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Determinants of Export Performance in the Philippine Manufacturing Sector

Ma. Teresa S. Dueñas-Caparas

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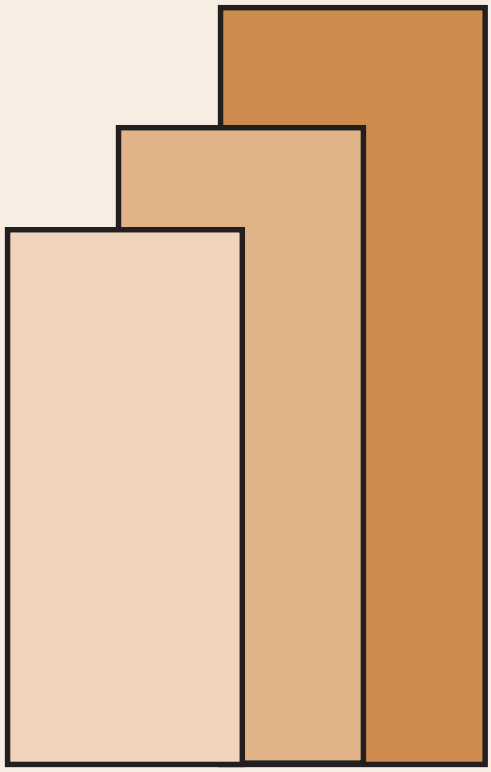

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For comments, suggestions or further inquiries please contact:
The Research Information Staff, Philippine Institute for Development Studies
5th Floor, NEDA sa Makati Building, 106 Amorsolo Street, Legaspi Village, Makati City, Philippines
Tel Nos: (63-2) 8942584 and 8935705; Fax No: (63-2) 8939589; E-mail: publications@pids.gov.ph
Or visit our website at http://www.pids.gov.ph

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Philippine Institute for Development Studies
Makati City, Philippines

Why are some firms better exporter than others?

Ma. Teresa S. Dueñas-Caparas
Research Associate

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Abstract:

The paper determines the factors affecting the export performance of firms in three main manufacturing sectors in the Philippines. Specifically, firm-level characteristics like firm size, firm age and foreign affiliation are identified and statistically tested to determine if it affects a firm's capability to export. The study uses a novel econometric model which specifically addresses fractional response behavior and estimates the model using a modified quasi-maximum likelihood procedure. Among the firm-level characteristics tested, foreign affiliation has the most prominent influence on a firm's propensity to export.

Keywords: export determinant, firm-level characteristics, technology factors

Table of Contents

Determinants of Export Performance in the Philippine Manufacturing Sector

Ma. Teresa S. Dueñas-Caparas[♣]

I. Introduction

The importance of export as an economic activity and a driver of growth has long been established in various research endeavors. Issues addressed in these studies include quantifying the contribution of export to economic growth, designing appropriate trade and industrial policies, and identifying macroeconomic factors that affect trade performance.

As international competition became more innovation and knowledge-based, understanding trade performance went beyond the parameters of the comparative advantage paradigm and stressed the role of technology in affecting international competitiveness (Mytelka 2000). Focusing on the role of entrepreneurs in shaping international competition, a critical observation made is that all firms face the same macroeconomic condition yet these firms respond and perform differently in their export activities. This suggests that there must be firm-specific characteristics that significantly influence a firm's capability to perform in the world market. Hence, research direction shifted towards understanding the different forces that influence firm-level performance. This research interest was further facilitated by the increasing availability of large micro-datasets but is unfortunately limited to developed countries (Wagner 2001, Sterlacchini, 2001).

This paper aims to contribute to the meager but growing literature on firm-level export performance for developing countries using the Philippines as the empirical platform. As most trade-related studies in the Philippine setting are conducted against a macroeconomic setting, this research paper will focus on firm-level behavior and pose the question "***what are the factors affecting the export performance of local firms*?"** This task is facilitated by the availability of firm-level dataset culled from the Investment Climate Survey conduced by the Asian Development Bank in 2003. The paper is outlined as follows; section I provides a brief introduction and rationale of the study. Section II gives an overview of the various studies done on the determinants of firm-level export performance while Section III presents the theoretical underpinnings and conceptual framework of the study. Section IV outlines the empirical model and the results while Section V gives the conclusion.

[♣] Research Associate at the Philippine Institute for Development Studies. The author wishes to thank Professor Emeritus Rolando A. Danao of the UP School of Economics for the extensive discussion in econometrics, Dr. Josef T. Yap of PIDS for the substantial comments in the earlier draft, and Mr. JM Ian Salas for the research support. The views expressed in this paper are solely that of the author and do not represent the Institute.

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II. Studies on Export Performance and Technological Development

Remarkable changes have been occurring in the global front. Focusing on manufactured exports and technological activities, dramatic increases in both international trade and innovative behavior are evident in the sectors related to electronics, physics and pharmaceuticals. Using patent activity and export share to world trade, these sectors have shown above-average growth rates for the period 1985-98 (see Table 1). The figures suggest that sectors which offered large technological opportunities show the largest improvements in world export shares. Countries like China, Malaysia, Singapore and Thailand offers empirical evidence supporting this observation. Similarly, as these countries advance in technological and export performance, significant structural changes accrue in the economy where the share of medium-high technology products to total exports improved substantially (Montobbio and Rampa 2005).

Table 1. Annual Growth Rate of Patents and Exports Shares to World Total

Sector	Annual Growth, % 1985-98	
	Patents	**Exports**
Computing and Data Processing	108.96	33.80
Electricity and Electric Power	2.77	24.77
Electronics and Components Classes	94.15	62.38
Optics-radiant energy-photography	30.36	-7.37
Communications and networking	94.98	14.77
Electronics, Physics	42.93	25.19
Pharmaceuticals	34.19	38.14
Surgery-body care-cosmetics	62.60	8.27

Source: Montobbio and Rampa, 2005.

