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Multinationals, Technology and Regional Linkages in Myanmar's Clothing Industry*

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Abstract: *Myanmar's clothing industry has played a pivotal role in generating employment and exports. This article makes a contribution to the explication of the role of supporting institutions in the development of clothing manufacturing in Myanmar. The statistical analysis show that technological intensity is not correlated with labour productivity and export-intensity, which may be a consequence of the infancy of the industry and the use of old technologies in Myanmar. Also, the Probit estimations show that regional linkages matter in labour productivity and export-intensities but not with technological intensities in the clothing industry in Myanmar.*

Keywords: Clothing, Myanmar, productivity, regional linkages, technology
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1. Introduction

Clothing manufacturing export makes a significant contribution to economic growth in many economies, especially in the developing countries. Neoclassical economists believe that it is an important step in the industrialization process. Despite the fact that the nature and characteristics of firms in the garment sector are more or less similar, the development trends vary from one country to another. Since the new government headed by President Thein Sein came to power in March of 2011, Myanmar has embarked on an ambitious programme of reforms to end its isolation and integrate its economy with the global economy. It is trying its utmost in mobilizing the participation of local people and foreign investors by clarifying the economic policy and securing the rule of law. The Myanmar clothing industry is expecting rapid export growth in 2013 as a result of enhancement in the institutional and business environment, modernizing the financial sector, liberalizing trade and foreign direct investment that was initiated since 2011. However, the rapid expansion of international investment, trade and production network is not just in scale, but also in complexity.

Our objectives in this article are, firstly, to do an in-depth study on the evolution of the clothing industry in Myanmar, and secondly, to evaluate technological capabilities in Myanmar's clothing industry. This article consists of two sections – the first section presents a historical overview and circumstances of clothing manufacturing in Myanmar while making an attempt to provide a glimpse of the atmosphere in which clothing firms operate, and the second section presents a quantitative analysis of the relationship between technological capabilities, production linkages, export intensity and labour productivity among clothing firms in Myanmar.

2. Clothing Manufacturing

In the late 1950s, Myanmar was well known for its cotton industry and the local clothing industry, which was regarded as the most advanced in Southeast Asia. During the socialist era 1962-1988, the clothing industry stagnated due to the closed market economy and lack of advanced technology inputs. The development of the clothing sector resumed in 1989 after the Military resumed power in line with the transformation of the socialist planned

economy to an open market economy. Enactment of the Foreign Investment Law in November 1988 attracted foreign firms to investment in Myanmar including the clothing sector with FDI inflows increasing steadily for a decade.

The major turning point for Myanmar's clothing industry came with open market economy. The establishment of private clothing factories began in 1994 with 25 firms. The driving factors behind the developing countries embarking into the clothing industry are more or less similar. Clothing manufacturing can be seen as buyer-driven-chain because mass merchandisers, large brand holders and marketers, are playing a central role in shaping global production network (Gereffi, 1994). It is labour-intensive and export-oriented with low start-up costs and utilizes standardized technology. It was first started up with the foreign firms from Korea followed by the firms from other East Asia countries, Taiwan and Hong Kong. Most of the clothing firms were established after 1997. The establishment of these firms not only motivated major buyers to capitalize on the Myanmar quota but also motivated domestic firms to enter the export market. With more buyers looking into Myanmar, local entrepreneurs were able to set up small, medium and even large firms to cater for the niche high volume and labour intensive products.

A large proportion of clothing firms use subcontractors in order to meet the deadlines and this has also caused the emergence of small and medium firms in the industry. The number of firms involved in the export sector rapidly increased to almost 300 firms in 1999. Myanmar Garment Manufacturing Association (MGMA) reported the existence of 272 clothing firms in 2000. Although this number fell to 142 in 2004, it has started to rise again to 180 in 2011 (see Table 1). In 2011, there were 155 local private firms and 21 foreign firms with 100 percent foreign ownership.

