Third Draft

Employment and Wages in Export-Oriented Garment Industry: Recent Trends in Low-income Countries under Trade Liberalization

Background paper to Industrial Development Report 2013

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1. Introduction

After World War II, the textile industry flourished in less developed countries. The competitive edge of late comers to the textile industry lay in its labor-intensive nature and the low wage rate associated with the low per capita incomes in these countries. During the Industrial Revolution, as innovations in the spindle and loom spread, the textile industry's upstream processes became increasingly more capital intensive. Sewing, the only downstream process, remains this industry's singular labor-intensive process in the value chain. The sewing process, in textiles, is currently undertaken mainly in developing countries (Gereffi and Memedovic 2003). China is the top apparel exporter to the world economy, while many other lower-income countries such as Bangladesh and Cambodia are among the leading exporters to the global market on basis of their low-wage advantage (Lopez-Acevedo and Robertson 2012, UNIDO 2004). Since the export-oriented garment industry provides ample employment opportunities for unskilled and female workers, the industry has contributed to poverty reduction in low-income garment-exporting countries (Fukunishi et al. 2006, Yamagata 2009).

Competition based on low wages, however, necessarily raises concerns about degradation in workers' welfare. Given the world's substantial pool of low-wage labor, there is little scope for an increase in the price of apparel products without improving product quality. In particular, the entry of large low-income countries, namely China and India, into the apparel market is likely to lower both apparel prices and garment workers' wages, as the Stolper–Samuelson Theorem indicates[1]. This is the point that the "race to the bottom" argument claims

[1] The theorem implies that when the price of a commodity declines, the price of the factor intensively employed for the production of the commodity declines in both nominal and real terms. This is because a

(Tonelson 2002, Kaplinsky 2000). In fact, in 2005, after the removal of the quota system, due to termination of Multi-fibre Arrangement (MFA) competition in the apparel market intensified. Since the 1970s, apparel imports to the US and EU markets had been under a quota system that restricted the quantity of imports from major individual exporters. As expected, the removal of quotas, a policy in line with the World Trade Organization's (WTO's) principle of trade liberalization, led to an increase in exports from competitive countries, namely China, and a fall in export prices.

Another important issue concerning employment in the garment industry is technological change. Given the global trend in the increasing number of educated workers, technological changes in the garment industry can be directed toward using more skilled and less unskilled labor. If this is the case, employment of unskilled workers decreases and accordingly their wages also decline. While technological upgrading is increasingly important to sustain growth in the liberalized export market, it may reduce the industry's contribution to poverty reduction in low-income countries.

Through the observations over the period, including those on trade liberalization, this study analyzes how competition and technological change have affected employment in the garment industry, an industry that provides the largest number of manufacturing jobs in low-income countries. The authors specifically focus on dynamism in the industry, since changes in the labor market have already been illustrated in the existing literature. In fact, recent studies find little empirical evidence to support the "race to the bottom" argument. Studies based on large-scale labor surveys demonstrated that wages in the garment industry did not decrease (but rather increased in some cases) in Bangladesh, Cambodia, Pakistan, and Vietnam, among others (Lopez-Acevedo and Robertson 2012, Robertson et al. 2009, Asuyama et al. 2011, 2013). Contrary to the prediction given by the Stolper–Samuelson theorem, they find the rise in the average wage that coincides with a growth in exports. On the basis of successful experiences in the abovementioned countries, the role of the garment industry in poverty reduction through employment creation has been recently revisited (World Bank 2011, 2012).

While recent studies have uncovered the contribution of labor-intensive industry to employment, the mechanisms that lead to both employment growth and to upgrading working conditions including wages has, so far, not been adequately understood. The issue here is under which conditions labor-intensive industry contributes to poverty reduction and employment creation in low-income countries.

We mainly use original firm-level data collected for Bangladesh, Cambodia, Kenya, and Madagascar, as well as empirical literature on the garment industry. Our dataset is a

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decline in the product price amplifies the decline in the wage which is equal to the marginal product with respect to labor in a competitive labor market. For a simple explanation of the theorem, see Jones (1965).

comparable cross-country set and is repeatedly collected in 2002 and 2008 (though data for Madagascar contains only information for 2008), which is hardly available elsewhere.[2] Though the dataset is highly unbalanced because of the high frequency of firms' entries and exits, it contains detailed information on production, employment, sales, and accounting. For example, it allows for a better measurement of the output value, which is intrinsically problematic in the garment industry because of the under-reporting of material costs. It also gives a better estimation of wage changes controlling for firm-specific effects. See Appendix 1 for a summary of the dataset.

The main results of analyses of this paper are threefold. First, employment in the garment industry provides better income opportunities for the less educated and particularly for female workers. Even after trade liberalization, real wages increased and working conditions generally improved. Second, productivity growth is a key to realizing employment growth and improving job quality. While labor costs factor significantly in determining competitiveness, firms' productivity enhancement efforts have enabled growth under an increasingly upward trend in wages in the medium-to-long term. Third, skill-biased technological progress has not yet spread to the garment industry. Current innovations in the garment industry allow it to retain its labor-intensive nature. These industry characteristics permit low-income countries to maintain their competitiveness and increase employment without reducing job quality.

The rest of paper is organized as follows. In Section 2, the garment industry's employment, wages, and working conditions are illustrated in reference to their relevance to poverty reduction. The third section is a survey of empirical studies supporting the views expressed in this paper. The concluding section summarizes the discussions.

2. Employment in the Garment Industry

2.1 Overview of the Garment Industries in Four Countries

Four developing countries, each with its own method for developing their garment industry, were selected for case studies. All four countries are classified as the low-income according to the World Bank definition. Moreover, they all experienced rapid growth in garment exports to developed countries, at least for some years. The Bangladeshi industry started to grow in the early 1980s, followed by Madagascar's industry in the beginning of 1990s, based on investment from Mauritius. The Cambodian industry started exporting in the late 1990s, underpinned by its bilateral trade agreement with the United States. Finally, the Kenyan garment industry experienced rapid growth in the early 2000s, triggered by duty-free access to the U.S. market.

[2] The Enterprise Survey conducted by the World Bank is another well-known firm dataset covering a number of countries. However, a substantial difference in survey design, e.g. different survey years across countries, and small coverage of garment firms make comparison difficult.

There is significant diversity among garment industries in the four countries. The largest industry is in Bangladesh, whose export value exceeded 10 billion dollars in 2010, followed by Cambodia, Madagascar, and Kenya (Table 1). As shown in Table 2, except for Kenya, these countries continued to grow after trade liberalization until the markets were hit by the 2009 financial crisis. In 2010, exports from Bangladesh and Cambodia recovered, yet Madagascar showed an even more accelerated decline than previously that year. This is mainly due to suspension of duty-free access to the U.S. market since 2010, which was caused by the political turmoil in Madagascar. Although industry sizes vary, they each have a substantial share in commodity exports and provide significant employment opportunities (Table 1).