Earlier works of economists Lindbeck and Vernon stressed the importance of technology factors in international competition and discussed the determinants of firm- and country-specific technological advantages. However, they differ in conclusions. Lindbeck espouses the view that entrepreneurial function is fulfilled by talented individuals and technology needed for innovation consists of specific knowledge of a particular product, process and market. Vernon, on the other hand, believes that technological advantages emerge from a deliberate search of industrial firms and knowledge needed for innovative activities is widely accessible (Dosi et al 1990). Guided by these principles and modified over time, various research works emerged which gave prominence to the role of entrepreneurs in technology development. Specifically, mastering technology is costly and firm-initiated where firms, even of the same industry, have different ways of mastering technology and this in itself is a source of technological advantage, thereby affecting trade performance.

A. Firm-level Studies

A study assessing the impact of technology and structural change on export performance was conducted for nine developing countries, namely, Argentina, Brazil, China, Columbia, India, Malaysia, Mexico, Singapore and Thailand (Montobbio and Rampa 2005). The research posited the existence of the relationship between technology and trade and attempted to analyze the impact of structural change on the sectoral distribution of export activities and market shares. Factors like foreign direct investment, technological specialization, skills and research and development (R&D) were tested using structural decomposition analysis. The study confirmed that structural change is an important characteristic of modern economies and affects the growth trajectories of developing countries.

Sectoral and firm-specific factors affecting the trade performance of British manufacturing firms were identified and analyzed (Bleaney and Wakelin 1999). Using share of export to total sales, the study concluded that higher export shares were evident in firms which engaged in technologically innovative activities, as measured by R&D expenditures. A similar study is conducted for Italian manufacturing firms where firm size, as measured by total sales, was identified to be the most significant factor affecting the export behavior of local firms (Sterlacchini 2001). Firm characteristics, technological capabilities and commercial capabilities were tested as possible determinants for small and medium enterprises (SMEs) in Canada (Lefebvre and Lefebvre 2001). The study empirically supported the hypothesis that import activities, R&D expenditures, distribution access, knowledge intensity and size significantly affect export performance. The study also showed that these determinants vary according to the industrial sector where the SMEs belong. Technological capabilities have the strongest effect in high-knowledge industries while commercial capabilities are more salient in low and medium-knowledge sectors.

Studies analyzing firm-level export performance in developing countries were conducted for Chile (Alvarez, 2002), Mauritius (Wignaraja 2002), Ghana (Sarpong and Wolf 2004) and Indonesia (van Dijk 2002). In the Chilean firms, factors affecting the decision to export and the determinants of export success were identified. The study concluded that productivity, firm size and human capital increases the sustainability of export while foreign technical licenses and foreign capital participation positively improves export performance. In Ghana, the relationship between export performance and investment behavior of private firms was tested using a simultaneous equation model. However, the study did not find any positive or significant relationship between the two variables. Other factors like firm age and firm size were similarly tested and results indicate that younger and larger firms are likely to invest and export compared to older and smaller firms.

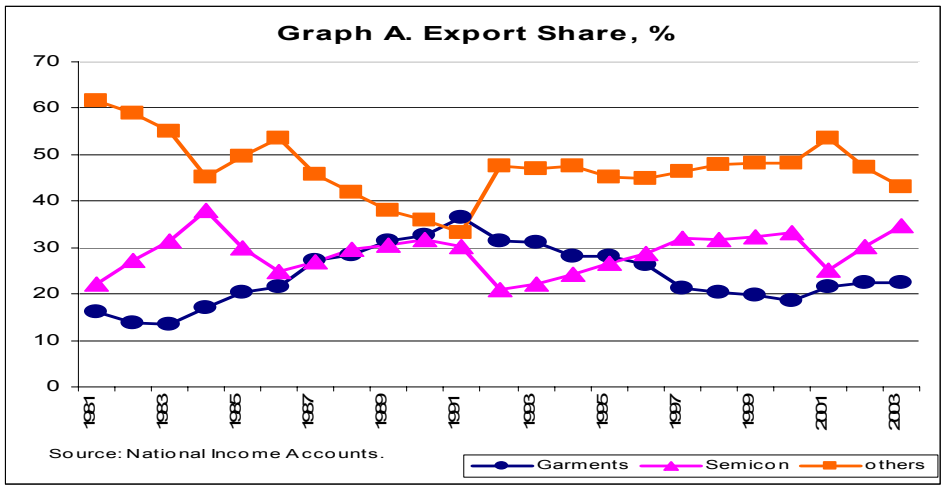
In Mauritius, the export behavior of garment firms was analyzed using foreign equity, firm size, age, technological index and human capital (measured by the share of engineers and technician to total employment) as possible determinants of export performance. Among these factors, only technological index and foreign ownership yielded significant results. A major contribution of the research is the construction of a technology index which was intended to capture the technological capability of firms. Firm-level capabilities were classified into production, investment and linkage

activities following the taxonomy espoused by Lall (1992). A scoring system was assigned in each classification to build the index. A corollary objective of the study is to determine the factors affecting technological capabilities of firms. The study showed that firm size, engineering and technical manpower, employee training and external technical assistance have significant and positive influence on export behavior while foreign ownership and age in production showed no significant influence. A related study stressing technological capabilities and firm-level export competitiveness for East and South East Asian economies was also conducted focusing on three industries—electronics, auto parts and garments (Rasiah 2003). The study showed that scale, human resource capability and institutional and systemic capabilities are some of the major factors that positively stimulate a firm's export performance.

The study of van Dijk (2002) attempted to determine the factors affecting export performance for Indonesian manufacturing firms. It highlighted the importance of sectoral variation in determining export activities and concluded that relative size, foreign ownership and age were significant factors across all sectors while skilled labor differs according to the industry which the firm belongs. The study also demonstrated that research and development activities in Indonesia only benefit exports in relatively mature industries while capital intensity does not influence export behavior in scale-intensive firms.

B. The Philippine Setting

The export structure of the Philippine manufacturing sector took a dramatic shift when it embarked on a progressive export promotion regime. With traditional export products like sugar, banana, coconut oil, and abaca dominating approximately 75-85 per cent of total Philippine exports in the 1970s, it took a sizeable drop in export share to approximately 20 per cent in the 1990s. The fall of the traditional exports in terms of export share coincided with the rapid rise of non-traditional export products like electronics, garments, handicrafts, and furniture and fixtures. The growth of the non-manufactured exports was definitely the most dynamic component of export growth since the 1970s (Pante and Medalla 1990) (see Graph A).