Table 1: Clothing Manufacturing Firms, Myanmar, 2000-2011

Year	State Owned Enterprise	Foreign JV		100% Foreign Firms	Private National Firms	Total
		With MTI UMEH	With Private			
2000	1		5	28	248	272
2001	1	7	5	23	194	230
2002	0	6	4	27	180	217
2003	0	6	4	27	165	202
2004	0	4	4	22	112	142
2005	0	2	4	21	115	142
2006	0	2	4	21	126	153
2007	0	2	4	21	139	166
2008	0	2	2	21	145	170
2009	0	2	2	21	140	165
2010	0	2	2	21	145	170
2011	0	2	2	21	155	180

Source: MGMA 2012 **.**

The total employment in the clothing industry is estimated to be about 135,000 persons in 2001 (MGMA, 2012). The estimated employment of the clothing industry in and around 2000 and 2001 was less than 1 percent of the total employment and about 8 percent of employment in the processing and manufacturing sector (MGMA, 2012). Unfortunately as soon as the industry was ready to take off, "Made in Myanmar" products were starting to be boycotted by the major importing countries, the United States and the EU at the beginning of 2000. The boycotts in some states and countries even proudly advertised that they do not sell "Made in Myanmar" products. When the consumer resistance was growing stronger, some foreign buyers, especially brand names holders were hesitant to buy "Made in Myanmar Garment". Finally, US imposed sanctions on Myanmar clothing products in 2003 which was the first time economic sanctions imposed by the US in the history.

Under this circumstance, although the foreign companies were more or less able to survive through their international networks, local firms faced more difficulties in securing orders. As a result, the majority of domestic firms and some of the foreign firms were shut down. It was estimated about 70,000-80,000 workers were laid-off from the industry (MGMA, 2012). The total employment may be estimated to be about 55,000 to 60,000 people in 2004 (Kudo 2005) and it will be remained more or less the same in 2010. To make matters worse, the government imposed greater control over the formal process of exports and imports in terms of procedures. Consequently, the business environment for clothing to import raw materials and export finished products became more bureaucratic and time consuming. However, increased exports to other countries such as Japan and Korea leading the way has helped prevent its total collapse.

However, there was a tremendous positive change for the clothing industry after the elected assumed power in 2011. Myanmar's clothing export outlook looks positive as the government is working actively to improve its governance procedures. In 2013, 205 clothing firms were operating in Myanmar. An increasing number of foreign clothing producers, mainly from Asian countries, have also been entering Myanmar in view of positive developments in the country and the issuance of the new FDI law. Rasiah (1993) had established that clothing firms have gradually enjoyed skill-intensive operations, but found that considerable infrastructure problems have hampered its development in Cambodia, Laos and Myanmar (see Rasiah, 2009). Although export is still dominated by cut, make and pack (CMP) operations (see Table 2), as Rasiah and Myint (2013) have argued there is evidence of technological learning in the clothing firms in Myanmar.

There are also several challenges that Myanmar must overcome in order to compete in the global market. Among them, logistics/transportation time which closely clicked with the long order leading time in Myanmar clothing industry. Myanmar clothing needs 12 days for transport from/to South Korea while Cambodia and Vietnam need 8 days and 9 days respectively. On the other hand, transport time between Myanmar and Europe is also longer than it should be since it has to transit at Singapore. Underdeveloped banking and financial system and rigidity in trade procedural matter results in high transaction cost too. Under this circumstance, the clothing industry suffers from one of the lowest connectivity levels due to poor infrastructure as Myanmar ranks very low on the Logistic Performance Index 2013 (129^{th} among 155 countries in the world). Moreover, while the development of business enterprises, investment and entrepreneurship is being promoted through legislative frameworks for investment and economic development, sound legislation and policies are also being enacted to safeguard the interests of employees. Social Security law, Settlement of Labour Disputes Law, Labour Organization Law, and the Minimum Wages law are enacted to guarantee rights and responsibilities of working people. While the development of a business community capable of leading the national economy under the changed national order is crucial, the labour community needs to be well developed to complement the development of the business community. Harmonious relationships are fundamental for both employers and employees to ensure industrial peace and higher productivity. In order to maintain good relationships with the employees, every organization should avoid any dispute with them or settle it as early as possible.

