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Export and innovation in Cambodian clothing manufacturing firms

Rajah Rasiah[a], Vignes Gopal[a] & Puvanesvaran Sanjivee[a]
[a] Department of Development Studies, University of Malaya, Kuala Lumpur, Malaysia
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Rajah Rasiah*, Vignes Gopal and Puvanesvaran Sanjivee

Department of Development Studies, University of Malaya, Kuala Lumpur, Malaysia

This paper uses embodied measures of innovation with a focus on changes in machinery and equipment, material inputs and plant layouts and products to analyse the incidence of participation and the relationship between exports and innovation intensity in Cambodian clothing firms. Contrary to claims that foreign cut, make and pack clothing operations are unlikely to stimulate innovation, this paper tests the industrial policy exponents' argument that there is a positive relationship between exports and innovation (division of labour). The results show that Cambodian clothing firms show a strong participation in innovation; in addition, the relationship between exports and innovation intensity is strong and positive. The positive relationship between exports, innovation and employment suggests that efforts should be initiated by poor populous economies to stimulate technological upgrading even in the lowest value-added segments of production.

Keywords: export, innovation, employment, clothing manufacturing, Cambodia

1. Introduction

Concerns about post-multi-fibre arrangement restructuring have centred on China acting as a vacuum that would absorb disproportionate amounts of the global production of clothing products (Rasiah 2005); however, Cambodia has managed to have strong economic growth through a dramatic expansion in clothing exports by preferential access to US and European Union markets from 1999 to 2011. The gross domestic product (GDP) per capita of Cambodia in constant 2000 prices rose from US$211 in 1993 to US$275 in 1999, US$428 in 2005 and US$590 in 2011 growing on average 4.6% per annum from 1993 to 1999, 7.6% per annum from 2000 to 2005 and 5.5% per annum from 2006 to 2011. Value-added manufacturing increased from US$177 million in 1993 to US$499 million in 1999, US$1118 million in 2005 and US$1614 million in 2011 with GDP contributions rising from 8.9% in 1993 to 14.0% in 1999, 18.8% in 2005 before falling to 15.6% in 2011.

The prime contributor to GDP growth in Cambodia has been clothing manufacturing. Clothing exports have expanded sharply; however, given the uncertainty of international trading arrangements it cannot be assumed that the industry will remain the future spearhead of growth in Cambodia. As in many least developed countries (LDC), clothing manufacturing in Cambodia has evolved largely in export-processing zones (EPZ) through the proliferation of low value-added cut, make and pack (CMP) activities that use foreign inputs. Some EPZs have become ghost towns; however, others have stagnated without a significant impact on the creation of new jobs and wages (e.g. Athi River Valley in Kenya) (Rasiah 2004). However, as Rasiah

*Corresponding author. Email: rajah@um.edu.my

(2004) and Rasiah and Myint (forthcoming) have shown clothing firms have managed to upgrade activities in some locations (Rasiah 2009; Rasiah and Myint forthcoming) contrary to accounts that simply dismiss CMP operations as sweatshops that turn banana republics into low value-added pyjama republics (cf. Fatemi 1990; Barrientos 2008). This paper evaluated the potential of sustained clothing manufacturing through an assessment of the innovation intensity of clothing firms operating in Cambodia to examine if countries newly integrated at the bottom of the clothing value chain are characterized by innovation initiatives.

This paper examined the relationship between innovation intensity and export growth in Cambodian clothing firms using a sample of 94 firms drawn from a 2012 survey. This survey (based on the sampling frame used by the Ministry of Commerce of Cambodia that assessed ownership, size and location) was contracted to Chettra Kuo (a Ministry of Commerce Official) and conducted between June and November 2012.[1] Unless otherwise stated, the survey data are for the year 2011. The rest of the article is organized as follows. Section 2 discusses theoretical considerations. Section 3 presents methodology and data. Section 4 analyses export scale-based differences and the relationship between exports and innovation intensities. Section 5 presents the conclusions.

2. Theoretical considerations

Studies that utilize techniques to analyse the relationship between innovation and economic performance are currently popular (Rasiah 2004); however, the literature is dominated by disembodied technical progress. The attempt by Romer (1986) to endogenize technology triggered research by economists (Young 1995) to adapt the total factor productivity model of Solow (1957) through the inclusion of proxies of embodied technology, such as human capital, machinery and equipment. However, Rasiah (2008) and Fuentes and Dutrenit (2013) argued that the total factor productivity model did not adequately differentiate technology from productivity.[2] Attempts to examine the relationship between innovation intensity and exports in LDCs are also limited. This paper recognizes the importance of innovation even in the poorest of economies and examined its relationship to exports.

