis than is possible with industry-level data.

3. Empirical Methodology, Data, and Analysis of Results

3.1. Trade and Productivity Literature

With the availability of micro data, the recent literature on trade liberalization and productivity has increased substantially. This body of literature shows that industries facing the greatest tariff reduction and import competition have faster productivity growth than relatively protected industries. This is due to resource allocation arising from the exit of inefficient plants and productivity improvements within existing plants. Empirical studies showing these results were pioneered by Pavcnik (2000) for Chile; Topalova (2004) for India; Muendler (2004) and Amiti & Konings (2005) for Indonesia, Schor (2004) for Brazil and Fernandes (2007) for Columbia.

The empirical literature has shown that through competition and selection mechanisms, trade liberalization leads to productivity increases. Bhagwati (1968) emphasized that trade liberalization is seen as a powerful and administratively simple way to enhance competition. Helpman & Krugman (1989) further indicated that international trade increases competition. With trade liberalization, imports can discipline the market by forcing domestic firms to lower their prices and behave competitively.

Through the competition channel, trade liberalization also leads to selection effects. As trade liberalization squeezes price cost margins, some intra-plant efficiency gains and additional efficiency gains are induced due to the shutting down of weak plants. In the presence of within-industry firm heterogeneity, trade liberalization may lead to improved productivity through the exit of inefficient firms and the reshuffling of resources and outputs from less to more efficient firms. As Melitz (2003) points out, trade opening may induce a market share reallocation towards more efficient firms and generate an aggregate productivity gain, without any change at the firm level[3]. Pavcnik (2000), Topalova (2004), and Tybout (2001) showed that trade liberalization induces the least productive firms to exit the market and the most productive non-exporters to become exporters.

In the case of the Philippines, Aldaba (2010) provided some evidence that trade liberalization leads to productivity increases. Following Pavcnik (2000), Aldaba decomposed aggregate productivity growth into two components: (i) unweighted productivity growth or within firm productivity and (ii) covariance growth or reallocation of resources and market shares from less to more efficient firms. The

[3] In Melitz (2003), the channel through which selection happens is through the labor market, trade liberalization increases labor demand, this bids up wages and cost of production forcing least productive firms to exit the market.

results showed that in sectors such as leather, textile, furniture, basic metals and other manufacturing, growth was driven mainly by the reallocation of market shares and resources from less productive to the more productive firms. The manufacturing sector was further divided into four groups: non-traded, purely importable, purely exportable, and mixed. Both the non-traded and purely exportable sectors posted positive growth rates from 1996 to 2006, most of which was contributed by growth in the covariance component. The non-traded sector grew by 3.9% during this period, of which 3.2% was due to the reallocation of market share from less efficient to more efficient firms. The purely exportable sector grew by 3.8%, of which 5% was contributed by the reshuffling of market shares towards more efficient firms.

Applying a regression framework to examine the impact of firm exit on productivity, the study showed that gains from trade liberalization could arise from reallocation effects with more efficient firms gaining market share and increasing average industry productivity. This is indicated by a negative and highly significant coefficient on the exit indicator for the mixed sector group implying that exiting firms have lower productivity than surviving or continuing firms.

3.1.1. Trade Liberalization and Firm Survival

As earlier indicated, trade forces the least productive firms to exit and reallocates market shares towards the more productive exporting firms while lower productivity firms only serve the domestic market (Melitz, 2003). Empirical studies suggest that lower trading cost through tariff reduction or elimination and higher import competition will increase exit. In assessing the role of import competition from low wage countries on the survival of US plants, Bernard & Jensen (2002) showed that import penetration (measured by the share of imports from low wage countries) sharply increases the probability of plant death. Based on probit regressions, their results confirmed findings from previous research that plant size, age and productivity are important determinants of plant survival. As expected, the probability of plant shutdown is significantly decreasing in plant size, age, and productivity. Exporting plants are far less likely to shut down than non-exporters. Both capital and skill-intensive plants are also less likely to die and death rates are greater for plants with low capital-labor ratios and those with relatively low skilled workers.

To capture within industry heterogeneity, import measures were interacted with plant characteristics. The results indicated that high capital, high skill plants are better able to survive in the face of rising import shares from low wage countries. Although in terms of the interaction of plant productivity and low wage imports, the coefficient has the wrong sign but is not significant.

Bernard, *et al.* (2003) examined the impact of changes in tariff and transport costs on industries and plants using disaggregated US import data and trade cost which is measured as the sum of ad valorem duty and ad valorem freight and insurance rates. The study focused on the following industry- and plant- level outcomes: industry productivity growth, plant death, new exporters, export growth, domestic market share, and changes in plant productivity. The following control variables were used in the model: plant productivity, size, age, plant capital intensity, wage level, export status, multiproduct indicator, multi plant status and multinational ownership. Based on probit regression, the results provided support for the predictions of the heterogeneous-firm trade models andhighlighted the following: *first*, lower trade costs increase the probability of plant death, especially for lower productivity, non-exporting plants; *second*, surviving high productivity, non-exporters are more likely to enter the export market and expand their sales; and *third*, existing exporters see their exports grow more quickly as trade costs fall.

The results showed that the interaction of trade cost and productivity is negative and statistically significant, the probability of death is lower for high productivity plants in the face of falling trade costs. With respect to other plant characteristics, the study indicated that larger, older, and more capital intensive firms are more likely to survive as are plants that pay higher wages or produce multiple products.

In another study, Bernard, *et al.* (2006) again examined the role of international trade in the reallocation of US manufacturing within and across industries from 1977 to 1997. As trade variable, they used import penetration by low wage countries. In terms of plant characteristics, the following were applied: log total employment, age, log TFP, log capital intensity, and skill intensity. Based on logistic regression of plant death on levels of import penetration by low wage countries and plant characteristics; they found that across industries,plant survival and growth are disproportionately lower in industries with higher exposure to imports from low wage countries. Within industries, the higher the exposure to low-wage countries, the bigger is the relative performance difference between capital-intensive plants and labor-intensive plants in terms of survival and growth. The study also showed that some US manufacturing plants adjust their product mix in response to competition from low-wage countries. Plants facing higher shares of imports from low-wage countries are more likely to switch industries. When plants switch, they move towards industries that are on average less exposed to low-wage countries and are more capital and skill intensive. One issue that the study raised is while high productivity, like capital intensity, improves plant performance and survival; unlike capital intensity, it does not disproportionately benefit plants facing high exposure to low-wage country imports. Another puzzling result is that skill intensity does little to mitigate the effects of low-wage country imports.

Looking at the impact the Canada-US FTA tariff cuts on Canadian manufacturing firms; Gu, *et al.* (2003) showed that tariff reductions affected productivity growth through its effect on firm turnover. They found that the FTA tariff cuts increased the exit rate of Canadian manufacturing firms. The FTA-induced increase in the exit rate was bigger for small firms than for large firms which is consistent with the view that the FTA tariff cuts forced the least productive firms to exit. The authors concluded that productivity grows through a mechanism or restructuring process of market selection where low productivity firms exit and are replaced by higher productivity entrants while higher productivity incumbents gain market share.

In another paper using Canadian firm level data, Baggs (2004) also examined the impact of the Canada-US FTA by investigating simultaneously the effect of falling Canadian tariffs and American tariff changes on Canadian firms. The results showed that both firm and industry level characteristics are important determinants of survival and while Canadian tariff reductions reduced the probability of survival, US tariff reductions exhibited the opposite effect. Falling Canadian tariffs decrease the probability of survival since declining domestic protection increase threats. Falling US tariffs increase the probability of survival among Canadian firms since opening foreign markets increase opportunities. The study also showed that more productive firms have an improved chance of survival. The Canadian tariff interaction with productivity is positive and significant suggesting that although falling Canadian tariffs decrease the probability of survival, this is smaller for firms with higher productivity. This is consistent with Melitz (2003) who finds that trade liberalization induces a net exit of low productivity firms. The interaction term for US tariff and productivity is negative and significant suggesting that although falling US tariffs are beneficial for firm survival, this effect is smaller for highly productive firms. Based on these results, the author concluded that higher productivity shelters firms from the effects of changing tariffs and firms that are highly productive are neither as adversely affected by falling domestic protection levels, nor as favorably affected by falling levels of protection for the foreign market.

Using Chilean manufacturing plant data, Alvarez & Vergara (2008) showed that more productive plants as well as larger and more capital intensive plants are less likely to exit. The authors also found a negative relationship between the probability of exit and tariffs, however, this was not robust to the inclusion of variables such as other structural reforms, economic growth, and real exchange rate.

Muendler (2004) assessed the impact of Brazil’s trade liberalization on productivity using firm level data. One of his findings showed that increased foreign competition makes the least efficient firms to shutdown and enables the surviving, competitive firms to increase market share. This firm turnover and exit of the least productive firms contribute positively to productivity change in the aggregate.

Using a panel of Columbian manufacturing plants in evaluating the impact of trade liberalization on productivity, Fernandes (2003) showed that exit probabilities increase as tariffs decline. However, plant exit played a minor role in generating productivity gains in the face of lower trade protection.

3.2. The Data and Descriptive Analysis of Firm Entry and Exit Patterns

The dataset consists of firm level information on sales revenues, employment, compensation, physical capital, exports (only for certain years) and production costs from the Annual Survey of Establishments and Census of Establishments of the conducted by the National Statistics Office (NSO). The firms are identified by unique establishment numbers that allows us to create a panel dataset. The dataset covered the period 1996 to 2006, with three missing years in between: 1999, 2001, and 2004. Surveys were carried out in 1996, 1997, 1998, 2002, 2003, and 2005 and census in 2000 and 2006. Note that one limitation of the dataset is it includes only firms with at least two observations and excludes all firms with only one observation during the eight-year period 1996-2006. Firms with missing, zero or negative values for any of the variables listed above were dropped as well as those firms with duplicates. These were mostly firms with less than 10 workers. The total number observations are 20,815.

Entry and exit are traced based on the establishment numbers. However, there is no information whether exits are due to mergers and acquisitions. Entry and exit may be due to true entry and exit but also due to firms being included in the sample or not. Entry is defined as the year when the firm started its operations. This is based on information provided by the firm. Firm exit is indicated when the firm no longer appears in the dataset. Entry and exit also occurs when a firm's 2-digit PSIC code changes.

The firms are classified based on the following definitions:

- New Entrant: firm that enters a given industry sector in a given year t as indicated by the year when the firm started its operations
- Exitor: firm is present in a given year but will not be present in subsequent year t+1
- Survivor: firm is neither a new entrant nor exitor, it is present in a given year t as well as in subsequent year t+1

Table 9 presents the number of firms in the dataset along with calculated annual entry, exit, and survival rates in the manufacturing industry. The exit rate dropped from 36% in 1997 to about 17% in 2000 (see also Figure 3). This went up to 22% in 2002 andto 24% in 2006. Entry rates are low relative to exit rates declining from 33% in 1996 to about 8% in 1998 and 6% in 2006. Firm entry could be attributed not only to the establishment of a new firm but also due to an existing firm changing its sector. In recent years, entry was mostly due to sector change. The average turnover rate was 24% during the years under review.

Table 9: Summary of Number of Firm Entrants, Exitors, and Survivors

Year	Total	Entrants (N)	Exitors (X)	Survivors (S)	Sector Change	Turnover Rate (in %)	As % of total N	X	S
1996	2,576	858					33.3		
1997	2,599	9	927	1,663		36	0.4	35.7	64
1998	2,263	177	180	1,906	34	16	7.8	8	84.2
2000	2,043	28	344	1,671	0	18	1.4	16.8	81.8
2002	2,072	6	455	1,611	5	22	0.3	22	77.8
2003	2,031	32	359	1,640	13	19	1.6	17.7	80.8
2005	3,365	20	505	2,840	4	16	0.6	15	84.4
2006	3,866*	221	942	2,703	215	30	5.7	24.4	68.9
Total	20,815	1,351	3,712	14,034	271	24	6.5	17.8	67.4

**Note*: Firm exit and survival in 2006 were based on whether the firm operated in 2008 as reflected in the 2008 Survey of Business Establishments.

Figure 3: Entry and Exit Rates

Table 10 contains the structure and distribution of the manufacturing firms by sub-sector. On the overall, the firms were dominated by food and beverage manufacturers with a share of almost 21% of the total during the period 1996-2006. Second was machinery, equipment and transport sector with a share of 19%. Coke, petroleum, chemicals and rubber products had a share of 12% closely followed by wood, paper products and publishing with a share of 11% and garments with a share of 10%.

Table 10: Number of Firms by Sector, 1996-2006

PSIC2	1996	1997	1998	2000	2002	2003	2005	2006	Total	in %
1. Food, beverages, tobacco	608	614	483	502	410	400	643	754	4,414	21
2. Textile	141	143	133	103	117	104	151	165	1,057	5
3. Garments	265	266	223	101	232	219	368	364	2,038	10
4. Leather & leather products	71	70	68	58	45	42	78	87	519	2
5. Wood, paper products, & publishing	253	257	204	220	213	203	401	486	2,237	11
6. Coke, petroleum, chemicals, rubber & plastic	317	321	279	196	258	268	420	535	2,594	12
7. Non-metallic products	145	148	107	96	91	93	119	140	939	5
8. Basic metals & fabricated metal	175	176	188	169	186	168	335	379	1,776	9
9. Machinery, equipment & transport	434	439	431	466	389	413	618	672	3,862	19
10. Furniture	82	81	80	49	74	74	146	180	766	4
11. Other manufactured products	85	84	67	83	57	47	86	104	613	3
Total	2,576	2,599	2,263	2,043	2,072	2,031	3,365	3,866	20,815	100

Source: Author's calculation.

Table 11 shows the pattern of entry and exit rates by manufacturing subsector. In all sectors, exit rates are substantially higher than entry rates, with very low entry rates that remained almost flat in many of the manufacturing sub-sectors during the years covering 2000 to 2005. Some notable improvements in entry rates were observed in 2006 as manufacturing sub-sectors registered entry rates ranging from 8 to 10% in the following sectors: basic and fabricated metal products; coke, petroleum, chemicals, rubber and plastic products; machinery, equipment and transport; furniture, and other manufacturing. During the same year, the highest exit rates ranging from 30 to 38% were posted in the following sectors: garments, leather, and non-metallic products. For the entire period 1997 to 2006, the same sectors together with furniture and other manufactured products registered the highest exit rates.

Tables 12 and 13 present a comparison of the characteristics of firm entrants, exitors, and survivors in terms of mean levels of employment, age, total factor productivity, capital intensity, tariff rates, effective protection rates and export shares. The firms are also compared with respect to foreign equity participation.

Table 11: Patterns of Entry and Exit by Manufacturing Sub-sector

PSIC2	1997	1998	2000	2002	2003	2005	2006	Total
1. Food, beverages, tobacco								
entrants	0.16	3.93	1.39	0	0.75	0.31	0.8	1
exitors	36.16	6	15.34	23.17	16.25	10.42	25.07	19.55
2. Textile								
entrants	0.01	0.06	0.01	0	0.02	0	0.04	0.02
exitors	0.36	0.08	0.16	0.26	0.24	0.19	0.25	0.22
3. Garments								
entrants	0	11.66	0	0.43	2.74	0.54	1.65	2.31
exitors	39.85	10.76	15.84	20.69	21.46	13.04	38.46	24.2
4. Leather & leather products								
entrants	0	10.29	1.72	0	0	1.28	1.15	2.23
exitors	38.57	10.29	22.41	33.33	21.43	14.1	35.63	25.22
5. Wood, paper products, & publishing								
entrants	0.78	4.9	2.73	0.94	0	0.5	4.73	2.27
exitors	32.3	9.8	13.64	21.6	17.73	12.47	23.66	19.15
6. Coke, petroleum, chemicals, rubber & plastic								
entrants	0.62	7.17	1.02	0.78	1.49	0.48	8.97	3.51
exitors	30.84	8.6	17.86	15.89	18.28	14.05	20	18.18
7. Non-metallic products								
entrants	0.68	11.21	1.04	0	0	0.84	1.43	2.14
exitors	37.16	7.48	22.92	21.98	23.66	15.13	31.43	23.8
8. Basic metals & fabricated metal								
entrants	0	9.57	0.59	0	3.57	0.9	10.03	4.12
exitors	33.52	5.32	15.38	24.19	16.07	20.6	20.58	19.61
9. Machinery, equipment & transport								
entrants	0.46	9.51	1.5	0.26	2.42	0.97	9.82	3.88
exitors	33.71	8.58	17.81	22.11	14.77	18.93	18.6	19.17
10. Furniture								
entrants	0	8.75	2.04	0	1.35	0	8.89	3.65
exitors	46.91	6.25	20.41	17.57	16.22	11.64	27.78	21.2
11. Other manufactured products								
entrants	0	13.43	1.2	0	0	1.16	8.65	3.79
exitors	45.24	8.96	19.28	28.07	12.77	23.26	21.15	23.48
Total		7.82	1.37	0.29	1.58	0.59	5.72	
entrants	0.35	7.95	16.84	21.96	17.68	15.01	24.37	2.7
exitors	35.67							20.35

Source: Author's calculation.

Table 12: Firm Characteristics (Mean Values)

	Exitors	Entrants	Survivors
NEWXSH	0.1909945	0.2325583	0.2536151
TFPindex	0.9775679	1.000022	1.009972
epr	15.93131	18.71752	15.79757
tariff	12.23409	17.40083	12.15751
age_variable	12.26192	2.907476	15.78112
totworkers	189.2605	267.1088	297.1154
kl	129591.1	146782.1	181049.3

Table 13: Firm Characteristics by Foreign Equity (Mean Values)

	With Foreign Equity			Without Foreign Equity		
	Exitors	Entrants	Survivors	Exitors	Entrants	Survivors
NEWXSH	0.4905109	0.4751562	0.5055091	0.1233792	0.1331912	0.1447464
TFPindex	1.038226	1.045255	1.066084	0.9630107	0.9835545	0.9893141
epr	13.68456	15.26986	12.98908	17.00747	21.07707	17.6796
tariff	10.34223	15.66044	11.03515	13.4628	19.57278	13.4692
age_variable	11.20558	2.668639	14.65387	12.79192	2.043231	17.33735
totworkers	463.8106	501.5799	574.3987	124.9346	188.9966	189.3089
kl	230340.3	293818.6	347400.9	105372.5	96483.15	121212.3

Exitors are, in general, relatively younger, smaller in terms of average size of employment, have lower productivity and are less capital-intensive than survivors. They seem to be more oriented towards the domestic market with their share of exports to output lower than survivors. In terms of tariff and effective protection, exitors have slightly higher tariff and effective protection rates. Entrants are younger than exitors and have larger number of workers. They are also also more capital intensive, have higher productivity level and higher export ratio than exitors. In terms of protection, entrants have higher tariff and effective protection rates than exitors and survivors.

Exitors with foreign partners have higher export ratios, higher productivity level, more workers, and are more capital intensive than firm exitors without foreign partners. They are also younger and have lower effective protection rate than those without foreign partners.

Entrants with foreign partners are more export-oriented, have higher productivity, larger in terms of employment size, and are more capital intensive than entrants without foreign partners. They are also slightly older and have lower tariff and effective protection rates.

Survivors with foreign partners are more export-oriented, have higher productivity level, and are more capital intensive than survivors without foreign partners. They are younger and have lower levels of tariff and effective protection than purely domestically-owned firm survivors.

3.3 Overall Framework

There is already a large body of literature examining the determinants of firm exit and survival applying several types of regression analyses. In these studies, the importance of firm characteristics for firm demographic dynamics have been evaluated. These firm characteristics include age, size, wage, R&D as well as industry features such as capital intensity, productivity, industry growth and concentration (see Ferragina *et al*. 2010) along with technology and innovation variables as well as ownership structure variables. Studies have also investigated the relevance of firms' globalization activities through exports or FDI (Kimura & Fujii 2003; Perez & Lilopis 2004; Giovanetti *et al*. 2011; Mata & Portugal 2001). In estimating the relationship between explanatory variables and the continuing firm's conditional probability of exit (hazard rate), survival analysis specifications have included both probability-based survival/exit equations and more advanced analysis techniques (Ahn 2001).

To examine the impact of trade liberalization (*TRADE*) on firm exit,a probit model is estimated where the dependent variable is set to one if the firm exited and zero if it survives the next year. The model is specified as follows:

$$\Pr(exit_{it} = 1) = F\left(TRADE_{jt}, SIZE_{it}, TFP_{it}, FOREIGN_{it}, AGE_{it}, EXPORT_{it}, KL_{it}, Dummies\right)$$

equation 1

where *i* indexes firms, *j* industry, and *t*year. The explanatory variables include firm-level controls such as size (*SIZE*), productivity (*TFP*), foreign ownership (*FOREIGN*), age (*AGE*), export (*EXPORT*), and capital intensity (*KL*) as well as industry and year dummies.

TRADE is the trade policy variable proxied by nominal tariff and effective protection rates (EPRs) in sector *j*. Effective protection rates take into account both the tariff on the firm's output and the tariffs on the inputs that the firm uses. EPRs are important because tariffs vary considerably along the production stage generally exhibiting an escalating structure with inputs having lower protection while final goods receive higher protection. The literature on liberalization, competition and productivity tends to suggest a negative effect on the exit rate and a positive effect on firm survival. This implies that a lower (higher) tariff increases (decreases) the probability of exit and reduces (increases) the firm's survival likelihood.

SIZE is the firm's size in terms of number of workers at time *t*. Studies indicate that firm size has a negative effect on the exit rate and positive effect on firm survival.

TFP is the firm's total factor productivity defined as the residual of a Cobb-Douglas production function and estimated using the methodology of Levinsohn & Petrin (2003). In estimating the production function, data on value added (output less cost of materials and energy) and two factors of production, labor and capital, were used. Fuel and electricity data were employed as proxy for productivity shocks.[4] A production function was estimated for 11 industry-sectors. The estimates of firm i's TFP is obtained by subtracting firm i's predicted y from its actual y at time t. To make the estimated TFP comparable across industry-sectors, a productivity index is created. Firms with higher productivity are expected to have higher survival rates.

FOREIGN is an indicator of firm ownership, it is equal to 1 if the firm has 10% or more foreign equity. A negative coefficient implies that a higher foreign equity participation decreases the probability of exit and has a positive effect on survival.

AGE is the difference between year t and the year the firm started its operations. It is expected that the probability of exit declines with the age of the firm.

EXPORT is a ratio of the firm's total exports to total output. A negative coefficient is expected indicating that a higher export ratio reduces the probability of exit.

[4] To address the simultaneity problem in input choice when estimating the production function by ordinary least squares (OLS), a semi-parametric estimator with an instrument to control for unobserved productivity shocks is applied. For this instrument, Olley and Pakes (1996) use investment while Levinsohn & Petrin (2003) suggest the use of intermediate inputs.

KL is capital intensity measured as the ratio of the book value of assets to total workers. It is expected that with high capital intensity, the probability of exit declines.

3.4 Analysis of Results

Table 14 provides a descriptive summary of the statistics for all the firms in the dataset. MFN and ASEAN tariff rates are simple applied averages by manufacturing industry sub-sectors at the two-digit level. Tariff rates were linked to the manufacturing data by converting HS and AHTN Codes into their corresponding two-digit industry codes. MFN rates were from the Philippine Tariff Commission while the ASEAN rates were from the ASEAN Secretariat database.