Despite the notable performance of the Philippine products in the world market, a fundamental weakness in the export structure continues to persist until the 21st century. Approximately two-thirds of Philippine exports are concentrated to just three products, namely semiconductors, garments and electrical machinery and equipment. These goods are considerably dependent on imported inputs and have weak backward and/or upward linkages with the rest of the manufacturing sectors. This resulted to an alarming productivity gap where export growth is not translated to overall economic growth (see Table 2).

Table 2. Average Annual GDP and Export Growth

Country	Growth in Crisis (1997-98), %		Growth Post-crisis (1999-2000), %	
	GDP	**Export**	**GDP**	**Export**
Korea	(0.9)	1.0	9.8	15.5
Singapore	4.8	(6.2)	7.9	12.4
Thailand	(6.1)	(1.5)	4.2	13.5
Indonesia	(4.2)	0.8	2.8	15.0
Philippines	***2.4***	***19.8***	***3.6***	***13.8***

Source: Asian Development Bank.

Studies done on the Philippine export performance were mainly focused on industrial policies and competitiveness.

The study of Pante and Medalla (1990) outlined and evaluated the various trade and industrial programs implemented after the collapse of the industrial and manufacturing sectors in the 1980s. In a grand effort to restart the economy through an active participation in the export market, the reforms were aimed to increase the efficiency of the economy by eliminating the distortions in the incentive structure, by revitalizing the private sector, and by establishing greater reliance on market forces. The study concluded that the reforms were selective in revitalizing the economy. The trade reform program was successful in lowering protection but was not able to alter the biases against exports and agriculture. Similarly, the investment reform program reinstated the capital bias and reduced the incentives given to exporters vis-à-vis non-exporters. The study recommended an aggressive export promotion reform focusing on export finance, a program for the regional dispersal of industries, a program for small and medium enterprises, and a program for technological development.

The research work of Medalla, Tecson, Bautista, and Power and Associates (1996) is one of the first extensive studies that provided valuable empirical evidence on the importance of trade policies in shaping industrial efficiency and performance. Entitled "Catching Up with the Asia's Tigers", the study demonstrated how enterprises and industries respond to economic incentives, proving that policy reforms matter. Eight industry studies were analyzed namely; (1) textile and garment, (2) motorcycle and parts, (3) meat and dairy processing, (4) appliance, (5) packaging, (6) synthetic resin and plastic, (7) agricultural machinery, and (8) shipbuilding/repair and boatbuilding. Each industry study used plant-level data from the Census of Establishment for the years 1983 and 1988, representing pre-and post tariff policy

regimes. Measures of allocative and technical efficiency were calculated to determine whether or not the industry has comparative advantage.[1] Generally, the study observed a pattern of declining inefficiency and improvement in allocative efficiency with the partial implementation of the trade reforms. Export-oriented industries were found to be relatively efficient and realized their comparative advantage in the world market. However, structural weaknesses remain and need to be addressed, specifically the continued high reliance on imported products as evidenced by the shrinking intermediate and capital goods sector. The study recommended that policy attention should focus on the improvement of efficiency and competitiveness of the intermediate and capital goods sector--highly regarded for its strategic role of generating and diffusing technological change throughout the economy.

Yap (1999) examined the link between trade patterns and competitiveness in the manufacturing sector for the period 1980-95. The study hypothesized that export performance is significantly affected by macroeconomic stability and the structure of the financial sector in its capacity to deliver and meet world demand. Using revealed comparative advantage (RCA) as a measure of trade performance, the study tested the influence of labor productivity, price competitiveness and capital stock on export. The study failed to establish an empirical link between export performance and productivity where the econometric tests yielded statistically insignificant coefficients and opposite signs. The paper however highlighted the existence of a dichotomy between the domestic manufacturing sector and the export sector, indicating that the export sector has its own dynamics independent of the development in the local manufacturing sector. Ruling out macroeconomic factors in affecting export performance, the study pointed at real factors such as (1) low level of technological capability that hampered forward and backward linkages across industries, (2) poor human resource development, and (3) inadequate infrastructure as the culprit behind the failure of the macroeconomic reforms to transcend to the microeconomic level. Though the study did not statistically test the relationship of export performance and the identified real factors, it opened an alternative view in understanding trade performance and competitiveness.

Lall (2000) observed that the Philippine competitive base is narrow, primarily dominated by one product group—semiconductor. The semiconductor industry specializes in low-end final assembly and testing phase—activities that are vulnerable to competitive entry and technological change. The garment industry, initially the forerunner in the manufactured exports, suffered from poor utilization of cheap but skilled labor force. Other significant observations made in the study are the following; (1) technological and design activities are low, (2) technical support for domestic firms is weak, (3) the two industries suffer from structural weaknesses in its search for technological development, i.e., quality and relevance of the education and training system of the country compounded by the incompatibility between industry needs for employment and school training, and (4) mismatch between local technological effort and the high-technology structure of exports where overall levels of R&D are low, exacerbated by poor quality of management. Incentive system is weak aggravated by a limited relevance for industrial technology progress. The study claimed that the technology system in the Philippines is of limited effectiveness governed by too many institutions with different programs and objectives. It

[1] An industry is said to have comparative advantage if the domestic cost it incurs to earn a foreign exchange is less than or equal to the shadow price of foreign exchange (Tecson, 1996).

concluded that the lack of technology development and management in the country could significantly hamper the sustainability of its export performance that has been visibly threatened by emerging Asian counties like Vietnam. More over, the country's sole reliance on semiconductor as its large export earner is risky unless technology upgrading is initiated to improve competitiveness.