Table 2: CMP Clothing Export, Myanmar, 1997-2011

(USD Mil)

Sr	Importers Countries	1997	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
1	EU (15 countries)	94.1	276.1	348.8	307.2	339.9	457.48	237.1	256.6	215.7	210.4	174.4	175.6	179.8
	Germany	23.1	65.2	75.3	66.1	90.9	115.9	96.3	103.6	94.6	91	76.7	74	78.7
	Spain	3.5	17	26.9	20.6	24.2	43.8	19.8	42.4	45.4	53.8	44.4	47.5	42.7
	UK	31.9	80.8	97.3	98.6	102.6	139	53.8	51	36.5	40	29.3	30.7	34.8
	France	29.2	57.6	70.6	61.7	52.3	62.9	26.2	18	11.3	7.8	3.4	1.7	0.5
	Netherland	5.7	29.6	35.1	9.8	15.3	26.1	7.2	11.9	7.6	7.1	7.6	5.5	7
	Italy	4.1	13.1	19.2	20.7	21.6	33.3	11	14	6.8	1.8	5.9	6.2	6.3
2	Japan	1.1	4.6	7.5	15	32.2	44.8	52.7	71.4	95.5	132.6	149.2	183.4	348.7
3	Korea	0.1	0.7	3.3	1.7	5	6.3	7.4	18.2	30.1	30.2	53.9	124	232.4
4	USA	85.3	403.5	408	298.6	232.7	0	0	0	0	0	0	0	0
	Total	180.6	684.9	767.6	622.5	609.8	508.6	297.2	346.2	341.3	373.2	377.5	483	760.9

Source: MGMA 2012

3. Theoretical Considerations

In the late 20th century, the application of theory to the growth of trade and industrialization became dynamic with the works of several evolutionary economists who examined simultaneous coordination of economic factors. The general economic thinking changed from classical comparative advantage to competitive advantages. Under intense pressure as a result of growing export competition among the countries, technological specialization and innovation has received renewed attention within the literature linking technology to export trade and competitiveness. Based on Smith‘s (1776) notion of economic specialization, Ricardo‘s (1817) comparative advantages, Marshall’s (1890) industrial districts, Young’s (1928) increasing return, Freeman’s (1988), Lundvall’s (1992), Nelson’s (1993) arguments on national innovation systems, Porter‘s (1990) diamond, Best‘s (2001) productivity triad, and Rasiah‘s (2007) systemic quad, many studies have attempted to identify the drivers of firm performance.

Arguments were made on the factor endowments of a nation or a firm, and stylized facts and models were developed. From capital and labour cost considerations, therefore, attention has turned to questions of innovation, of efficiency, of skill, of scale, of leads and lags (Posner 1961, Freeman 1993). According to them, new advanced factor endowments such as highly skilled labour force, strong technology and knowledge base, high-tech infrastructure and production linkages can be created by dynamic and coherent economic strategies (Porter 1990, Rasiah 2007). Industrial strategies have focused on the appropriation of economic synergies from upgrading industrial characteristics and promoting inter-firm, firm-institution and multinationals-host-site linkages with proper basic infrastructure and bureaucratic coordination.

Adding to the problem of bridging economic theory with empirical results, several economists have studied the determinants of differentiation in trade and industrialization. At the macro level, scholars have modelled export performance based on international trade theories and investigated key issues including export competitiveness of nations, magnitude and direction of trade flows, demand and supply conditions, political systems and policy regimes, public expenditure and infrastructure, and institutional and business environments. They have produced many

theoretical explanations for this positive relationship. Several of these explanations have particular relevance to the case of developing countries. The critical concepts developed by Romer (1987) emphasized the role of R&D and capital accumulation (human and physical) in economic growth. Grossman and Helpman (1991) focused on the role of knowledge and technology spill-over.

At the firm-level, the way in which firms are organized and managed and the degree of competitiveness between them influence their success and failure (Porter 1990, Singleton 1997). Firm-level empirical findings reveal that a firm‘s competitiveness is a function of its own endowments, export strategy and characteristics (Rasiah 2004). The main determinants of firm performance are firm-specific factors and to less extent, country-specific and industry-specific factors. Analyzing firm performance in terms of export performance and productivity are the best tools (Roger and Tseng 2000, Rasiah, 2004). Scholars have focused on establishing a link between different firm resources and characteristics, such as technological capabilities, skill intensity, managerial motivation, technology spill-over, firm size, age of the firms to export performance. Therefore, recent industrial studies have analysed the determinants of firms export performance and productivity.