Table 1. An Overview of the Garment Industry in Bangladesh, Cambodia, Madagascar, and Kenya (2010)

	Export value (million $)	Share of textiles and apparel in total exports	Employment (thousand, 2008)	Main investing country	GNI per capita	Population (millions)
Bangladesh	11,791	71.5% (2007)	3100	Local	700	148.7
Cambodia	3,069	54.4%	325	China, Taiwan, Korea	750	14.1
Madagascar	311 (2010) 617(2008)	28.0% (2010) 53.1% (2008)	107	Mauritius, France	430	20.7
Kenya	213	3.8%	26	India, China	770	39.8

Source: UN Comtrade (export value), World Development Indicators (share, GNI per capita, population), BGMEA, Ministry of Commerce Cambodia, Ministry of Trade and Industry Madagascar, EPZ authority Kenya (employment)

Table 2. Growth Rate of Export Value (%)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average annual growth
World	−0.4	2.6	12.0	10.9	7.3	8.1	7.8	3.6	−10.6	7.9	4.7
Bangladesh	2.0	−3.1	19.0	23.1	2.8	28.7	4.6	13.9	0.8	10.0	9.7
Cambodia	19.7	13.0	17.9	21.1	11.2	23.1	10.8	1.2	−18.7	13.6	10.6
Vietnam	−2.3	117.2	91.4	13.1	6.5	25.6	30.8	19.3	−5.0	14.2	26.4
Pakistan	1.9	1.1	18.9	15.3	−1.4	13.1	7.5	3.9	−10.3	9.3	5.6
Kenya	46.2	92.5	49.2	47.1	−3.2	−3.4	−6.4	−0.6	−21.4	4.3	16.0
Madagascar	20.0	−46.5	56.0	52.1	−4.5	4.9	18.9	−4.9	−18.0	−38.5	−1.4
China	4.2	12.1	23.4	22.6	45.0	13.9	20.9	12.2	−3.3	10.9	15.6
India	0.4	7.0	12.5	12.2	29.2	12.2	5.6	5.7	−3.4	1.5	8.0

Source: UN Comtrade (US and EU report of import value)

In the four low-income exporting countries, wages are well below those in China, Mauritius, Turkey, Mexico, and El Salvador (Table 3). This suggests that the competitive advantage of low-income exporters rests at least partially on low wages. However, Table 3

depicts substantial wage increases in Bangladesh, Cambodia, and Kenya, with nominal growth rates ranging from 36.5% to 65.8%. Furthermore, a detailed investigation shows that there is also substantial variation in wages among low-income countries. Wages are lowest in Bangladesh and highest in Kenya in both years; Cambodia and Madagascar lie between the two figures.

Table 3. Average Monthly Wage of an Operator (Nominal, $)

	Bangladesh	Cambodia	Kenya	Madagascar	China (2006)	Mauritius	Turkey (2006)	Mexico	El Salvador
2008	63.0	88.9	105.2	73.8	125.1	256.10	459.9	294.1	188.1
	(22.9)	(19.5)	(8.8)	(27.8)					
	[203]	[33]	[5]	[75]					
2002	38.9	53.6	77.1			143.7		240.7	159.9
	(13.1)	(13.2)	(16.1)						
	[167]	[90]	[3]						

Note: Wages of Bangladesh, Cambodia, Kenya, and Madagascar are average values for female machine operators with 1–5 years experience in exporting firms by IDE survey. Figures in parenthesis are standard deviations and those in square brackets are the number of samples. Wages of other countries are average of operators over sample workers by ILO survey.
Source: IDE Garment Firm Surveys (Bangladesh, Cambodia, Kenya, Madagascar), ILO Labor Statistics Database (China, Mauritius, Turkey, Mexico, El Salvador).

2.2 Relevance to Poverty Reduction

The garment industry has created large formal employment opportunities. In 2008, employment exceeded 3 million in Bangladesh, and more than 300 thousand workers were employed in this industry in Cambodia (Table 1). Before the political turmoil in Madagascar, the number of garment workers in that country exceeded 100 thousand, which is a remarkable figure for formal employment in a single sector in sub-Saharan Africa.

Garment manufacturing employment is more accessible to uneducated workers than other types of formal sectoral employment. According to our surveys, machine operators, on average, attain primary-level education or less in 87% of firms in Bangladesh and 82% of firms in Cambodia. The figures for Madagascar and Kenya are 68% and 75%, respectively. While primary education has become increasingly more common among the poor, in recent years, 37%–53% of garment manufacturing firms do not set educational requirements for helpers, which are entry-level workers. As a result, positions that constitute the majority of jobs are accessible to uneducated workers. However, educational requirements, tends to be significantly high for supervisors and other high-skilled workers. For a supervisory position, 70%–93% of firms require at least secondary education, which is not common among the poor in the four countries in our study.

The garment industry is occasionally criticized for its low wages, long working hours,

and unhealthy working environment. However, in the four countries under review, unskilled workers' wages, namely those of machine operators and helpers, were well above the poverty line[3], and real wages rose in Bangladesh and Cambodia (Asuyama et al. 2011)[4]. Recent studies indicate that wages in the garment-manufacturing sector are not necessarily lower than those in other formal sectors. They are clearly higher than wages in informal sectors and are increasing in real terms in Vietnam and Pakistan as well as in Bangladesh and Cambodia (Robertson et al. 2009).

The consumer's mounting ethical concerns regarding developed countries' compliance with labor laws and growing labor demand among low-income exporters drives significant improvements in working conditions and an increase in nominal wages. Buyers in the United States and the European Union are increasingly concerned with working conditions in garment manufacturing firms, and occasionally conduct inspections and deal only with firms that pass them. In 2008, buyers monitored 72% of firms in Madagascar (IDE's garment firm survey). In this respect, a remarkable case is that of Cambodia, where a monitoring program facilitated by the International Labour Organization (ILO), the government, and the industrial association has been conducted for almost all exporting firms. The core program is called "Better Factories Cambodia," which involves third party monitoring of a broad range of working conditions including wages, safety and health, and social welfare.[5] It was initially linked to a quota system of garment exports to the U.S. market, in which the industry was awarded additional quota by compliance with labor legislation, yet the program has been continued even after the removal of the quota system in 2005. There is evidence that non-wage working conditions have also been recently improving in many countries (Lopez-Acevedo and Robertson 2012), although studies demonstrated poor working conditions are still widespread (Shea at al. 2010).

While the monitoring scheme has played an important role in helping improve working conditions and real wages in the garment industry, steady economic growth has been a fundamental driving force in these two factors in many garment-exporting countries. With increased labor demand in other sectors, as well as in the garment industry, in order to attract workers, garment firms need to offer higher wages and better working conditions. Vietnam is a typical case of increased labor demand (Goto 2013). Meanwhile Bangladesh recently experienced a significant increase in real wages (Figure 1).

[3] Fukunshi et al. (2006) for Bangladesh and Kenya, Yamagata (2006) for Cambodia, Fukunishi and Ramiarison (2013) for Madagascar.

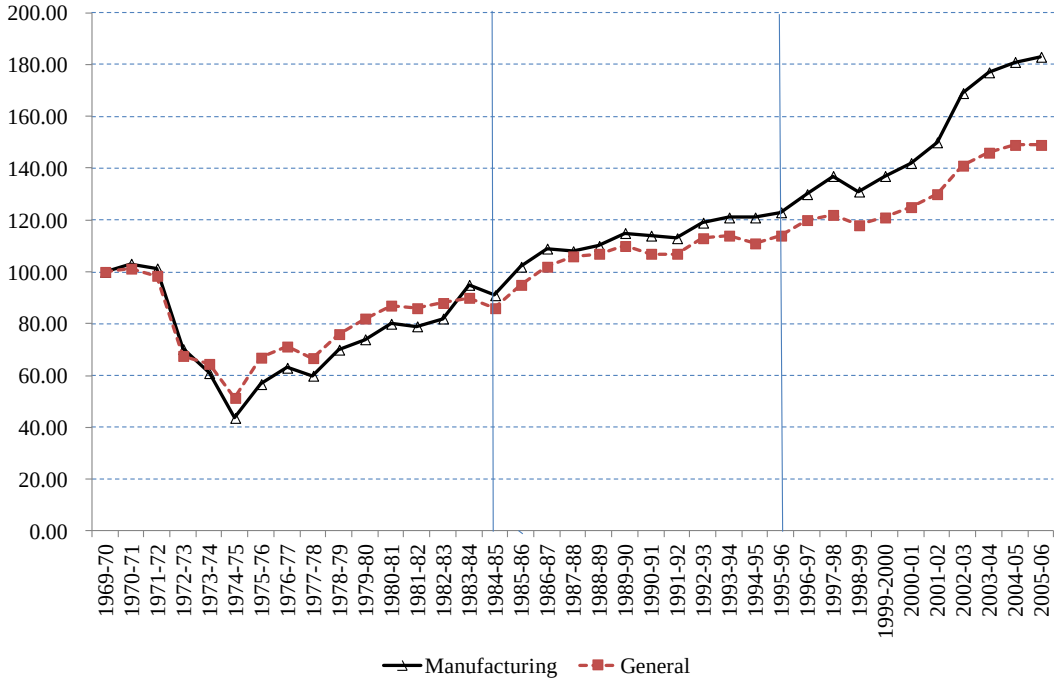
[4] Real wages decreased in Kenya between 2002 and 2008, though nominal wages rose considerably; for example, the nominal wage for operators with one to five-years experience rose by 41%. The survey was not conducted for Madagascar in 2002.