Evolutionary economists advanced the concept of technological capability as a superior method to capture the relationship of embodied technology vs. disembodied technical change and economic performance (Dahlman and Westphal 1982; Lall 1992; Bell and Pavitt 1995; Figueiredo 2002; Rasiah 2003). However, technological capabilities capture the latent innovative capacity of firms and not the processes of innovation. It is difficult to capture innovation completely due to the systemic nature of knowledge flows (Nelson and Winter 1982). However, evolutionary economists have attempted to estimate innovation through the measurement of changes recorded in different types of embodied technologies (e.g. processes, machinery and equipment, knowledge enjoyed by human capital and plant layouts and products). Some knowledge is registered through intellectual property rights (such as patents, industrial designs, industrial layouts and copyrights) that are subsequently appropriated through commercialization. Innovation is broad-based and is considered to occur as long as there are minor changes to any of the targets (Schumpeter 1934).

2.1. *Exports*

Competitiveness is widely used as a concept and there has been no consensus reached over its measurement (Lall 2001). However, there is a general agreement that export scale and export intensities can be useful proxies for competitiveness as long as the estimation accounts for protection levels while controlling industrial specificity and the location of firms in the value chain (Nelson 2008). Export scale is preferred over export intensities as a performance-based variable in this paper because most firms in Cambodia export all outputs; therefore, we did not estimate effective rates of protection since Cambodian clothing firms do not face export tariffs.

Smith (1776); Young (1928); Hirschman (1958, 1970) and Amsden (1985) argued that exports expand market size and attract competition to stimulate creative destruction. Marx (1967) and Schumpeter (1934) developed the argument that technology (innovation) is a vehicle that stimulates competitiveness. Firms that participate in export markets can improve their competitiveness; however, the relationship between exports and performance is unclear. Export markets can promote innovation through creative destruction (Schumpeter 1934); however, it can also destroy (crowd out) domestic enterprises if requisite technological capabilities are not developed (Lall 2001). Technological capability can grow through export scale and competition that influence economic performance and stimulate cumulative causation; subsequently, exports may have direct and indirect influences on the economic performance.

2.2. *Innovation intensity*

The relationship between firm characteristics and innovation capabilities (and their effects on international competitiveness) has been discussed in previous studies (Posner 1961; Krugman 1979; Scherer 1980; Fagerberg 1988). Schumpeter (1934, 1942) provided the most clear account of innovation based on creative destruction (Mark 1) as a new method to replace old modes of technology. However, neo-Schumpeterian economists (such as Nelson and Winter 1982) have advanced the concept of creative accumulation (Mark 11) by referencing innovation cycles that create new knowledge paths through investment in R&D activities. There are few accounts that use innovation directly due to the difficulty of measuring it; subsequently, Rasiah and Myint (forthcoming) argue that economists have preferred to work on technological capabilities rather than innovation.

Rosenberg (1975, 1976) analysed specific categories, phases and processes of technological change. Rosenberg and Frischtak (1985) define technological capability as a process of accumulating technical knowledge or a process of organizational learning. Dahlman and Westphal (1982); Westphal, Kim, and Dahlman (1985) and Dahlman, Ross-Larson, and Westphal (1987) presented the concept of a trajectory of deepening capability that transitions from technology-using production capabilities to innovation-driving capabilities. They developed a sequence of capabilities that ranged from production capability (via investment capability) to innovation capability that were consistent with the taxonomy of technological capabilities presented by Dosi (1982) and Pavitt (1984). Lall (1992) outlined a functional categorization of technological capabilities based on the tasks that face a manufacturing firm. Tasks and associated capabilities are classified into investment capabilities and production capabilities that are further divided into three levels. The first level is simple and experience-based, the intermediate level is adaptive and duplicative in nature when the early aspects of R&D are undertaken and the advanced level is innovative and risky (but is strongly R&D-based). Figueiredo (2002), Rasiah (2003), Ariffin and Figueiredo (2004) refined the classifications of Lall to focus on industry-specific technological upgrading. Wei (1995) integrated the functional categories of Lall (1992) with the technology flow classification of Bell (1984) to conclude that: (i) not all technology flows generate technological capability and (ii) linkages with local suppliers and other groups within the local economy are critical to the enhancement of capabilities.