Table 14: Descriptive Statistics for All Firms

Variable	Obs	Mean	Std. Dev.	Min	Max
TFP	20815	1.00355	0.11252	0.37725	1.653914
EPR	20815	16.0109	20.3977	-605.588	237.9509
MFN Tariff	20815	12.5115	8.99241	1.07317	71.66666
ASEAN Tariff	20195	6.04849	5.056	0	30
Age	20806	14.3175	16.2026	0	154
Size	20815	275.934	648.353	10	16190
EXPORT	13347	0.24035	0.40712	0	3.530536
KL	20815	169649	830337	0.00067	5.59E+07

Based on equation 1 and using tariff rates as trade liberalization variable, the initial probit results explaining the probability of exit for a given firm are presented in Table 15. Year and two-digit level sector dummy variables are included in all specifications to account for macroeconomic fluctuations and industry effects that may affect firm survival. Model I is the basic specification that looks at trade and firm characteristics such as productivity, age, size, foreign ownership and export intensity. Model II introduces an additional variable, capital intensity while Models III, IV and V add interaction variables in which tariff is interacted with firm age, foreign equity participation, and productivity.

Table 15: Firm Exit (using tariff as trade indicator)

	I	II	III	IV	V
TFP	-.2660082***	-.2624585***	-.2617539***	-.2607624***	-.162516 ***
	(0.03383)	(0.03441)	(0.03443)	(0.03448)	(0.05991)
MFN Tariff	-.0020483***	-.0020647***	-.0024427***	-0.0020612***	0. 0039196
	(0.00051)	(0.00051)	(0.00058)	(0.00060)	(0.00314)
Age	-.0012013***	-0.001203***	-.0017676***	-.0017323***	-0.0017817***
	(0.00027)	(0.00027)	(0.00053)	(0.00052)	(0.00053)
Size	-0.0000263**	-.0000265**	-0.0000267**	-0.0000267**	-0.0000271**
	(0.00001)	(0.00001)	(0.00001)	(0.00001)	(0.00001)
Foreign	-0.0479928***	-.0475833***	-0.0476424***	-0.0152569	-0.0234071
	(0.00839)	(0.00843)	(0.00844)	(0.01525)	(0.01559)
Export	-0.0257471***	-.0260085**	-0.0267236***	-.0283355***	-0.0280222***
	(0.01008)	(0.01009)	(0.01011)	(0.01016)	(0.01015)
KL		-3.13E-09	-3.20E-09	-3.93E-09	-5.02E-09
		(0.00000)	(0.00000)	(0.00000)	(0.00000)
MFN Tariff*Age			0.0000346	0.0000332	0.0000365
			(0.00003)	(0.00003)	(0.00003)
MFN Tariff*Foreign				-.0025539***	-.0019955**
				(0.00093)	(0.00098)
MFN Tariff*TFP					-0.0062066**
					(.00322)
Year	Yes	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes	Yes
Log Likelihood	-5147.3082	-5147.1091	-5145.8368	-5142.2226	-5140.2878
No. of Obs	11972	11972	11972	11972	11972

Notes: The reported coefficients are marginal effects representing the change in the marginal probability of firm exit at the mean of the regressors. Robust standard errors in parentheses. *** significant at 1% level, ** at 5% level, and *10% level.

The results in Table 15 show that the coefficients of the firm level control variables are consistent with expectations. For all specifications, the productivity term is negative and highly significant, this is consistent with the literature that more productive firms have a better chance of survival. Larger and older firms are also found to have a lower probability of exit. The coefficient on Size, which is measured by number of employees, is negative and significant at 5% level for all specifications. The coefficient on Age is negative and highly significant for all specifications.

In terms of the impact of foreign ownership, the results show that the coefficient on Foreign is negative and highly significant for specifications I to III indicating that the higher the level of foreign equity participation, the lower the probability of exit for a given firm. It is widely accepted that multinational firms are an important source of international capital and technology. They have better technical and business know-how resulting in productivity gains and competitiveness and increased survival likelihood.

In terms of Export, which is measured as the share of exports to total output, the results show a highly significant negative coefficient on Export for all specifications. This indicates that the more export-oriented a firm is or the higher its level of exports to total output, the lower the probability of exit.

In terms of tariff, the coefficient is negative and highly significant for specifications I to IV indicating that the lower the tariff, the higher the probability of death. High tariffs tend to be associated with greater firm inefficiency and misallocation of resources away from efficient sectors towards less efficient ones by artificially raising the profitability rates of the latter. When the market is opened up for more competition from imports arising from trade liberalization, it becomes difficult for these firms to survive. Looking at the tariff interaction with productivity, the results in Table 15 show a negative and significant coefficient indicating that while reduced tariffs increase the probability of exit, this effect is smaller for firms with higher productivity. This seems to be consistent with Melitz' (2003) finding that trade liberalization induces the exit of less productive firms. Tariff reduction allows imports from other countries resulting in more import competition which implies a higher likelihood of death for firms with low productivity.

In terms of the other interaction variables, the results show that the tariff interaction with firm age is insignificant. However, the tariff interaction with FDI shows a negative and significant coefficient suggesting that although declining tariffs increase the probability of exit, this effect is smaller for firms with foreign partners or affiliates. Note that with the inclusion of the interaction terms for tariff and foreign ownership as well as for tariff and productivity in Models IV and V, respectively, the individual terms for tariff and foreign ownership lose their significance. Though the coefficient on capital intensity is negative, it is not significant for all specifications.

Table 16 presents the results of the same model using effective protection rate as trade liberalization variable. The coefficients of the firm level control variables are as predicted; productivity, age, firm size, export intensity, and foreign ownership affect firm survival. The coefficient on EPR, however, is not significant and none of the interaction variables was found significant.

Table 16: Firm Exit (using EPR as trade indicator)

	I	II	III	IV	V
TFP	-.2542065***	-.2518801***	-.2517447***	-.2521132***	-.2190156***
	(0.03381)	(0.03433)	(0.03433)	(0.03434)	(0.04057)
EPR	0.0000251	0.000023	-0.0001569	-.0002263	. 0015012
	(0.00014)	(0.00014)	(0.00017)	(0.00021)	(0.00117)
Age	-0.001184***	-0.001185***	-0.0014677***	-.0014657***	-.0014545 ***
	(0.00027)	(0.00027)	(0.00034)	(0.00034)	(0.00034)
Size	-0.0000267**	-0.0000268**	-0.0000271**	-.0000271**	-.0000274**
	(0.00001)	(0.00001)	(0.00001)	(0.00001)	(0.00001)
Foreign	-0.0469265 ***	-0.0466582***	-0.0467457***	-.0499777***	-.0527659***
	(0.00844)	(0.00847)	(0.00847)	(0.00926)	(0.00938)
Export	-0.0249502***	-0.0251171***	-0.0254479***	-.0253697***	-.0249829***
	(0.01010)	(0.01010)	(0.01010)	(0.01010)	(0.01009)
KL		-2.01e-09 (0.00000)	-2.08e-09 (.00000)	-2.09e-09 (.00000)	-2.29e-09 (00000)
EPR*Age			.0000133 (0.00001)	.0000132 (.00001)	. 0000128 (.00001)
EPR*Foreign				0002277 (.00027)	. 000407 (.00031)
EPR*TFP					-.0016816 (.00109)
Year	Yes	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes	Yes
Log Likelihood	-5155.4848	-5155.3962	-5154.2697	-5154.0831	-5153.2736
No. of Obs	11972	11972	11972	11972	11972

Notes: The reported coefficients are marginal effects representing the change in the marginal probability of firm exit at the mean of the regressors. Robust standard errors in parentheses. *** significant at 1% level, ** at 5% level, and *10% level.

Table 17 summarizes the results based on ASEAN tariff rates as trade indicator. The results for specifications I to IV are the same as those obtained using MFN tariff rates. For models I to IV, the coefficient on ASEAN tariff is negative and highly significant indicating that ASEAN tariff reductions increase the probability of exit. The coefficient on productivity is negative and highly significant for all model specifications suggesting that more productive firms have lower probability of exit and higher chance of survival. For all specifications, older and larger firms are also found to have a lower probability of exit. For models I to III, the coefficient on foreign ownership is negative and highly significant indicating that firms with foreign equity have lower probability of exit. The only difference is in terms of the interaction variable; while MFN tariff interacted with productivity is significant, ASEAN tariff interacted with productivity is insignificant.

Table 17: Firm Exit (Using ASEAN Tariff Rates as Trade Indicator)

	I	II	III	IV	V
TFP	-.2585655***	-.255724***	-.2559872 ***	-.2535458***	-.278988***
	(0.03418)	(0.03475)	(0.03475)	(0.03481)	(0.05870)
ASEAN Tariff	-.0023947***	-.0024084***	-.002939***	-.0020535**	-.0049613
	(0.00091)	(0.00091)	(0.00102)	(0.00106)	(0.00553)
Age	-.0011835***	'-.001185***	-.0015573***	-.0015173***	-.0015066***
	(0.00027)	(0.00027)	(0.00045)	(0.00045)	(0.00045)
Size	-.0000267**	-.0000269**	-.0000269**	-.0000275**	-.0000274 **
	(0.00001)	(0.00001)	(0.00001)	(0.00001)	(0.00001)
Foreign	-.0459234***	-.0455876 ***	-.0458545***	-.0105577	-.0086215
	(0.00861)	(0.00865)	(0.00864)	(0.01503)	(0.01542)
Export	-.0257052***	-.025916***	-.0262826***	-.0274258***	-.0274059***
	(0.01040)	(0.01041)	(0.01042)	(0.01047)	(0.01047)
		-2.39e-09	-0.00000000239	-2.76e-09	'-2.59e-09
KL		(0.0000)	(0.0000)	(0.0000)	(0.0000)
ASEAN Tariff*Age			.0000442	.0000427	.0000415
			(0.00004)	(0.00004)	(0.00004)
				-.0048566***	-.0051079***
					(.00164)
ASEAN Tariff*Foreign				(0.00159)	(0.00164)
					.0030026
ASEAN Tariff*TFP					(.00558)
Year	Yes	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes	Yes
Log Likelihood	-4981.6817	-4981.5592	-4980.8584	-4976.2471	-4976.0963
No. of Obs	11569	11569	11569	11569	11569

Notes: The reported coefficients are marginal effects representing the change in the marginal probability of firm exit at the mean of the regressors. Robust standard errors in parentheses. *** significant at 1% level, ** at 5% level, and *10% level.

To examine the impact of the two tariff rates MFN and ASEAN, the same model is applied with both MFN and ASEAN tariff rates as trade indicators. Model 1 provides the basic specification, model II introduces capital intensity while models III, IV, and V introduce interaction terms where the two trade indicators are interacted with firm characteristics age, foreign equity participation, and productivity. In model VI, all the six interaction variables are included.

Table 18 shows that for all specifications, firm characteristics are important determinants of exit. The coefficients on productivity, age, size, and export intensity are as predicted and are highly significant for all specifications, except for age which is significant at 5% level. The coefficient on foreign ownership is negative and highly significant in models I to III as well as in V. In model IV, its coefficient is no longer significant, but is significant when interacted with Tariff and ASEAN.

Table 18. Firm Exit (Using MFN and ASEAN Tariff Rates as Trade Variables)

	I dy/dx	II dy/dx	III dy/dx	IV dy/dx	V dy/dx	VI dy/dx
TFP	-.2694193***	-.2654823***	-.265189***	-.2633771***	-.1608981***	-.2010679***
	(0.03424)	(0.03486)	(0.03487)	(0.03495)	(0.06345)	(0.06599)
MFN TARIFF	-.0018968***	-.0019144***	-.0022376***	-.0016756 ***	.007932**	.006943*
	(0.00051)	(0.00051)	(0.00061)	(0.00053)	(0.00352)	(0.00363)
ASEAN Tariff	-.0021571**	-.0021748**	-.0023842**	-0.0015538*	-0.0084072	-.0113422*
	(0.00091)	(0.00091)	(0.00105)	(0.00096)	(0.00601)	(0.00616)
Age	-.0011982***	-.0012004***	-.0019129***	-.0011741***	-.0011882***	-.001878***
	(0.00027)	(0.00027)	(0.00056)	(0.00027)	(0.00027)	(0.00056)
Size	-.0000264**	-.0000266**	-.0000268**	-.000027**	-.000027**	-.0000276**
	(0.00001)	(0.00001)	(0.00001)	(0.00001)	(0.00001)	(0.00001)
Foreign	-.0468753***	-.0464089 ***	-.0465607***	.0042809	-.047622***	-.0025077
	(0.08570)	(0.00861)	(0.00861)	(0.01729)	(0.00860)	(0.01777)
Export	-.0264473***	-.0267561***	-.0276202***	-.0287413****	-.0265539***	-.0290047***
	(0.01040)	(0.01041)	(0.01043)	(0.01048)	(0.01042)	(0.01051)
KL		-3.41E-09	-3.44E-09	-4.29E-09	-4.99E-09	-5.35e-09
		(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
MFN Tariff*Age			(.00003)			.0000326 (.00003)
ASEAN Tariff*Age			.0000268			.0000227
			(0.00004)			(0.00004)
MFN Tariff*Foreign				-0.0019484*		-.0010955
				(0.00112)		(0.00117)
ASEAN Tariff*Foreign				-0.0034842*		-.0042722**
				(0.00186)		(0.00189)
MFN Tariff*TFP					-.0100102**	-.0092407***
					(0.00356)	(0.003720)
ASEAN Tariff*TFP					0.0063395	.0099276
					(0.00598)	(0.00623)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Log Likelihood	-4974.7577	-4974.5249	-4973.0912	-4968.0878	-4970.1519	-4963.2622
No. of Obs	11569	11569	11569	11569	11569	11569

Notes: The reported coefficients are marginal effects representing the change in the marginal probability of firm exit at the mean of the regressors. Robust standard errors in parentheses. *** significant at 1% level, ** at 5% level, and *10% level.

With respect to the trade indicators, both coefficients on Tariff and ASEAN are negative and significant for Models I to IV. In Model IV which introduces trade interaction variables with productivity, the coefficient on ASEAN is negative but insignificant while the coefficient on Tariff turns positive and significant at 5% level. The Tariff interaction variable with productivity remains negative and significant at 5% level. In Model VI which combines all MFN Tariff and ASEAN interaction variables, the coefficient on ASEAN tariff is still negative and significant while the coefficient on MFN Tariff remains positive and significant. The results tend to indicate two opposite effects of changes in tariffs on the likelihood of firm exit. While a reduction in ASEAN tariff tends to increase the probability of firm exit, a reduction in MFN tariff tends to reduce it. With respect to the trade interaction variables, the coefficient on Tariff interacted with productivity is negative and highly significant while the coefficient on ASEAN interacted with foreign equity is negative and significant at 5% level.

4. Conclusions and Policy Suggestions

This paper aims to examine the role of trade liberalization using micro level data to allow a more in-depth analysis than is possible based on an industry level analysis. With competitive pressures arising from trade liberalization, understanding the impact on firm survival is crucial particularly since the birth of new firms and their survival in the market are often seen as closely intertwined with economic growth and competitiveness in a modern economy.

Initial analysis of the micro level data indicated that during the period 2000 to 2005, exit rates in all sectors were substantially higher than entry rates. Entry rates were very low in many of the manufacturing sub-sectors. Some improvements in entry rates were observed in 2006 with entry rates that ranged from 8 to 10% posted in the following sectors: basic and fabricated metal products; coke, petroleum, chemicals, rubber and plastic products; machinery, equipment and transport; furniture, and other manufacturing. For the period 1997 to 2006; garments, leather, and non-metallic products, furniture and other manufactured products registered the highest exit rates.

Initial analysis indicated that exitors are, in general, relatively younger, smaller in terms of average size of employment, have lower productivity and are less capital-intensive than survivors. They seem to be more oriented towards the domestic market. In terms of tariff and effective protection, exitors have slightly higher tariff and effective protection rates. Exitors with foreign partners have higher export intensity, higher productivity level, more workers, and are more capital intensive than firm exitorsthat are 100% Filipino-owned. They are also younger and have lower effective protection rate than those without foreign partners.

Meanwhile, compared with exitors, entrants are younger and larger in terms of number of workers. They are also more capital intensive, have higher productivity level and higher export intensity than exitors. In terms of protection, entrants have higher tariff and effective protection rates than exitors and survivors. Entrants with foreign partners are more export-oriented, have higher productivity, larger in terms of employment size, and are more capital intensive than entrants without that are 100% Filipino-owned. They are also slightly older and have lower tariff and effective protection rates.

The results of the regression analysis provide some evidence that tariffs have a highly significant negative impact on firm exit suggesting that trade liberalization increases the probability of exit of a given firm. These effects are mitigated by the characteristics of individual firms, particularly by productivity and foreign equity participation. The interaction terms indicate that firms with high productivity and those with foreign partners are less likely to die as tariffs are reduced. This seems to be consistent with Melitz’ (2003) finding that trade liberalization induces the exit of less productive firms. The results also show that individual firm characteristics matter with highly productive, larger, older, foreign-affiliated and export-oriented firms having a lower probability of exit.

Looking at the effect of ASEAN tariff rates on firm death, in general, similar results are obtained. The coefficient on ASEAN tariff is negative and highly significant indicating that ASEAN tariff reductions increase the probability of exit. The coefficient on productivity is negative and highly significant suggesting that more productive firms have lower probability of exit. In terms of the firm control variables, older and larger firms are found to have a lower probability of exit. The coefficient on foreign ownership is negative and highly significant indicating that firms with foreign equity have lower probability of exit. The only difference is in terms of the interaction variable when tariff is interacted with productivity. The results show that while MFN tariff interacted with productivity is significant, ASEAN tariff interacted with productivity is not significant.

Combining the two tariff rates together, the same results are again obtained as indicated by the negative and significant coefficients on both Tariff and ASEAN. However, the results differ when the trade-productivity interaction variables are introduced in the model. While the coefficient on ASEAN tariff is negative and significant; the coefficient on Tariff turns positive and significant. However, in terms of the tariff interaction variable with productivity, the coefficient still remains negative and highly significant while the coefficient on ASEAN interacted with foreign equity is negative and significant.

Regarding the use of effective protection rate as trade indicator, the results indicate that the coefficient on EPR is not significant and none of the interaction variables was found significant. However, the coefficients of the firm level control variables are as predicted; productivity, age, firm size, export intensity, and foreign ownership affect firm survival. With respect to capital intensity, the results also show that although its coefficient is negative, it remains insignificant.

According to Melitz (2003), trade liberalization drives the selection and reallocation among heterogeneous firms within an industry leading to changes in average productivity. Due to the presence of trade costs, only the most productive firms self-select into exporting. As trade costs decline, low productivity firms exit and this increases the level of aggregate productivity. Exposure to trade induces only the more productive firms to export while simultaneously forcing the least productive firms and the additional export sales gained by the more productive reallocate market shares towards the more productive firms and contribute to an aggregate productivity increase.

In general, the results tend to provide support to Melitz' model where trade liberalization leads to aggregate productivity increase through the intra-industry reallocation across heterogeneous firms. As the results show, exposure to trade forces the least efficient firms out of the industry. This leads to reallocation towards more efficient firms that may generate aggregate productivity gains. In a related paper on the determinants of productivity of the Philippine manufacturing industry, trade liberalization was found to have a significant negative effect on productivity indicating that trade leads to productivity gains (Aldaba, 2010). The results also showed that exiting firms have lower productivity than surviving or continuing firms. The analysis of the decomposition of aggregate productivity growth showed that productivity growth was driven mainly by the reallocation of market shares and resources from less productive to the more productive firms in sectors such as leather, textile, furniture, basic metals and other manufacturing.

The present paper emphasizes the importance of productivity and foreign ownership in mitigating the negative impact of trade liberalization on the probability of exit and survival of firms. The results also highlight firm characteristics that significantly affect survival such as export intensity, age, and size. The probability of exit will be highest among firms with low export intensity as well as firms that are younger, smaller, have low productivity and purely Filipino-owned.

In designing adjustment policies that would address the transition towards a more open trade regime, it is necessary to understand not only the process or mechanism of inter-firm reallocations taking place in the face of declining tariffs but also the factors hindering this process. It is important to emphasize the crucial role that firm entry and exit play in spurring a reallocation of resources across firms as tariffs are reduced. It is within this light that the focus of government policy be designed towards those measures that would enhance firm productivity as well as link domestic firms with multinational companies and attract more foreign direct investment in the manufacturing industry.

Economic theory suggests that foreign direct investment can generate positive spillovers to domestic firms in the host country. Since multinational corporations are an important source of international capital and technology, their entry can facilitate the transfer of technical and business know-how resulting in productivity gains and competitiveness among local firms. These spillover effects develop through best practice demonstration and diffusion, or through the creation of linkages with foreign and domestic firms becoming either suppliers or customers, or through the movement of experienced workers from foreign to local firms. The entry of MNCs may also increase competition and force domestic firms to imitate and innovate.

Deepening linkages with multinational firms' international production networks would be important in increasing our gains from trade. Policies geared towards providing export assistance would also be necessary along with measures crafted to boost the survival of new entrants particularly small and medium enterprises. Making small and medium manufacturers internationally competitive is a major challenge that would require government support and close coordination between the government and the SME sector. Addressing financing issues including inadequate working capital, insufficient equity, difficulties of credit finding and prohibitively expensive credit cost since these have severely constrained the growth of SMEs. Improving the technological capabilities and strengthening supply chains are necessary to enable SMEs to move up the technology scale as well as to create and enhance existing linkages with production networks. Participation in regional/global production networks provides domestic firms not only access to export markets but to newer technologies as well. To increase their overall competitiveness in international markets, leading multinational firms provide their local affiliates and local suppliers with more rapid technological upgrading and greater attention to quality control, cost control and human resource development. In light of rising globalization and increasing economic integration in East Asia, SMEs are seen as potential suppliers of outsourced parts and services and could provide a link to the export sector and/or production networks which have increasingly grown in manufacturing sectors such as automotive, machinery, electronics and garments. To benefit from the opportunities arising from the ASEAN Economic Community and the on-going integration between ASEAN and East Asia, linking our SMEs with production networks would be crucial.

Finally, the selective protection policy of the government must be reviewed to address the distortions and inefficient resource allocation that it has created. The policy has not only shielded selected sectors from import competition, but has also led to disparities in protection particularly among finished goods that make use of these as inputs. Favored sectors include sugar, petrochemicals, float glass, and steel which are inputs to a lot of products. Since the tariffs on inputs are greater than the tariffs on outputs, cost of production has remained high and negatively affected the user sectors' productivity and competitiveness.

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Appendix

Appendix I: Highly protected manufacturing and agriculture sectors

Sector	1998	2000	2002	2004	Ave	Classification
Coffee roasting & processing	*	*	*	*	*	Food processing
Pesticides, insecticides	109	-96	110	238	89	Chemicals products
Mfr and assembly of vehicles	97	77	78	76	82	Transport equipment
Meat & meat products	60	49	52	41	50	Food processing
Rice & corn milling	51	47	43	42	45	Food processing
Wire nails	74	44	28	32	43	Basic metals
Coffee	48	38	43	38	41	Agriculture
Carpets & rugs	52	43	32	33	39	Textile
Hog	40	37	36	35	37	Agriculture
Rebuilding of vehicles	43	33	34	33	36	Transport equipment
Motorcycles & bicycles	45	31	32	35	36	Transport equipment
Hardboard & particle board	38	40	29	29	34	Wood & wood products
Ready made clothing	45	37	28	27	33	Garments
Structural products	59	28	16	26	32	Non metallic mineral
Made up textile goods	40	32	26	29	32	Textile
Sugar milling & refining	36	31	31	30	31	Food processing
Corn	36	31	31	26	30	Agriculture
Radio and TV receiving sets	37	37	22	19	29	Machinery & electrical
Bakery products	35	29	23	28	29	Food processing
Furniture & fixtures, metal	37	31	23	24	28	Miscellaneous products
Hosiery, underwear	36	30	22	21	27	Textile
Other wearing apparel	35	29	22	22	26	Garments
Veneer & plywood	35	27	19	19	25	Wood & wood products
Leather & leather substitutes	37	23	14	23	24	Leather
Articles of native materials	31	25	20	22	24	Textile
Metal stamping, coating	36	24	16	20	24	Non metallic mineral
Rubber footwear	37	26	14	19	24	Rubber& plastic
Wire & cable prods	33	25	16	16	23	Non metallic mineral
Furniture	33	25	17	17	22	Furniture &fixtures
Flat glass	30	22	14	20	22	Non metallic mineral
Leather footwear	33	22	13	19	21	Leather
Commercial & job printing	36	21	14	10	21	Paper & paper products

The EPR formula is given by: $EPR = (V-V^*)/ V^*$ where V is the domestic value added per unit of the final good (including the tariffs on that good and on its inputs) and V^* is the value added under free trade. Note that * refers to a negative free trade value added.