Since FDI plays an important role in developing economies, there is a growing literature exploring the linkages between foreign and local ownership and export performance, ownership and labour productivity, ownership and technology spill-over etc. With regard to the ownership effect on labour productivity, the most frequent finding in the literature is that foreign firms are more productive than domestic firms (eg: Liu 2000; Sun 1998; Baldwin and Gu 2003; Conyon *et al.* 2002). The technological capability approach has important implications for export and industrial strategies. Rosenberg and Frischtak (1985) defined technological capability as a process of accumulating technical knowledge or a process of organizational learning. Many of these attempts were, explicitly or implicitly, based on Schumpeter‘s analysis of technological innovation and diffusion as the driving forces behind market competitiveness and economic growth.

Firms’ investments or achievements in implementing new technologies or the development of new products or processes should be associated with learning capabilities and adaptive behaviour of firms (Metcalfe, 1997), the intensity and extent

of organizational and inter-personal interactions (Maillat, 1991; Grabher and Stark, 1997), and decision rules and social conventions (Morgan, 1997). With regard to productivity growth, most theoretical and empirical studies claim that both technology demand and technology supply are important determinants. Endogenous growth models emphasize that investment in intellectual capital formation contributed by human resources and R&D activities leading to improvements in technology creation, adoption, and absorption is an important determinant of productivity growth (Romer, 1987; Mahood and Siddiqui, 2000).

While technological capabilities are a prerequisite for firms‘performance, a bundle of other key factors consisting of both firm factors and institutional factors also play an important role in explaining firm performance. There are many variables correlated with firm performance such as ownership, size, age, wages, capital intensity, human capital inclusive of workers‘ education, training and working experiences, management and organizational pattern, workers-related factors, quality of input raw materials, labour turnover (Mefford, 1986; Söderbom and Teal, 2001). Wider technological gaps between domestic and foreign-owned activities tend to lessen both backward and forward linkages (Lall and Narula, 2004). However, most of the developing economies, which are hosting FDI for labour-intensive manufacturing at the initial stage, are unable to conduct R&D for technology innovation and renovation or to import technologies and modern machines. The mechanism of transfer in both private sector arrangements take the form of foreign direct investment (FDI), licensing, and joint ventures, or bi/multilateral technology agreements among governments (Lewis, 2007). Under such circumstances, transfer technology is an important issue for developing countries for their economic development.

4. Methodology

This study is based on primary data obtained from a questionnaire survey and secondary data from various sources. Firm-level survey data is used to look at not only the extent and causes of export intensity and productivity differentials among firms

but also the relationship between ownership, technological capabilities and regional production linkages. Additional information was gathered from personal interviews conducted in 2013. The sampling design used for this study considers type of ownership. The questionnaire survey ended up with 81 firms located in Yangon out of about 180 firms: 27 foreign and Joint venture firms and 54 national firms. The questionnaire survey was conducted with the assistance of Myanmar Garment Manufacturing Association (MGMA). A series of discussions with factory owners was organized in order to get insights into the owner‘s views on regional production linkages, international competitiveness and technological capabilities of clothing firms in Myanmar.

4.1. Specification of Variables

4.1.1. Export Intensity

Firm performance is used as one proxy of performance and is measured as follows:

$$\text{Export Intensity} = X_i/Y_i$$

where X and Y refer to exports and gross output respectively of firm *i* in 2012.

4.1.2. Labour Productivity

Labour productivity is used as the second proxy of firm performance, and is measured as follows:

$$\text{Labour Productivity} = V_i/L_i$$

where V and L refer to value added and total labour employed of firm *i* in 2012.

4.1.3. Technological Intensity

The impact of technology on firm performance has been discussed extensively in the international literature (Krugman 1983, Lall, 1992, Kumari, 2007). The studies dealing with technology development reveals that export intensity and efficiency of the firms rely on technology capability which is determined by the firms’ specific characteristics. While a variety of characterizations are available, broadly technology can be characterized by knowledge which is embodied in the three Ps: products, processes and practices including organizational routes (Basant and Chandra, 2002).

In this exercise, technology intensity is measured by incorporating the proxies of production technology (*PT*), human resource (*HR*) index and R&D Capability (*RD)*. The TI proxy used here are in line with Rasiah's (2006) specifications.

$$TI = \sum (PT + HR + RD)$$

TI was composited into three variables representing measures needed in the export performance. PT, HR and RD were used in order to minimize the overlapping objectives. The composition of PT, HR and RD are explained below.