Abrenica and Tecson (2003) analyzed the technological underdevelopment of the Philippine manufacturing sector, and offered an explanation why the country failed to catch up with its technologically progressing Asian neighbors. The paper debunked some of the "known facts" about the country like (1) dominance of high-technology industries, (2) reliable pool of human resource, and (3) attractive site for foreign investors anchored on educated and English-speaking labor force and generous government incentives. By providing an alternative way of looking at the same statistics, the study showed that the country's failure to catch up rested on its weak ability to absorb and assimilate knowledge and technology. While most firms have adopted an outward orientation strategy, its weakness in technological capacity was traced to policy neglect. The study recommended setting a national agenda that will help define the technological path of the country. Complementing this strategy is to upgrade the technological and physical infrastructure that will ensure the smooth and fast flow of communication across sectors. Of equal importance is the rehabilitation of the deteriorating educational system that would not only meet industry skill requirements, but will also produce a critical mass of engineers and scientists who will conduct R&D activities in the future.

C. Literature Gap

The emerging literature on understanding export performance is now taken to the level of the firms stressing the significance of technology-related factors. While it is not intended to diminish the contribution of studies that focused on the macroeconomic factors, the availability of micro datasets will provide an alternative way of understanding trade performance. Clearly, there is no existing study conducted on the Philippines regarding the export performance of firms. The current research will attempt to fill this literature gap and provide an empirical contribution to the growing number of technology-related studies on export performance.

III. Theoretical Underpinning

A. Trade Paradigms

Trade pattern is largely explained by comparative cost advantages and relies on cost or price competitiveness. Early trade theorist David Ricardo stressed on the relative labor productivity differentials as the basis of trade and showed that each country has comparative advantage--an ability to find some good it can produce at a lower relative cost, and thereby trade with other countries. This notion was extended in the Hecksher-Ohlin model where countries were treated to have two factors of production, labor and capital, and face the same production functions but different factor endowments. The difference in relative factor endowment generates trade

activities. Both models treat technology either as a costless activity or irrelevant in the production and trading process. The recognition of human capital as the "third" factor of production became the significant contribution of the neo-factor trade theory but still maintained the static view of the Hecksher-Ohlin model.

As the conceptualization of trade theories became more rigid, some of the assumptions adopted in the traditional trade models were relaxed like constant returns to scale and product homogeneity. This resulted to the development of the strategic trade models were scale economies and oligopolistic competition became important factors in determining trade patterns. This view was modified and embraced by the proponents of neo-technology trade theory where the emphasis is placed on the role of innovation in creating new markets and conferring cost advantages on the innovating nation. Technology became a crucial determinant of international trade and differences in technologies and tastes now form the basis of trade. Using the ideas espoused by Posner (1961) and Vernon (1966), exporting activity is now determined by technological differences which constantly evolve. A major prediction of the model is that technologically-advanced nations will export new products and import standardized one. However, its limitation lies in the failure to account for a catch-up process between the rich and poor countries. Learning modes are not incorporated, resulting to an insufficient treatment of technology.

The negligence of industry-level approach on the different market conditions and the capabilities of firms within the same industry became the starting point for the proponents of the capability framework as influenced by Austrian economist J. Schumpeter. Schumpeter places great value on the capitalist business enterprise and regards it as his core economic agent. He puts importance on the monopolistic and oligopolistic market structures believing that large firms carry out more innovative activities than small firms. He also claims the importance of non-price factors in competition, and when these factors are incorporated in models which solely use price as a competitive leverage, the results will be significantly different. Dynamic changes are the expected outcome that will raise competition to the level of new products, new source of supply, new process, and new type of organization. Ultimately, it is the firm, not the industry, that decides if it should trade or not.

The capability literature highlights the importance of the firm as the core player in the acquisition and assimilation of new technology. Technical change is regarded as an activity that can be generated by firms involving a continuous search and learning process that could have varying results ranging from the adaptation and improvement of chosen technology to the generation of an entirely new technology. These skills and knowledge are firm-specific and necessary in order to acquire, assimilate, adapt, change and create technology. Enabling the firm's performance is a network of economic actors like other firms, suppliers, institutions and the government.

B. Determinants of Export Performance

Firm characteristics have been identified as possible determinants of export performance. Some studies have shown that from these characteristics, competitive advantages are built and economic rents are realized. There are also other studies that showed that firms of the same industry differ in their performance, enactment of

technology policy and corporate strategies, or use of technology (Lefebvre and Lefebvre 2001). These studies simply point to one significant implication—analysis of trade performance cannot be contained to the level of the country alone, but has to go down to the level of the firm where the importance of firm-specificity in affecting export activities cannot be neglected or underestimated.

The relationship of ***firm size*** and export is traditionally considered as positive, i.e., "to compete globally, you have to be big" (Lefebvre and Lefebvre 2001 (Chandler 1990)). Larger firms are generally regarded as more capable of bearing the large investments and high risks associated with exporting. Several studies support this view empirically, i.e, ((Dholakia and Kapur, 1999 (Aitken, Hanson and Harrison, 1997, Roberts and Tybout, 1997, Hirsch and Adar, 1974, Bernard and Wagner 1996, Wignaraja and Akiara, 1999, and Lall and Kumar, 1981)). However, some researches found negative or no relationship between firm size and exports. An explanation for this kind of relationship is the possibility that a non-linear relationship might exist between firm size and exports. After a certain threshold, size no longer plays a significant role. This explanation is empirically observed in Australia, Denmark, Italy, Japan, Spain ((Lefebvre and Lefebvre 2001, (OECD 1997)) and Germany (Wagner 2001). Another explanation offered regarding the non-linear relationship between size and export is that the advantages of exporting may not be totally attractive for large domestic firms who might be oriented towards the domestic market and capitalize on domestic monopoly (Wakelin 1998).

Firm age and export may similarly produce conflicting relationships. As the firm matures, it may have accumulated knowledge stock from which to build their capabilities and provide them better leverage to compete in the world market. However, core capabilities can become more rigid and younger firms may be more flexible, aggressive and proactive in catering world demand (Lefebvre and Lefebvre 2001).