[5] See the Better Factories' website (http://www.betterfactories.org) for the detail.

2.3. Contributions to Female Employment

Another notable feature of employment in the export-oriented garment industry is its lesser gender bias. In almost all countries, female labor makes up the majority of the labor force. According to our four-country surveys, on average, 56%–90% of total employment is female. Pakistan is one of the few exceptions. The female labor force participation rate is considerably limited in this country owing to cultural norms, such as *purdah*, that constrain the presence of women in public spaces. Therefore, in the Pakistani garment industry, the shop floor is dominated by male workers, while recent studies demonstrate that garment manufacturing firms are attempting to increase the number of female workers in order to gain competitiveness in export markets (Makino 2013, Haque 2009)[6].

Figure 1 The Real Wage Index in Bangladesh (1969–70 = 100)



Source: Figure 4 in Yunus and Yamagata (2013). Originally from the Bangladesh Bureau of Statistics (BBS), *Statistical Yearbook of Bangladesh*, various issues, Dhaka: BBS.

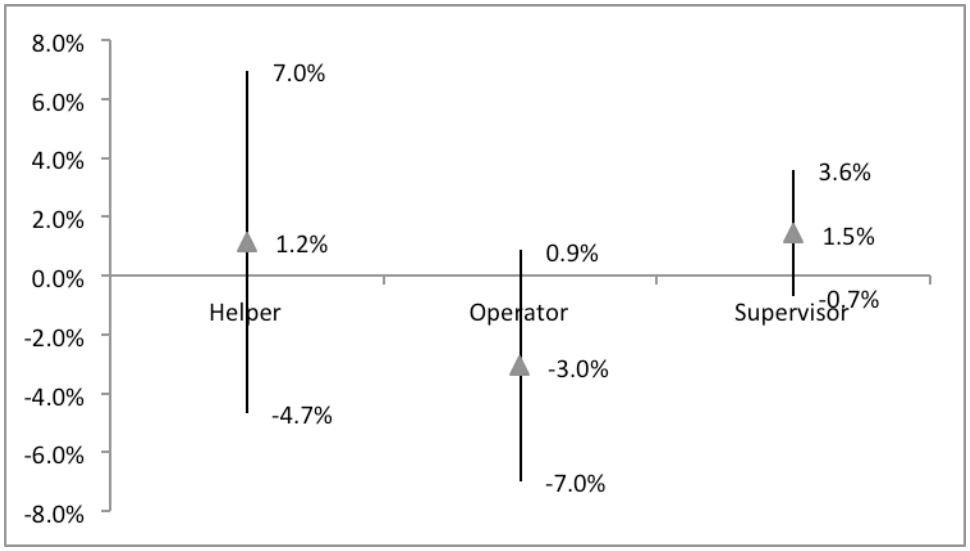
It is also notable that there is a little wage gap by gender. Studies based on labor surveys in developing countries reported small but significant gender wage gaps in the garment industry (Lopez-Acevedo and Robertson 2012, Robertson et al. 2009)[7]. However, with controlling positions and experiences and focusing on the wage gap within a firm, our survey

[6] Makino (2013) argued that a piece-rate system that is entailed with labor contract with male workers in Pakistan prevents from upgrading of product quality.

[7] They also reported that the gender wage gap in the garment industry tends to be smaller than that in other industries and among informal sectors.

data shows no significant gender gap for the main workforce, namely the supervisor, machine operator and helper, in all four countries[8]. For example, estimates of a gender wage gap in Madagascar indicate that the male wage exceeds the female wage by 1.2% for helpers and by 1.5% for supervisors, and that it is lower by 3.0% for operators, but the differences are not statistically significant (Figure 2). Any discrepancy between the two lines of studies seems to come from gender differences in skilled/unskilled ratios. It is clear, in our data, that the share of female workers is significantly smaller in high-skilled jobs such as quality controller and engineer, and in managerial positions, than it is in low-skilled jobs. As a result, male garment workers are more likely to hold high-skilled positions than female workers[9].

Figure 2 Estimates of Male and Female Wage Ratios in Madagascar (2008)



Note: The wage gap is estimated with controls for experience and the firm fixed effect based on the wage data of 49 firms for helper, 58 firms for operator, and 48 firms for supervisor. Estimates of the ratio of male wage to female wage are shown as a triangle with a 95% confidence interval.

In Bangladesh, the studies on female garment workers indicate that their earnings substantially contribute to household income. In Zohir and Pratima (1995), female workers contribute 45.8% of household income and 30% of them were the primary earner. More recently, Murayama (2008) reported that more than half of female workers who contributed to household income were their household's primary earner. Their income was also spent on their brothers and sisters' education (Zohir and Pratima 1995). A World Bank report (World Bank 2011) referred to a change in the *purdah* norm in Bangladesh followed by an increase in the number of

[8] Asuyama et al. (2011) for Bangladesh, Cambodia, and Kenya, and Fukunishi and Ramiarison (2011) for Madagascar. For wages in Kenya, the firm fixed effect is not controlled due to the small number of samples.

[9] It indicates a possibility of gender bias in a firm's decision on job assignment.

female workers in the garment industry. Similar changes may occur in Pakistan in the future.

3 The Impact of Labor Cost on Competitiveness and Employment

Labor cost is obviously an important factor in the garment industry's competitiveness, given its high labor intensity. In fact, countries known to be garment exporters in the past, such as East Asian countries and Mexico, experienced a decline in garment exports when labor costs rose. This indicates that labor cost and employment size are negatively correlated. However, as shown in the previous section, the garment industry can sustain growth in spite of a steady increase in wages, at least in the short-run. Sustained growth occasionally continues for up to 30 years, as in the cases of Bangladesh, Sri Lanka, India, and Mauritius. Given the considerable increase in labor costs during the period of export growth, this fact indicates that export performance is not highly sensitive to labor cost. Such growth entailed wage increases that cannot be completely attributed to the quota system, since even after the quota was abolished in 2005, many low-income exporters continued to grow.

In this section, mechanisms that enable both export growth and wage increases are investigated mainly on the basis of one of the authors' recent work (Fukunishi 2013). Two approaches are taken. First, the competitive advantages of the three countries experiencing growth, Bangladesh, Cambodia and Madagascar, are examined. Given the wage differences, cross-country comparisons demonstrate how a relatively high-wage country, namely Cambodia and Madagascar, maintained growth. Second, to see the direct evidence of the mechanisms, the adjustment of garment industries to the recent increase in wages is explored for the period including the MFA phase-out, mainly for Bangladesh and Cambodia. This demonstrates how garment industries compensated for the loss of their low-wage advantage in the liberalized export market.