4.1.4. Production Technology Index

Some firms have introduced a number of new technologies in their production processes in order to achieve higher levels of productivity and product quality, which lead to higher export intensity and labour productivity. Similarly, other advancements in gathering information on the market, installing effective management system, modifying production lines and system and etc. are also enhancing the level of technological capabilities. Production technology (PT) intensity refers to process technology competency of firms and is expected to have a positive relationship with export intensity, and is measured as follows:

$$PT = \sum (MRP, SPC, QCC, TPM, SGA, ISO, JIT)/7$$

MRP, QCC, ISO and *JIT* refer to materials requirement or resource planning (*MRP*), statistical process control (*SPC*) quality control circles (*QCC*), total preventive maintenance (*TPM*), small group activities (*SGA*), certification of ISO9000 or ISO 14000 series, just-in-time (*JIT*) or quality standards (*QS*).

4.1.5. Human Resource Index

The important role of human capital in terms of education and training in productivity growth is widely recognised in many firm level studies. It is generally recognised that human resource development is of crucial importance in securing competitiveness for the individual firms and human resource practice is expected to have a positive relationship with firm performance. Measurements of human resource development vary among studies.

$$HR = \sum (SI + TE + CHR)/3$$

where skills-intensity (SI) was measured as a ratio of professionals, engineers and technicians to total workers, training expenditure (TE) represents training expenditure as a percentage of total payroll and cutting-edge human resource (CHR) practices by a score of 1 for each practice and divided by total number of such practices. The proxies used for CHR were team-working, quality control circles, small group activity, performance-based rewards and total preventive maintenance. Firms were asked to answer yes (1) or no (0) on teamwork, informal contact between managers and different units, multi-disciplinary or cross-disciplinary skills and expertise, feedback from customers, participation of lower level employees, independent and group learning, strong upward mobility of employees and environment-friendly measures for employees.

Since SI and TE were measured using actual percentages, and CHR as a cumulative total of different practices, the following formula was used to normalize the scores:

$$\text{Normalization score} = (Xi - Xmin)/(Xmax - Xmin)$$

where Xi, Xmin and Xmax refer to the i^{th}, minimum and maximum values of the proxy.

4.1.6. R&D Capability

Generally, a higher level of R&D expenditure helps firms improve their positions in the export market and move up in the value chain (Singh 2009). The empirical evidence with respect to relationship between R&D expenditure and firm performance, however, is unclear and controversial. The low adaptive nature of overall technical change is attributed the low level of R&D for firms in developing countries. In this scenario, R&D is very marginally undertaken in the majority of the firms in the clothing industry and the R&D expenditure is more on kinds of market research rather than technological innovations. As an exception, some foreign firms that are affiliated with overseas firms may undertake R&D activities. R&D is measured here as follows:

$$RD = \sum (RD_{exp} + RD_{inh})/2$$

Where RD_{exp} and RDi refer to percent of R&D expenditure in sales and incidence of participation in R&D. The latter was measured as 1 when the firm reported having a R&D department or R&D personnel, and 0 otherwise.

5. Regional Production Linkages

Regional Production Linkage (RL) is measured by sales and purchases to East and Southeast Asia divided by total sales and purchases. RL is used as the basis for differentiating firms in two groups, one with high RL and the other with low RPL.

RL= (Sales to Southeast and East Asia + Purchases from Southeast and East Asia) / (Total Sales + Total Purchases)

High and low *RL* are classified by using the following:

RL = 1 when the *PL* score exceeds the median figure;

PL = 0 otherwise.

5.1. Other Critical Firm-level Variables

At the firm-level, firm organization, management and competitiveness influence their success and failure (Porter 1990, Singleton 1997). While technological capabilities are a prerequisite for success, a bundle of other key factors consisting of both firm factors and institutional factors also play an important role in explaining firm performance. Three other important determinants of export behaviour are included in the analysis, namely, ownership, size and age.

5.1.1. Ownership

Recent studies have sought to explore whether foreign firms enjoy superior export performance over national firms, and whether such superiority is associated with firm productivity (Davies and Lyons 1991, Caves, 1982, Aitken and Harrison, 1999, Rasiah 2004). Evidence from Liu (2000), Papadogonas and Voulgaris (2005) and Benfratello and Sembenelli (2005) show that foreign firms enjoy higher technological capabilities and economic performance than national firms in export-oriented industries. Pillai (1979) stressed that domestic firms outperformed foreign firms in traditional manufacturing and labour-intensive export-oriented industries while the latter outperformed the former in high-tech capital-intensive manufacturing.