Human capital is strongly related with technological capabilities, an aspect that needs to be developed by firms to remain competitive in the export market. This is usually represented by the share of the skilled employees to total employment and/or the number of employees with degrees in either mathematics or science. Neo-technology model suggests a strong and positive relationship between human capital and export propensity because educated and skilled manpower possesses certain abilities that make it easier to establish and maintain certain contacts with the foreign market. On the other hand, Hecksher-Ohlin model predicts that for countries with abundant unskilled labor, investment for skilled labor would be costly and will have a negative effect on exports. This is empirically tested and shown for Brazilian and Indonesian firms where human capital variable yielded statistically negative relation with export performance ((van Dijk, 2002 (Willmore 1992, Ramstetter 1999)).

Research and development expenditure is the often-used proxy variable for technology and is expected to influence export performance positively as empirically tested in Brazil (Willmore 1992) and Germany (Wagner 2001). However, some studies yielded negative results between R&D and export performance specifically in India (Lall, 1981) and Canada (Lefebvre, 1998). The mixed empirical results could be traced to the fact the R&D is simply a partial measure of technology and does not account incremental improvements in products and processes. Further, the

importance of R&D on export intensity differs across sector and country; hence, it may have strong influence on Germany but weak impact on Canada.

Training of workforce is a proxy measure of technological capability and is expected to have a positive relationship with export performance. Skill training enhances learning and accumulates additional skills which can improve productivity and export propensity.

Foreign interest in a local firm and export activities are expected to have positive relationship mainly because of the multinational's (MNE) access to superior production, technology and management know-how which the local firm can acquire. Further, MNEs have sophisticated international networks which facilitate the exporting process. The studies on Indonesian firms validate this hypothesis ((van Dijk, 2002 (Ramstetter 1999 and Willmore 1992)).

Capital intensity is often included as a determinant of firm export performance. The Hecksher-Ohlin model predicts that capital-intensive industrialized countries export more while the opposite is expected for labor-intensive developing countries. Another explanation why a more capital intensive firm have higher propensity to export is due to the past innovations and knowledge the capital embodies, reflecting economies of scale (van Dijk 2002).

C. Significance of Sectoral Variation

Some scholars believe that industrial sectors have different technological opportunities and development. This implies that the role of technology in export performance differs across sectors. The highly influential work of Pavitt (1984) is one of the corner stones in stressing sectoral variation and technical change. Using firm and innovation data in Britain from 1945-1979, the study attempted to describe and explain the differences among sectors in the sources, nature and impact of innovations. Additional characteristics like sources of knowledge inputs, size and principal lines of activity of innovating firms, and the sectors of innovations' production and use were also analyzed.

From the information obtained, Pavitt came up with three basic categories, namely (1) supplier-dominated, (2) production intensive, and (3) science-based. The production-intensive category can be further divided into (a) scale-intensive and (b) specialized suppliers. The various sectors were then classified according to technological trajectories, characteristics and determinants of technological trajectories. It stressed the importance of knowing the production of technology that is reflective of sectoral diversity. Table 3 presents a summary of the characteristics with the corresponding classification.

Table 3. Sectoral Taxonomy

Firm Category	Determinants of Technological Trajectory		Measured Characteristics	
	Core Sector	**Source of Technology**	**Source of Process Technology**	**Relative Size of innovating firm**
Supplier-dominated	Agriculture, housing, private services, traditional manufacturing	Suppliers, research extension services, big users	Suppliers	Small
Scale-intensive	Bulk materials like steel, and glass, assembly like consumer durables and automobile	Product engineering, suppliers, R&D	In-house; suppliers	Large
Specialized supplier	Machinery and equipment	Design and development users	In-house; consumers	Small
Science-based	Electronics, electrical machinery, chemicals	R&D, public science, production engineering	In-house; suppliers	Large

Source: Pavitt 1984

IV. Empirical Application : Philippine Firms

A. Firm-level Dataset

The research uses data from the firm-level survey carried out by the Asian Development Bank (ADB) in collaboration with the World Bank and the Philippine National Statistics Office. The survey was conducted in the year 2002 and was primarily intended to analyze the investment climate and productivity performance of local firms for the period 2000-02. A total of 716 firms were surveyed across key urban areas using stratified simple random design. Firms belonging to these four specific industries were the target of the survey; (1) food and food processing, (2) textiles, (3) garments, and (4) electronics and electrical machinery. A frequency weight is applied, determined by the National Statistical Office, to make the survey sample representative across the population size. The survey was primarily intended to obtain information that will help better understand and improve the investment climate and its effect on business performance. Key questions regarding the company profile, finance, technology, relations with other businesses, government regulation, contract enforcement, labor relations and international trade were asked in a two-part questionnaire.

For the purposes of this study, information on sales, export level, foreign equity and the like were extracted from the survey set. Some business units however failed to complete the survey form appropriately and had missing information. Firms for the garment and textile industries were combined to form the clothing sector and the three major sectors are classified according to the Pavitt taxonomy, i.e., food processing is classified as scale-intensive, clothing sector is supplier-dominated and the electronic sector is science-based. Table 4 shows the basic descriptive statistics culled from the survey.

Table 4. Descriptive Statistics, ADB

Export Sale/ Total Sales (EXP)	Food	Clothing	Electronics	Total
Non-exporter where EXP=0	204	156	31	391
Partial exporter where 0<EXP<1	32	48	24	104
Full exporter where EXP=1	5	88	58	151
Missing Information	52	54	35	141
Total Firms	241	292	113	646
“filtered” firms	189	238	78	505

The following observations are drawn;

Among the electronic firms, only 27 per cent are non-exporters while over 50 per cent are full exporters. In a reduced sampling of 97 electronic firms, 60 per cent have foreign affiliations and only 4 firms without foreign interest cater to the local market. The 39 firms without foreign affiliation were mainly operating to meet domestic demand.[2] The oldest electronic firm has been operating for 56 years while the youngest is barely 2 years in operation.

In the clothing sector, 53 per cent of the total firms surveyed were domestically operating while only 30 per cent are full exporters. Foreign participation in local firms is alarming where only 52 firms of the 288 filtered firms have foreign equity participation of more than 50 per cent. From the 52 firms, only 2 firms have no export activities suggesting that the presence of foreign interest is vital in the export performance of the clothing firms. There are 236 firms whose foreign equity is either zero or less than 50 percent—of these, 65 per cent are non-exporters. Majority of the surveyed firms have been in the business for more than 15 years where the oldest clothing firm has been operating for 79 years.