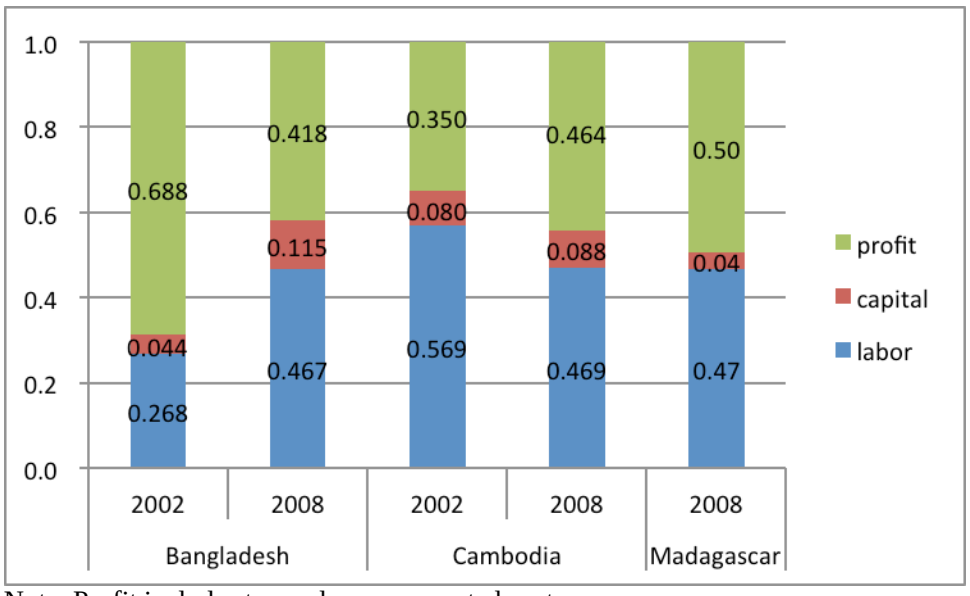
3.1 Cross-Country Comparisons of Competitive Advantage

We first define measure of competitiveness. Quality, delivery, and price are basic components of competitiveness in export markets in which buyers specify the design. However, prices are the most important component for basic and low-priced apparel products in which low-income exporting countries specialize (Lall and Wignaraja, 1994). Although short lead-time deliveries are increasingly important, the importance of price is not minimized in the decreasing trend in export prices. We define unit costs, specifically the cost per value added, as a measure of competitiveness because a garment firm with a lower unit cost can accept orders at a lower price.[10]

[10] Cost per physical unit of a product (per piece or per dozen) is a straightforward measure of price

Figure 3 shows the share of labor costs, capital costs, and profits in value added for 2002 and 2008 respectively, which are before and after the 2005 MFA phase-out. Unit costs equal the share of labor and capital costs, and thus a larger share of profits implies greater competitiveness. Remarkably, the three countries' industries share very similar cost structures in 2008 and unit costs of approximately 50%–57%, in which the difference is not statistically significant. Although only Madagascar had duty-free access to the U.S. market, its unit cost does not differ significantly from those of the other three countries after adjusting for the duty-free effects.[11]

Figure 3 Cost and Profit in Value Added



Note: Profit includes tax and any unreported costs.
Source: IDE Garment Firm Survey

Average unit costs are decomposed into factor prices, human capital, productivity, production scale, and efficiency of input allocation.[12] The contribution of each factor as well as the unit cost are compared among the three countries, so as to indicate which factor contributed to reduce (or increase) the unit cost relative to those of other countries (Figure 4). To facilitate comparisons, figures are benchmarked at the Bangladeshi averages (1.0); hence, a factor whose

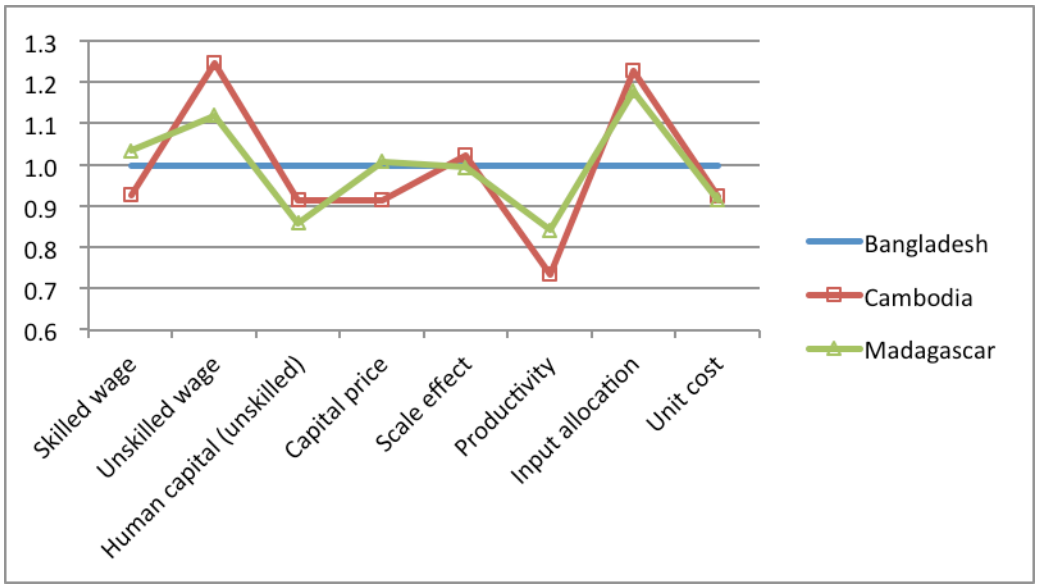
competitiveness. However, comparing this cost across products differing in quality is difficult from a practical perspective. Given the assumptions that garment firms are price takers and the market price is shared across firms, the cost per value added can be compared consistently across firms and countries.

[11] Buyers may offer higher prices for Madagascar's products by up to the tariff rates. The average tariff rate, based on the product composition of Madagascar's exports, was 18.5%, which was subtracted from the value added of Madagascar's garment manufacturing firms.

[12] "Productivity" means total factor productivity. Human capital is assumed to augment an effective unit of labor on the basis of an estimation of the production function. Efficiency of input allocation reflects the allocative efficiency, which is measured according to how close the actual combination of inputs (capital, and skilled and unskilled labor) is to cost-minimization. See Appendix 2 for details of the methodology.

contribution is greater than one increases unit costs relative to the Bangladeshi average and *vice versa*. Thus, a low-skilled worker's wages increases the unit cost of Cambodian and Madagascar's firms by 12%–25% relative to the Bangladeshi average, whereas their richer human capital lowers unit costs. In particular, Madagascar firms' rich human capital fully compensates for the higher wage by augmenting labor's effectiveness; consequently, their wage per effective unit of labor is lower than in Bangladesh.[13] The factor that differs most significantly across countries is productivity; the higher average productivity contributed to lower unit costs for Cambodian and Madagascar firms relative to those of Bangladeshi firms.

Figure 4 Cross-country Comparisons of Factors of Unit Costs (2008)



Note: The product of each term (from skilled wage to input allocation) is equal to the unit cost. See appendix 2 for details of the methodology.
Source: Fukunishi (2013)

The results demonstrate that the Cambodian and Madagascar garment industries compensated for the relatively high wage with rich human capital and high productivity. This appears to indicate that low-income exporters who are generally considered less capable are, in fact, able to increase productivity. In the next subsection, we see direct evidence of a firm's capacity to maintain its competitiveness.