CHAPTER 8

Export intensity, Markup and Productivity: Micro-evidence from the Korean Manufacturing

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Taking recent new developments in trade literature on firm heterogeneity into account, this paper extensively investigates the relationship among export intensity, markup and productivity. We employ a new empirical framework à la De Loecker and Warzynski (2010) to measure plant-level markup and productivity of the Korean manufacturing sector for the periods of 1992-2002. Then using these measures and the generalized propensity score methodology, we reconsider the related empirical evidence provided in the existing literature.

While our estimation results are largely in line with those from the existing literature, we also provide a number of new insights into the literature. First, we find productivity- (as well as markup-) premia of exporters relative to non-exporters, but also a substantial degree of heterogeneity among exporters with different export intensities. Generally, the dose-responses both of TFP level and of markup level along export intensity suggest an inverted U-shaped relationship.

In addition, our estimation results still suggest that exporting activity generally provides a better opportunity for productivity improvement, but not all exporters benefit from exports. Importantly, our analytic results do not support for the hypothesis that the higher export intensity induces higher productivity growth among exporters.

Finally, we find that the rankings of TFP level among plants tend to be preserved over time, but this is not the case for markup dynamics. Specifically, markup gaps between exporters and non-exporters are shown to be gradually reduced over time and the rankings of markup level substantially change over the 3-year span.

Keywords: Export intensity, markup, productivity, pro-competition effect

JEL classification: F1, L1, L6

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1. Introduction

A growing body of empirical work in international economics has documented the superior performance characteristics of exporters relative to non-exporters. Exporters tend to be larger, more productive, more capital-intensive, and pay higher wages. And it is now widely recognized that the productivity premium of exporters vis-à-vis non-exporters can be attributed largely to the fact that more productive firms only self-select into exporting activities. Meantime, the empirical evidence on the causal link from participation in export markets to plant-level productivity growth has been inconclusive so far.

A relatively unexploited but recurring issue in the literature is the relationship between firm-specific pricing behavior and exports. Different firm characteristics and competitive environments as well as the presence of trade costs would induce exporters to employ a distinct pricing strategy compared to non-exporters. For example, exporters, having an apparent productivity advantage, could sustain higher price cost margins than non-exporters, unless they pass all of the efficiency differentials to consumers in the form of lower prices. Furthermore, since exporting activity incurs trade costs, firms could charge higher markups on foreign markets than on domestic markets in order to recover their additional frictional trade costs.

On the other hand, the markup premium that a firm sets on its export markets also depends on its relative efficiency compared to foreign competitors. If competitive environment is tougher in foreign markets than domestic counterparts, exporters should charge lower markups in order to remain competitive relative to the more efficient foreign competitors. Likewise, an endogenous distribution of markups across firms would depend largely on productivity differentials, trade costs and the relative toughness of market competition between foreign and domestic markets.

There are some reasons why the export-markups nexus has been understudied in the literature so far. From a theoretical point of view, new models of international economics put firm heterogeneity at the core of the analysis, but most of these models assume either a perfectly competitive or a Dixit-Stiglitz market structure. Under such assumption, all firms in an industry have the same degree of markups. Consequently, these studies are unable to explain differences in pricing behavior, or more precisely markup heterogeneity, across firms.

Only recently, a number of papers propose a more realistic model by relaxing assumptions on market structure and thus provide a theoretical basis to investigate the relationship between markup heterogeneity and export. For example, under the monopolistically competitive framework with firm heterogeneity, Notably, Melitz & Ottaviano (2008)'s model predicts that markups are positively related to firm productivity as well as to export intensity. Their model also indicates that all surviving firms are worse off in terms of price markups after trade liberalization, due to pro-competitive effects, while trade does not affect the rankings of firms ordered by profitability.

On the other hand, the fact that establishment-level prices are typically unobserved has posed a serious limitation in empirical research on the export-markup nexus across firms. Very detailed micro-level data on prices, quantities sold and characteristics of products are often needed in accurately estimating firm-level markups, but researchers hardly have access to those data.

Recently, De Loecker & Warzynski (2010) and Martin (2010) propose a new empirical framework to measure firm-specific markup and productivity on the insight of Hall (1986).[1] For example, De Loecker & Warzynski (2010) identify markups as the difference between a firm's variable input cost share and revenue share, where the cost share is not observed in the data but under optimality conditions has to equal the output elasticity of the relevant input.

Taking these new developments in the literature into account, our paper empirically investigates the relationship among markup, productivity and exporting activities, using the Korean manufacturing plant-level data for the periods of 1992-2002. Here we estimate firm-specific markup and productivity by adopting De Loecker & Warzynski (2010)'s procedure.

As for exports, our research focus is on export intensity rather than export status. Most of the current studies investigate the relationship between a firm's export status and the productivity growth, by measuring firms' export status as a binary treatment

[1] Robert Hall published a series of papers suggesting a simple way to estimate (industry) markups based on an underlying model of firm behavior (Hall, 1986, 1988, 1990).

variable and comparing the performance of exporters relative to non-exporters. Such practices may overlook the important fact that not all exporters have the same level of engagement in export markets. Some firms may devote considerable resources to their export activities, but others do not. Therefore, it is also an important issue to understand underlying mechanisms of apparent heterogeneity in market conduct and performance among exporters.

In order to investigate productivity and markup differentials not only between exporters and non-exporters but also among exporters, we adopt the Generalized Propensity Score (GPS hereafter) methodology developed by Hirano & Imbens (2004). This GSP method is a generalization of the binary treatment propensity method, and allows for continuous treatment like export intensity, of which the latter is measured by the export-shipment ratios.[2] Using the GSP method, we examine distributional attributes of productivity and markups at each level of export intensity.

The main research questions posited in our analyses are threefold: First of all, in order to understand the underlying mechanism of firms' decision to serve foreign markets, we examine what kinds of firms' attributes induce their export decision and determine their relative exposure to foreign markets.

Second, we explicitly investigate whether the empirical findings on the export-productivity nexus so far are also applicable to the relationship between export behavior and markups. Do markups differ dramatically between exporters and non-exporters and if so to what extend? More importantly, does there exist any systematic relationship between export intensity and markup level among exporters?

Third, we also examine the impact of export intensity on productivity and markup dynamics. In the current literature, export intensity is often related to learning-by-exporting. If learning by exporting does exist, then the higher export intensity would induce higher productivity growth, which in turn could increase markup. At the same time, export intensity also reflects competitive environment differentials between foreign and domestic markets. Hence, if firms participating in international markets are exposed to more intense competition, exposure to pro-competitive environments

[2] Unfortunately the Korean plant-level manufacturing data do not contain total sales information. Therefore, we employ export-shipments ratio as a proxy for export intensity, rather than export-sales ratio.

may worsen firms' profitability but induce a higher incentive to improve productivity. Consequently, depending on the relative importance of pro-competition effect vis-à-vis the extent of learning-by-exporting, firm-level productivity and markup dynamics may possibly differ.

The rest of this paper is organized as follows. The next section provides a brief literature survey on the related studies. In Section 3, we present our empirical strategy including estimation of TFP and markup. Section 4 provides our empirical results and the final section concludes and provides some policy implications.

2. Literature Survey

This paper is motivated by the two strands of the previous research. The first is the international trade literature on the interaction between trade and the distribution of the firm-level productivity. Since the mid-1990s, an extensive body of empirical work demonstrates that firms engaging in international trade differ substantially from those that solely serve the domestic market. For example, documenting the characteristics of U.S. export manufacturers, Bernard & Jensen (1995) confirm that exporting plants are larger, more capital intensive, more productive, and pay higher wages and salaries than plants that do not export.

These findings raise important research questions about the sources of such systematic differences between exporters and non-exporters. In fact, two alternative hypotheses are proposed and extensively tested since then; "self-selection hypothesis" suggesting that higher-productivity firms self-select into export markets, and "learning-by-exporting hypothesis" that exporting causes productivity growth through some form of learning-by-exporting. The empirical studies largely confirm that high productivity precedes entry into export markets. On the other hand, most studies find little or no evidence of learning-by-exporting. For example, the work of Bernard & Jensen (1999) on U.S. firms and the work of Clerides, Lach and Tybout (2001) on firms in Mexico, Colombia and Morroco find no differential growth in firm productivity among exporters versus non-exporters (Bernard *et al*., 2007).[3]

Fryges & Wagner (2007) recently suggest several reasons why the evidence from previous studies could be in favor of self-selection hypothesis. First of all, for a forward-looking firm, the decision to enter into export markets may induce a strong incentive to improve productivity prior to starting exporting activities. This can explain a certain extent of the ex-ante productivity differences between exporters and non-exporters.

In addition, most of the current studies investigate the relationship between a firm's export status and the productivity growth, using the firms' export status as a binary treatment variable and comparing the performance of exporters and non-exporters. Such practices may overlook the important fact that not all exporters have the same level of engagement in export markets. Some firms may devote considerable resources to their export activities, but others do not. Hence the scope for productivity improvement through learning-by-exporting may differ, depending on export intensity.[4]

Recently, Fryges and Wagner (2007) test the relationship between export intensity and productivity, by adopting the GPS methodology developed by Hirano & Imbens (2004). They find that, while there is a causal effect of firms' export activities on labor productivity growth, exporting improves labor productivity growth only within a sub-interval of the range of firms' export-shipment ratios.

The second strand of research that motivates this paper is the recently emerging empirical literature on the relationship between trade and firms' markups. Most notably, Melitz & Ottaviano (2008) propose a monopolistically competitive model of trade with firm heterogeneity where aggregate productivity and average markups respond both to the size of domestic market and to the extent of its integration through trade. Their model predicts that markups are positively related to firm productivity. That is, more efficient producers have a cost advantage over their competitors, set higher markups and have higher levels of measured productivity.

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[3] For an excellent survey of the empirical findings on learning-by-exporting, see De Loecker (2010) and Wagner (2007).

[4] Using measures of export intensity rather than export status, Fernandes & Isgut (2007) find strong evidence of learning-by-exporting for young Colombian manufacturing plants between 1981 and 1991.

Melitz & Ottaviano (2008) also suggest that markups are positively related to firm export intensity and markups are higher on the export market than on domestic markets. According to their model, the presence of trade costs leads firms to charge higher markups on foreign markets than on domestic markets in order to recover their additional frictional trade cost.

Theoretically, however, the markup premium that a firm sets on its export markets, would depend on its relative efficiency compared to foreign competitors. Exporters could charge lower markups in order to remain competitive relative to more efficient foreign competitors. Likewise, if foreign demand elasticity is bigger than domestic ones, non-exporting firms would have higher price-cost margins than exporters. Last not the least, if firms that extend their export activities face additional variable costs, for example due to the increasing geographic distance and differences in culture and peculiarities of the individual foreign market, this may adversely affect productivity as well as markups. Hence, unlike Melitz & Ottaviano (2008)'s prediction, it may be at least theoretically plausible that firms with less exposure to foreign markets charge higher markups.

Finally, Melitz & Ottaviano (2008)'s model indicates that all surviving firms are worse off in terms of price markups after trade liberalization, due to pro-competitive effects, while trade does not affect the rankings of firms ordered by profitability.

Using Slovenian firm-level data for the periods of 1994-2000, De Loecker & Warzynski (2010) find that exporters charge higher markups on average and firms' markups increase upon export entry. Fryges & Wagner (2010), adopting a continuous treatment approach, also provides evidence of the profitability premium of exporters compared to non-exporters from the German enterprise-level data. In addition, they find that exporting improves the profitability almost over the whole range of the export-shipment ratios.

In a similar vein, Görg & Warzynski (2003) find that exporters have higher markups than non-exporters for differentiated goods, while no significant differences are found for the case of homogeneous goods for both types of firms. Finally, Lourdes & Rodríguez (2010) suggest that non-exporters have smaller margins than persistent exporters, but larger export ratio is negatively associated with margins for persistent exporters, largely due to higher competitive pressure in international markets.

Among the aforementioned papers, De Loecker & Warzynski (2010) and Fryges & Wagner (2007, 2010) are the most closely-linked ones to our current research. As mentioned earlier, unlike De Loecker & Warzynski (2010), we focus on the relationships between export intensity and firm's performance measures such as productivity and markups.

Our research is similar in spirit to Fryges & Wagner (2007, 2010) that each study examines the potential relationships either between markups and export activities or between productivity and export activities. However, our paper is different from Fryges & Wagner (2007, 2010) in the following ways. First, Fryges & Wagner (2007) use labor productivity in their analysis, due to data constraints, without considering the possibility that their productivity measures may be contaminated due to firm-specific markups. As Martin (2008) shows, productivity changes could be under-estimated if the market power effects are ignored in estimation. Second, Fryges & Wagner (2010) calculate the rate of profits from the cost structure surveys but we instead estimate markups controlled for unobserved productivity shock.

Third, Fryges & Wagner (2007, 2010) examine the productivity-export nexus and the profitability-export nexus independently in separate papers, without taking the linkage between productivity and profitability into account. On the other hand, our paper estimates and compares productivity and markups dynamics together at each level of export intensity.

3. Empirical Strategy

3.1. Estimation of Productivity and Markups

A common practice in the existing literature to estimate plant-level total factor productivity is based on output measure calculated as revenue or value-added divided by a common industry-level deflator, due to the fact that plant-specific output prices are typically unobserved. Consequently, within-industry price differences are embodied in output and productivity measures. Then if these prices reflect mostly market power variation rather than production efficiency differences, high "productivity" firms may not be necessarily technologically efficient. Furthermore, if this is indeed the case, then the empirical literature on the export-productivity nexus possible documents the importance of selection on profits, but not necessarily productivity (Foster *et al*., 2008).[5]

Recently, empirical models to estimate TFP and markups in the absence of establishment-level prices are proposed by a number of papers, including De Loecker & Warzynski (2010) and Martin (2010). These studies rely on Hall (1986, 1988)'s methodology that provides an estimate for the industry-markup jointly with a productivity index by introducing the demand side into the structural model of the production process.[6]

Consider the cost minimization problem for a firm i at time t with value-added production technology, $Q_{it} = f(L_{it}, K_{it})$ where L_{it} and K_{it} denote labor, which is the only variable input, and capital. Assume that $Q_{it}(\cdot)$ is continuous and twice differentiable for each of its arguments. Let w_{it} and r_{it} be firm-specific input prices for labor and capital, respectively. Then, the first-order condition indicates that

$$\frac{\partial Q_{it}(\cdot)}{\partial L_{it}} = \frac{w_{it}}{\lambda_{it}} \tag{1}$$

where λ_{it} measures the marginal cost of production. By multiplying both sides of Equation (1) by L_{it}/Q_{it} and rearranging it, we get

$$\frac{\partial Q_{it}}{\partial L_{it}} \frac{L_{it}}{Q_{it}} = \frac{1}{\lambda_{it}} \frac{w_{it} L_{it}}{Q_{it}} \tag{2}$$

Now define the markup, μ_{it} as $\mu_{it} \equiv P_{it}/\lambda_{it}$. where P_{it} denotes output price for a firm i at time t. Then we can rearrange Equation (2) into the following;

$$\mu_{it} = \frac{\partial Q_{it}}{\partial L_{it}} \frac{L_{it}}{Q_{it}} \bigg/ \frac{w_{it} L_{it}}{P_{it} Q_{it}} = \frac{\theta_{it}^{L}}{\alpha_{it}^{L}} \tag{3}$$

where θ_{it}^{L} denotes the output elasticity of labor input and α_{it}^{L} is the expenditure share on labor input in total shipment. The latter can be directly obtained from the data and

[5] Foster *et al*. (2008) argue that "*because physical productivity is inversely correlated with price while revenue productivity is positively correlated with price, previous work linking productivity to survival confounded the separate and opposing effects of technical efficiency and demand on survival, understating the true impacts of both.*"

[6] At the same time, however, while Hall (1987, 1988) mainly considers industry-level productivity dynamics and concentrates on separating the markups from the degree of returns to scale, the recent studies focus on establishment-level productivity and markups.

thus we only need to estimate θ_{it}^{L} to get the markup measure price for a firm i at time t.

De Loecker & Warzynski (2010) consider the following estimation equation based on a translog production function;

$$q_{it} = \beta_l l_{it} + \beta_k k_{it} + \beta_{ll} l_{it}^2 + \beta_{kk} k_{it}^2 + \beta_{lk} l_{it} k_{it} + \psi_{it} + \varepsilon_{it} \tag{4}$$

where lower cases denote the natural logarithm of each variable, ψ_{it} is an index for firm's productivity and ε_{it} is a white noise.

The estimation procedure of Equation (4) applied by De Loecker & Warzynski (2010), which is adopted in this paper, consists of two steps and follows the control function approach of Ackerberg *et al.* (2006).[7] In the first stage, the following equation is estimated semi-parametrically to obtain estimates of expected output ($\widehat{\phi}_{it}$) and an estimate for ε_{it}.

$$q_{it} = \phi_{it}(l_{it}, k_{it}, m_{it}) + \varepsilon_{it} \tag{5}$$

Our functional form of the expected output from the first stage estimation is given by

$$\phi_{it} = \beta_l l_{it} + \beta_k k_{it} + \beta_{ll} l_{it}^2 + \beta_{kk} k_{it}^2 + \beta_{lk} l_{it} k_{it} + h_{it}(m_{it}, k_{it}) \tag{6}$$

where $\psi_{it} = h_t(m_{it}, k_{it})$ à la Levinsohn & Petrin (2003) is introduced to proxy for productivity in the production function estimation. Using the first stage estimation, we can calculate

$$\psi_{it} = \widehat{\phi}_{it} - \beta_l l_{it} - \beta_k k_{it} - \beta_{ll} l_{it}^2 - \beta_{kk} k_{it}^2 - \beta_{lk} l_{it} k_{it} \tag{7}$$

for any value of $\beta = (\beta_l, \beta_{ll}, \beta_{lk}, \beta_k, \beta_{kk})$.

In the second stage, given the assumption that productivity follows a first order Markov process, i.e. $\psi_{it} = g_t(\psi_{it-1}) + \xi_{it}$, we non-parametrically regress $\psi_{it}(\beta)$ on $\psi_{it-1}(\beta)$ to get the residual ξ_{it}. And finally, based on moment conditions, the estimates of production functions are obtained using standard GMM estimation, which derives our estimated total factor productivity.

In addition, the estimated output elasticity of labor input can be given by

$$\hat{\theta}_{it}^{L} = \hat{\beta}_l + 2\hat{\beta}_{ll} l_{it} + \hat{\beta}_{lk} k_{it} \tag{8}$$

Then, we can plug Equation (8) into (3) to get the plant-level estimates of markup.

[7] Ackerberg *et al.* (2006) extend the semi-parametric estimator of Olley and Pakes (1996) to solve the multi-collinearity and identification issues with the labor variable. While further discussions on these issues are beyond the scope of this paper, the interested readers can find them in Van Beveren (2010) for more details.

3.2.Generalized Propensity Score (GPS) Approach

In order to investigate the potential relationship among markups, productivity and export intensity, we will utilize the generalized propensity score (GPS) methodology recently developed by Hirano & Imbens (2004). Much of the work on propensity score analysis regarding the causal effect of firms' export on productivity used export status as a binary treatment variable for each firm (e.g., De Loecker [2007] with Slovenian data and Wagner [2002] with German data). While the binary export status variable contains its own valuable information, it cannot incorporate the degree or extent of export intensity in empirical analysis.

By extending standard propensity score analysis from Rosenbaum & Rubin (1983) with binary treatment variable, Imai & van Dick (2004) and Hirano & Imbens (2004) proposed the GPS methodology which allows for the case where the treatment variable (export intensity variable in our analysis) may take on a continuum of values. Fryges & Wagner (2007) applied this GPS methodology in order to investigate the relationship between firms' export activities and productivity using German manufacturing data set.[8] However, unlike Fryges & Wagner (2007) where firm's productivity was measured by labor productivity (total sales per employee), we will use total factor productivity (which is preferred to labor productivity measure) and in addition firm's markup variable will be analyzed as firms' performance variable in our analyses.

The basic logic of the GPS methodology is as follows.[9] Let N denote the size of our random sample (i.e., number of firms). For each firm i, we observe Xi (pre-treatment covariates that may affect the level of treatment), Ti (the level of treatment received, i.e., firm's export intensity) and Yi(t) (the value of the outcome associated with treatment, i.e., TFP or markups). Yi(t) is referred to as the unit-level dose-response function (potential outcome corresponding to the level of the treatment received) and the average dose-response function, $\mu(t) = E[Y_i(t)]$, is of our interest to be estimated.

[8] Another application can be found in Du & Girma (2009) which investigated the causal effects of foreign acquisition on domestic and export market dynamics with GPS methodology using Chinese firm-level data.

[9] See Hirano and Imbens (2004) for more details.

We can define the generalized propensity score (GPS), $R = r(T, X)$, where $r(t, x) = f_{T|X}(t|x)$ is the conditional density of the treatment given the pre-treatment covariates. If suitably specified, the GPS has a balancing property similar to that of the standard propensity score for the binary case:[10] that is, within strata with the same value of r(t, X) the probability that T=t does not depend on the value of X.[11]

Combining this balancing property with the weak unconfoundedness assumption, Hirano & Imbens (2004) proved that for every level of treatment t,[12]

$$f_T\{t|r(t, X), Y(t)\} = f_T\{t|r(t, X)\} \tag{9}$$

which implies that assignment to treatment T is unconfounded given the GPS and that the conditional density of the treatment level at t can be calculated using the GPS at the corresponding level of the treatment.[13]

Hirano & Imbens (2004) finally proved that with weak unconfoundedness assumption, the GPS can be used to eliminate any biases associated with differences in the covariates because it can be shown that

$$\beta(t, r) = E[Y(t)|r(t, X) = r] = E[Y(t)|T = t, R = r] \tag{10}$$
$$\mu(t) = E[\beta(t, r(t, X)] = E[Y(t)] \tag{11}$$

where equation (11) is the average dose-response function we are interested in.

In practice, estimating the average dose-response function consists of the following three steps. First we estimate the GPS, the conditional distribution of the treatment variable given the pre-treatment covariates: $E[T_i|X_i]$. In our case, Ti takes many zeros in our sample and thus natural choice of the estimation method would be the fraction logit model developed by Papke and Wooldridge (1996). In the second stage with the estimated GPS ($\widehat{R}_i$) from above, we estimate the regression equation (10) by using quadratic approximation following Hirano & Imbens (2004).

$$E\left[Y_i\middle|T_i, \widehat{R}_i\right] = \alpha_0 + \alpha_1 T_1 + \alpha_2 T_i^2 + \alpha_3 \widehat{R}_i + \alpha_4 \widehat{R}_i^2 + \alpha_5 T_i \widehat{R}_i \tag{12}$$

This is estimated with OLS.

In the final stage with estimated coefficient from equation (12), we estimate the average potential outcome at treatment level t (equation (11)) as

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[10] Note that with the GPS we are considering the case where $T_i \in [t_0, t_1]$ (i.e., when the treatment can take ay value between t_0 and t_1). If $T_i \in \{0,1\}$, (i.e., when the treatment is binary), we get back to the case of Rosenbaum and Rubin (1983)'s traditional propensity score.