The food processing sector has a reduced sampling size of 241 firms, of which 204 are non-exporters. Cross tabulating for foreign affiliation, only 9 out of 234 firms have foreign interest and 60 per cent of these are exporters. Average number of years of operation is 23 years, the longest average business life among the three sectors. Table 5 presents the summary characteristics for the three sectors.

Table 5. Mean and (standard deviation).

Firm Characteristic	Electronics	Clothing	Food Processing
Size	0.89 (0.15)	0.33 (0.00)	0.40 (0.01)
Proportion of skilled workforce	82.36 (0.24)	79.08 (0.24)	57.41 (0.32)
R&D Expenditure/ Sales	0.70 (0.04)	0.70 (0.05)	0.70 (0.03)
Proportion of exporters in the industry providing training	48%	9%	8%
Proportion of exporters in the industry with foreign affiliation	58%	17%	3%
Capital Intensity	6.21 (22.58)	2.57 (8.32)	4.47 (10.86)
Average years of operation	15.1 (10.54)	17.5 (13.11)	23.4 (20.1)

[2] Foreign affiliation is approximated by foreign equity participation of more than 50%.

Information from the publication Census of Philippine Business and Industry (CPBI) are obtained for comparative purposes against the ADB dataset. The CPBI is the official publication of the National Statistical Office containing information on large and small establishments in the Philippines. Its most detailed information is given at the 5-digit sector classification and the survey is conducted every three years. The latest publication available is for 1999. Table 6 provides basic descriptive statistics from CPBI.

Table 6. Descriptive Statistics, CPBI 1999

Sector	No. of Establishments	Total Employment	Value of Output (P)
Food	1,427	212,707	P443,424,765
(% share)	(19.2%)	(19.5%)	(25.2%)
Clothing	1,303	199, 376	P85,007,408
(% share)	(17.5%)	(18.3%)	(4.8%)
Electronics	878	283,889	P513,845,489
(% share)	(11.8%)	(26.0)	(29.2%)
Others	3,842	393,865	P716,407,618
(% share)	(51.6%)	(36.1%)	(40.7%)
Philippines	7,450	1,089,837	P1,758,685,271

B. Empirical Model with Testable Hypotheses

Using the concepts guided by the capability literature and stressing the importance of firm as a core economic agent, a firm-level export function is specified as

$$EXPORTP2 = \mathrm{F}(\alpha_0 + \alpha_1 RSIZE + \alpha_2 RSIZE2 + \alpha_3 SKILLED + \alpha_4 RNDSALES00 + \alpha_5 TRAINING + \alpha_6 MNC + \alpha_7 CAPINTENSITY + \alpha_8 AGE + \alpha_9 AGE2)$$

where

Variable	Definition
EXPORTP2	Export performance
RSIZE	Relative firm size
RSIZE2	Square of relative firm size
SKILLED	Skilled manpower
RNDSALES00	R&D expenditure
TRAINING	Skill training
MNC	Foreign affiliation
CAPINTENSITY	Capital intensity
AGE	Firm age
AGE2	Square of firm age

EXPORTP2 represents the export performance of the firm defined as export / sales. This value ranges from 0 to 1.

RSIZE is defined as the number of employees in firm j / total number of employees in sector i where firm j belongs. A larger firm is expected to influence export performance positively since a big workforce is indicative of the firm's capability to produce a large level of production and meet international demand.

SKILLED represents the share of skilled workers to total workers in firm j where skilled workers include management, professional and skilled production workers. A large pool of skilled workers is expected to have a positive influence on export performance across all sectors due to higher labor productivity associated with skilled manpower.

RNDSALES00 is the share of R&D expenditure to total sales in year 2000. A higher proportion of sales allotted for research and development activities is expected to influence export performance positively. Investment in R&D is expected to improve the knowledge and skill base of the firms, hence more capable to withstand the pressures of international competition.

TRAINING is a dummy variable where 1 represents the firm offering formal training to permanent employees while 0 otherwise. This partly measures the quality of human capital where regular training of employees improves the quality of work therefore export performance.

MNC is a dummy variable representing the foreign affiliation of local firms. A value of 1 is assigned if the firm has foreign equity participation of more than 50 per cent while 0 otherwise. A high degree of foreign affiliation among local firms is expected to influence export performance positively where foreign participation is regarded as an important source of knowledge and technology in developing countries.

CAPINTENSITY is defined as capital stock / labor cost where capital stock is the sum of value of machinery and equipment, and land, building and leasehold improvement while labor cost is the sum of wages and salaries, and allowances and bonuses. Higher capital intensity is expected to affect export performance positively assuming that technology and knowledge favorable to local firms is embedded in the machineries and equipments.

AGE represents the years of operation. This is obtained by getting the difference between the year 2003 and the year the firm started actual operation. A mixed effect is expected for the age variable. For the clothing and food manufacturing sectors, an older firm is expected to export better since it takes years to learn about the market it caters whereas for the electronic firms, a young firm may be able to penetrate the export market as effectively as the older firm due to the fast pace of technology. A younger firm may enjoy production flexibilities an older firm cannot afford like drastic change in production lines and concepts.

C. Estimation Procedure

Studies on determinants of export performance uses either ordinary least squares (OLS), two-step model or one-stage model as estimation procedures. However, some criticisms arise from the use of these estimation procedures (Wagner 2001). The OLS estimation is not appropriate when dealing with export performance behavior since it does not take into account the restriction, by definition, of export performance, i.e., $0 \leq EXPN \leq 1$ where EXPN is defined as export / total sales. Studies by Wignaraja (1998, 2002) used this methodology. An alternative methodology is the use of the two-step model where export behavior is analyzed in two stages. In the first stage, the firm decides whether it will export or not. If yes, then the model goes to the second stage and determines the proportion it will export from the total sales/production (van Dijk 2002 (Wakelin (1998), Sterlachinni (1999) and Nassimbeni (2001)). A major criticism of this approach is based on the grounds that a profit maximizing firm does not make a distinction between the two stages, and simultaneously decides if and how much to export.