3.2. Changes in Competitiveness after the MFA Phase-out

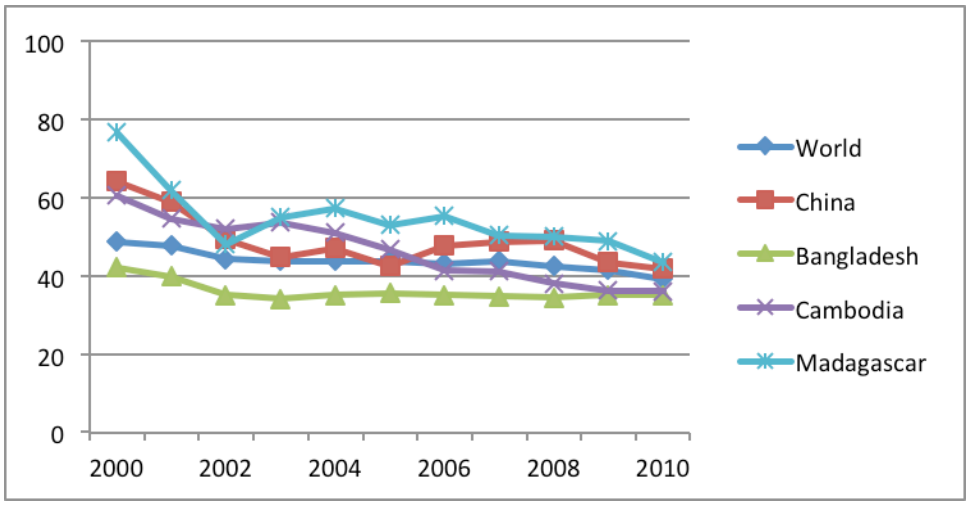
At the end of 2004, the MFA was terminated. Although time-limited export restrictions on

[13] Unskilled labor's wages increased Madagascar's unit cost by 12% and human capital decreased cost by 14% (Figure 4).

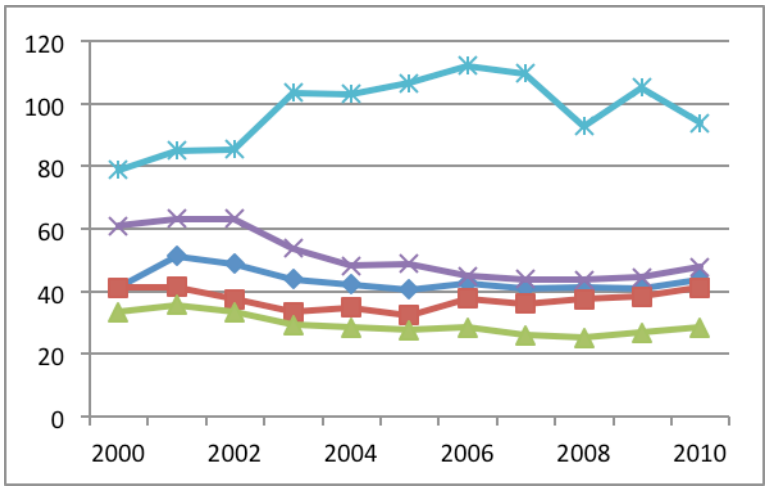
certain garment items were re-imposed to the largest exporter, China, until 2007 in the EU market and 2008 in the U.S. market, for the rest of the garment-exporting countries, significant trade liberalization was observed (Kowalski and Molnar 2009). As predicted, export prices fell in many countries (Figure 5); according to estimations made by Harrigan and Barrows (2009) this fall in export prices resulted in fall of prices in 12 of the top 20 exporting countries including China, Bangladesh, and Cambodia. In the period, wages rose substantially in low-income countries as shown earlier.

Figure 5. Unit Price ($ per dozen)

Panel A. US market



Panel B. EU market



Source: Calculation by author using UN Comtrade (US and EU report of import value)

As previously described, productivity improvement is an important strategy for maintaining competitiveness under a condition of increased labor costs. Table 4 compares the

averages of firm-level total factor productivity (TFP) of the Bangladeshi and Cambodian garment industries in 2002 and 2008[14]. The table shows that average productivity did not significantly change in Bangladesh, while the Cambodian industry achieved substantial growth. Consequently, the average productivity differed between the two industries in 2008, although this difference was not significant before the MFA termination. This means that the Bangladeshi industry managed to grow in the absence of productivity growth.

Table 4. Change of Average Productivity

	2002	2008	*t* test 2002–08
Bangladesh	0.008	−0.006	
	(0.839)	(0.762)	
Cambodia	−0.214	0.564	***
	(1.172)	(1.119)	
t test: Bangladesh–Cambodia		***	

Note: *** indicates that the means of productivity differ significantly at the 1% level. Standard deviations are in parenthesis. Refer to Appendix 2 for the methodology.
Source: Fukunishi (2013)

A detailed analysis clearly demonstrates the effect of wages and productivity on unit cost. As Figure 3 shows, the average unit cost of the Bangladeshi firms, in the study, increased substantially while it decreased in the Cambodian firms. Although the industry in both countries continued their growth trend, the two countries' industries contrasted in cost structure after trade liberalization; price competitiveness of the Bangladeshi firms was significantly downgraded, while it improved for the Cambodian firms. Figure 6 shows a decomposition of the unit cost discussed in the previous subsection. Here, each factor's contribution as well as the unit cost is compared between 2002 and 2008, so that it indicates which factor contributed to a decrease (or an increase) in unit cost during the period[15]. For ease of comparison, the 2002 values are standardized at one. The two panels illustrate that an increase in the wage, in particular the unskilled wage, contributed to an increase in unit costs. This is the primary cause of an increase in unit cost in Bangladeshi firms, and in contrast, Cambodian firms managed to reduce unit cost thanks to the large improvement in productivity that completely offset the effect of increased wages.

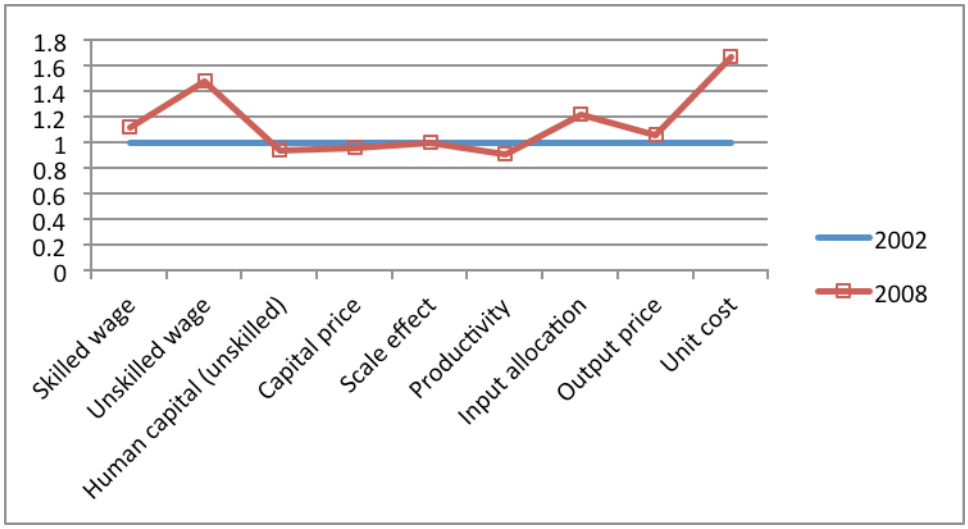
Productivity growth was realized throughout several channels in the Cambodian garment industry (Asuyama and Neou 2013). A high rate of firm turnover facilitated the closure

[14] TFP is measured as an OLS residual of the production function estimate. See Appendix 1 for the methodology.
[15] The output price is added to the factors that contribute to unit cost, as a fall in the output price increases the unit cost, holding cost constant. See Appendix 2 for details of the methodology.