[11] That is, we have $X \perp I(T = t) \mid r(t, X)$where $I(\cdot)$ is the indicator function.

[12] The weak unconfoundedness assumption can be written as $Y(t) \perp T \mid X$ for all *t*.

[13] Roughly speaking, equation (1) implies that $Y(t) \perp T \mid r(t, X)$. Thus theorem is referred to as weak unconfoundedness given generalized propensity score.

$$E[\widehat{Y(t)}] = \frac{1}{N}\sum_{i=1}^{N}\{\hat{\alpha}_0 + \hat{\alpha}_1 \cdot t + \hat{\alpha}_2 \cdot t^2 + \hat{\alpha}_3 \cdot \hat{r}(t, X_i) + \hat{\alpha}_4 \cdot \hat{r}(t, X_i)^2 + \hat{\alpha}_5 \cdot t \cdot \hat{r}(t, X_i)\} \quad (13)$$

This will be done for every level of the treatment we are interested in to obtain an estimate of the entire dose-response function.

4. Empirical Results

4.1. Data and Descriptive Statistics

Our plant-level micro-data come from the "Survey of Mining and Manufacturing" conducted by the KNSO (Korea National Statistical Office). This Survey covers all establishments with five or more employees in the mining and manufacturing sectors and contains necessary information to construct the variables used in this paper at plant-level, such as value-added, labor, capital stocks, intermediate input usage and many other plant-specific characteristics.

We construct three groups of variables that will be used in our empirical analyses: (1) treatment variable, (2) outcome variables and (3) pre-treatment variables. First, the treatment variable is export intensity which is defined by export value divided by total shipment. Second, the outcome variables are TFP (after taking natural logarithm) and markup as estimated by the methodology described in section III. The data needed to estimate these two outcome variables are directly taken from the Survey mentioned above.

Third, the pre-treatment variables include plant's size, age, wage, non-production workers' share, capital-labor ratio and R&D dummy. Plant's size is measured as the natural logarithm of the number of total employment and plant's age as (current year - established year + 1) divided by one hundred. Wage is the natural logarithm of yearly wage bill divided by the number of total employment. The share of non-production workers is the number of non-production workers divided by total employment. The capital-labor ratio is measured as the natural logarithm of capital stock over total employment. R&D dummy takes the value of one if firm's R&D expenditure is positive number and zero otherwise. In addition to these plant-specific pre-treatment variables, we also constructed Herfindahl-Hirschman Index (HHI) at KSIC (Korea

Standard Industry Classification) 4-digit level.[14] HHI measures the degree of competition in each industry and is defined as the sum of the squares of the market share of each plant.[15]

After we constructed our variables as mentioned above for the time period of 1990~2002, we included plants with at least four consecutive years of observations in our sample period. In our empirical analyses using dose-response function below, we would like to analyze the dynamic impacts of export intensity on TFP and markup up to the next three years from the base year. Since one of our interests is to investigate how these dynamic impacts change over time, we excluded plants with less than four consecutive years of observations.

Table 1 shows simple correlations among these variables. First we can confirm that the export-premia found in the previous literature do exist in our sample plants as well. The export dummy variable is positively correlated with all other variables: that is, exporters are more productive, charging higher markup and at the same time they are older, paying higher wage, having higher share of non-production workers, having higher capital-labor ratio and more likely to implement R&D activities. The export intensity, our treatment variable, also exhibits the similar patterns of export-premia just like the export dummy variable. However, in all cases the correlations between the export intensity and other variables are lower than those between the export dummy and other variables.

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[14] With KSIC 4-digit level, the number of industries in our sample is 214.

[15] HHI can range from 0 to 1, moving from a huge number of very small plants to a single monopolistic producer.

Table 1: Correlation among Key Variables

	Export intensity	Export dummy	lnTFP	Markup	Age	Size	Wag e	Non-production worker share	K/L ratio	R&D dummy	HHI
Export intensity	1.000										
Export dummy	0.694	1.000									
lnTFP	0.314	0.522	1.000								
Markup	0.035	0.037	0.117	1.000							
Age	0.126	0.235	0.323	-0.068	1.000						
Size	0.317	0.510	0.671	-0.013	0.324	1.000					
Wage	0.136	0.259	0.529	-0.566	0.246	0.307	1.000				
Non-production worker share	0.037	0.122	0.266	0.013	0.090	0.167	0.187	1.000			
K/L ratio	0.129	0.255	0.524	0.092	0.245	0.218	0.414	0.167	1.00 0		
R&D dummy	0.177	0.335	0.364	0.027	0.150	0.356	0.194	0.137	0.18 7	1.000	
HHI	0.068	0.093	0.101	0.072	0.026	0.096	0.030	0.034	0.03 2	0.068	1.000

In Table 2, we divide exporters by 10 categories according to their level of export intensity and provide mean values of our key variables for each group. While exporters' TFP levels are higher than that of non-exporters in all export intensity level, there seems to be no systematically monotonic relationship between export intensity and exporter's TFP level. Interestingly, the exporters with export intensity level of 0~10% have on average the highest mean value of TFP level, which is a similar level to those with 50~60%.

On the other hand, we can find a positive relationship between export intensity and markup: the higher the level of export intensity, the higher the level of markup. This positive and almost quasi-monotonic relation between markup and export intensity seems to be consistent with Melitz & Ottaviano (2008)'s theoretical prediction: markups are positively related to firm's export intensity.

Table 2: Summary Statistics by Export Intensity (Plants Surviving at Least for 4 years)

Export intensity	Obs.	ln(export)	ln(tfp)	Markup	Age	Size	Wage	NP worker share	K/L ratio	R&D dummy	HHI
0%	95,290	-	3.00	1.73	0.08	2.62	2.15	0.32	2.54	0.05	0.0464
0-10%	7,553	4.81	3.56	1.80	0.14	4.06	2.52	0.67	3.50	0.34	0.0616
10-20%	3,045	6.44	3.52	1.80	0.13	3.97	2.50	0.57	3.45	0.31	0.0621
20-30%	2,124	7.01	3.53	1.83	0.13	4.01	2.49	0.55	3.45	0.34	0.0626
30-40%	1,769	7.38	3.53	1.83	0.13	4.03	2.49	0.51	3.43	0.30	0.0604
40-50%	1,583	7.57	3.52	1.90	0.13	3.96	2.49	0.49	3.46	0.29	0.0662
50-60%	1,196	7.96	3.56	1.91	0.13	4.12	2.48	0.47	3.42	0.30	0.0678
60-70%	1,168	7.99	3.52	1.93	0.13	4.05	2.47	0.44	3.33	0.30	0.0686
70-80%	1,043	8.10	3.51	1.86	0.12	4.02	2.45	0.45	3.32	0.28	0.0655
80-90%	1,004	8.08	3.47	1.85	0.12	3.98	2.41	0.40	3.13	0.28	0.0632
90-100%	2,761	7.59	3.34	1.89	0.11	3.54	2.28	0.36	2.82	0.15	0.0613
Total	118,536	6.55	3.10	1.75	0.09	2.88	2.22	0.36	2.70	0.10	0.0497

Interestingly, among exporters, those with relatively lower levels of export intensity are older, paying higher wages, having a higher share of non-production workers, having higher capital-labor ratio and more likely to implement R&D activities, relative to those with higher export intensity. On the other hand, firm size, which is proxied by employment size, does not show a systematic relationship with export intensity. Finally, the extent of competitive pressure in domestic markets tends to be higher for exporters with lower export intensity.

Table 3. to Table 4. contain Markov transition matrices of export intensity for 3 years forward. As shown in the tables, 58% of non-exporters existed at year t remains as non-exporters one year later, while only around 3% of them becomes exporters at year t+1. This tendency remains about the same for 2- and 3-year span forward.

On the other hand, as for exporters, around 20% of them at year t exits out of export markets and serve only for domestic market at year t+1. The probability for switching to non-exporters is higher for exporters with relatively lower export intensity. For example, for 3-year span from t to t+3, more than one-fourth of exporters with export intensity level of 0~25% at year t becomes non-exporters at t+3, while only less than 20% of those that sell more than a half of their products to foreign markets switches their status to non-exporters.

Table 3: Markov Transition Matrix of Export Status and Intensities (one-year interval)

t=0 \ t = 1		Non-exporter	Exporter				Non-Existence	Total
			0~25%	25~50%	50~75%	75~100%		
Non-exporter		331,905 (58.2)	9,895 (1.7)	3,103 (0.5)	1,840 (0.3)	3,056 (0.5)	220,450 (38.7)	570,249 (100.0)
Exporter	0~25%	8,645 (26.9)	12,442 (38.7)	1,764 (5.5)	469 (1.5)	315 (1.0)	8,490 (26.4)	32,125 (100.0)
	25~50%	2,754 (21.4)	1,566 (12.2)	3,305 (25.7)	1,106 (8.6)	421 (3.3)	3,714 (28.9)	12,866 (100.0)
	50~75%	1,593 (17.9)	420 (4.7)	1,056 (11.9)	2,218 (24.9)	855 (9.6)	2,773 (31.1)	8,915 (100.0)
	75~100%	3,176 (18.8)	335 (2.0)	408 (2.4)	944 (5.6)	5,492 (32.5)	6,555 (38.8)	16,910 (100.0)
Non-existence/Exiter		245,565 (14.3)	9,104 (0.5)	4,011 (0.2)	2,738 (0.2)	6,715 (0.4)	1,449,862 (84.4)	1,717,995 (100.0)
Total		593,638 (25.2)	33,762 (1.4)	13,647 (0.6)	9,315 (0.4)	16,854 (0.7)	1,691,844 (71.7)	2,359,060 (100.0)

Note: Exporters are divided into four categories according to export intensities. The probabilities of status change from t to t+1 are in the parentheses.

Table 4. Markov Transition Matrix of Export Status and Intensities (two-year interval)

t=0 \ t = 2		Non-exporter	Exporter				Non-Existence	Total
			0~25%	25~50%	50~75%	75~100%		
Non-exporter		231,660 (45.9)	9,528 (1.9)	2,895 (0.6)	1,696 (0.3)	2,632 (0.5)	256,705 (50.8)	505,116 (100.0)
Exporter	0~25%	7,547 (26.9)	8,460 (30.2)	1,663 (5.9)	543 (1.9)	318 (1.1)	9,504 (33.9)	28,035 (100.0)
	25~50%	2,327 (21.1)	1,265 (11.5)	2,013 (18.3)	907 (8.2)	401 (3.6)	4,092 (37.2)	11,005 (100.0)
	50~75%	1,486 (19.4)	385 (5.0)	736 (9.6)	1,318 (17.2)	751 (9.8)	3,000 (39.1)	7,676 (100.0)
	75~100%	2,605 (17.6)	306 (2.1)	393 (2.7)	738 (5.0)	3,493 (23.6)	7,289 (49.2)	14,824 (100.0)
Non-existence/Exiter		294,408 (18.9)	10,937 (0.7)	4,772 (0.3)	3,260 (0.2)	7,247 (0.5)	1,235,874 (79.4)	1,556,498 (100.0)
Total		540,033 (25.4)	30,881 (1.5)	12,472 (0.6)	8,462 (0.4)	14,842 (0.7)	1,516,464 (71.4)	2,123,154 (100.0)

Note: Exporters are divided into four categories according to export intensities. The probabilities of status change from t to t+2 are in the parentheses.

Table 5. Markov Transition Matrix of Export Status and Intensities (three-year interval)

t=0 \ t = 3		Non-exporter	Exporter				Non-Existence	Total
			0~25%	25~50%	50~75%	75~100%		
Non-exporter		164,484 (37.8)	7,174 (1.7)	2,049 (0.5)	1,122 (0.3)	1,758 (0.4)	259,071 (59.5)	435,658 (100.0)
Exporter	0~25%	6,909 (26.5)	6,741 (25.9)	1,446 (5.6)	427 (1.6)	245 (0.9)	10,306 (39.5)	26,074 (100.0)
	25~50%	2,088 (20.0)	1,135 (10.9)	1,560 (15.0)	814 (7.8)	322 (3.1)	4,513 (43.3)	10,432 (100.0)
	50~75%	1,257 (16.9)	378 (5.1)	704 (9.5)	1,056 (14.2)	631 (8.5)	3,398 (45.8)	7,424 (100.0)
	75~100%	2,276 (15.5)	273 (1.9)	384 (2.6)	705 (4.8)	2,837 (19.3)	8,232 (56.0)	14,707 (100.0)
Non-existence/Exiter		306,370 (22.0)	12,009 (0.9)	5,162 (0.4)	3,518 (0.3)	7,235 (0.5)	1,058,659 (76.0)	1,392,953 (100.0)
Total		483,384 (25.6)	27,710 (1.5)	11,305 (0.6)	7,642 (0.4)	13,028 (0.7)	1,344,179 (71.2)	1,887,248 (100.0)

Note: Exporters are divided into four categories according to export intensities. The probabilities of status change from t to t+3 are in the parentheses.

4.2. Determinants of Export Intensity

As aforementioned, we estimate generalized propensity score by using fractional logit model where export intensity is regressed on one year lag values of pre-treatment variables (TFP, markup, age, size, wages, non-production worker share, capital-labor ratio, R&D dummies and HHI), year dummies and industry dummies. Basing on this estimation results, we can figure out what kinds of firms' attributes induce their export decision and determine their relative exposure to foreign markets. The estimation results are shown in Table 6.

Table 6: Fractional Logit Regression Results

	Dependent Variable: Export Intensity$_t$
$\ln TFP_{t-1}$	1.011*** (0.092)
Markup $_{t-1}$	-0.041 (0.038)
Age_{t-1}	2.639*** (0.396)
$(Age_{t-1})^2$	-7.769*** (0.947)
$Size_{t-1}$	0.442*** (0.019)
$Wage_{t-1}$	-0.110 (0.088)
NP share$_{t-1}$	-0.046** (0.019)
K/L ratio$_{t-1}$	0.076*** (0.015)
R&D dummy$_{t-1}$	0.038 (0.033)
HHI_{t-1}	1.097** (0.484)
$(HHI_{t-1})^2$	-2.971** (1.216)
Constant	-6.115*** (0.328)
Observations	71,979
Log-likelihood	-13,607

Note: One-year lags are taken for all explanatory variables. Year dummies and industry dummies are not reported but included in the regression. The robust standard errors are in the parentheses. *, ** and *** indicate that the estimated coefficients are significant at the 10%, 5% and 1% level, respectively.

Other things being equal, plants with higher productivity level, bigger size and higher capital-labor ratio tend to sell a higher portion of their products in foreign markets. This relationship does not hold for markups as the estimated coefficient for markup level is statistically insignificant. The estimation results also suggest that relatively younger plants tend to have higher export intensity, while interestingly exporters belonging to more concentrated industries sell a bigger portion of their products to international markets.[18]

4.3.TFP and Markup Differentials

Table 7 shows TFP and markup differentials between exporters and non-exporters. We can see that the mean value of exporters' TFP (after taking log) level (3.51) is higher than that of non-exporters (3.00) and the same is true with the median value (3.42 vs. 2.96). At the same time the mean value of exporters' markup level (1.84) is also higher than that of non-exporters (1.73).

Table 7: TFP and Markup: Exporters vs. Non-exporters

Outcome variable	Export status	Obs.	Mean	Standard deviation	p10	p25	p50	p75	p90
lnTFP	Non-exporter	95,290	3.00	0.29	2.66	2.80	2.96	3.15	3.37
	Exporter	23,246	3.51	0.46	3.01	3.18	3.42	3.76	4.15
	Total	118,536	3.10	0.39	2.69	2.84	3.03	3.27	3.60
Markup	Non-exporter	95,289	1.73	1.23	0.91	1.15	1.49	1.95	2.59
	Exporter	23,246	1.84	1.03	1.02	1.27	1.63	2.13	2.82
	Total	118,535	1.75	1.19	0.93	1.17	1.52	1.98	2.64

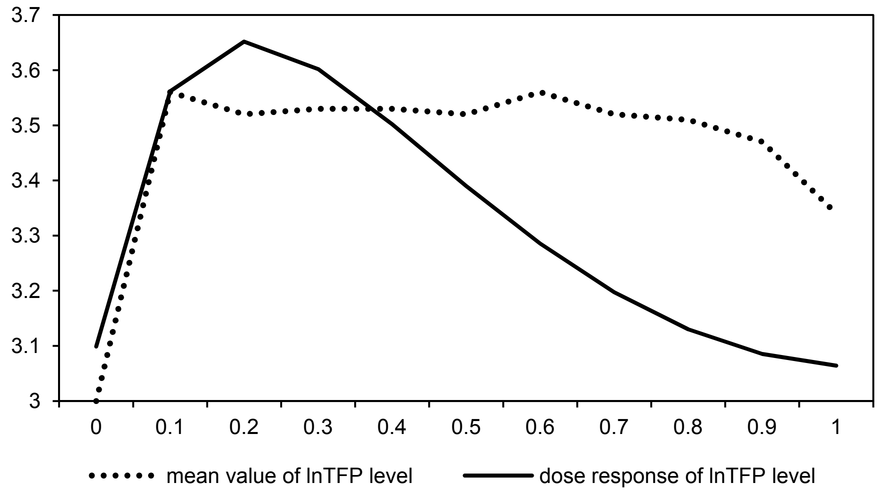
As shown in Table 2, while exporters' TFP levels are higher than that of non-exporters in all export intensity level, there seems to be no systematically monotonic relationship between export intensity and exporter's TFP level, which is depicted as a

[18] While the estimation results suggest an inverted U-shape relationship between export intensity and the extent of market concentration, the estimated turning point of the slopes is where the Herfindahl-Hirschman index reaches at 0.2. Since the HHI for most of the plants is much lower than this turning point, we can conclude the positive relationship between tow variables.

dotted line in Figure 1. In addition, as aforementioned, there exists a positive and almost quasi-monotonic relation between markup and export intensity (Figure 2).

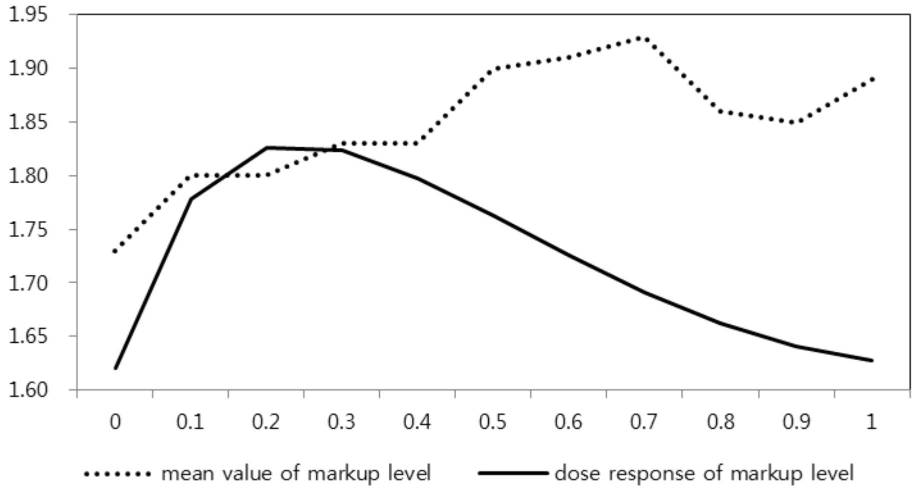
But how would TFP and markups at each level of export intensity look like once we control for other plant-specific characteristics at hands? In this purpose, we adopt here the generalized propensity score (GPS) methodology recently developed by Hirano & Imbens (2004), in order to see the causal effect of firms' export intensity on productivity and markups. After having run the aforementioned fractional logit model, we get the estimates for propensity score of each firm. With these estimates and observed export intensity, we can calculate dose-response function of outcome variables by estimating (13) in section III.[19] The dose-response functions of TFP and markup levels are drawn as solid lines in Figure 1 and 2. The dotted line (observed mean value of outcome variable) and the solid line (estimated dose-response of outcome variable) in these figures provide strikingly different implications.

Figure 1: Mean Value and Dose-Response of TFP Level



[19] In the next subsection, we will estimate the dose-response function of growth rate of TFP and markup which is the major part of our empirical work. Here we will take the level of TFP and markup as outcome variables in order to see how these variables are different after we control for other pre-treatment variables.

Figure 2: Mean Value and Dose-response of Markup level



While observed mean value of TFP level has little variation among exporters, the dose-response of TFP level reveals an inverted U-shaped relationship. The level of TFP increases until the export intensity reaches at 10~20% but above this threshold level it actually decreases, once we control for plant-specific characteristics, such as productivity level at year t-1, size, wages, capital-labor ratio and R&D activity among many others. Hence, on average, the productivity premium still hold for exporters vis-à-vis non-exporters, but the estimation results suggest substantial heterogeneity in productivity level among exporters with different export intensities.

As a matter of fact, Fryges &Wagner (2007) provide a plausible explanation for this inverted U-shaped relationship. They argue that for firms that sell a relatively small share of their total sales in the foreign market, here those with export intensity of less than 10%, learning by-exporting could be less relevant for them. Thus, it can be hypothesized that an exporter must exceed a minimum export-sales ratio before it can benefit from learning-by-exporting. Beyond this minimum intensity productivity growth is expected to increase with the firms' export intensity.

However, when a firm's export intensity exceeds a critical value, then increasing its foreign engagement incurs rising coordination and control costs for exporting activities. For example, As Gomes & Ramaswamy (1999) suggest, firms that extend their export activities often enter more distant markets. The increasing geographic distance, differences in culture and peculiarities of the individual foreign markets raise the costs of exporting, which adversely affects productivity.

One notable observation is a strong correlation between the TFP level and markup. Like TFP, the level of markups also increases as the export intensity approaches to 10~20% after which it decreases, as depicted in Figure 2. While a similar explanation as the inverted U-shape of the TFP distribution in terms of costs incurred by internationalization could be also applied to explain markup distribution, we can add some other plausible explanations; for example, if foreign markets are more competitive compared to domestic ones and/or if foreign demand elasticity is bigger than domestic counterparts, exporters with relatively higher exposure to foreign markets would charge lower markups in order to in order to remain competitive in foreign markets.

4.4. The Impacts of Export Intensity on TFP and Markup Dynamics

In the following we examine the impact of export intensity on productivity and markup changes. As aforementioned, the existing studies often relate export intensity either to learning-by-exporting or to competitive environment differentials between foreign and domestic markets. According to these studies, in the presence of learning-by-exporting, the higher export intensity could induce higher productivity growth, which in turn could increase markups. On the other hand, if firms participating in international markets are exposed to more intense competition, exposure to pro-competitive environments may worsen firms' profitability but induce a higher incentive to improve productivity. Consequently, depending on the relative importance of pro-competition effect vis-à-vis the extent of learning-by-exporting, firm-level productivity and markup dynamics may possibly differ.

To see this, we estimate here three dose-response functions that depict TFP growth rate and markup change in the periods from year t to t+3, given the export-shipment ratio in t. The dose-response functions are based on the pooled data set, using data from 1992 to 2002. Figure 3 presents the dose responses of productivity growth over 3-year span forward at each level of export intensity in t.

As depicted in the Figure, our findings indicate that over time an inverted U-shaped relationship with a peak at 0~10% of the export-shipment ratio emerges between a firm's export intensity and its TFP growth. This result is consistent with Fryges & Wagner (2007)'s empirical findings on the nexus between labor productivity and export intensity for the German manufacturing.