Firm-level innovation leads to changes in a wide range of processes, production layouts, organizational structure and products. The Oslo Manual differentiates innovation through a wide range of classifications. It is possible to measure innovation (including patents, industrial designs, copyrights and industrial layouts, machinery and equipment and adapted and new products); however, it is difficult to identify the amount of value attributable to the new knowledge generated. Consequently, experts that measure innovation tend to use loose categories (such as new to the universe, new to the country, new to the location and new to the firm), adaptations or completely new developments in the categories of processes, organizational or production layouts, machinery and equipment and products (Figueiredo 2002; Rasiah 2006). The typology of taxonomies and trajectories of innovation advanced by Dosi (1982) and Pavitt (1984) allowed the use of taxonomic terms to consider innovation by technological components (machinery, equipment, layouts, processes and products) or trajectory terms (acquisition of dated technologies, acquisition of frontier technology, adaptations to old technology or the development of new technologies). Subsequently, this paper uses technological components and trajectory terms to classify innovation.

Smith (1776) and Marx (1967) noted a two-way relationship between competition and innovation. Competition from integration into export markets force firms to replace old technologies with new ones; however, innovations also assist firms to compete strongly in export markets. This is the logic behind Smith's (1776) famous dictum, 'the size of the market determines the division of labour' and 'the division of labour determines the size of the market' (Amsden 1985). Hence, we do not assume a causal relationship between these variables in the paper.

Recent econometric works show that a strong relationship exists between innovation (or technological capability) and export performance (Hirsch and Bijaoui 1985, pp. 240–241; Teece 1996, pp. 194–195; Roper and Love 2002; Smith, Erik, and Mogens 2002; Biesebroeck 2005; Harris and Li 2006; Chandran and Rasiah 2013). Hirsch and Bijaoui (1985) and Smith et al (2002) observed a positive link between exporters and innovation; subsequently, they argued that innovative firms concentrate on export expansion. Smith et al. (2002) also showed that innovation is faster among exporting than among non-exporting firms. Özçelik and Taymaz (2004) also showed a positive correlation between product and process innovations and export intensity in Turkish manufacturing. Rasiah (2008) showed a positive statistical relationship between technological capability and export intensity in automotive firms in East Asia and Southeast Asia. Roper and Love (2002) showed that product innovations had a positive impact on the likelihood and intensity of exports in manufacturing firms in the UK and Germany. Biesebroeck (2005) asserted that large-scale exports may hasten productive activities by manufacturing firms in sub-Saharan Africa.

2.3. *Employment and factor intensity*

Due to the developmental position of Cambodia (an LDC), employment effects are a major government objective to stimulate domestic clothing manufacturing. In addition, firms are likely to use labour-intensive technologies in poor labour surplus economies (such as Cambodia) unless production necessitates the use of specific assets (e.g. petroleum mining). Hence, we use employment and factor intensity (capital/labour) as independent variables to examine export and innovation intensities. Cambodia is a poor underdeveloped country and we expect exports to be positively correlated with employment; subsequently, innovation should be inversely correlated with capital–labour ratios. Increased exports offer an appropriate scale (market) to expand employment (Hirschman 1970); however, likely innovations tend to be oriented towards raising the labour-intensity of technologies (Myrdal 1957; Lewis 1965). Lewis (1965) provided an argument for the elasticity of substitution by pointing to the massive reserves of disguised unemployment in poor economies.

For a number of reasons firms sometimes introduce capital-intensive technologies even in labour surplus economies due to uncertainty caused by absenteeism (Arghiri 1982), specificity of production that requires specific assets (Coase 1937) or when foreign firms (that relocate from developed locations) simply implement used capital-intensive technologies (Rasiah 2005). These possibilities are likely if firms that initiate operations seek to remain transient due to the uncertainty associated with global trading arrangements, final markets and host-site institutions. Newly emerging labour surplus sites are expected to demonstrate a strong and positive elasticity between growth in employment and growth in exports; however, export expansion may not be strongly reflected in rising capital–labour ratios. Subsequently, no direction of causality is assumed between innovation intensity and capital–labour ratios.

2.4. *Innovation intensity and exports*

This paper uses clothing manufacturing in Cambodia to investigate if production has evolved to include innovation changes and to test two hypotheses: a positive relationship between exports and innovation intensity as well as a positive relationship between exports and employment growth.