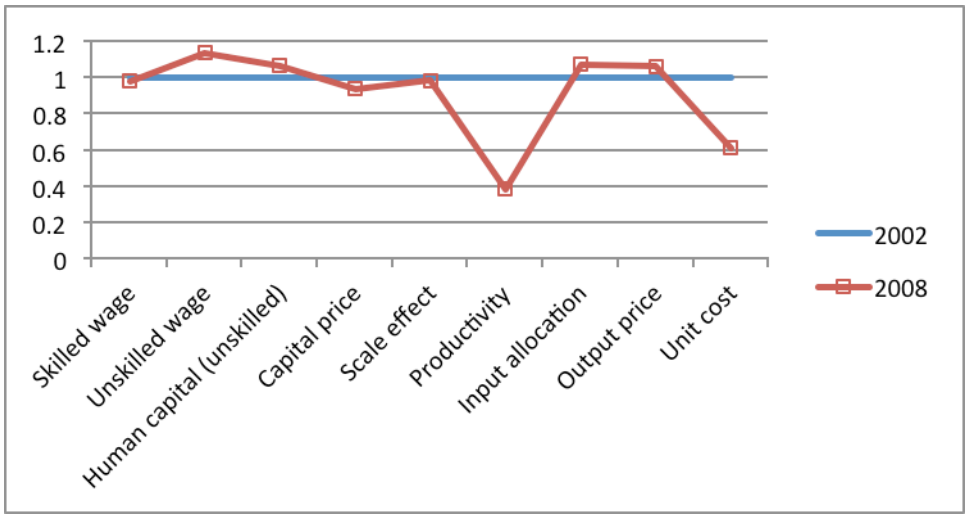
of unproductive firms and the entry of productive ones. Among those that continued to operate, process innovation and workers' increased educational attainment contributed to enhanced productivity, whereas no evidence of product upgrading was found[16]. It is noted that, given frequent firm turnover, workers are at a high risk of unemployment, but this also means a significant chance of workers at new firms becoming employed.

Figure 6. Decomposition of Unit Costs

Panel A: Bangladesh



Panel B. Cambodia



Note: The product of each term (from skilled wage to output price) equals unit cost. See appendix 2 for details of the methodology.
Source: Fukunishi (2013)

[16] Goto (2013) reports product upgrading in the Vietnamese industry, and Lopez-Aceved and Robertson (2012) argues that the Bangladeshi industry has made functional upgrading.

The Cambodian experience demonstrates that garment firms successfully mitigated the adverse effects of increased wages on competitiveness through productivity enhancement, while the Bangladeshi firms absorbed cost increases by reducing the large profit margin that they enjoyed under the MFA. There are some possible explanations for the heterogeneous responses between the two industries. Some argue that the Better Factories Cambodia (BFC) program contributed to productivity enhancement by providing better working conditions and/or increased demand for the Cambodian apparel products that are regarded as sweatshop free in the global market (Brown et al. 2011, Oka 2012), although there is, presently, no clear empirical evidence supporting this view. The other possibility is that a firms' motivation for productivity enhancement differed by country because of differences in the wage level. Wages in Bangladesh were low enough (therefore, the profit margin was large enough) to absorb the wage increase, whereas the smaller profit margin in Cambodia necessitated the achievement of higher productivity. The Kenyan case adds evidence to the relationship between wage and firms' responses. The fact that many garment firms closed after the 2005 MFA phase out suggests that it was difficult to maintain competitiveness under the condition of a significant increase in wages and a reduced output price. It is noted that, given the highest wage among the three countries, the unit cost among Kenyan firms was highest in 2002 (Table 5). This cost structure necessitated higher productivity for the Kenyan garment industry in order for it to achieve the same unit cost as that of the other industries.

Table 5 Comparison of Unit Costs (2002)

	Bangladesh	Cambodia	Kenya
Cost per Value-added	0.312	0.650	0.895
labor	0.268	0.569	0.738
capital	0.044	0.080	0.157
Sample size	173	94	5

Note: Figures of Bangladesh and Cambodia are same as those presented in Figure 3.

Source: IDE Garment Firm Surveys

This evidence indicates that there exists a certain range of labor costs that allows garment firms to be competitive. To the extent that the degree of productivity enhancement is limited, particularly in the short run, there should be a maximum wage level within which firms stay competitive. One may notice that there are many garment-exporting countries whose wages are higher than those in Kenya (see Table 3). However, high-wage exporters export higher quality products than those exported by low-income exporters, and it is assumed that it is not possible for low-income exporters to instantaneously upgrade their products, because of their relatively low workers' skill level and infrastructure quality. The wage must be considered in

association with skill endowments and the business environment, which are roughly correlated with income level[17]. The Kenyan wage presumably hit the threshold that is applicable to low-income countries[18].

Our findings show that, although it does not completely determine competitiveness, labor cost is crucial in the success of the garment industry as a whole. Productivity growth is a key to breaking the links between labor cost and competitiveness, and hence, to break the positive association between the output price and the wage that is predicted by the Stolper–Samuelson theorem. The evidence demonstrates that realizing both growth in employment and upgrading job quality is possible.

4. Technological Change

The final discussion in this paper is about the direction of technological progress. Globally, the level of educational attainment is increasing. That implies that highly educated labor becomes relatively more abundant vis-à-vis other factors of production than before. There are both theoretical and empirical works which state that technological progress is likely to be directed (in other words, biased) for using abundant resources and saving scarce ones.[19] In fact, it is revealed that after the number of university graduates increased in the United States in the 1960s to 1980s, the wage skill premium that accrued to tertiary education (over lower education) initially declined. This was followed by a skills-biased technological progress that caused an increase in demand for educated workers and resulted in another increase in the skills premium (Katz and Murphy 1992, Hornstein et al. 2005). Since an improvement in the level of education is nearly universal, skills-biased technological progress may appear to take place irrespective of geographical region and industry. On the flip side of this skills-biased technological progress, unskilled-labor-saving technical change occurs under the name of automation.

As a matter of fact, upstream processes in the textiles value chain were drastically reorganized with unskilled-labor-saving technical changes that took place during the Industrial Revolution. Automated spinning machines and looms, which replaced manually operated ones, were symbols of the Revolution (Clark 2007: Chapter 12, Mokyr 1990: Chapter 5). By contrast, pre-Revolution technology is represented by Mahatma Gandhi's "charkha," a spinning wheel with which he wanted to mobilize income generation for the general public.

[17] The empirical literature on economic growth demonstrates a correlation between GDP per capita and human capital (Hall and Jones 1999), and institutions (Acemoglu et al. 2001).

[18] Among the countries for which data is available, Kenya is ranked second with respect to the ratio of average wage in the manufacturing sector to GDP per capita (Fukunishi and Yamagata 2013).

[19] This sort of technological progress is called "directed technological change" (Hicks 1932, Acemoglu 2002, and Acemoglu 2009: Chapter 15) or "induced innovation" (Hayami and Ruttan 1970).

The downstream process, i.e., sewing, however, was transformed from a skill-centric mode of production to the one that instead intensively employs machines and labor. Before the use of the sewing machine fully spread after World War II, this downstream process was solely undertaken by skilled tailors. The lock stitch, a key invention on the sewing machine, was invented in 1846 (Mokyr 1990: pp. 141-142). Since then, the production of machine-assembled garments has spread throughout the tailor-made apparels industry, globally. The former are manufactured by mass production, which requires less skill. Examining firm-level data collected in 2002 in Bangladesh, Fukunishi et al. (2006) showed that less than one year, on average, is necessary for a helper who is supposed to do only chores on the shop floor to become a sewing machine operator.