Another approach uses the one step model where export behavior (with one equation) is analyzed using BOTH exporting and non-exporting firms and is estimated using Tobit procedure (Sterlacchini 2001 (Wagner 1995, Kumar and Siddharthan, 1994, Lefebvre 1998)). A criticism of this procedure is the failure of Tobit to recognize endogenous variable that is bound by zero or positive by definition. Tobit estimation is more appropriate when the value of the variable is less than the lower limit but observations with such values are not observed because of censoring.

Recent development in the econometric literature experimented with estimation procedures dealing with fractional response, of which export performance is qualified (fraction of sales that is exported). The model of Papke and Wooldridge (1996) was specifically developed to deal with percentage variables bound by zero and one. By expanding the literature on generalized linear models and quasi-likelihood estimation, they were able to obtain robust methods for estimation and inference with fractional response variables. The model addresses the limitations encountered in OLS estimation (failure to recognize the limit definition), and Tobit estimation (censoring and variables bounded by the limits). It consists of quasi-likelihood method using Bernoulli quasi-maximum likelihood estimator with asymptotically robust inference for the conditional mean parameters and is relatively efficient.

The study will adopt the Papke-Wooldridge model in determining the factors that affect export performance in the Philippine firms. The often-used OLS procedure is not appropriate for this type of estimation due to its failure to recognize the restrictions in the data definition (bound by 0 and 1) while the Tobit estimation is used for censored variables. The ADB firm-level dataset provides for full information ($0 \leq$ export performance ≤ 1) on the export propensity of firms and censoring the dataset (i.e, filter export performance = 0) will yield biased results. The same estimation procedure was used by van Dijk (2002) in determining the export performance of Indonesian firms. The Papke-Wooldridge model can be estimated using the statistical package STATA 9.0 under generalized linear model with Logit as the link function and robust estimators.[3]

[3] See Wagner (2001) for the details in estimation procedure and Papke and Wooldridge (1996) for the fractional response modeling.

D. Empirical Results

Result of the econometric test is shown in Tables 7.1, 7.2, and 7.3. The empirical model attempts to determine if characteristics like firm size, skills, training, R&D expenditure, foreign affiliation, capital intensity and age can influence the export performance of firms in selected Philippine manufacturing sector. Regression analyses were conducted on an industry level basis stressing the significance of sectoral variation. This means that for the same firm characteristic, it is possible that it may have different influence on export behavior depending on which sector the firms belongs.

Table 7.1 Estimation Results for Food Processing

Variable	Estimation 1 General Model	Estimation 2 Alternate Model	Marginal Effects
Constant	-4.70 (-5.56)	-5.04 (-6.39)	
Rsize	18.06 (0.25)	4.73 (0.06)	0.165
(Rsize)^2	-147.52 (-0.32)	-181.70 (-0.15)	-6.329
Skilled	**3.42*** **(2.20)**	**3.50*** **(2.31)**	0.122
RNDSales00	-54.77 (-1.14)		
Training	1.11 (1.24)	0.76 (0.90)	0.034
MNC	**1.24*** **(2.10)**	**1.64*** **(2.71)**	0.123
Capintensity	-0.00 (-0.29)	0.00 (0.26)	0.000
Age	-0.56 (-1.15)	-0.04 (-0.87)	-0.001
(Age)^2	0.00 (1.73)	0.00 (1.23)	0.000
AIC	1.82	1.81	
No. of firms	189	189	

Note: z values are reported in parenthesis; * means significant at 95% interval.

Using the general model where all the possible determinants were included in the estimation, only SKILLED and MNC showed positive and significant influence of export performance as expected. Foreign affiliation appears to be the primary source of knowledge and technology for local firms while technical skills improve the quality of production, thereby making the goods more attractive in the world market. Size and export performance exhibit an inverted U relation but the z-tests are insignificant rendering the non-linear effects of size inconclusive. Similarly, the RNDSALES00, AGE and CAPINTENSITY variables yield signs contrary to expectations but are not significant.

An alternative or reduced-form model is estimated by removing RNDSALES00 from the original function. The rationale behind the alternative or reduced model is due to the belief that most local firms hardly do R&D activities. The results are similar to the general model but slightly increased the level of significance of SKILLED and MNC variables. Obtaining the marginal effects, the results indicate that by increasing the proportion of skilled workers in the work force by 1%, export performance will increase by 12% assuming all things are constant. Similarly, a 1% increase in foreign equity participation will improve the proportion of export to sales by 12%.

Table 7.2 Estimation Results for Clothing

Variable	Estimation 1 General Model	Estimation 2 Alternate Model	Marginal Effects
Constant	-1.82 (-3.02)	-1.84 (-3.15)	
Rsize	**295.29*** **(2.55)**	**232.09*** **(2.65)**	53.93
(Rsize)^2	**-9885.13*** **(-2.46)**	**-6162.76*** **(-2.66)**	-1431.91
Skilled	-0.34 (-0.57)	-0.17 (-0.29)	-0.041
RNDSales00	**-10.11*** **(-1.88)**		
Training	0.47 (0.71)	0.38 (0.64)	0.091
MNC	**5.81*** **(4.98)**	**5.01*** **(5.60)**	0.741
Capintensity	-0.00 (-0.02)	-0.00 (-0.08)	-0.000
Age	**0.08*** **(1.80)**	**0.07*** **(1.80)**	0.015
(Age)^2	**-0.00*** **(-1.88)**	**-0.00*** **(-2.01)**	-0.000
AIC	4.06	4.04	
No. of Firms	238	265	

Note: z values are reported in parenthesis; * means significant at 90% interval.

The variables MNC, RSIZE and AGE are significant with the expected signs. This means foreign interest in the clothing firms is an important determinant of export performance and firm maturity matters suggestive of scale economies and vintage effects. The square for AGE and RSIZE were included to test for possible non-linear effects of firm age and firm size. The z-test turns out significant with a negative sign for both squared variables. This means that the effect of age and size can be depicted by an inverted U-shape implying that at a certain threshold level, the positive effect of firm maturity and size will diminish. It implies that advantages of size and age can only be reaped at a certain point and beyond that, further expansion will no longer be profitable.