3. Methodology and data

This section discusses the methodology and data used to examine the impact of export scale on innovations as well as the relationship between exports and innovation in Cambodian clothing manufacturing firms. Export-scale-based statistical differences in innovation intensity and the variables of employment (capital–labour ratios and age) are examined using Levene's two-tailed *t*-tests; in addition, the relationships between exports and innovation are examined through regression equations.

The data collection for this paper was contracted to Chettra Kuo (a Ministry of Commerce official), to undertake a survey in 2012 that followed the national sampling frame of Cambodia to obtain data from100 clothing manufacturing firms.[3] The survey yielded 94 responses from 100 firms derived from the sampling frame used by the Ministry of Commerce in internal data compilation. The sampling frame was based on ownership, employment size and the location of the firms. The sample was highly representative (at 94%), as it exceeded the 67.7% level of the Cronbach's alpha test. All responses were for the year 2011, unless otherwise stated. Table 1 gives the breakdown of clothing firms in the sample by median score of export scale.

3.1 *Specification of variables*

The specification variables are described in this section. The defined firm-level explanatory variables refer to exports and innovation intensity. Exports were preferred as an indicator of competitiveness over productivity due to the problems of the shortcomings of total factor

Table 1: Breakdown of sample by export scale, for clothing firms, Cambodia, 2011

	Responding firms
Above median	47
Below median	47
Total	94

Source: Ministry of Commerce (Cambodia), 2012 productivity (TFP) and the inability of labour productivity to address changes that resulted from the differences in capital–labour ratios.

3.2. *Exports*

Firm-level performance was estimated using export scale (X) and measured as follows:

$$\text{Exports} = \text{Ln}(X_i),$$

where X refers to exports in US dollars of firm i in 2011.

An export dummy variable was estimated using the median to examine innovation incidence and intensity, employment, capital–labour ratios and age by firms showing lower (XD = 0) and higher (XD = 1) than the median value of exports. The XD was estimated as:

XD = 0 when exports fell below the median of Ln(X) fell below 6.26 and XD = 1 otherwise.

3.3. *Innovation intensity*

No firms in the survey reported the innovation of processes, machinery and equipment and products as totally new to the universe. Firms that reported innovation indicated only changes to the components and adjustments of plant layouts. Therefore, innovation intensity (II) was measured as:

$$\text{II} = \text{ME}_\text{i}+\text{PL}_\text{i}+\text{PD}_\text{i}+\text{PC}_\text{i},$$

where ME, L, PD and PC refer to adaptations made to machinery and equipment, plant layout, product and processes in firm i in 2011. A score of 1 was given if the firm reported yes and 0 otherwise.

3.4. *Employment*

The labour market variable of employment was used as an explanatory variable as the export elasticity of employment was expected to be strong in populous poor economies. Employment was estimated as

EM = actual full-time employment used in the Levene's two-tailed t-test
$E = \text{Ln}(E_i)$ in the regressions

where E is the employment of firm i in the year 2011.

3.5. *Control variable*

We excluded ownership from the analysis because only 2 of the 94 firms in the sample showed a national equity of at least 50%; subsequently, only age was used as a control variable:

Age = years since production began in the Levene's two-tailed t-tests
$A = \text{Ln}(A_i)$ in the regressions

where A refers to the age of firm i since production commenced.

The relationship between age, export performance and innovation capabilities is unclear. Some argue that age is positively correlated with export performance and innovation capabilities because firms gradually gather the required knowledge and innovation capability to perform better than start-ups. In addition, the mortality rate is higher for firms in the first few years.

Some arguments show that new firms find it more convenient to begin production with novel technology or that recently established foreign firms provide superior technology and enjoy better access to international markets (Rasiah 2003). A neutral sign is assumed due to conflicting and consistent evolutionary arguments.

3.6. *Specification of equations*

The following equations estimate the statistical relationships:

$$X = \alpha + \beta_1 \mathrm{II} + \beta_2 E + \beta_3 A + \mu, \quad (1)$$

$$\mathrm{II} = \alpha + \beta_1 \mathrm{AE} + \beta_2 E + \beta_3 A + \mu. \quad (2)$$

Equation (1) was run using the ordinary least squares (OLS) model; however, Equation (2) was run using the Tobit model because Dependant Variable II was estimated using scores that take a minimum possible value of 0 and a maximum possible value of 4 (Greene 2003). Table 2 gives the expected relationship between the dependent variables of exports and innovation intensity as well as the independent variables. All colinearity problems between the independent variables were taken care of using the usual correlation of coefficient matrix (see Appendix 1).