Evident skill bias does not appear to occur in contemporary technological progress that takes place through the use of the sewing machine either. The JUKI Corporation is one of the world's leading manufacturers of sewing machines. Looking into its major inventions, Yamagata and Asuyama (2011) found no strong tendency for skill bias among the company's inventions made during the 1950s to 1990s. Both time/worker savings and skill saving inventions were almost evenly produced.

The bottom line is that skill-biased technical change, which is widely seen outside the garment industry, has not been the norm in this industry. As a result, the industry is likely to continue to be a labor-intensive one, which, for the time being, provides ample employment opportunities for less educated people in developing countries..

5. Conclusion

The garment industry is noted for its exceptionally high labor-intensity among formal industrial sectors; particularly in its use of unskilled labor. This feature provides a foothold for industrial development in low-income countries that have little chance of penetrating markets in developed countries. This industry has provided a large number of formal jobs in low-income countries for undereducated and female workers, in particular, who have little opportunity for formal employment. Although the garment industry has been occasionally criticized for its low wages and poor working conditions, recent studies show that, when worker's characteristics are controlled, wages in this industry are clearly higher than those in the informal sector and are as high as wages in other formal sectors in many countries. Despite the trade liberalization in the apparel market that was adopted in 2005, real wages have significantly increased since then. Working conditions are also steadily improving because of the surge of consumers ethical concerns; however, they still need further upgrading, particularly under the present condition of intensified competition in export markets. Remarkably, wage increases and improved working

conditions coincided with employment growth in this industry.

This evidence indicates that increased labor costs do not immediately hinder a labor-intensive industry's growth. The most significant contrast between the "race to the bottom" argument and the factors that are actually taking place in the garment industry appears in the consequences of dynamism in the industry. That is, unlike technologically dormant firms depicted in the "race to the bottom" argument, garment-producing firms upgraded their production processes in response to market conditions. This allowed for employment growth and improved job quality. However, it is also noted that garment firms cannot sustain competitiveness if the wage is too high, as the Kenyan case illustrates. There appears to be a certain range of labor cost that allows garment firms to remain competitive.

With such favorable outcomes in the labor market, we have no reason to deny the positive and significant impact of the labor-intensive industry on industrial development in low-income countries. Given that technological changes have not been skills biased so far, the garment industry will continue to provide employment opportunities for unskilled and female workers in low-income countries.

Policy recommendations are as follows. To motivate firms toward productivity improvement, market competition should be maintained and minimum wages need to be updated in accordance with the inflation rate. Further interventions in working conditions at the shop floor level, such as in the "Better Factories Cambodia" program, would improve workers' welfare, although its effect on competitiveness needs investigation. Finally, the labor-intensive industry should not be sidelined from a development strategy for low-income countries. Compared with a strategy that stresses the role of industries that are more likely to reap dynamic comparative advantage, such as geographical agglomeration and learning-by-doing, the strategy emphasizing the roles of the labor-intensive industry provides greater employment opportunities.[20] Furthermore, as discussed throughout this paper, the latter strategy does not rule out the possibility of technological upgrading.

[20] The strategy that stresses the role of labor-intensive industries dates back to Myrdal (1968: part 5). Thereafter, Chenery et al. (1974), Amjad (1981), and the World Bank (1990) indicated its promise for the initiation of industrial development as well as lending a great contribution to poverty reduction.

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Appendix 1. Garment Firm Surveys

Garment firm surveys were conducted in 2003 and 2009 by the teams of Institute of Developing Economies and counterpart institutions in each country, namely University of Dhaka, Bangladesh Institute of Development Studies, LIDEE Khmer, the Economic Institute of Cambodia, Institute of Development Studies at University of Nairobi, Institute of Policy Analysis and Research, and Observatoire pour le Développement national des Ressources humaines du niveau de l'Enseignement Supérieur at University of Antananarivo. The survey in Madagascar was conducted only in 2009. The surveys collected information of FY2002 and FY2008.

In Bangladesh, samples was drawn from the list of industrial association member (Bangladesh Garment Manufacturers and Exporters Association: BGMEA) by the stratified sampling on the basis of firm size for the 2003 survey. In 2009 survey, the sample firms chosen in the first round were traced and new samples were added. In Cambodia and Kenya, exhaustive survey was conducted in 2003 on the basis of a member list of Garment Manufacturers Association in Cambodia (GMAC) and several incomplete firm lists in Kenya because of non-existence of a complete list of garment producing firms. Madagascar's survey was based on random sampling from an Export Processing Zone (EPZ) firm list and a non-EPZ firm list. Surveys in Kenya and Madagascar include non-exporting firms as well as exporting firms, while only exporting firms are analyzed in this paper.

The sample size of each data set is shown in Table A-1. Except Bangladesh in which number of firm size is quite large, coverage of the survey is relatively high. In Cambodia, our sample covers 85.4% of GMAC member firms in 2003 and 49.0% in 2008, and in Kenya our survey covers 48.6% of all EPZ firms in 2003 and 47.4% in 2009. In Madagascar, our sample represents 64.9% of all firms registered as EPZ. However, adequacy of information was challenged in the Cambodian 2009 survey and in the two Kenyan surveys. Many firms did not disclose input and output data or answered data lacked consistency. This problem substantially reduced number of the sample (figures in parenthesis in Table A-1), and we excluded the Kenyan 2009 survey from this study. It is noted that despite the missing sample, the averages of input and output of our sample are comparable with the averages drawn from industry-level data. Refer to Asuyama et al. (2013) for Cambodian survey, and details of the Bangladesh, Madagascar, and Kenyan surveys will be provided upon request.

Table A-1 Number of Sample

		2002	2008
Bangladesh	exporting	222 (172)	230 (218)
Cambodia	exporting	163 (117)	123 (61)
Kenya	exporting	17 (5)	9 (1)
	non-exporting	59 (42)	74 (34)
Madagascar	exporting	-	98 (91)
	non-exporting	-	19 (18)

Note: Figures in parenthesis are number of samples with consistent input and output data. Because of missing information, number of samples used in productivity analysis is smaller in some countries.

Appendix 2. Decomposition of Unit Cost

We begin with defining unit costs as cost per value-added. We assume three inputs to yield value-added, namely capital (*K*), skilled labor (L^s) and unskilled labor. Unskilled labor is composed of human capital (h^u) and effective unit of unskilled labor (L^u) to reflect substantial difference in human capital across countries and time. Therefore, production function is

$Y = f(K, L^s, h^u L^u, A, TFP)$,

where *A* stands for productivity of technology that is common across firms and *TFP* indicates individual productivity dispersion from *A*.

Then, cost function is

$C = g(r, w^s, w^u, Y, TFP)$,

where *r* is rental price of capital, w^s is wage of skilled labor, and w^u is wage per effective unit of unskilled labor. Dividing cost by value-added, unit cost function is expressed in

$D \equiv {}^{C}/_{Y} = l(r, w^s, w^u, Y, TFP)$.

With functional form and parameters, unit cost can be decomposed to augments in the above function. We estimate parameters of a cost function through transforming those of a production function rather than directly estimating a cost function. This is primarily because we do not have reliable information of rental price at firm level. While rental price can be estimated using capital service costs that include interest, dividend and rent, they are occasionally underreported. The most evident example is payment to a firm owner who invested personal asset in own firm, which is not occasionally reported in an account book. Also firm-level interest rate is very hard to know practically. To avoid serious bias in parameter estimates caused by measurement error in rental price, we estimate a production function and derive cost function parameters using duality of two functions. Shortcomings of this methodology is to impose Cobb-Douglas form for both functions, otherwise, cost function parameters are not specified. We believe that Cobb-Douglas assumption causes much smaller bias than measurement error in rental price. Estimated model is

$$Y_i = \alpha\, K_i^{\beta 1} L_i^{s\,\beta 2} \left(h_i^u L_i^u\right)^{\beta 3} \lambda_i$$
$$h_i^u = e^{\pi_1 Tenure + \pi_2 Education} \quad , \qquad (1)$$

where *Y* is value-added, *K* is physical capita, L^s is skilled labor, L^u is unskilled labor, h^u is quality of unskilled labor, λ is total factor productivity, *Tenure* and *Education* indicate average tenure and years of education of unskilled workers, and *i* denotes a firm. Annual operational hours are controlled. Estimation is based on log form of (1) and TFP measure is defined as $TFP_i \equiv \log(\lambda_i)$.