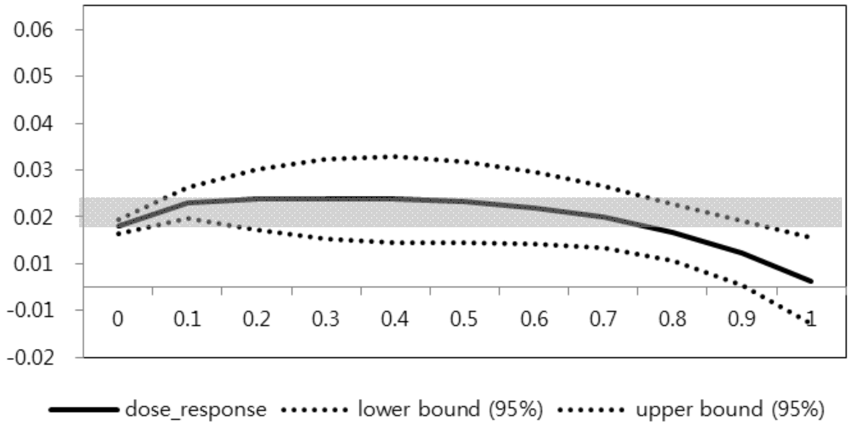
On the other hand, our results suggest that exporters with export intensity of less than 10% experience the largest productivity gains, while it is around 50% of export intensity in the case of Fryges & Wagner (2007)'s estimation. We believe that such difference in estimated peaks of the TFP growth distribution compared to Fryges and Wagner (2007) attributes largely to the extent of controlling for industry characteristics to which each firm belongs. We adopted quite a disaggregated industrial classification (KSIC 4 digit with a total of 214 different industries) in controlling unobserved industry-specific attributes. Such practice is legitimate because it allows for more stringent control for unobserved characteristics. In fact, when we re-do the estimation with less disaggregated industrial classification, the peaks of the TFP growth distribution gradually move towards around 30~40%. Figure A.1 and A.2 in appendix present estimation results when KSIC 2 digit (23 sectors) and 3-digit (61 sectors) classifications are applied, respectively.

The estimation results also show that the TFP growth rates for exporting firms with export intensity ranging from 10% to 70% are slightly higher than those for non-exporters. One the other hand, if a firm's export-shipment ratio exceeds 70%, then its productivity growth rate is lower even than non-exporters. This implies that exporting activity generally provides a better opportunity for productivity improvement, but not all exporters benefit from exports. Importantly, our GPS estimation results do not support for the hypothesis that the higher export intensity induces higher productivity growth among exporters.

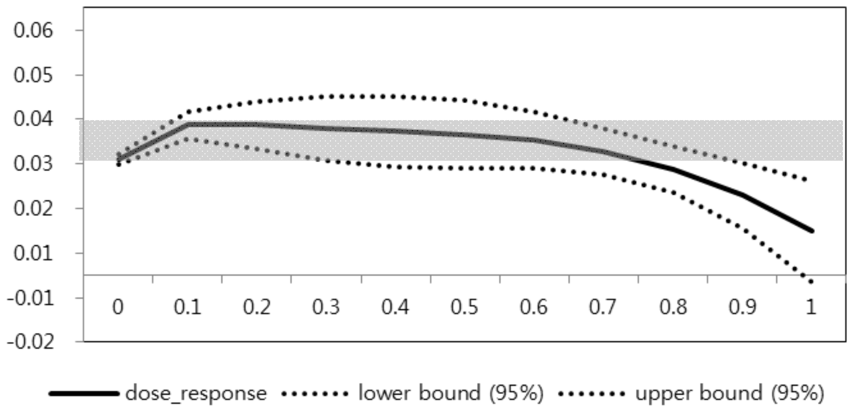
One additional interesting finding here is that generally more productive plants reveals higher productivity enhancement. As shown in Figure 2, exporters with export intensity up to 30% are most productive relative to others. These exporters are also those that experiences relative faster productivity growth. This implies that the rankings of TFP level and thus the shape of TFP distribution would be preserved over time.

Figure 3: Dose Responses of TFP Growth over 3-year Span Forward

a. TFP Growth after one year



b. TFP Growth after two years



c. TFP Growth after three years

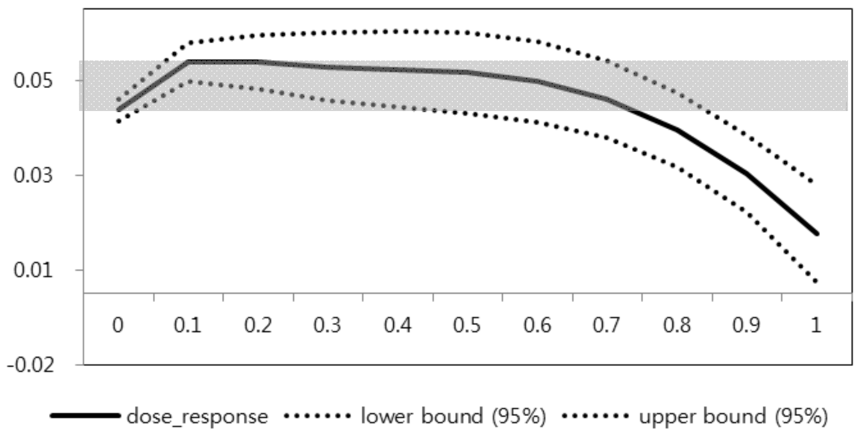


Figure 4 depicts the dose responses for the impact of the export-shipment ratio on markup changes. We can see that, regardless of export status, markups have been generally deteriorating. During the sample periods of 1992-2002, Korean firms faced a more intense competitive pressure both in domestic and foreign markets, largely due to the country's liberalization efforts as well as to accelerating globalization in the world. In addition, Korean firms also experienced rising wages over time, with a notable exception of the Asian financial crisis period of 1998-1999. These all led to a general trend of markup decreases.[20]

Our results suggest that markup deterioration has been more severe for exporters than non-exporters. The extent of markup deterioration is the largest for exporters with export intensity of less than 20%, which are relatively more productive, have a higher capital-labor ratio and, most importantly, pay higher wages than others. And over the periods from t to t+3, non-exporters' markups has declined the least, compared to exporters at any level of export intensity.

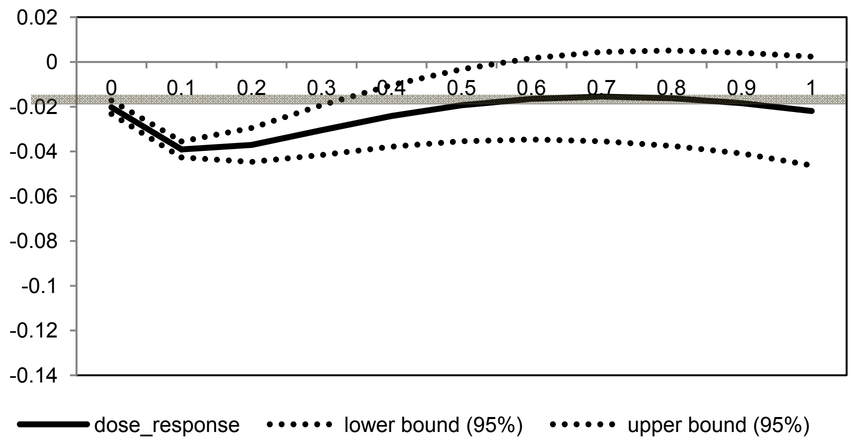
Given these observations Figure 5 depicts changes in the markup-level distribution over time given the export-shipment ratio in t, after controlling for plant-specific characteristics via the GPA method. In the figure, we normalize the markup level of non-exporters to 1 for each time period. As shown in the figure, all of exporters had higher markups than non-exporters at the reference year t, but markup gaps between exporters and non-exporters are shown to be gradually reduced over time. Furthermore, the markup levels for exporters that sell more than 80% of their products to foreign market become even lower than non-exporters after 3 years.

Generally, as markup gaps between exporters and non-exporters tend to decline, markup distribution becomes more flattened out over time. And the peak of distribution moves from 10~20% to 30~40%. These all indicate that, unlike the TFP case, the rankings of markup level substantially change over the 3-year span.

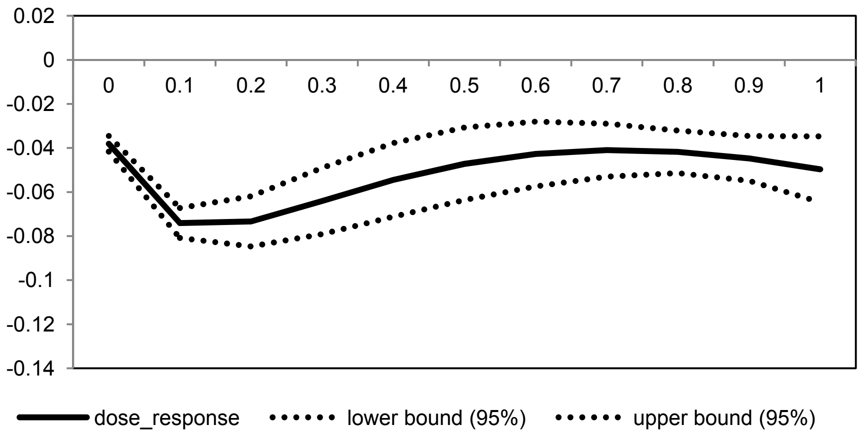
[20] Bellone *et al*. (2008) also find a sharp decline in the average markup for French manufacturing since the early 1992.

Figure 4: Dose Responses of Markup Changes over 3-year span forward

a. Markup Changes after one year



b. Markup Changes after two years



c. Markup Changes after three years

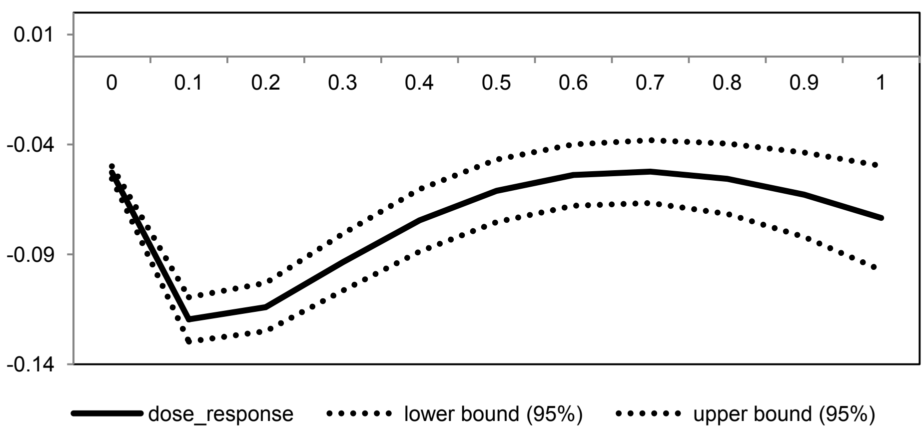
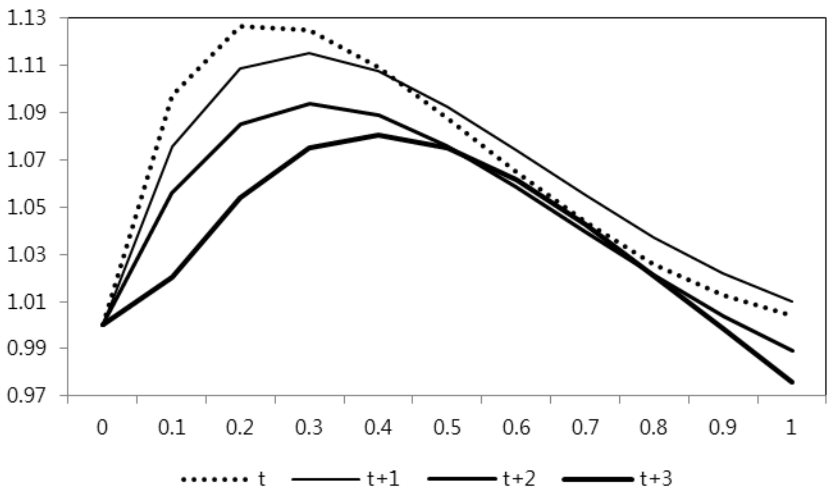


Figure 5: Markup Dynamics by Export Intensity (Markup for non-exporters=1)



5. Conclusions and Policy Implications

Taking recent new developments in trade literature on firm heterogeneity into account, this paper extensively investigates the relationship among markups, productivity and exporting intensity. We employ a new empirical framework à la De Loecker & Warzynski (2010) to measure plant-level markups and productivity of the Korean manufacturing sector for the periods of 1992-2002. Then using these measures and the GPS method, we reconsider the related empirical evidence proposed in the existing literature.

Our main findings can be summarized as follows; first of all, similar to the well-known productivity-export nexus, we find that the markup premia of exporters do exist. However, taking export intensity rather than export status into consideration, there is no monotonic relationship between export intensity and productivity (markup as well) level. Rather, the dose-responses both of TFP level and of markup level given export intensity suggest an inverted U-shaped relationship. Both TFP and markup increase until the export intensity reaches at 10~20% but above this threshold it actually decreases.

Second, this paper also finds an inverted U-shape between a firm's export intensity and its subsequent TFP growth with a peak at 0~10% of the export-shipment ratio. While our estimation results still imply that exporting activity generally provides a better opportunity for productivity improvement, but not all exporters benefit from exports. Importantly, our GPS estimation results do not support for the hypothesis that the higher export intensity induces higher productivity growth among exporters.

We can infer from our results that a usual positive relationship between export intensity and TFP growth suggested in the existing literature could stem mainly from different performances between exporters and non-exporters, but not necessarily from those among exporters. To confirm our inference here, we run fixed-effect model estimations for the whole sample and for exporters only, respectively. The results are reported in Table A.1 and Table A.2. When we test the relationship between export intensity and TFP growth for the whole sample, then we find statistically significant and positive effect of export intensity on subsequent TFP growth. However, such relationship does not emerge when we pursue the same estimation only for exporters' sample. These are largely consistent with our inference.

Third, we find that markup deterioration over the sample periods has been more severe for exporters than non-exporters. The extent of markup deterioration is the largest for exporters with export intensity of less than 20%, which are relatively more productive, have a higher capital-labor ratio and, most importantly, pay higher wages than others. And while all of exporters had higher markups than non-exporters in a reference year, markup gaps between exporters and non-exporters are shown to be reduced over time. Furthermore, the markup levels for exporters that sell a significant portion of their products to foreign market become even lower than non-exporters after 3 years. These all indicate that, unlike the TFP case, the rankings of markup level substantially change over the 3-year span.

Generally speaking, our estimation results indicate that increased global competition seems to have reduced markup differentials among plants, but at the same time has contributed to productivity improvement. From a policy perspective, our finding that the higher export intensity does not induce higher productivity growth among exporters seems to be disappointing, but as a matter of fact it does not necessarily imply that trade benefits, such as learning-by-exporting are non-existent. It is highly plausible that export intensity at a given time could be a weak measure to capture such effects. For instance, using a cumulative intensity of exposure to foreign markets rather than export intensity at a given time, Lee & Choi (2009) finds a strong evidence of learning-by-exporting in the Korean manufacturing plants.

At the same time, one finding to which we need to pay special attention here is that exporters' internationalization costs seem to be significant and thus policy efforts to reduce such costs would be very important.

As illustrated in Fryges & Wagner (2007), the costs of coordination and control rise as a firm increases its foreign engagement, possibly due to the increasing export destinations/geographic distance, differences in culture and peculiarities of the individual foreign markets, etc. Furthermore, the costs could begin to escalate when a critical value of the export sales ratio is exceeded, which results in the inverted U-shaped relationship between export intensity and TFP, as we found in this paper.

Descriptive statistics from our data indicate that exporters who have relatively higher export intensity are on average younger, smaller in size and less productive than those with lower intensity. In the existing literature such firm attributes are often shown to be critical factors for seemly higher exit rates of these firms out of export markets. Therefore, government support to help these firms to reduce internationalization costs would be invaluable, in order for them to continue to engage in international activities and to benefit from exporting.

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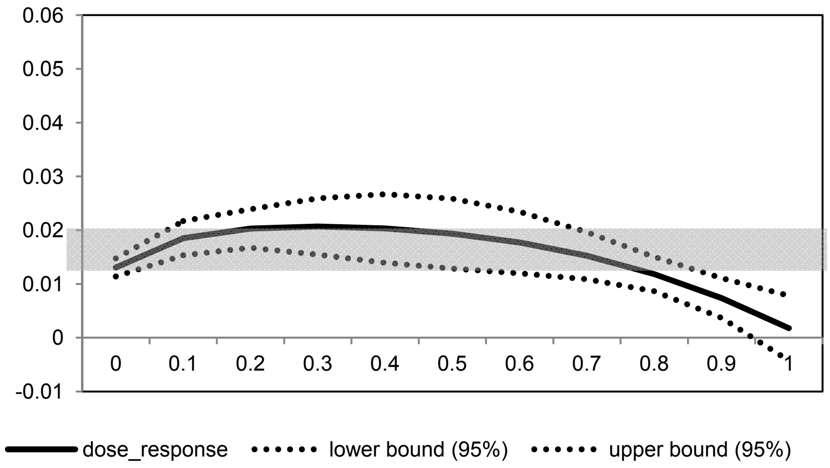
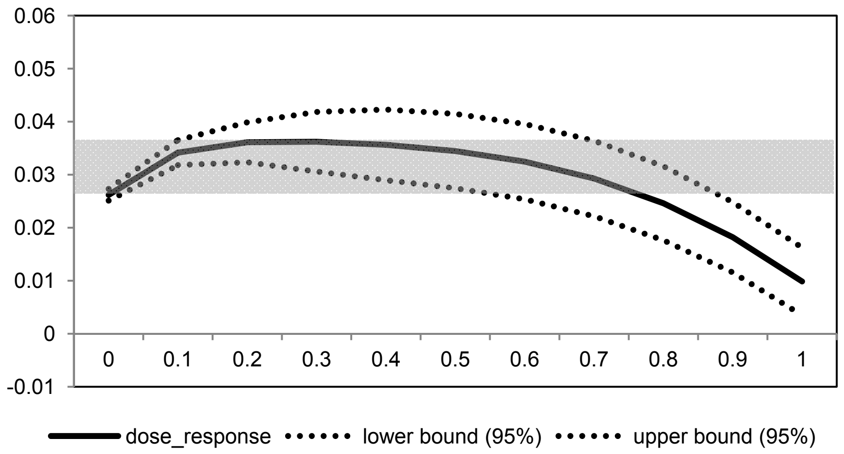
Appendix

Figure A.1: Dose Responses of TFP Growth (KSIC 2 digit classification applied)

a. TFP Growth after one year



b. TFP Growth after two years



c. TFP Growth after three years

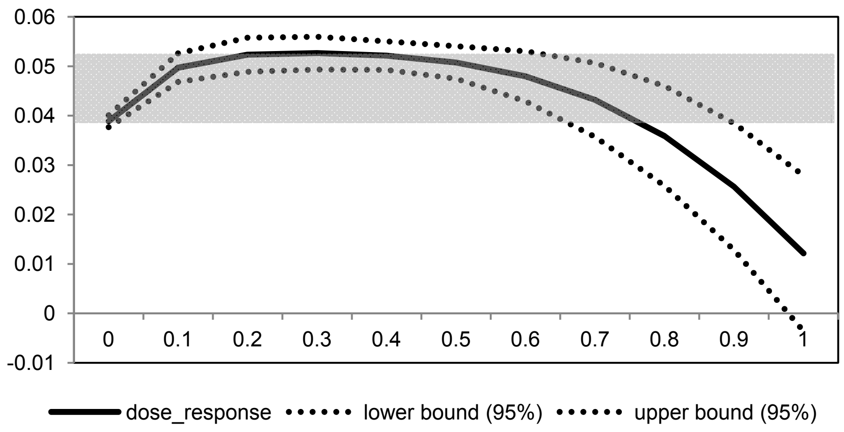
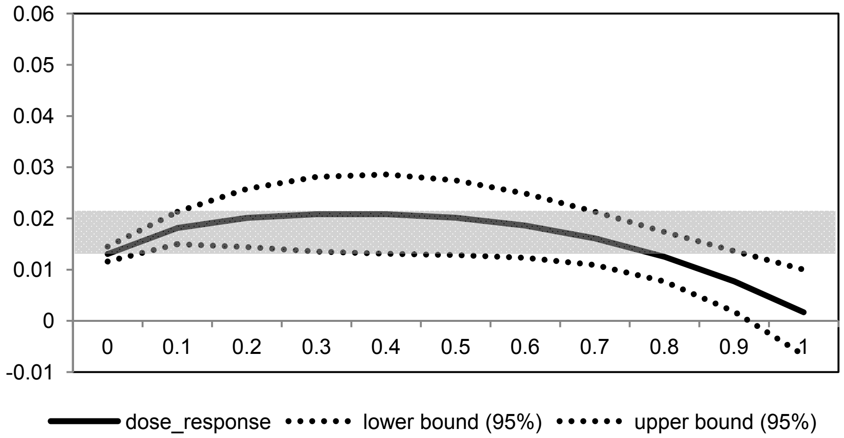
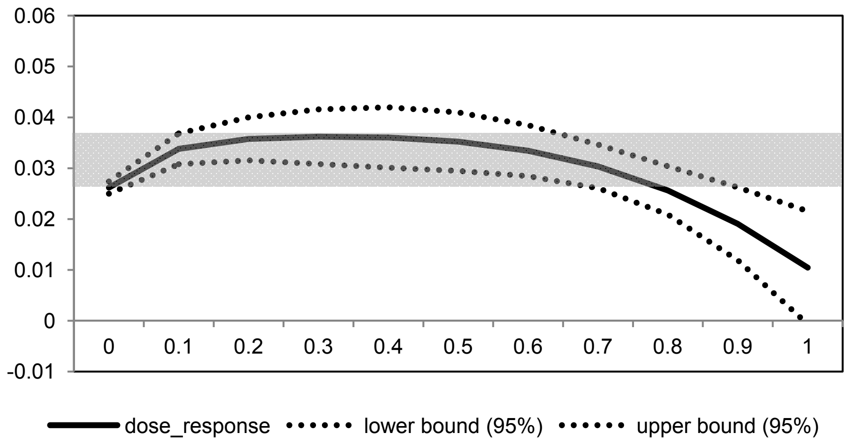