Therefore, firm ownership is used as a proxy to control for ownership effects in firm performance, and is measured as follows:

Foreign= 1 if foreign equity ownership of firm i was 50 per cent or more;

Local = 0 if otherwise.

5.1.2. Size

Firm size is a critical variable in explaining export behavior and success of firms (Cavusgil and Naor 1987, Louter, Ouwerkerk, and Bakker 1991, Christensen, da Rocha, and Gartner 1987). Scherer (1980) posited that firms achieve competitiveness with a certain minimum efficiency scale. Existing empirical findings support this argument (e.g. Rapp 1976, Glesjer *et al.* 1980, Auquier 1980, Caves 1982, Wagner 1995, Erramilli and Rao 1995, Singh 2009), but some consider size to be unimportant (Moen 1999, Katsikeas 1994, van Voorthuizen and O'Rourke 2000, Roper and Love 2002, Bonaccorsi 1992). Therefore, firm size is used as a control variable without any direction of causality, and was measure as follows (Bilkey, 1978).

S = 0, when Size $\leq$ 500 employees

S = 1, when Size > 500 employees

5.1.3. Age

The role of age in firm performance is debatable (Rasiah,2006). Age is defined in two ways: numbers of years of the establishment's existence and number of years of participation in export markets. Typical internationalization theory states that experience in export market is likely to reduce the level of uncertainty as a result of accumulated learning from export activities, and hence, the significance of export experience on firm performance (Aaby and Slater, 1989). Internalization theory states that firms with long export experience might have high export performance because they are better connected with the international supply chains, and thus, are likely to reduce the level of uncertainty and risks (Cavusgil, 1980, Aaby and Slater 1989, Katsikeas, 1994, Barrios *et al.* 2003).

However, other studies have found no influence by export experience on firm performance (e.g. Van Voorthuizen and O'Rourke, 2000, Coskun, 2001, Dean *et al.* 2000, Katsikeas, 1994, Kokko *et al.* 2001, Barrios *et al.* 2003). In the same way, newer plants are also expected to export more because they often use relatively modern machines and equipment, which increase productivity and product quality (Ramstetter 1999, Dijk 2002, Rasiah 2004).

Therefore, no sign is defined on age, while it is introduced as a control variable and measured as follows:

Age = years of export

5.2. Specification of Econometric Models

The final evaluation carried out uses econometric equations to examine differences in economic performance and technology variables controlling for industry-based, size-based, ownership- based and age-based influences. In this exercise, Ordinary Least Squares (OLS) is used for all regressions as all the CMP firms are export-oriented and there were none with zero export-intensity. The following basic equations were estimated:

$$OLS: VL = XY + TI + S + Age \qquad (1)$$

$$OLS: XY = VL + TI + S + Age \qquad (2)$$

where *VL, TI, XY, PL, Own, S* and *Age* refer to labour productivity, technological intensity, exports intensity, production linkage intensity, ownership, size and age respectively of firm i.

A second set of regressions were run using the probit model to predict if RL mattered in economic performance and technological intensities. The probit model was preferred over the logit model because the distribution of the data was normal. The following probit models were estimated:

$$Probit: RL = 1, 0) = VL + Size + Own + Age \quad (3)$$

$$Probit: RL = 1, 0) = XY + Size + Own + Age \quad (4)$$

$$Probit: RL = 1, 0) = TI + Size + Own + Age \quad (5)$$

The independent variables in equations 1, 2, 3, 4 and 5 did not suffer from multi-collinearity problems (see Appendix 1).

5.3. Statistical Differences

The results of the univariate tests of means, medians, standard errors, standard deviation and the number of observations are presented Table 3. The sampled CMPs recorded average labour productivity of US$ 4590 in 2011. The median labour productivity figure was US$ 3824. The maximum and minimum labour productivity figures recorded were US$ 10764 and US$65 respectively. The mean and median export intensities recorded were 86.17 and 95.00 respectively. To some extent, higher export-intensities seem to support stronger production linkages. The maximum and minimum export intensities were 95 and 13 respectively. The mean and median technology intensities were 0.27 and 0.28 respectively.