4. Statistical results

This section examines export-based statistical differences in innovation, employment, capital–labour ratios and age as well as the relationship between exports and innovation intensity in Cambodian clothing manufacturing firms.

4.1. *Innovation incidence*

Table 3 gives that a large number of clothing firms reported innovations in 2001. Of the 94 firms studied, the number of firms that reported innovation changes to machinery and equipment (MEI), plant layouts (PLI), material inputs (MTI) and products (PDI) in 2011 were 35.1%, 50.0%, 73.1% and 61.7%, respectively. The CMP operations have transformed into a record number of innovations by Cambodian clothing manufacturing firms.

A higher export scale did not translate into a higher incidence of innovation changes with MEI and PLI (Table 3). The incidence of PLI was (50%) between the higher and lower export-scale groups; however, 64.9% of firms (that reported innovation changes) were in the lower export-scale group. Firms with a higher export scale showed a higher incidence of innovation changes to MTI and PDI. The incidence of firms that reported innovation changes to MTI and PDI were significant at 73.4% and 61.7%, respectively.

Table 2: Expected relationships between dependent and independent variables

Dependent variables	II	*E*	KL	*A*
X	+ve	+ve		Unclear
II			Unclear	Unclear

Source: Authors

Table 3: Innovation by type of clothing firm, Cambodia, 2011

	MEI = 0	MEI = 1		PLI = 0	PLI = 1
$X = 0$	32	15	$X = 0$	24	9
$X = 1$	29	18	$X = 1$	23	38
Total	61 (64.9%)	33 (35.1%)	Total	47 (50.0%)	47 (50.0%)
	MTI = 0	MTI = 1		PDI = 0	PDI = 1
$X = 0$	15	32	$X = 0$	25	22
$X = 1$	10	37	$X = 1$	11	36
Total	25 (26.6%)	69 (73.4%)	Total	36 (38.3%)	58 (61.7%)

Source: Computed from data supplied by the Ministry of Commerce (Cambodia) using a SPSS 11 package.

4.2. *Export-based statistical differences*

The variables of KL, II, EM and Age showed a statistically significant higher means when XD = 1 and showed that larger exports were more capital-intensive, innovation-intensive, employment-intensive and older in age (Table 4). A simple Levene's two-tailed *t*-tests indicated that exports increased the capital, innovation, employment and age activities of Cambodian clothing firms.

The Levene's two-tailed *t*-test result indicated a strong association between exports as well as II and EM (i.e. exporting firms were more innovative and employed more workers). Export firms were more capital-intensive and showed longer years of operation.

4.3. *Statistical relationships*

This section examined the relationship between exports and innovation intensity as well as employment, capital–labour ratios and age. The regressions given in Table 5 (*F*-stats) passed the model fit test. The data used are cross-sectional data and with no test for causation.[4]

Table 5 indicated that II is statistically positively correlated in Equation (1) with X ($p < .5\%$) and demonstrated a positive relationship with innovation. Employment is positively highly correlated with X ($p < .1\%$). Both variables were in logarithms; therefore, a 1% rise in employment will increase exports by 1.1%. Age was also positively correlated to exports

Table 4: Levene's two-tailed *t*-test scores by export size and clothing firm, Cambodia, 2011

	XD	*N*	Mean	*F*-stat@	Standard error	Standard deviation
KL	0	47	3436	1.99**	701.6***	4810
	1	47	5698		2436.5**	16,704
II	0	47	1.96	0.73	0.16***	1.12
	1	47	2.68		0.14***	0.96
EM	0	47	611	35.93***	14.89***	287
	1	47	1368		135.20***	927
Age	0	47	6.36	3.43***	0.65***	4.42
	1	47	6.98		0.52***	3.55

Note: @ – equality of means assumed when *F*-statistic is significant and not assumed otherwise. *Statistical significance at 10%. **Statistical significance at 5%. ***Statistical significance at 1%.
Source: Computed from data supplied by the Ministry of Commerce (Cambodia) using SPSS 11.0 for Windows package.

Table 5: Exports and innovation intensity for clothing manufacturing firm, Cambodia, 2011

	(1)	(2)
II	0.511 (2.303)**	
E	1.148 (3.511)***	
X		0.140 (3.016)***
KL		−0.000 (−1.269)
A	2.817 (1.858)**	0.200 (1.173)
C	6.260 (2.927)***	−0.080 (−0.110)
N	94	94
R^2	0.204	
F-stats	7.703***	
LL		−138.880***

Source: Computed from data supplied by the Ministry of Commerce (Cambodia) using EViews 6 package.
Note: Figures in parentheses refer to *z* statistics.
*Significant at 1% level.
**Significant at 5% level.
***Significant at 10% level.