Figure A.2: Dose Responses of TFP Growth (KSIC 3 digit classification applied)

d. TFP Growth after one year



e. TFP Growth after two years



f. TFP Growth after three years

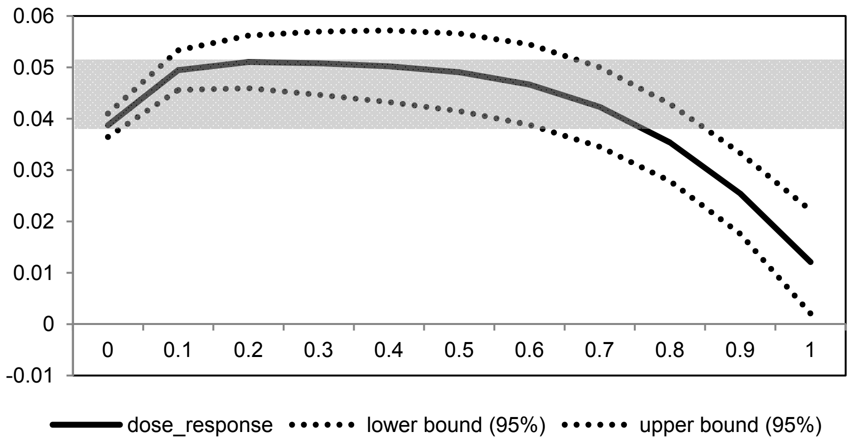
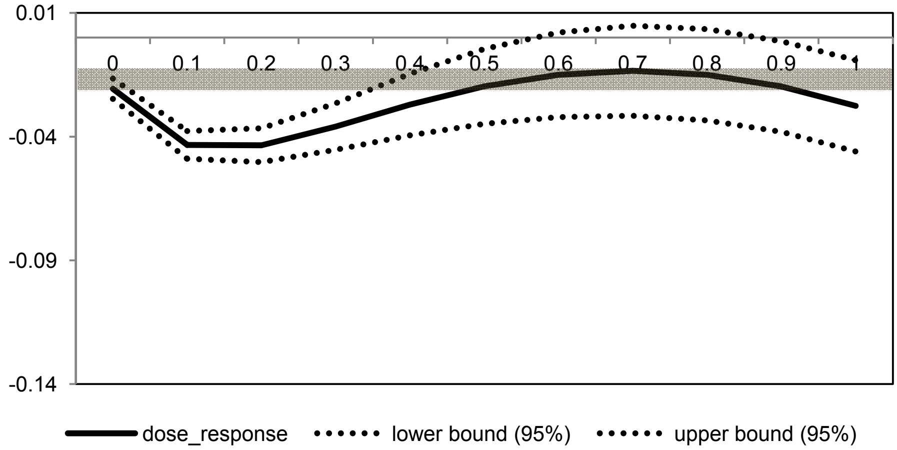
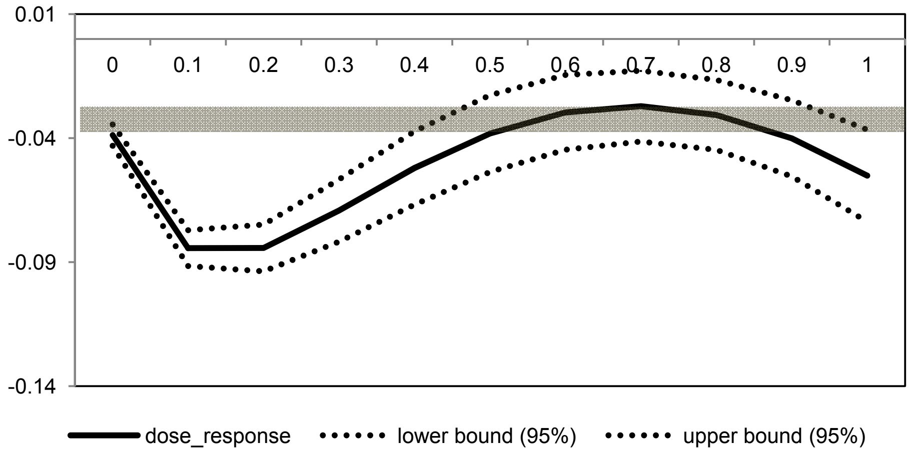


Figure A.3: Dose Responses of Markup Change (KSIC 2 digit classification applied)

a. Markup Changes after one year



b. Markup Changes after two years



c. Markup Changes after three years

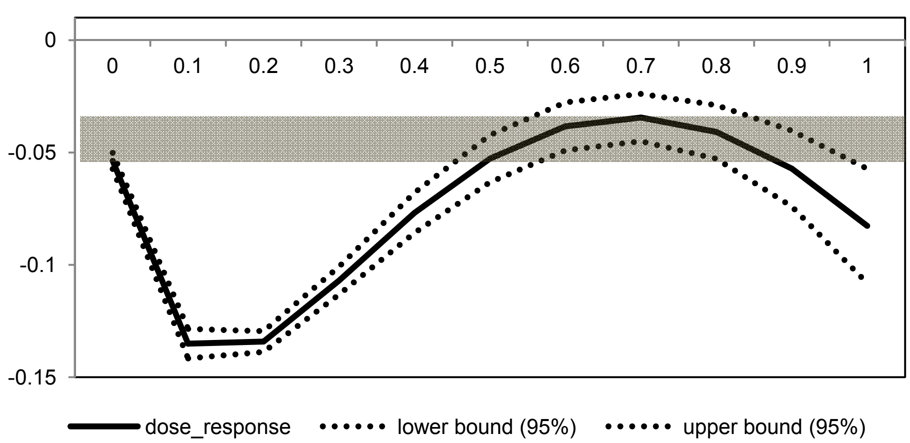
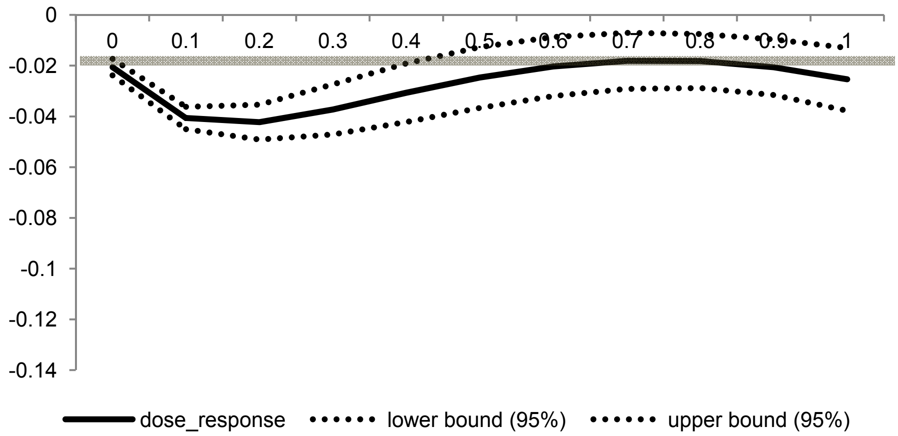
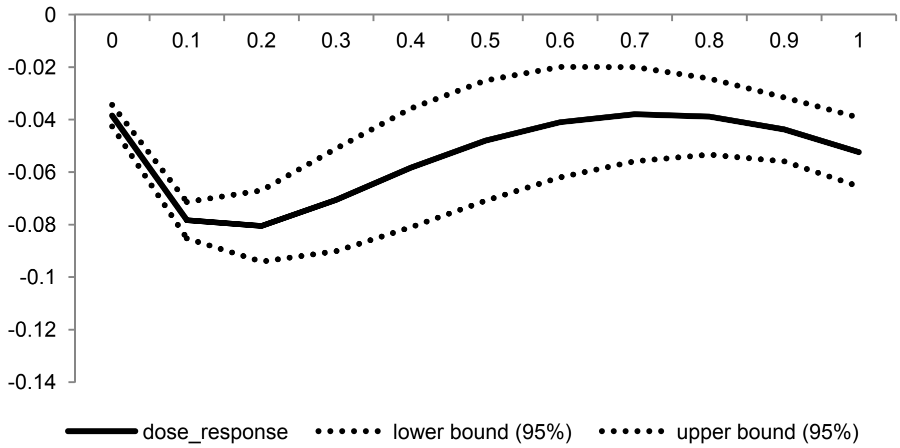


Figure A.4: Dose Responses of Markup Change (KSIC 3 digit classification applied)

d. Markup Changes after one year



e. Markup Changes after two years



f. Markup Changes after three years

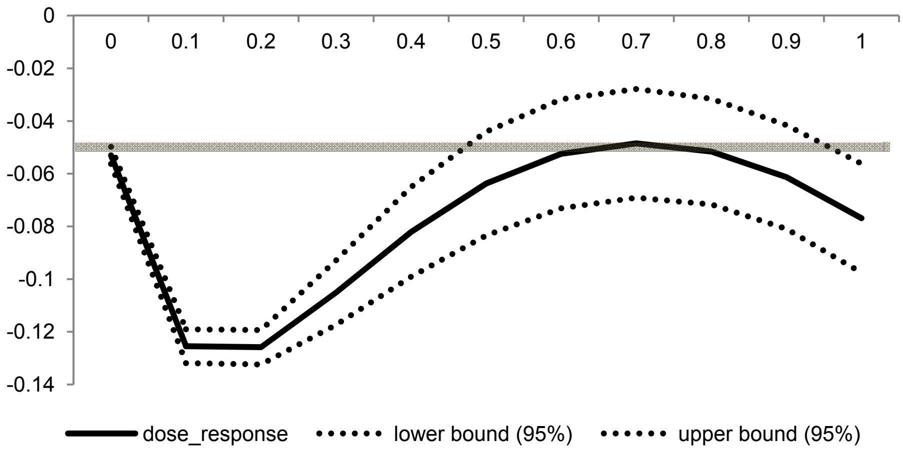


Table A.1: Fixed-effect Model Estimation Results (Exporters and Non-exporters)

	TFP growth			Markup change		
	one year	two years	three years	one years	two years	three years
Export intensity$_{t-1}$	0.017** (0.007)	0.024*** (0.007)	0.013* (0.007)	-0.012 (0.016)	-0.010 (.017)	-0.010 (0.017)
lnTFP$_{t-1}$	-0.916*** (0.004)	-1.035*** (0.004)	-1.047*** (0.004)	-0.865*** (0.010)	-0.945*** (0.010)	-0.959*** (0.010)
Markup $_{t-1}$	0.002** (0.001)	-0.000 (0.001)	0.001 (0.001)	-0.060*** (0.002)	-0.065*** (0.002)	-0.071*** (0.002)
Age$_{t-1}$	-0.037 (0.026)	-0.035 (0.027)	0.010 (0.027)	0.364*** (0.063)	0.168*** (0.065)	0.087 (0.066)
(Age$_{t-1}$)^2	0.050 (0.053)	0.089* (0.054)	-0.023 (0.055)	-0.595*** (0.126)	-0.247* (0.131)	-0.044 (0.136)
Size$_{t-1}$	0.055*** (0.002)	0.036*** (0.002)	0.022*** (0.002)	0.043*** (0.004)	0.069*** (0.004)	0.077*** (0.005)
Wage$_{t-1}$	0.003 (0.003)	0.003 (0.003)	0.008*** (0.003)	0.885*** (0.006)	0.898*** (0.007)	0.860*** (0.007)
NP share$_{t-1}$	-0.000 (0.001)	0.001 (0.001)	0.002 (0.001)	-0.002 (0.002)	0.003 (0.002)	0.004* (0.002)
K/L ratio$_{t-1}$	0.005*** (0.001)	0.006*** (0.001)	0.003*** (0.001)	-0.055*** (0.002)	-0.064*** (0.002)	-0.065*** (0.002)
R&D dummy$_{t-1}$	0.003 (0.002)	0.004** (0.002)	-0.001 (0.002)	0.009** (0.005)	0.002 (0.005)	-0.003 (0.005)
HHI$_{t-1}$	-0.049* (0.026)	0.004 (0.026)	0.037 (0.027)	-0.024 (0.062)	0.009 (0.064)	-0.121* (0.065)
(HHI$_{t-1}$)^2	0.131** (0.053)	-0.005 (0.054)	-0.101* (0.055)	-0.076 (0.126)	-0.087 (0.131)	0.313** (0.133)
Observations	117,635	117,635	117,635	117,635	117,635	117,635
R-Squares						
(within)	0.477	0.527	0.524	0.549	0.545	0.529
(between)	0.030	0.032	0.032	0.318	0.339	0.350
(overall)	0.042	0.041	0.038	0.301	0.321	0.332

Note: Year dummies and a constant term are not reported but included in the regression. The robust standard errors are in the parentheses. *, ** and *** indicate that the estimated coefficients are significant at the 10%, 5% and 1% level, respectively.

Table A.2: Fixed-effect Model Estimation Results (Exporters Only)

	TFP growth			Markup change		
	one year	two years	three years	one years	two years	three years
Export intensity$_{t-1}$	0.003	0.013*	0.010	-0.004	0.009	0.015
	(0.008)	(0.008)	(0.008)	(0.016)	(0.016)	(0.016)
lnTFP$_{t-1}$	-0.835***	-0.961***	-1.021***	-0.656***	-0.749***	-0.802***
	(0.011)	(0.011)	(0.011)	(0.022)	(0.023)	(0.023)
Markup $_{t-1}$	-0.004*	-0.005**	0.001	-0.119***	-0.137***	-0.140***
	(0.003)	(0.003)	(0.003)	(0.005)	(0.006)	(0.006)
Age$_{t-1}$	-0.116**	-0.057	0.039	0.152	0.063	0.064
	(0.055)	(0.057)	(0.057)	(0.114)	(0.120)	(0.118)
(Age$_{t-1}$)^2	0.174	0.126	-0.036	-0.310	-0.037	0.212
	(0.108)	(0.110)	(0.112)	(0.221)	(0.233)	(0.231)
Size$_{t-1}$	0.072***	0.045***	0.033***	0.038***	0.044***	0.048***
	(0.005)	(0.005)	(0.005)	(0.010)	(0.010)	(0.010)
Wage$_{t-1}$	-0.006	-0.013	0.004	0.733***	0.735***	0.731***
	(0.008)	(0.008)	(0.008)	(0.016)	(0.017)	(0.016)
NP share$_{t-1}$	-0.003*	0.003	0.003	-0.009**	0.009**	0.005
	(0.002)	(0.002)	(0.002)	(0.004)	(0.004)	(0.004)
K/L ratio$_{t-1}$	0.004*	0.008***	0.004	-0.041***	-0.058***	-0.071***
	(0.003)	(0.003)	(0.003)	(0.005)	(0.006)	(0.006)
R&D dummy$_{t-1}$	0.003	0.008**	-0.001	0.004	0.004	0.006
	(0.003)	(0.003)	(0.003)	(0.006)	(0.007)	(0.007)
HHI$_{t-1}$	-0.066	-0.065	0.110*	-0.113	0.002	0.268**
	(0.060)	(0.061)	(0.062)	(0.123)	(0.129)	(0.128)
(HHI$_{t-1}$)^2	0.244*	0.082	-0.173	0.108	-0.033	-0.503*
	(0.128)	(0.131)	(0.133)	(0.264)	(0.278)	(0.275)
Observations	23,203	23,203	23,203	23,203	23,203	23,203
R-Squares (within) (between) (overall)	0.432 0.016 0.028	0.491 0.020 0.027	0.503 0.019 0.025	0.495 0.205 0.211	0.505 0.231 0.231	0.517 0.258 0.261

Note: Year dummies and a constant term are not reported but included in the regression. The robust standard errors are in the parentheses. *, ** and *** indicate that the estimated coefficients are significant at the 10%, 5% and 1% level, respectively.

CHAPTER 9

Skill Upgrading, Technology Choice, and the Role of Exporting in Korean Manufacturing Sector

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We examine the role of export and innovation activitiesin skill upgrading of Korean manufacturing sector during 1990's utilizing a unique plant-level panel data. The paper offers three interesting empirical regularities. First, Korean manufacturing sector experienceda significant degree of skill upgrading during 1990's. The share of non-production workers in total employment increased very fast both at industry and plant levels. Second, the larger part of skill upgrading during 1990's can be attributable to reallocation of resources within plants rather than across plants. Third, we offer some evidence broadly supporting recent theoretical development in international trade that emphasizes the inter-connectedness of export market participation, innovation activities and skill upgrading.

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1. Introduction

The increase in the ratio of skilled and unskilled employment, accompanied by the rise in skilled wage premia, is a global phenomenon; these changes have been observed in both OECD and developing countries for the past decades. As well known, most early studies have considered trade and skill-biased technical change (SBTC) as two competing explanations for the rise in the relative demand for the skilled workers. One consensus from the literature is that skill-biased technical progress is an important part of the story while the role of trade is less clear-cut. However, several recent theories of trade based on heterogeneous firms and monopolistic competition[1] renewed our attention to the important role played by international trade in this phenomenon. That is, trade can raise the relative demand for the skilled workers by inducing exporters to invest in new technologies that are skill-biased. Thus, trade and SBTC could be complementary, rather than competing, explanations for the rising relative demand for the skilled workers.

In this paper, we aim to examine the effects of exporting and innovation on skill upgrading within plants, utilizing plant-product matched panel data on Korean manufacturing for the period 1990-1998. To set the stage, we start by examining the changes in skill composition in Korean manufacturing sector and then try to figure out the sources of the change in skill composition by decomposing the changes into two components: between- and within-effect. Next, we try to explain skill-upgrading within plants. Here, we first examine whether within-plant skill upgrading is related to exporting and innovation activities of plants based on cross-section regressions. Then, we explore whether there are inter-temporal complementarities between exporting and R&D as sources of within-plant skill upgrading. For this purpose, utilizing the propensity score matching framework, we examine whether the export market participation of plants affect the R&D participation and R&D intensity of plants and, symmetrically, whether the R&D participation of plants affect the export participation and export intensity of plants. We hope this approach may help us understand better the complicated inter-

[1]See, for example, Yeaple (2005), Bustos (2011), Costantini & Melitz (2008), and Bustos (2009).

relationship among exporting, innovation, and within-plant skill upgrading. To the best of our knowledge, this paper is an addition to the several early empirical studies that clarifies the role of exporting and innovation in the within-plant skill upgrading and, hence, in the increase in the aggregate skill intensity.

In Korea, at least since the early 1990s, the employment share of skilled workers in the manufacturing sector has increased steadily. Although the rising employment share of the skilled workers does not appear to have been accompanied by the rise in the relative wages of the skilled workers during the early 1990s, a recent study suggests that the wage gap has increased especially since the 1997/98 financial crisis[2]. It is worthwhile to note the context under which the rise in the employment share of the skilled workers has occurred. Firstly, while the manufacturing export growth rate increased slightly during the 1990s over the previous decade[3], the employment-creating effect of manufacturing exports decreased significantly. Nam (2008) uses input-output based approach and shows that employment created by export production for the manufacturing sector grew at an annual rate of 5.0 percent during 1975-1990, but at -2.2 percent during 1990-2000.

Table 1: Employment and Wage Bill in Korean Manufacturing Sector: 1990-97

(Unit: Person, Million Korean Won)

Year	Number of Plants	Total Workers	Non-production	Production	Total Wage Bill	Non-Production	Production
1990	68690	2951893	701851 (0.2378)	2250042 (0.7622)	19532300	5592167 (0.2863)	13940133 (0.7137)
1991	72213	2853563	720343 (0.2524)	2133220 (0.7476)	22830419	6735912 (0.2950)	16094507 (0.7050)
1992	74679	2734179	704997 (0.2579)	2029182 (0.7421)	25234409	7638439 (0.3027)	17595970 (0.6973)
1993	88864	2804591	754112 (0.2689)	2050479 (0.7311)	28834306	9039673 (0.3135)	19794633 (0.6865)
1994	91372	2848789	771047 (0.2707)	2077742 (0.7293)	32791213	9889262 (0.3016)	22901917 (0.6984)

[2] Kim (2007) shows empirical evidence indicating that the wage gap between skilled and unskilled workers has increased after the 1997/98 financial crisis in Korea. The fact that rising relative employment of the skilled workers was not apparently accompanied by the rising wage gap during the early 1990s suggests that the supply side factors, such as the rapid increase of the college graduates, also played a role in the changing skill structure of employment.

[3] Since the 1997/98 financial crisis, the ratio of exports to GDP became higher than pre-crisis period.

1995	96202	2865221	800121 (0.2793)	2065100 (0.7207)	37844431	11494509 (0.3037)	26349922 (0.6963)
1996	97130	2811974	775896 (0.2759)	2036078 (0.7241)	42327601	13115744 (0.3099)	29211857 (0.6901)
1997	92138	2618792	739138 (0.2822)	1879654 (0.7178)	41489165	13261271 (0.3196)	28227894 (0.6804)

Notes: 1) The table is constructed based on *Survey of Mining and Manufacturing* which includes all manufacturing and mining plants with five or more employees.
2) Numbers in parentheses are the proportion of workers or wage bill in non-production and production jobs, respectively.

Source: Hahn and Park (2011)

Secondly, during the 1990s, the manufacturing sector exhibited rapid increase in labor productivity. Since the late 1980s, the aggregate manufacturing employment has been declining not only as a share of total employment but also in absolute terms, while the value added share of manufacturing has remained stable since the late 1980s up until recently. This seems to suggest the potentially important role of technical progress in the declining manufacturing employment share. The last point to note is that the above changes have occurred roughly since the late 1980s when the pace of globalization is has accelerated. In our view, the Korean manufacturing sector during the 1990s provides an excellent case for studying the role of trade in the widening disparity between skilled and unskilled employment.

As well noted, most empirical studies conducted during the 1990s were based on the Heckscher-Ohlin framework. There are at least two observations to which advocates for traditional trade theory would find it hard to offer justification. According to the Heckscher-Ohlin theory, when a skill abundant country trades, it should experience a rise in the relative price of skill-intensive goods and a rise in the relative demand for the skilled workers. Furthermore, the rise in the relative demand for the skilled workers should be accompanied by the compositional shifts in sectoral employments. Thus, the theory predicts that the reallocation of factors of production across industries that differ in skill intensity, the so-called “between” effect, should be largely responsible for the increase in the aggregate relative employment of the skilled. However, most early studies found that the rise in the aggregate skill intensity are mostly accounted for by the “within” effect, the increase in the relative employment of the skilled within firms or a narrowly defined industries, and that skill upgrading tend to be more rapid in industries using computer more intensively (See, among others, Katz and Murphy 1992, Lawrence and Slaughter 1993, Berman, *et al.*1994, and Autor, *et al.* 1998). Another observation at odds with Heckscher-Ohlin theory is that a rising disparity between skilled and unskilled workers is observed not only in skill-abundant countries but also in skill-scarce developing countries. According to the theory, the reverse should be happening. Based on these findings, researchers have concluded that the skill-biased technical progress, not trade, is the main story behind the rising relative demand for the skilled workers.

With the availability of the firm- or plant-level micro datasets, this issue received renewed attention. Bernard & Jensen (1997) uses the U.S. plant-level data and shows that most of the increase in the aggregate skill intensity is attributable to the "between" effect and is accounted for by exporters. This study renewed our attention to the potentially important role of international trade in the rise in the relative employment of the skilled. However, Bernard and Jensen's finding of the large and dominant "between" effect and the dominance of the between effect as a mechanism of trade raising the aggregate skill intensity did not prove to be a universal phenomenon. Bustos (2011) uses Argentinean firm-level data during the early 1990s and shows that most of the increase in the aggregate skill intensity is attributable to the "within" effect. Unlike the early empirical literature based on the H-O theory, however, Bustos shows that the within effect or the skill upgrading within plants is an outcome of the interaction between firm's exporting and technology investment decisions. Later on, Bustos (2009) shows that the reduced trade cost (tariff) associated with Argentina's joining in MERCOSUR induced increased probability of export participation as well as increased investments in technologies. She also finds a sorting pattern of firms in their responses to the reduced trade cost as predicted by her own theoretical model.

This paper takes the broad implications from the several heterogeneous firm trade theories with complementarity between exporting and innovation, such as Bustos (2011), Costantini & Melitz (2008), and Aw, *et al.* (2009), and tries to examine whether exporting and innovation are complementary factors inducing within-plant skill upgrading.

2. Skill Upgrading in Korean Manufacturing Sector in 1990's[4]

The increase in aggregate relative demand for skilled labor can be driven by factor reallocation towards skill-intensive firms holding skill intensity within firms or industries constant, between effects, or by the increase in skill intensity within firmsholding the share of each firm in total factor demand constant, within effects. Following Bernard and Jensen(1997), we first construct two measures to capture the level of high skilled labor relative to low skilled one; the ratio of non-production workers to total employment and wage bill for non-production workers to total wage bill and then decompose the changes in two ratios into between and within effects. The decomposition is conducted according to the following formulae;

$$\Delta NPL = \sum_{i=1}^{I}(\Delta L_i)(\overline{NPL_i}) + \sum_{i=1}^{I}(\Delta NPL_i)(\overline{L_i}) \quad (1)$$

$$\Delta NPW = \sum_{i=1}^{I}(\Delta W_i)(\overline{NPW_i}) + \sum_{i=1}^{I}(\Delta NPW_i)(\overline{W_i}) \quad (2)$$

whereL_i is the share of total employment of firm*i* and NPL_i the share of non-production workers[5] at firm*i*. In addition, Δ indicates time difference and upper bar means time average of the corresponding variable. The first term in (1) represents the change in employment share of firm*i* weighted by the average share of non-production workers of the firm so that it approximates the change of shares of non-production workers due to reallocation of labor force across firms, which is called between effect in the literature. The positive sign indicates that the share of total employment at firms with higher than average share of non-production workers has increased. That happens when labor force shifts towards firms whose skill intensity is relatively higher. The second term in (1) measures the change in the share of non-production workers at firm *I* weighted by average share of total employment of the corresponding firm.Since the term represents the changes in skill composition of a firm due to reallocation of labor inside the firm, it is called within effect. The

[4]This section heavily draws from Hahn and Park (2011).