5.3.1. Ownership

In general, foreign firms enjoyed higher export intensity and labour productivity. Foreign firms were more technology-intensive and enjoyed more international marketing experience than national firms in Myanmar's clothing industry. Also, foreign firms are willing to invest on product redesigning to meet changes in market preference and production technology as they generally hire more qualified workers

and managers and have better knowledge of global markets, though national firms have better knowledge of local markets and knowledge workers, connections with national organizations, domestic logistics and dealing with domestic norms.

The results showed foreign firms accounted for 49 percent of total exports, though they only comprised 32 percent of surveyed firms in 2012 (see Table 4). Also, foreign firms accounted for 48 percent of total fulltime employment with the mean employment of 1,081 being much higher than the overall mean.

Table 4: Economic Contributions of Foreign Firms, Clothing, Myanmar, 2012

Year	2000			2006			2012		
	Total (66)	Foreign (23)	%	Total (78)	Foreign (26)	%	Total (81)	Foreign (27)	%
Export Value (US$)	98,583,109	67,747,705	68.62	214,473,317	113,794,923	53.06	279,442,310	137,077,216	49.05
Employment	40,361	23,151	57.36	40,655	20,118	49.48	61,072	29,174	47.77
Fixed Capital (US$)	31,564,736	23,751,713	75.25	36,661,948	24,604,645	67.11	52,225,579	31,681,698	60.66

Source: Author survey (2013).

5.3.2. Technological Intensity

Foreign firms (0.28) showed higher technological intensity than national firms (0.21). While the mean value of PT in foreign firms was 0.29, it was 0.19 in national firms. This suggests that national firms lack technological capabilities to match foreign firms, which supports findings the findings of Rasiah (2004) and Wignaraja (2006). The mean value of Human Capital (HC) in foreign firms was 0.30 compared to for 0.22 national firms.

Clothing is a low-tech traditional industry, which adapts and uses existing manufacturing techniques rather than new inventions and is normally carried out in labour-rich low wage economies. The skill levels of clothing workers in Myanmar is low and the workers are generally little educated. Generally, the machinery and equipment are directly purchased from suppliers who supply the technicians to train the staff. In other words, technology and management skills come with the purchase of machinery and equipment. In some cases local technicians are sent to install and maintain equipment with the training provided by the suppliers.

5.4. Regional Linkages

The clothing industry is entirely reliant on regional and international markets for both inputs and exports. Firms engaged in production linkages accounted for 48.8 percent of respondents.

Table 3: Descriptive Statistics, Clothing Firms, Myanmar, 2012

	VL	*XY*	*TI*	*SIZE*	*AGE*	*OWN*	*RPL*
Mean	4,590.70	86.17	0.27	766.89	12.21	0.32	0.43
Median	3,824.04	95.00	0.28	626.00	12.00	-	0.47
Maximum	10,764.17	97.00	0.39	2,800.00	21.00	1.00	1.00
Minimum	65.22	13.00	0.14	80.00	1.00	-	-
Std. Dev.	2,857.39	16.72	0.06	506.51	3.89	0.47	0.14
Observations	81	81	81	81	81	81	81

Source: Author survey (2013).

6. Statistical Analysis

We examine the statistical relationships in this section. In the first section we examine the influence of *TI* on *XY* and *VAL*, and of *XY* on *VAL* using OLS regressions. In the subsequent section we examine the influence of *TI* on *RPL*, and *VA*L on *RPL* using probit regressions.

6.1. Technological Intensity and Economic Performance

The model fit (F-statistic) was statistically significant to allow the interpretation of the results. Because the constant is not significant it can be confirmed that the results do not suffer from endogeneity problems.

The results showed that export intensity and labour productivity were positively correlated with each other and were statistically highly significant at 1 percent level. However, the high coefficient value of the export intensity variable demonstrated that exports offer the scale and competitiveness to raise labour productivity. The impact of export intensity on labour productivity was stronger than the impact of labour productivity on export intensity.

However, TI was not correlated with both export intensity and labour productivity, which could denote the infancy of the industry in Myanmar. The survey found that investments in *PT, HR* and *RD*, key technology intensity components, were very weak in Myanmar clothing firms. Similarly, the number of years that firms have stayed in the international market and the size of firms were not correlated with export intensity and labour productivity, and showed no statistical significance. It suggested that firms' age and size are non-influential on firm performance.