With first order conditions of cost minimization, conditional input demand functions

with respect to capital, skilled labor and unskilled labor are derived. Multiplying three input demand functions by prices respectively, cost function can be derived as

$$\hat{C}_i = r_i K_i + w_i^s L_i^s + w_i^u (h_i^u L_i^u) = A\, r_i^{\frac{\beta 1}{\beta}} w_i^{s\frac{\beta 2}{\beta}} \left(\frac{\overline{w}_i^u}{h_i^u}\right)^{\frac{\beta 3}{\beta}} \hat{Y}_i^{\frac{1}{\beta}} TFP_i^{\frac{-1}{\beta}} \overline{AE_i},$$

where $\beta = \beta_1 + \beta_2 + \beta_3$, $\overline{w}_i^u$ is wage per physical unit of unskilled labor without controlling human capital. It is noted that we incorporate optimization error in input choice (allocative efficiency), that is the gap between actual combination of inputs and that minimizing costs, denoted as $\overline{AE}$.[21] Dividing this cost function by value added, we get unit cost function,

$$D_i = A\, r_i^{\frac{\beta 1}{\beta}} w_i^{s\frac{\beta 2}{\beta}} \left(\frac{\overline{w}_i^u}{h_i^u}\right)^{\frac{\beta 3}{\beta}} \hat{Y}_i^{\frac{1-\beta}{\beta}} TFP_i^{\frac{-1}{\beta}} \overline{AE_i}. \qquad (2)$$

Based on this function, unit cost is decomposed to factor prices (r w^s, and $\overline{w^u}$), human capital (h^u), economies of scale (Y), productivity (TFP), and allocative efficiency ($\overline{AE}$).

A straightforward comparison of unit cost and determinants across firms can be conducted by taking ratios as

$$\frac{D_i}{D_j} = \left(\frac{r_i}{r_j}\right)^{\frac{\beta 1}{\beta}} \left(\frac{w_i^s}{w_j^s}\right)^{\frac{\beta 2}{\beta}} \left(\frac{\overline{w}_i^u}{\overline{w}_j^u}\right)^{\frac{\beta 3}{\beta}} \left(\frac{h_i^u}{h_j^u}\right)^{-\frac{\beta 3}{\beta}} \left(\frac{Y_i}{Y_j}\right)^{\frac{1-\beta}{\beta}} \left(\frac{TFP_i}{TFP_j}\right)^{\frac{-1}{\beta}} \frac{\overline{AE}_i}{\overline{AE}_j}. \qquad (3)$$

And a comparison across is expressed as

$$\frac{D_{i,t+1}}{D_{i,t}} = \left(\frac{r_{i,t+1}}{r_{i,t}}\right)^{\frac{\beta 1}{\beta}} \left(\frac{w_{i,t+1}^s}{w_{i,t}^s}\right)^{\frac{\beta 2}{\beta}} \left(\frac{\overline{w}_{i,t+1}^u}{\overline{w}_{i,t}^u}\right)^{\frac{\beta 3}{\beta}} \left(\frac{h_{i,t+1}^u}{h_{j,t}^u}\right)^{-\frac{\beta 3}{\beta}} \left(\frac{\overline{\overline{Y}}_{i,t+1}}{\overline{\overline{Y}}_{i,t}}\right)^{\frac{1-\beta}{\beta}} \left(\frac{TFP_{i,t+1}}{TFP_{i,t}}\right)^{\frac{-1}{\beta}} \frac{\overline{AE}_{i,t+1}}{\overline{AE}_{i,t}} \frac{p_t}{p_{t+1}}, \qquad (4)$$

where $\overline{\overline{Y}}_t = \frac{\hat{Y}}{P_t}$ (value-added in real term) and p is price of output, and t denotes time. Because comparisons across time incorporate changes in factor prices and output price, the effect of output price changes is separated from the effect of returns to scale.

We first estimated production function (1) by OLS and obtained parameters (β, π) and TFP, and then, obtained allocation efficiency from the three first order conditions with respect to capital, skilled labor and unskilled labor, and derived the cost of allocation efficiency ($\overline{AE}$). As mentioned, we do not have reliable firm-level rental prices. Then, using the arbitrage condition in rate of return on investment, we estimated national-level rental price at time t (hence, rental price is constant within a country during the same period). Refer to Fukunshi (2009) for details.

With this information and nominal wages, human capital variables, real value-added,

[21] Refer to Fukunishi (2009) for details of derivation of cost function, and the exact form of $\overline{AE}$.

and output price indicators, we obtain each term on the right hand side of equation (2) for individual firms. For cross-country comparison shown in Figure 4, a country average of each term on the RHS of (2) is taken for three countries respectively, which are expressed in the form of the equation (3). For a comparison between 2002 and 2008 depicted in Figure 5, average of individual terms on the RHS of (2) is drawn for 2002 and 2008 respectively. The two averages are compared in the form of equation (4). Results of estimation and comparison across country are shown in Table A-2 and those across time are in Table A-3.

Table A-2 Decomposition of Unit Cost (cross-country comparison)

	High-skilled wage	Low-skilled wage	Human capital (low-skilled)	Capital price	Scale effect	Productivity	Input allocation	Unit cost
	a	b	c	d	e	f	g	h
Average of 2008								
Bangladesh	14.502	26.215	0.953	0.762	1.334	1.543	1.101	0.577
Cambodia	13.437	32.725	0.873	0.698	1.367	1.134	1.353	0.534
Madagascar	14.997	29.328	0.818	0.768	1.326	1.299	1.297	0.527
Ratio to the Bangladeshi average								
Cambodia	0.93	1.25	0.92	0.92	1.02	0.73	1.23	0.92
Madagascar	1.03	1.12	0.86	1.01	0.99	0.84	1.18	0.91

Note: As shown in the equation (2) and (3), the equality of a*b*c*d*e*f*g=h holds for individual firms. However, it does not hold for the figures in this table that represent the average.

Table A-3 Decomposition of Unit Cost (across time comparison)

	Wage: Skilled	Wage: Unskilled	HC: Unskilled	Capital price	Scale	TFP	Allocative efficiency	Output price	Unit cost
	a	b	c	d	e	f	g	h	i
Bangladesh									
Average of 2002	6.801	39.380	0.923	0.856	0.820	1.484	0.849	0.942	0.345
Average of 2008	7.627	58.388	0.866	0.819	0.818	1.349	1.035	1.000	0.577
Ratio 2008/2002	1.12	1.48	0.94	0.96	1.00	0.91	1.22	1.06	1.67
Cambodia									
Average of 2002	7.347	67.349	0.747	0.819	0.817	2.369	1.074	0.942	0.872
Average of 2008	7.199	76.737	0.794	0.767	0.803	0.916	1.151	1.000	0.534
Ratio 2008/2002	0.98	1.14	1.06	0.94	0.98	0.39	1.07	1.06	0.61

Note: As shown in the equation (2) and (3), the equality of a*b*c*d*e*f*g*h=i holds for individual firms. However, it does not hold for the above figures because of rounding errors.