[5]We take non-production workers for skilled ones. Notwithstanding strong foreseeable arg ument against our strategy, there are two reasons we take this route. Our data set does not provide skill level or education achievement of individual workers so that it is impo ssible to obtain a direct or more accurate measure of skill intensity. In addition, many s tudies utilizing firm-level or plant-level data also took similar approach in measuring skil l intensity and offered many meaningful results. See Berman, *et al.* (1994), and Bernard and Jensen (1997), for example.

positive within effect results from increases in non-production worker ratio at firms with higher than average employment share. By separately aggregating the two effects across all firms and adding them all, we obtain the overall change in non-production worker ratios in manufacturing workforce and use the result as a measure of the overall change in skill intensity. Similarly, we can decompose the change in the share of wage bill paid to non-production workers into between and within effects with the same procedure as (1) after replacing employment with wage bill. W_i is the share of total wage bill offirm *i* and NPW_i the share of wage bill paid to non-production workers at firm *i*.A positive between effect indicates that shares of wage bill have increased at firms with higher than average proportion of non production workers and a positive within effect that the proportions of wage bill paid to non-production workers have increased at firms with higher than average size in terms of total wage bill.

Throughout the analysis, we utilize an unpublished plant-level annual census datain Korea, the *Survey of Mining and Manufacturing*. Our data set covers the period from 1990 to 1998 andincludes all plants with five or more employees in 580 manufacturing industries classified at KSIC (Korean Standard Industrial Classification) five-digit level. The data set is in unbalanced panel form reflecting frequent exits and entries. The survey reports several important variables especially relevant to our study such as the number of non-production and production workers, total wage bill paid to both production and non-production workers. Unfortunately, it does not provide detailed information on demographic and socio-economic variables of the labor force at plant level to accurately measure skill intensity. Following previous researches such as Berman, *et al.* (1994), and Bernard and Jensen (1997), we regard non-production workers as the skilled and production workers as the unskilled. Our data set includes information on exporting activities of a plant; value of products shipped for direct exports, and the value of products shipped for other exporters. In addition, it also includes information on the value of total production andshipments, the number of products produced, expenditure on research and development.

Table 2 reports the results of decomposition described in equations (1) and (2) conducted in both industry and plant levels. First, a significant degree of skill upgrading and increasing skill premiumoccurred in Korea manufacturing sector during 1990's. At five-digit level of KSIC, the share of non-production workers increased at the rate of 1.9427% per year and the share of wage bill paid to non-production workers at 1.3684% per year. The result is fairly robust to aggregation level of industries since we obtain almost the same magnitude of changes at four-digit classification of industries. Second, employment share of non-production workers increased faster than wage share of non-production workers, which indicates that the wage inequality between two types of laborhad been narrowedduring 1990's. The finding does not seem to be consistent with the conventionalbelief that increased demand for skilled labor driven by skill biased technological change orshift of product demand may have resulted in labor market conditions favorable to skilled labor. However, demand side story is not enough to account for the changes in Korean labor market during 1990's. For example, loosening restriction on college admission quota in early 1980's resulted ina massive entry of new college graduates into market for skilled labor beginning in early 1990's. That may have at least partially offset the upward pressure on wages of skilled labor from demand increase. In addition, we may offer an explanation on the narrowing wage gap based on different job tenure across industries. According to Table.2,asignificant chunk of changes in employment share of non-production workers occurred through reallocation of workers across rather than within industries. If high-skilled reallocated workers were relatively young with shorter job tenure than low-skilled staying workers at the same industries, a large increasein relative employment share of non-production workerscould be accompanied by less significant increase in their wages shares. Therefore, it would be too hasty to draw aconclusion solely based only on Table. 2 and we may need further investigation employing micro-level data with detailed information on worker characteristics. Third, skill upgrading in Korean manufacturing sector continued even after the foreign exchange crisis in 1997 and subsequent depression. Table. 3r eports that relative employment share of non-production workers increased by 1.5606% annually from 1999 to 2003 at five-digit level of industrial classification. Fourth, while between effect played bigger role in skill upgrading than within effect at industry level, reallocation of employment within a plant accounts for larger portion of skill upgrading. 61.1%

(1.0801% out of 1.9430%) of increase in the share of non-production workers can be attributed to reallocation across industries at four-digit level of industrial classification but the proportion shrinks to 42.8% (0.7540% out of 1.7611%) if the decomposition is done at individual plant level. The role of within effect in skill upgrading became more important during early 2000's. This is at odds with the findings for the U.S. and several Latin American countries where most skill upgrading are attributable to within effects both at industry and firm levels[6]. Fifth, contrary to employment share of non-production workers, both within and between effects seem to attribute to increase in wage share of skill labor.

Table 2: Changes in Employment and Wage Shares of Non-production Workers: 1991 - 1997

	Employment			Wages		
	Between	Within	Total	Between	Within	Total
Industry (four-digit)	1.0802	0.8628	1.9430	0.6529	0.7156	1.3685
Industry (five-digit)	1.2822	0.6605	1.9427	0.8635	0.5049	1.3684
Plant	0.7540	1.0071	1.7611	0.5695	0.4911	1.0806

Table 3: Changes in Employment Share of Non-production Workers: 1999-2003

	Employment		
	Between	Within	Total
Industry (four-digit)	0.5514	0.8857	1.4371
Industry (five-digit)	0.8770	0.6836	1.5606
Plant	0.3536	1.4882	1.8418

The finding that most of increase in the relative demand for skilled labor is explained by skill upgrading within firms implies that changes in production technologies could be the main driver for increase in the relative demand of skilled

[6]See Berman, *et al.* (1994) for U.S. and Goldberg & Pavcnik (2007) for Latin American countries.

labor. From now on, we will focus skill upgrading at plant level and pay more attention to the role of exporting and innovation in the process by investigating the patterns of skill upgrading across different groups categorized according to exporting status and innovation activities.

Since our data setcontains all plants with five or more employees, the sample changes substantially due frequent to entry of new plants and exit of dying ones. We include only those plants that had existed during the entire period from 1991 to 1997. The final sample contains 27,246 plants[7] and we perform the same decomposition after splitting the sample into four groups according to the following criteria. If a plant appears both in 1991 and 1997 and the value of products shipped for export in 1991 is positive, it is classified as an exporter. If a plant is observed in 1991, but not in 1997 and the value of products shipped for export in 1991 is positive, we regard it as an exporter. In addition, if a plant is observed in 1997, but not in 1991 and the value of products shipped for export in 1997 is positive, it is also classified as an exporter. All other plants are classified as non-exporter. The same classification rule is applied for innovation with expenditure on research and development as the criterion.

Table 4: Plant Characteristics and Skill Upgrading

	Employment: 1991-1997			Employment: 1999-2003		
	Between	Within	Total	Between	Within	Total
All plants	0.7540	1.0071	1.7611	-0.2619	1.2894	1.0275
Non-exporter	0.7788	0.1968	0.9756	1.1191	0.0151	1.1342
Exporter	-0.0248	0.8103	0.7854	-1.3810	1.2743	-0.1067
All plants	0.7540	1.0071	1.7611	n.a.	n.a.	n.a.
Non-innovator	-0.1738	0.3680	0.1942	n.a.	n.a.	n.a.
Innovator	0.9278	0.6391	1.5669	n.a.	n.a.	n.a.

We can infer two important implications from Table 4.concerning the role of

[7]This may introduce some potential data problems such as size and survivorship bias. Siz e bias means that larger plants are more likely to stay at the sample than medium and small sizes plants. Survivorship bias points out the possibility that balanced panel appr oach may distort the whole picture when skill compositions of exiting and entering plan ts are significantly different from the existing ones. For example, average number of w orkers employed by plants in the sample was 55.30 in 1997 but plants excluded from t he sample employed only 17.06 workers the same year.

export and innovation activities. First, majority of the skill upgrading achieved through reallocation labor force with plants were driven by exporters. Even though the speed of skill upgrading by non-exporters was faster than that of exporters, 0.9756% vs. 0.7854%, 80% of within effect are accounted for by that of exporters during 1990's. Second, plants with positive R&D expenditure contributed more to both within and between effects in employment share of non-production workers. Consequently, 89% of growth of employment share, 1.5669% out of 1.7611%, was attributed to plants actively involved in R&D investments during 1990's. Moreover, innovators achieved skill upgrading in a faster pace both within and between plants than non-innovators.

3. The Roles of Export and Innovation in Skill Upgrading

In this section, we investigate the roles of export and innovation activities in skill upgrading of a firm. We try to figure out the complicated inter-relationship among three key variables by relating the changes in skill intensity between 1991 and 1997 to changes in exporting status and innovation activities.

$$\Delta\left(\frac{NPL}{L}\right)_i = \beta_0 + \beta_1{}'EXP_i + \beta_2 INNO_i + \gamma' X_{i,0} + \varepsilon_i \tag{3}$$

The dependent variable $\Delta\left(\frac{NPL}{L}\right)_i$ is the changes in the share of non-production workers at plant i between 1991 and 1997. EXP_i isan (1×3) column vector of dummy variables representing the changes in exporting status of plant i between 1991 and 1997. We define a plant as a non-exporter (NN) if it exported neither in 1991 nor 1997, anexporter (EE) if it exported both in 1991 and 1997, a starter (NE) if it did not export in 1991 but did in 1997, and a stopper (EN) if it exported in 1991 but not in 1997. We take non-exporter as the base case so that we include only three dummy variables. $INNO_i$ representsinnovation activities at plant i, measured as the average from 1991 to 1997 of R&D expenditure relative to total production (RND). $X_{i,0}$ is the vector of explanatory variables included to control the initial heterogeneity across plants in 1991. We include plant size, age, productivity, and capital intensity to control initial firm heterogeneity. Plant size is measured in terms of the natural log of total employment, age as the number of years since establishment, productivity as the total factor productivity calculated following multilateral chained index number method, and capital intensity as per worker stock of fixed assets[8].

The estimation results are reported in Table 5.First, export seems to play an important role in explaining changes in skill composition of a firm. Once we control for the initial heterogeneity of firms (Model II), starters (NE) that did not export in 1991 but did in 1997 showed a significantly faster skill upgrading than non-exporters (NN) that did not export in neither year. On the contrary, stoppers (EN) that exported only in 1991 but stop exporting in 1997 exhibited significantly slower skill upgrading than non-exporters (NN).The result implies that participation in export market may bring a significant change in skill mix of a firm by adopting more skill intensive technologies. Second, innovation activities are also strongly correlated to skill upgrading. Firms conducting more intensive innovation activities on average achieved faster skill upgrading. Third, initial size of a firm and capital intensity of a plant arestrongly associated with changes in skill intensity in the subsequent period. Larger and less capital intensive firms are more likely to be experiencing faster skill upgrading. Larger plants are in better position to overcome fixed cost for export market participation and more likely to upgrade skill mix faster than smaller ones. Moreover, since technology and capital are complementary factors in most cases, less capital intensive firm in initial state may experience much faster skill upgrading once they adopt more advanced technology. Fourth, differences in initial productivity across firms help predict changes in skill mix in the subsequent years. Firms with higher productivity in 1991 were more likely to achieve larger increase in the proportion of skilled workers in the following years.In sum, changes in skill mix of a firm seem to be closely related to export market participation and innovation activities as well as initial status of the firm.

[8]Summary statistics of the variables are reported in Appendix 1.

Table 5. Skill Upgrading: Export and Innovation

	Model I	Model II	Model III
CONSTANT	-13.0927*** (2.8277)	-13.7887*** (2.9520)	-13.8176*** (2.9267)
NE	1.6061*** (0.4081)	1.2664*** (0.4182)	1.2147*** (0.4181)
EN	-0.4571 (0.4334)	-0.9577** (0.4449)	-0.9875** (0.4448)
EE	1.4648*** (0.3230)	0.4912 (0.3836)	0.4514 (0.3839)
$SIZE_{91}$		0.6819*** (0.1248)	0.6621*** (0.1253)
AGE_{91}		0.0096 (0.0165)	0.0108 (0.0165)
TFP_{91}		0.7273** (0.3650)	0.7611** (0.3656)
$CAPINT_{91}$		-0.3980*** (0.1086)	-0.4070*** (0.1086)
RND			0.1279** (0.0600)
Industry Dummies	Yes	Yes	Yes
R^2	0.0055	0.0079	0.0082
# of Obs.	24,166	23,809	23,809

Notes: 1) Numbers in parentheses are standard errors of coefficient estimates. All standard errors are corrected for possible heteroskedasticity following White (1980).
2) ** and *** indicate statistical significance at 5% and 1%, respectively.
3) Four-digit KSIC industry dummies are included in all models.

The result inTable 5.may not berobust to the way we measure innovation activity of a firm. One may argue that introduction of a new product is the outcome of innovation efforts that can ultimately affect the skill composition of labor force employed by a firm. Fortunately, our data set is rich enough to include detailed information on products of individual plant that we can identify the number of new products introduced each year.For robustness reason, four different measures of product innovation are considered; dummy for introduction of new products between 1991 and 1997(ECDUM), the number of products newly introduced by a firm between 1991 and 1997 (EC), the ratio of the number of newly introduced products between 1991 and 1997 to the number of total products produced in 1997(ECR), and the ratio of theshipment of newly introduced products between 1991 and 1997 to the total shipment of a firm in 1997 (ER). All variables are measured at plant level and the estimation results are reported in Table 6. The main results in Table 5.are preserved even after we replace expenditure on R&D with various measures of product innovation. Starters (NE) experienced fastest skill upgrading. Unlike Table 5., exporters (EE) that exported both in 1991 and 1997 achieved a significantly faster increase in the proportion of non-production workers that non-exporters (NN). In addition, product innovation measures seem to maintain meaningful correlation with skill upgrading. Both ECDUM and EC are significant at 10% level. Though the estimated coefficients on ECR and ER do not show statistical significance at conventional levels, their p-values are 15.0% and 16.7%, respectively.

Table 6: Skill Upgrading: Export and Product Innovation

	Model III-1	Model III-2	Model III-3	Model III-4
CONSTANT	3.9465*** (1.2769)	4.3734*** (1.2185)	4.0541*** (1.2723)	4.0841*** (1.2696)
NE	2.0564*** (0.6315)	2.0730*** (0.6319)	2.0579*** (0.6314)	2.0595*** (0.6314)
EN	-0.8420** (0.6515)	-0.8522 (0.6516)	-0.8434 (0.6515)	-0.8450 (0.6514)
EE	1.1362* (0.5841)	1.1291** (0.5841)	1.1279** (0.5842)	1.1281** (0.5843)
$SIZE_{91}$	0.5247*** (0.1831)	0.5214*** (0.1831)	0.5256*** (0.1831)	0.5257*** (0.1831)
AGE_{91}	0.0069 (0.0241)	0.0061 (0.0241)	0.0068 (0.0242)	0.0061 (0.0242)
TFP_{91}	0.4073 (0.5184)	0.3949 (0.5185)	0.4062 (0.5184)	0.4048 (0.5184)
$CAPINT_{91}$	-0.4334*** (0.1537)	-0.4331*** (0.1537)	-0.4330*** (0.1537)	-0.4326*** (0.1537)
ECDUM	0.7164* (0.4210)			
EC		0.3109* (0.1751)		
ECR			0.0060 (0.0042)	
ER				0.0057 (0.0041)
Industry Dummies	Yes	Yes	Yes	Yes
R^2	0.0105	0.0105	0.0104	0.0104
# of Obs.	11,232	11,232	11,232	11,232

Notes: 1) Numbers in parentheses are standard errors of coefficient estimates. All standard errors are corrected for possible heteroskedasticity following White (1980).
2) *, ** and *** indicate statistical significance at 10%, 5% and 1%, respectively.
3) Four-digit KSIC industry dummies are included in all models.

4. Complementarity between Exporting and R&D

The analyses above do not provide usthe answer the question oftemporal sequencebetween innovation and exporting. At conceptual level, causality can run in both directions. Firms with more R&D expenditure are more likely to participate in export market since they may possess better technology necessary to compete in international market. On the other hand, large market size associated with exporting may provide firms with greater incentive to do R&D. Therefore, a plausible conjecture is that there exist complementarities between exporting and R&D decisions. We now examine the possibility. Specifically, utilizing the propensity score matching procedure a la Becker & Ichino (2002), we examine whether the decision to participate in exporting strengthens the plants' incentive to do R&D and, conversely, whether the decision to participate in R&D activity strengthens the plants' incentive to export. We are interested in the effects of export (R&D) participation on R&D (exporting) at both extensive and intensive margins.

To estimate the effect of exporting on R&D, we first select a sample of *starter* and *never* plants. Starters are those plants that were non-exporters in the first year they appear in the dataset but switched to exporters in some later year and remained as exporters. Never is a group of plants that were non-exporters in the first year they appear in the dataset and never switched to exporters during the sample period of 1990-1998. When the outcome variable of interest is the extensive margin of R&D, the following probit model is estimated for these sample plants.

$$\Pr(x_i = 1 \mid r_i, rndr_i, X_i) = E(x_i \mid r_i, rndr_i, X_i), \quad (4)$$

where x_i is a dummy variable indicating export-market and R&D participation and the left hand side of equation (4) is the probability of becoming an exporter for plant i conditional onthe vector of pre-exporting characteristics one year before export market participation.[9] As the pre-exporting characteristics, we include a dummy variable indicating whether the plant reported a positive amount of R&D expenditure (r_i), R&D intensity (rndr = R&D/production ratio), and other plant characteristics X_i which includes plant TFP (log) , number of workers (log) as a proxy for the plant size,

[9]For never plants, the plant characteristics are the values in 1995. Main results in this pa per do not change qualitatively when we use 1994 instead.

plant age, capital intensity (fixed tangible assets per worker), and skill intensity (the share of non-production worker). We also include year and ten industry dummy variables.

When the outcome variable of interest is the intensive margin of R&D, we further restrict our sample to those plants which reported a positive amount of R&D one year before export-market participation.

Thus, the probit model estimated in this case is as follows.

$$\Pr(x_i = 1 | r_i = 1, rndr_i, X_i) = E(x_i | r_i = 1, rndr_i, X_i) \quad (5)$$

Based on the estimated probability of exporting, we match starter plants with never plants one year before export market participation. We use nearest neighbor matching to estimate the average effect of exporting on the extensive and intensive margin of R&D. The intensive margin of R&D is measured as the R&D intensity, *rndr*. The extensive margin of R&D is measured as the probability of a plant doing R&D, which is estimated from the followingprobit model.

$$\Pr(Z_i) = \Pr(r_i = 1 | Z_i) = E(r_i | Z_i) \quad (6)$$

where Z_i is the contemporaneous plant characteristics, which includes plant TFP (log), number of workers (log), plant age, capital intensity, skill intensity, and a dummy variable which is equal to 1 if the plant is a multi-product plant.

By following a symmetric procedure, we estimate the effect of R&D on exporting. That is, we start by selecting a sample of *R&D starter* and *R&D never* plants. R&D starters are those plants that did not do R&D in the first year they appear in the dataset but switched to R&D-do*ers* in some later year and remained as R&D do*ers*. R&D never is a group of plants that did not do R&D in the first year they appear in the dataset and never switched to R&D-do*ers*.

Depending on whether the outcome variable of interest is extensive or intensive margin of exporting, each of the following probitmodel is estimated.

$$\Pr(r_i = 1 | x_i, xr_i, X_i) = E(r_i | x_i, xr_i, X_i) \quad (7)$$

$$\Pr(r_i = 1 | x_i = 1, xr_i, X_i) = E(r_i | x_i = 1, xr_i, X_i) \quad (8)$$

Here, *xr* denotes export intensity (=exports/production ratio). Based on the estimated probability of R&D participation, we match R&D starter with R&D never plants, and estimate the average effect of R&D participation on the extensive and intensive margin of exporting. Again, we use nearest neighbor matching. The intensive margin of exporting is measured as the export intensity, *xr*. The extensive margin of exporting is measured as the probability of a plant being an exporter, which is estimated from the following probit model.

$$\Pr(Z_i) \equiv \Pr(x_i = 1 \mid Z_i) = E(x_i \mid Z_i) \qquad (9)$$

Table 7.shows that export-market participation significantly strengthens the incentive to do R&D in subsequent years. It raises the subsequent probability of doing R&D, beginning from one year after export participation. There is some evidence that export participation also raises R&D intensity, but it is significant only for one year after export participation. We also find strong evidence indicating that R&D participation promotes subsequent exporting activity, particularly at extensive margin. Again, we find that R&D participation increases subsequent exporting intensity but with a time lag of about three years. In sum, our analysis shows that exporting and R&D activities are complementary to each other. There exists bi-directional causal relationship between exporting and R&D activities consistent with the underlying assumptions of Costantini & Melitz (2008) and Aw, *et al.* (2009).

Table 7: The Effect of Export (R&D) Participation on R&D (Exporting)

Treatment	Outcome Variable	No. Treated	ATT[a]				
			s=-1	s=0	s=1	s=2	s=3
export participation	Probability of doing R&D	4,231	-0.001 (0.003)	0.003 (0.003)	0.021*** (0.004)	0.038*** (0.005)	0.034*** (0.008)
	R&D intensity	460	0.918 (4.123)	0.499 (0.674)	0.747*** (0.333)	0.277 (0.779)	0.409 (0.614)
R&D participation	Probability of being exporter	3,442	0.023*** (0.005)	0.036*** (0.005)	0.098*** (0.008)	0.148*** (0.011)	0.094*** (0.023)
	export intensity	746	-1.570 (3.752)	-3.995 (4.097)	-3.910 (7.415)	16.071 (11.600)	47.332*** (16.122)

Note: a.The average treatment effect on the treated a la Becker &Ichino (2002) using nearest neighbor matching. The treated units are matched with the untreated one year before export or R&D participation. The numbers in the parenthesis are standard errors. *, ** and *** indicate statistical significance at 10%, 5% and 1%, respectively.

5. Conclusion

We examine the role of export and innovation activitiesin skill upgrading of Korean manufacturing sector during 1990's utilizing a unique plant-level panel data. Considering the vital role of export in economic development and industrial changes in Korea over the last decades, we believe that our exercise offers an excellent opportunity to investigate the impacts of export on labor market.

Korean manufacturing sector experienceda significant degree of skill upgrading during 1990's. For instance, the share of non-production workers at plant level increased at the rate of 1.7611% per year between 1991 and 1997. More interestingly, larger portion of skill upgrading was achieved within plants rather than through reallocations across plants. Within-plant skill upgrading explains 57.2% of total increase in the share of non-production workers between 1991 and 1997 while between-plant effect accounts for 42.8% of total skill upgrading. Finally, we found some evidence broadly supporting recent theoretical development that emphasizes the inter-connectedness of export market participation, innovation activities and skill upgrading. In regression analyses, we confirmed that both exporting and innovation are important factors in explaining changes in skill composition of a firm. Results of propensity score matching implies that once initiated, R&D activities and exporting show the tendency to reinforce each other in subsequent years.