Inverting the relationship in Equation (2), *X* remained highly positively correlated with II ($p < .1\%$) and showed that innovation incidence is strongly correlated to export scale. Although statistically insignificant, the sign for KL is negative and suggested the labour-intensity of innovations expected in a poor labour surplus economy such as Cambodia. Age was not statistically significant even though the sign was positive.

The results indicated that clothing manufacturing firms showed a high incidence of participation in innovation activities and that innovation intensity is highly and positively correlated with export scale. Exports and employment were highly and positively correlated to demonstrate the importance of external markets to generate jobs in Cambodia. The inverted regression results showed a strong relationship with export scale and innovation-intensity. The control variables of KL and age were not statistically significant in both regressions.

5. Conclusions

The results show that Cambodian clothing firms have upgraded from CMP operations to participate in innovation activities to adapt to machinery, material inputs, plant layouts and products. There have also been innovation changes in machinery and equipment and plant layout. A higher export scale showed a strong impact on innovation changes to material inputs and clothing products. The Levene's two-tailed *t*-tests indicated that export-orientated firms have a higher capital–labour, employment, innovation intensity and age than firms with minimum exports. The regression results showed a strong positive relationship between exports and innovation intensity as well as exports and employment. There remains a lack of panel data to examine the causation of the strong and positive correlation results; however, there is evidence that exports and innovation drive each other in Cambodian clothing manufacturing firms. In addition, clothing exports help support employment expansion in Cambodia.

Contrary to claims that CMP operations will only peripheralize operations in LDCs, the wide range of innovation activity reported by clothing manufacturing firms in Cambodia suggests that technological upgrading is possible in such sites. The evidence is consistent with Hirschman's (1958, 1970) argument that export markets offer room for the expansion of host-site capabilities. Export expansion offers a scale and competition to support innovation; however, innovation helps firms compete better in export markets. Innovation is shown to enable firms to compete in export markets; however, it is unclear if its intensity is sufficient for clothing operations in Cambodia to survive any removal of preferential access arrangements by developed countries. Effective industrial policy may be necessary to support technological catch-up so that Cambodian clothing firms can eventually compete in niche or open markets against external competitors.

The evidence shows that it is possible to connect with global value chains in the clothing industry, even if the point of integration is for CMP operations. It is salient to create institutional changes that are essential for firms to upgrade and for innovative activities. Future studies should focus on the relationship between institutional change and innovation capabilities of clothing firms in LDCs (such as, Bangladesh, Cambodia, Laos and Myanmar) relative to clothing firms in competitor countries.

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Notes

1. The questionnaire used was adapted from surveys contracted to the relevant data collection ministries/department of several countries by Rasiah. Because the study is industry-specific, it was developed from pilot interviews with six firms in Cambodia, Laos, Myanmar and Sri Lanka.
2. In the original Solow (1957) model, residue captured both technical change and productivity as only capital and labour were used as production factors. The total factor productivity argument offers a probable solution to firms operating at the production possibility frontier but using different mixes of capital and labour inputs; however, in reality firms are constrained from adopting input mixes based on relative prices of factor endowments. In addition, the assumptions of perfect substitutability between capital and labour and the homogeneity of products of different firms are unrealistic as well as the scale effects and input–output structures that vary between firms (Kaldor, 1979; Kornai, 1979; Rasiah, 2004).
3. We are grateful to Chettra Kuo for coordinating the survey.
4. Engle and Granger (1987) also convincingly argued spuriousness associated with normal time series econometric regressions.

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Appendix 1: Correlation coefficient matrix of independent variables for clothing manufacturing, Cambodia, 2011

	KL	II	*X*	*E*	*A*
KL	1.000	−0.111	0.158	−0.293	−0.189
II	−0.111	1.000	0.279*	0.202	0.198
X	0.158	0.279*	1.000	0.381*	−0.022
E	−0.293*	0.202	0.381*	1.000	0.411*
A	−0.189	0.198	−0.022	0.411*	1.000

Note: * – excessive correlation; subsequently, these variables were not included on the right side of the equations. Despite A showing strong correlation with E, their substitution in Equation (1) did not change their coefficients and they were retained in the model.
Source: Computed from UNU-MERIT Survey data using EViews Package 6.