Table 5: Economic performance and technology, Clothing firms, Myanmar, 2012

	VAL	***XY***
XY	4.528	
	(6.597)***	
VAL		0.081
		(3.916)***
TI	-1.388	-0.125
	(-0.448)	(-0.651)
AGE	0.084	-0.002
	(1.291)	(-0.384)
SIZE	-0.979	0.033
	(-1.544)	(1.019)
C	-2.306	0.286
	(-1.196)	(1.636)
R^2	0.267	0.203
Adjusted R^2	0.230	0.163
LL	-183.07	51.367
F-stats	7.213***	5.027***
N	81	81

Note: Figures in parentheses refer to t-statistics and *** refers to statistical significance at 1%.
Source: Computed from author survey (2013)

6.2. Regional Linkages, Economic Performance and Technological Intensities

Except for the 3rd model, the model fit (*LR*-statistics) of the remaining results in Table 6 were statistically significant to allow the interpretation of the results. Because the constant is not significant it can be confirmed that the results do not suffer from endogeneity problems.

Regional production linkages (*RL*) is the key differentiating variable in the regressions as the exercise is to establish the significance of stronger integration with Southeast and East Asia on productivity, export-intensity and technological intensities.

The results are interesting as apart from technology, integration in *PL* does seem to relate positively with the critical economic performance variables of labour productivity and export intensity. Regional production linkages were correlated with both *VAL* and *XY* and were statistically significant at the 5 percent statistically significant level. It suggests the significance of stronger integration with Southeast and East Asia as an important explanatory factor in the cases of productivity and export intensity. Greater integration in Southeast and East Asia networks appears to support productivity and export promotion. The explanatory variable of TI showed a negative

sign but was statistically insignificant in Model 3 and demonstrated that RL did not matter in technological intensities.

However, *TI* showed no relationship with RL but the model fit was not significant (*LR-stats*).

Table 6: The Relationship between RL, and VL and TI, Clothing firms, Myanmar, 2012

Variable	*RL*	*RL*	*RL*
C	-1.619	-0.100	0.468
	(-1.629)	(-0.187)	(0.686)
XY	2.516		
	(-2.428)**		
VL		0.155	
		(2.425)**	
TI			-0.103
			(-0.059)
AGE	-0.037	-0.042	-0.020
	(-0.961)	(-1.089)	(-0.528)
SIZE	0.029	0.232	0.063
	(0.098)	(0.745)	(0.208)
N	81	81	81
PL = 1	40	40	40
PL = 0	41	41	41
LR-STAT	0.082*	0.085*	0.960

Note: Figures in parentheses refer to Z-statistics and *, **, *** refer to statistical significance at 1%, 5% and 10% respectively.
Source: Computed from author survey (2013)

Overall, integration with Southeast and East Asia has been key in explaining strong firm-level export intensity and labour productivity but the results on is influence on technological intensity could not be confirmed. Because they are primarily CMP firms, Myanmar's clothing firms rely on regional markets for demand. Therefore, production linkages with East Asian markets have been crucial in driving exports and labour productivity in Myanmar.

7. Conclusions

With Myanmar's strong labour endowment and scarce supply of capital, the CMP production system has enabled the clothing sector to strengthen operational capacity

without much risk. A few firms have upgraded to undertake FOB operations. However, skills of workers and technological intensities must be improved to see further upgrading. Regional production linkages have stimulated export-intensity and labour productivity, but the results on technological intensities was not conclusive.

Hence, the Myanmar clothing manufacturing sector is now facing tough competition from other clothing exporting countries. With the current economic situation, individual firms face rising costs while workers are hit by high inflation rates and consumer prices, while finding it difficult to make profits. Although the clothing manufacturing industry in Myanmar is relatively small compared to that of other neighbouring countries, the necessary ingredients of success still exists, such as, cheap and trainable labour. The clothing manufacturing sector provides a solution to solve the problems of unemployment and underemployment in the country, contributing to economic growth and generating foreign exchange. However, Myanmar needs to create a highly skilled labour force, a strong technological and knowledge base, high-tech infrastructure, and corporate governance before it can compete effectively with countries in the region.

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