We can draw a few important policy implications from our study. A large share of aggregate skill upgrading was achieved through rebalancing of skill composition within firms rather than between firms in Korean manufacturing sector. Moreover, we found the evidence that there exist interactions between export market participation and skill mix choice of firms. Exporting firms experienced much faster skill upgrading than non-exporting ones and the process was further accelerated when export market participation was accompanied by more intensive innovation activities. Based on these findings, we can argue that policies to promote exporting and R&D activities of firms may bring faster skill upgrading and consequently higher aggregate productivity. Next, our empirical results suggest that skill upgrading associated with exportinghad been achieved mainly through within effects andexporting, or more broadly, trade liberalization may have differential effects on skilled and unskilled labors. Even though export market participation may have beneficial effects on both skilled and unskilled labors, the impact seems to be stronger for the former than the latter. Many countries adopted trade adjustment assistance (TAA) program to mitigate adverse impacts on the losers due to institutional changes in international trade. TAA may include cash transfer program to directly compensate for the loss as well as technical assistance such as job training and information provision to facilitate smoother transition. Most traditional TAA programs are designed to be triggered when total sales of an adversely affected firm drop to the pre-specified threshold. Our study suggests that trade may have distributional implication even among winners such as exporters and these subtle implications should be seriously taken into account in designing TAA program. It might be better idea to take individual workers rather than firms as the basic unit of TAA program since regime change in trade policy may result in both winners and losers for an individual firm. Lastly, now that exporting contributes to skill upgrading and subsequent increase in wage gap in a significant manner, we can offer another rationale for active labor market policy to help unskilled labor.

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Appendix 1. Descriptive Statistics

	Num. of Obs.	Mean	S. D.	Min	Max
NN	24174	0.7188	0.4496	0	1
NE	24174	0.0798	0.2710	0	1
EN	24174	0.0719	0.2584	0	1
EE	24174	0.1294	0.3356	0	1
$SIZE_{91}$	24173	733.1990	731.1062	761.0986	1210.3813
AGE_{91}	24175	8.8173	7.5927	1	92
TFP_{91}	23816	0.0058	2.3515	-3.4166	4.0517
$CAPINT_{91}$	24157	2.4939	1.2413	-3.8027	10.2277
RND	24175	0.5519	2.3505	0	120.7107
ECDUM	11448	0.8354	0.3708	0	1
EC	11448	1,0970	0.8874	0	16
ECR	11448	81.1021	37.5220	0	100
ER	11448	80.6480	38.2948	0	100

CHAPTER 10

Exporting, Productivity, Innovation and Organization: Evidence from Malaysian Manufacturing

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The main purpose of this paper is to untangle the complex relationships between exporting, productivity, innovation and organization. Findings from this paper provide evidence for strong productivity premium for continuing exporters (compared to non-exporters). The corresponding productivity premium is likely to be very weak (even negative) for new exporters. There is also evidence on causality from exporting to innovation which supports the learning-by-exporting hypothesis. Part of this effect may take place in the form of productivity improvements via process innovation. In terms of organization, continuous exporters are also likely to enjoy significant exporting premium in terms of scale of production. Exporting may also be associated with a decentralization of decision-making, especially for continuing exporters.

Keywords: Exporting, Productivity, Innovation, Organization

JEL Classification: L60, O3

1. Introduction

Economic globalization in the form of export-oriented industrialization (EOI) driven by foreign direct investment (FDI) has been the main industrialization strategy in the Southeast Asian region since the early 1970s. The sustainability of this strategy has been intensely debated especially in the aftermath of the 1997/98 Asian Financial Crisis (AFC). Today, there is widespread concern amongst policy makers in the region about whether their economies can graduate from a middle income to a high income country i.e. the so-called "middle-income trap". In Malaysia, this policy concern is manifested in the country's recent industrial policies such as the *Third Industrial Master Plan* (2008-2020) which put emphasis on upgrading the country's manufacturing base towards activities characterized by higher value-adding, productivity and innovation.

The key challenge in overcoming the "middle income trap" problem is finding ways to upgrade the industrial and technological capabilities of firms such that they are globally competitive – measured in terms of their ability to operate at the frontiers of global productivity and technology. The process of industrial and technological upgrading can take place either internally within a firm such as through undertaking research activities or externally via its interactions with suppliers, customers and universities (Griliches, 1979). In this regard, foreign sources of knowledge and technology are particularly important especially for developing countries. Knowledge and technological can diffuse from developed to developing countries through trade and foreign direct investment (FDI) (Keller, 2004). It is therefore important to understand how trade is related to both productivity and innovation. In addition, a deeper understanding of the relationship between trade, productivity and innovation requires an analysis of the nature and role of organization (Helpman, 2006 and Antras & Rossi-Hansberg, 2009). This is reflected by the recent convergence of four areas of studies in the study of trade, innovation, productivity and organization i.e. international trade, industrial organization, innovation studies and economics of organization.

The main purpose of this paper is to empirically examine the relationships between exporting, productivity, innovation and organization. More specifically, it investigates:

- the relationship between exporting decisions and productivity
- the causality between exporting decisions and innovation
- the relationship between productivity and innovation
- the relationship between trade and organization

The outline of the rest of the paper is as follows. Section 2 will briefly review the literature. This will be followed by a discussion of the research methodology which covers the framework utilized, econometric specifications and data source in Section 3. Section 4 provides a discussion of the results. Policy implications are discussed in Section 5. Finally, Section 6 concludes.

2. Brief Literature Review

This study draws from a number of related literatures. The first strand of literature focused on the relationship between trade (exporting), productivity and innovation. The second strand of literature deals with trade and organizations.

Exporting, Productivity and Innovation

The seminal work by Melitz (2003) provides a theoretical framework that relates trade to industry-level and firm-level changes in productivity. In his model, trade brings about intra-industry and inter-firm reallocation of resources which raises the average productivity level of the industry. This is brought about by the engagement (or self-selection) of firms with higher productivity in exporting as well as the exit of less productive (non-exporting) domestic firms. The empirical evidence on the role of self-selection at the firm-level in exporting is documented in Greenaway & Kneller (2007) and Wagner (2007). The role of innovation activities such as R&D (via their impact on productivity) on exporting has been highlighted by recent works such as Aw *et al.* (2007) and Damijan *et al.* (2010). Using a three year panel data from the Taiwanese electronics industry, Aw *et al.* (2007) find evidence of self-selection. In addition, exporting firms benefit from R&D investment and worker training in terms of higher future productivity. These activities are related to firms' in-house capabilities to assimilate new information. Using innovation survey data from Slovenia, Damijan *et al.* (2010) provides evidence that product and process innovation does not increase the probability of a firm becoming a first time exporter. Furthermore, past exporting does not have impact on product innovation but there is some indirect evidence of past exporting on process innovation - thus providing some evidence of learning-by-exporting.

Trade and Organization

Yeaple (2003) extends the theory of FDI using a three-country model to show that, aside from undertaking horizontal or vertical integration strategies, firms may undertake complex integration strategies in which firms may simultaneous adopt both types of integration strategies. Such strategies can arise due to complementarities between vertical FDI (benefit from factor price differentials) and horizontal FDI (minimize transport cost). Helpman *et al.* (2004) provides an analysis of firm's choice between exporting or horizontal FDI (defined by the authors as "investment in a foreign production facility that is designed to serve customers in the foreign market". They demonstrate that heterogenous firms (in terms of productivity) sort-out across the different forms of ownerships such that globalized firms (exporting and/or FDI) is more productive than non-globalized firm (serving domestic markets) and that globalized firms that engage in FDI are more productive than globalized firms that are engaged in exporting only. Tomuira (2007) investigates the relationship between productivity and the different modes of globalization such as FDI, exporting and foreign outsourcing. In the case of outsourcing, Tomuira (2007) uses unique cross section survey data from Japanese manufacturing sector that contains data on outsourcing to find some evidence of FDI firms being more productive than both foreign outsources and exporters.

3. Methodology

3.1. Exporting and Productivity

The relationship between exporting and productivity can be analyzed by examining the average differences in productivity between firms that always export, entering into exporting and exiting exporting. This is undertaken by regressing productivity (proxied by labour productivity) of firm *i* in industry *j* against dummies representing different types of establishments with regards to changes in exporting status. The specification is as follows:

$$LProd_{ij} = \alpha_1 AE_{ij} + \alpha_2 NE_{ij} + \alpha_3 EE_{ij} + I_j + \varepsilon_{ij} \quad (1)$$

where *AE* is a dummy for firms that export in t and t+1, *NE* firms that do not export in t but export in t+1, *EE* firms that export in t but do not export in t+1, *LProd* labour productivity and I_j are industry dummies. The reference category for these exporting/non-exporting status variables is non-exporters (in both t and t+1). Two versions of the performance variable, namely productivity (*LProd*) are used - level and changes. By and large, we expect the exporting premium in terms of productivity to be larger for firms that export (*AE* and *NE*) compared to those that exit from exporting (*EE*). If the productivity premium from exporting is larger for continuing exporters (*AE*) than new exporters (*NE*), then there might be a learning-by-exporting effect.

3.2. Exporting and Innovation

Following Damijian (2010) and Hahn & Park (2011), the bi-directional causality between exporting and innovation can be investigated by using propensity score matching. The propensity score specification for the probability to undertake innovation is given by:

$$\text{Prob}(Innov_{t-1}) = f(X_{t-1}) \quad (2)$$

where X_{t-1} is the vector of lagged explanatory variables. Three measures of innovation are used, namely - product innovation, process innovation and organizational innovation.

The lagged explanatory variables include natural log of the number computers (COMP), firm size measured by natural log of number of employees (SIZE), labour productivity (LPROD), foreign ownership dummy when the firm's head-quarter if located abroad (FOREIGN), research and development dummy variable (RND), average wage of employee (WAGE), managerial experience by dummy for more than 10 years' experience (MGREXP), percent of employees with degrees (EMPDEGREE), trade liberalization by average MFN tariff (TARIFF), dummy for government assistance in research (GOVRES), dummy for government financial assistance (GOVFIN) and industry dummies.

The propensity scores from the probit estimations of the probability to innovate (equation 2) are used to match innovators and non-innovators and test the effects of lagged innovation on current exporting status. Matching was undertaken using the STATA command psmatch2 which relies on nearest neighbour matching.

A similar exercise is undertaken for exporting:

$$\text{Prob}(Exp_{t-1}) = f(X_{t-1}) \qquad (3)$$

3.3. Productivity and Innovation

Productivity has been traditionally theorized in terms of a growth accounting production function framework. Within this framework, technological factors augment growth and is measured as a residual. In addition, human capital can also be included as an augmenting factor. Process innovation is generally understood to reduce fixed or variable costs (Swann, 2009). Thus, process innovation could reduce the use of factor inputs resulting in higher productivity. Product innovation can be conceived as involving the introduction of new product. Its effect on productivity is more ambiguous depending on whether the new products increases or reduces the total output of the firm.

Following Griffith *et al.* (2006), the relationship between productivity and innovation for firm *i* in industry *j* can estimated using an augmented production function in the form of:

$$Y_{ij} = f(K_{ij}, H_{ij}, \mathbf{T}_{ij}) \quad (4)$$

where Y is labour productivity (LPROD), K is capital intensity proxied by the number of computer per employee (COMPEMP), H human capital proxied by percentage of employees with degrees (EMPDEGREE), **T** is the vector of innovation comprising product innovation (INNOVPROD), process innovation (INNOVPROC) and organizational (INNOVORG).

3.4. Exporting and Organization

There have been a number of theoretical and industry/macro-level empirical studies linking trade and organization. Organizations have several characteristics such as horizontal boundaries (scale of production), vertical boundaries (make or buy/outsourcing decisions), and span of control.

Similar to the approach used by Bustos (2011), differences in organization characteristics of firm *i* in industry *j* are estimated using the following specification:

$$Y_{ij} = \alpha AE_{ij} + \alpha_2 NE_{ij} + \alpha_3 EE_{ij} + I_j + \varepsilon_{ij} \quad (5)$$

where AE are firms that export in 2002 and 2006, NE firms that do not export in 2002 but export in 2006, EE firms that export in 2002 but do not export in 2006, Y firm chacteristic(s) and I_j are industry dummies. The reference category for these exporting/non-exporting status variables is non-exporters (in both 2002 and 2006).

In the empirical exercise, scale of production is provided by natural log of revenue (REV) and natural log of employment size measured in full-time equivalent (EMP). The vertical boundaries variables are proxied by four dummies for outsourcing (OUTSOURCE), local outsourcing (LOUTSOURCE), insourcing (INSOURCE), local insourcing (LINSOURCE). The span of control is proxied by two dummies created for responses indicating "agree" or "strongly agree" to the questions on whether “senior managers and middle managers frequently supervise our workers on tasks” (SUPERVISEMGR) and ”our workers are directly involved in work-task decisions, and are not frequently supervised by middle or senior management” (SUPERVISEWKR).

3.5. Data

The firm-level data that are used in this study come from two sets of surveys for the *Study on Knowledge Content in Economic Sectors in Malaysia* (MyKE Study). The two waves of surveys were conducted by the Department of Statistics for the Economic Planning Unit at the Prime Minister’s Department (EPU) in 2002 and 2006. The dataset is not available publicly and were obtained from EPU by the author. The original dataset contains firms from the manufacturing sector as well as services sector. Only firms from the manufacturing sector are used for this study.

There are 1,228 firms and 1,148 firms in the 2002 and 2006 datasets, respectively. A balanced panel is constructed for 753 firms. **Table 1** provide a summary statistics for some of the key variables. There is significant diversity in the sample, judging from the mean and standard deviation for firm size and total revenues. Majority of the firms in the sample have headquarters in Malaysia. A high proportion of firms in the sample are exporters, about 77.8% in 2002 and 61.5% in 2006. Innovation is defined as per OSLO

Manual’s definition. Non-innovators make up about half of the firms in the sample. Industry dummies at the 2-digit level are included in all regressions.

Table 1: Basic Descriptive Statistics

Year 2002				
Variable	**Mean**	**Standard Deviation**	**Min**	**Max**
Size (no. Employees)	232	442	3	6086
Revenues (RM, million)	124	1040	0,14	24500
Year 2006				
Variable	**Mean**	**Standard Deviation**	**Min**	**Max**
Size (no. Employees)	265	562	11	8471
Revenues (RM, million)	183	1180	0,15	21300

	Year 2002		**Year 2006**	
	Number	**%**	**Number**	**%**
HQ in Malaysia	630	83,7	607	80,6
HQ Outside Malaysia	123	16,3	146	19,4

	Year 2002		**Year 2006**	
	Number	**%**	**Number**	**%**
Exporting	630	83,7	607	80,6
Non-Exporting	123	16,3	146	19,4

	Year 2002		**Year 2006**	
	Number	**%**	**Number**	**%**
Product Innovation	23	3	50	6,6
Process Innovation	176	23,4	154	20,5
Prod & Proc Innovation	134	17,8	147	19,5
Non-innovators	420	55,8	402	53,4

Source: Economic Planning Unit, Malaysia.

4. Result

4.1. Exporting and Productivity

The results from this study provide some evidence of a higher productivity premium of continuing exporters (**Table 2**). Only this result is statistically significant (at the 1 percent level). Surprisingly, the value of the coefficients indicate that the exporting premium of exiting exporters are higher than new exporters - even though only the exiting exporter variables are significant for the regression involving the productivity level in 2006. This might be due to the relatively smaller productivity gains achieved by new exporters. This is confirmed by separate regressions for the two different class sizes, namely small and medium sized firms (< 51 employees) and large sized firms (> 50 employees) [Note: Both definitions are based on official definitions adopted by the Malaysian Government]. In fact, SME-sized entry exporters may have lower productivity compared to their counterpart non-exporter (**Table 3**).

Table 2: Exporting and Productivity

Variables	LPROD Year 2002	LPROD Year 2006	LPROD Change
Always Export	0.442***	0.628***	1.427
	(0.125)	(0.117)	(1.338)
Entry Export	0,121	0.0955	0.687
	(0.252)	(0.247)	(2.730)
Exit Export	0.214	0.249*	-0.114
	(0.150)	(0.138)	(1.602)
Industry Dummies	Yes	Yes	Yes
Observations	633	749	630
R-squared	0.148	0.173	0.009

Note: Standard errors in parenthesis
*, ** and ** indicate statistical significance at 10, 5, and 1 percent, respectively
Source: Author

Table 3: Exporting and Productivity - SMEs and Large Firms

Variables	SME Firms LPROD Year 2002	Large Firms LPROD Year 2002
Always Export	0.482**	0.316*
	(0.224)	(0.164)
Entry Export	-0.269	0.0671
	(0.555)	(0.296)
Exit Export	0.155	0.132
	(0.238)	(0.194)
Industry Dummies	Yes	Yes
Observations	134	499
R-squared	0.150	0.168

Note: Standard errors in parenthesis

*, ** and ** indicate statistical significance at 10, 5, and 1 percent, respectively

Source: Author

4.2. Exporting and Innovation

The results from this study indicate that the causal direction between exporting and innovation is from exporting to innovation, and not vice versa (**Table 4**). This applies for both product and process innovations and not vice versa. Thus, with regards to these two types of innovations, the learning-by-exporting effects seem to apply. These results are similar to those from Damijan *et al.* (2010). Since both the results from this study and Damijan's (based on Slovenian data) differ from the selection hypothesis – it may indicate that the experience of developing countries may differ from more developed countries (such as Taiwan or South Korea). This would be consistent with the general observation that technology diffuse from developed to developing countries (Keller, 2004). For such countries, this occurs partly through exporting. Finally, there is no causal relationship between exporting and organizational innovation.

Table 4: Average Treatment Effects of Lagged Innovation (Exporting) on Current Exporting Status (Innovation)

Causality	Average Treatment Effects	Standard Error	Treatment Observations	Control Observations
Lagged product innovation on current exporting status	-0,056	0,066	125	460
Lagged exporting status on product innovation	0.150**	0.080	452	133
Lagged process innovation on current exporting status	-0.012	0.058	253	332
Lagged exporting status on process innovation	0.272***	0.090	452	133
Lagged organization innovation on current exporting status	-0.116	0.064	277	308
Lagged exporting status on organization innovation	0.051	0.100	452	133

Note: Standard errors in parenthesis
*, ** and ** indicate statistical significance at 10, 5, and 1 percent, respectively
Source: Author

4.3. Productivity and Innovation

Productivity is driven by capital intensity and human capital (proxied by percentage of employees with degrees) (**Table 5**). This is consistent with both the theoretical framework underlying growth theory as well as the empirical results from firm-level studies. Productivity is also driven by process innovation - which indirectly confirms Damijan *et al.*'s (2010) suggestion that exporting leads to productivity improvements via process innovation rather than product innovation. However, it should be noted that product innovation is not well measured in a production function approach to productivity measurement because the total output does not sufficiently capture product variety that arise from product innovation. Thus, the role of product innovation may be underestimated in such exercises.

Table 5: Productivity and Innovation

Variables	LPROD	LPROD	LPROD
COMPEMP	0.406***	0.357***	0.351***
	(0.0329)	(0.0352)	(0.0356)
EMPDEGREE		0.0142***	0.0141***
		(0.0036)	(0.0036)
INNOVPROD			-0.0415
			(0.0740)
INNOCPROC			0.140**
			(0.0699)
INNOVORG			0.0173
			(0.0648)
Industry Dummies	Yes	Yes	Yes
Observations	633	749	630
R-squared	0.148	0.173	0.009

Note: Standard errors in parenthesis

*, ** and ** indicate statistical significance at 10, 5, and 1 percent, respectively

Source: Author

4.4. Exporting and Organization

The evidence on organizational differences between exporters and non-exporters is complex. In terms of horizontal boundaries or scale or production, continuing exporters do have larger revenues or employment size compared to non-exporters (**Table 6**). The scale exporting premium of continuing exporters is larger than those enjoyed by new exporters and exiting exporters (the latter two are not statistically significant). New exporters performed worse than exiting exporters in terms of both revenue and employment size - similar to earlier findings on productivity.

Table 6: Exporting and Horizontal Boundaries

Variables	Revenue Year 2006	Employment Year 2006	Revenue Change	Employment Change
Always Export	2.154 e+08*	241.0***	5.671 e+07	46.30*
	(1.191 e+08)	(55.15)	(1.276 e+08)	(26.22)
Entry Export	-1.575 e+07	57.9	-1.060 e+07	12.18
	(2.481 e+08)	(114.9)	(2.660 e+08)	(54.63)
Exit Export	4.660 e+07	71.83	3.033 e+07	11.15
	(1.405 e+08)	(65.08)	(1.506 e+08)	(30.94)
Industry Dummies	Yes	Yes	Yes	Yes
Observations	753	753	753	753
R-squared	0.027	0.077	0.017	0.026

Note: Standard errors in parenthesis
*, ** and ** indicate statistical significance at 10, 5, and 1 percent, respectively
Source: Author

In terms of vertical boundaries (measured by outsourcing and insourcing), there are no statistically significant differences between continuing exporters, entry exporters and exit exporters (**Table 7**). There is strong evidence on exporting on decentralization (**Table 8**). This confirms the theoretical predictions that the accumulation of knowledge may lead to hierachies in which may routine-type decisions are delegated to production workers (see Caliendo & Ross-Hansberg, 2011).

Table 7: Exporting and Vertical Boundaries

Variables	Outsourcing	Outsourcing Local	Insourcing	Insourcing Local
Always Export	0.210	0.191	0.197	0.117
	(0.139)	(0.142)	(0.160)	(0.163)
Entry Export	0.0923	0.136	0.431	0.362
	(0.289)	(0.291)	(0.302)	(0.310)
Exit Export	-0.134	-0.106	0.173	0.187
	(0.170)	(0.172)	(0.186)	(0.189)
Industry Dummies	Yes	Yes	Yes	Yes
Observations	753	753	753	753

Note: Standard errors in parenthesis
*, ** and ** indicate statistical significance at 10, 5, and 1 percent, respectively
Source: Author

Table 8: Exporting and Decentralization

Variables	SUPERVISEMGR	SUPERVISEWORKER
Always Export	-0.513***	0.182
	(0.156)	(0.152)
Entry Export	-0.511*	-0.0201
	(0.295)	(0.327)
Exit Export	-0.301*	0.346**
	(0.182)	(0.173)
Industry Dummies	Yes	Yes
Observations	753	753

Note: Standard errors in parenthesis
*, ** and ** indicate statistical significance at 10, 5, and 1 percent, respectively
Source: Author

5. Policy Implication

A number of policy implications can be drawn from the findings of this study. The continued emphasis on exporting as a development strategy for the manufacturing sector is the right approach given the productivity premium associated with exporting. However, given the productivity differentials between continuing, new and exiting exporters (compared to non-exporters), the government should consider focusing on new exporters, especially SME firms.

With regards to innovation and exporting, the results on the direction of causality between the two (exporting → innovation) suggest that there is perhaps a need to policies to encourage more product innovation rather than policies to promote exporting per se. The findings on productivity and innovation imply that human capital development should be a key area of focus.

Whilst organizational innovation is likely to be mostly an endogenous and adaptive phenomenon, it is possible that human capital development plays an important role as suggested by the current theoretical literature on knowledge accumulation and hierarchies. The empirical evidence linking decentralization to exporting may constitute an early indirect evidence of this – thus reinforcing the importance of policies on human capital development.

6. Conclusions

Many developing countries continue to focus on export-driven industrialization as an engine of growth and development. There is a greater need to understand how exporting is related to productivity and innovation at the micro-level. Using firm-level data from Malaysian manufacturing, this study has found some evidence of strong productivity premium for continuing exporters (compared to non exporters). Such premium are much weaker (even negative) for new exporters, especially for smaller firms. There is evidence on the causality from exporting to innovation which supports the learning-by-exporting hypothesis. The impact of exporting on productivity may take place through process innovation. There are also important organizational changes associated with exporting, namely scale effects (horizontal boundaries) and the decentralization of decision-making, especially for continuing exporters. In terms of policy implications, findings from this study suggest that export entry is a difficult process especially for smaller firms. As the productivity gains from exporting are likely to come from learning-by-exporting, there is perhaps a need for government providing incentives and support for human capital investment to increase firm-level productivity (rather than provide incentives for exporting per se).

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