SKILLED, TRAINING and CAPINTENSITY did not yield significant results while RNDSALES00 is significant but with the opposite expected sign. The result of the latter variable is similar to the one conducted by Lall (1981) for Indian engineering firms. Possible explanation offered for the significant yet negative effect of R&D is that the variable is only a partial measure of technology and does not take into account incremental improvements in processes which the industry is more prone to experience. This is generally the case for developing countries where R&D is low due to the adaptive nature of technical change (van Dijk 2002). In the Philippine setting, a possible explanation is that clothing firms source their technology and knowledge from the capital goods they import and from suppliers of materials. Investment in R&D activities would likely burden their core activity given limited financial resources.

Table 7.3 Estimation Results for Electronics

Variable	Estimation 1 General Model	Estimation 2 Alternate Model	Marginal Effects
Constant	-8.31 (-3.70)	-5.05 (-2.79)	
Rsize	372.80 (1.68)	304.61 (1.41)	65.63
(Rsize)^2	-3734.93 (-1.43)	-3010.30 (-1.18)	-657.58
Skilled	1.29 (1.16)	1.54 (1.16)	0.23
RNDSales00	**275.56*** **(3.43)**		48.52
Training	**2.77*** **(3.31)**	**1.99*** **(2.75)**	0.48
MNC	**2.94*** **(4.06)**	**2.43*** **(2.95)**	0.52
Capintensity	**0.24*** **(3.05)**	**0.13*** **(2.29)**	0.04
Age	0.91* (2.12)	0.22 (1.15)	0.07
(Age)^2	**-0.01*** **(-2.65)**	-0.01 (-1.83)	-0.00
AIC	1.52	1.79	
No. of Firms	78	95	

Note: z values are reported in parenthesis; * means significant at 95% interval.

The variables RNDSales00, TRAINING, MNC, and CAPINTENSITY yield highly significant results with the expected signs. The study empirically confirms that a local firm which invests in R&D, conducts regular skill training to its employees, has considerable foreign influence, and has a high capital per employee ratio will have higher propensity to export. A higher R&D expenditure to sale ratio suggests that firms reinvest in learning which will improve its performance. Complementary training to its employees will further boost its productivity performance. The foreign

affiliation becomes the local firm's primary source of knowledge and network advantage. This knowledge source is deepened with the accumulation of capital goods where technology is likely embodied. The statistical results also partly confirm capital-labor complementarity where higher capital intensity requires better-trained employees.

RSIZE, AGE, and SKILLED variables have the expected signs but are not statistically significant. The non-linear effect of size is also incorporated but did not yield significant result. The variable age squared $(age)^2$ was included and turned out significant. This means that as the firm ages, the effects of cumulative learning and training improves firm performance but after a certain age threshold, the returns decline suggesting that firm experience only matters at a certain point. Considering the rapid pace of technical change occurring in the sector, this is not a surprising result since firms must continually adapt to these changes in order to grasp the profit opportunities presented in the world market.

V. **Summary and Conclusion**

The study analyzed the different factors that could affect the export performance of firms in selected Philippine manufacturing industries. The factors identified are basically firm-specific like size, percentage of skilled labor to total labor, training activities, foreign affiliation, R&D activities, capital intensity and firm age. The study was made possible due to the information-rich survey conducted by ADB in year 2002. The selected manufacturing sectors were classified using the Pavitt taxonomy to stress the importance of sectoral variation in determining the influence of these firm-specific factors to export performance. The possible relation between export performance and firm-level characteristics was tested using a novel econometric model by Papke and Wooldridge which was specifically developed for fractional response modeling.

The main findings of the study are summarized as follows;

- The influence of foreign affiliation is similar across all sectors—positive and strongly influential in improving a firm's export performance. The variable MNC is the only factor that is tested statistically significant in all three major sectors with the expected signs. The strong positive influence of MNC on a firm's export behavior confirms the beneficial effects of foreign participation in locally-initiated endeavors.

- Research and development activity is highly influential for science-based firms and confirms the belief that it is a necessary ingredient that will propel export propensity.

- Development of human capital through training strongly influences export performance for science-based sectors. This magnifies the importance of learning by training in improving the performance and productivity of firms (Bell 1984). The effect of training on clothing and food processing firms, together with the share of skilled workers across all sectors, is not conclusive.

- A higher capital per worker positively influences the export performance of electronic firms but not for the clothing and food processing sectors. This is reflective of the capital-intensive nature of the sector and the possibility of knowledge and technology embodied in the capital goods used by the electronic firms.

- Firm size across all sectors suggests an inverted U-shape suggesting a non-linear relation between size and export performance. This relationship is most significant for the clothing sector. A U-shape relation means that as firms expand it operation, as measured by the number of employees, this will have beneficial outcome in its export activities. However, after a certain level of expansion, any increases in firm will have less than preferred outcome in export performance.

- Firm age is an important factor in the export performance of electronics and clothing sectors. For the clothing sector, a firm's length of operation is suggestive of gains in scale economies and beneficial effects of deep knowledge in its customer base. For the electronic firms, however, maturity in operations will only be beneficial at a certain point. Beyond the threshold age, experience does not matter. This is a possible outcome of rapid technological changes in the sector where a younger and more flexible firm may be able to address immediately the changing consumer taste and preference for technological advancement.

In terms of policy initiatives, the importance of local firms to be affiliated with the foreign firms should be stressed. Be it in the form of foreign equity infusion, joint ventures, licensing agreements or direct investment, foreign firms carry strong network linkages with the international community which may be beneficial to the local firms.

Investments in R&D activities and training of employees significantly improve the export propensity of electronic firms. The merits of R&D activities have long been established in various studies, in spite the existence of some studies that says otherwise. It is stressed however that R&D activities are not limited to innovative activities but can be applied to improving technological capabilities which are necessary for firms in the developing countries.

Intensive acquisition of capital goods relative to increases in employment is a necessary ingredient for export performance in science-based sectors. With knowledge and technology embodied in these capital goods, local firms will benefit through improvement in productivity and efficiency.

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