International Competition and Industrial Upgrading Strategies in the Global Apparel Industry

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Abstract:

This paper serves as an exploratory study of the global apparel manufacturing industry during the time of the phaseout of the Multifiber Arrangement system of quotas. Underlying the analysis is the goal of identifying a causal relationship between increased international competition and country-level investment in product, process, and supply-chain upgrading. To examine this association, I focus on trade data in the years shortly before and after the MFA quotas were phased out- after which countries could export free from many of the limitations in place before. The resulting surplus of clothing and textile production worldwide provides an ideal environment to study the effects of increased competition on the apparel industries in different countries. Previous literature has linked competition to upgrading; however, this paper takes a novel approach by measuring competition in relation to the shifting trade dynamics at the time of the MFA phaseout. Also, this paper departs from previous studies by examining imports of new capital equipment as one of its measure of upgrading. Country-level data on imports of clothing and textile manufacturing machinery shows that countries invested more in process upgrading after increases in competition from 2001-2007; however, neither measure of product nor supply chain upgrading had as significant of a relationship to changing levels of competition.

I. Introduction

National economic growth requires a commitment to improving productive capacity. Acting as the world's specialist in low-value, low-skill production is not a fruitful strategy in the long-term. Thus, the goal of all developing economies should be to ascend the global value chain through the pursuit of higher value production- a process which is broadly defined as "industrial upgrading", or just "upgrading" (Bair & Gereffi, 2004). There are specific policies and situations that encourage firms to make such improvements, and it is important to understand the market forces underlying these decisions. With a framework revolving around competition and economic development, this paper contributes to the research on this critical topic of industrial upgrading.

A large body of economic literature proports the benefits of export-oriented development. One such benefit is that when firms produce manufactures intended for export, they are not only forced to be competitive domestically but are required to become competitive within larger foreign markets. Thus, heightened international competition could facilitate major gains in productivity for industrializing economies.

The apparel manufacturing industry is ideal for studying the relationship between international competition and industrial upgrading because of its dual status as a highly globalized and competitive enterprise. For years, the set of quotas under the Multifiber Arrangement (MFA) had dispersed clothing production across many developing countries (Goto, 1989). When these limitations were removed in 2005, the global supply of apparel increased dramatically, and many nations' industries suffered due to the increase in competition. In the end, China cemented its position as the largest exporter of clothing in the world.

Fortunately, with such expansive value chains, clothing manufacturers have various opportunities to make upgrades to their production and possibly alleviate the profit reducing effects of competition. In fact, after the MFA quotas had been phased out, the industries in some supplying countries were able to survive by making strategic adjustments. During this time, upgrading supplier capabilities became a salient method for manufacturers to differentiate themselves and capture larger portions of the value chain. This paper highlights 3 upgrading strategies that were of critical importance following the MFA phaseout: product, process, and supply chain upgrading (Lopez-Acevedo & Robertson, 2012).

With empirical analysis, I attempt to quantify the effects of increased competition on country-level engagement in different supplier upgrading strategies. Additionally, I aim to determine which type was most prevalent in response to the boost in competition. 3 measures are used for the respective upgrading strategies of interest and are implemented as separate dependent variables. Initial results indicate that competition induced more investment in process upgrading. This outcome is found in several country-fixed-effects regressions looking at a window of time from 2001-2007. In these regressions, the independent variable of competition is lagged to avoid issues of endogeneity.

The rest of the paper is organized as follows: Section II reviews the relevant economic literature. Section III provides a historical overview of the global T&C industry following the MFA phaseout and case studies on a few notable supplying countries. Section IV describes the data used and method of empirical analysis. Section V evaluates the results, and Section VI concludes.

II. Literature Review

Previous economic literature has linked international competition to different forms of quality upgrading, and many of these studies focus on clothing manufacturing to discover this result. Generally, findings indicate that competition induces upgrading efforts in certain firms. Many businesses however are not afforded the opportunity to be so forward thinking. In other words, investing in these types of improvements is a feasible strategy for some firms but not others. Those who can recognize greater rents from upgrading often choose to do so after competitive pressure is applied. Whereas those who cannot must focus on short term revenues.

Investment in industrial upgrading can be challenging to measure directly; as such, previous studies employ a variety of approaches and data sources. Amiti & Khandelwal (2013) use changes in product quality as a proxy for levels of innovation. They examine both unit values and market shares of exports to determine quality levels across several countries' clothing industries. Controlling for country-year fixed effects, the study identifies a nonmonotonic relationship between competition and product upgrading. Firms producing clothing goods with lower tariff rates, and thus facing higher import competition, experience more rapid rates of upgrading. However, this result was only true for clothing manufacturers that were already producing near the "quality frontier" (highest quality available on the market). These firms had higher "post-innovation rents", making product upgrading the optimal strategy to escape competition. For those who were far from the quality frontier, and thus needed more investment to catch up, lower tariffs did not have the same effect.

Studying the prices of exports is an extremely simplified measure for quality. Any sort of unit value analysis is most indicative of product upgrading, as in the Amitit et al. study. The current paper attempts to expand this line of research and observe multiple forms of industrial upgrading. Furthermore, by using tariff data as the independent variable to study competition, Amiti et al. measure changing levels of import competition. My analysis however focuses on competition in global export markets.

Because of China's status as the world's largest clothing supplier around the time of the MFA phaseout, it makes sense to measure competition in relation to Chinese export growth. According to a study by Medina (2017), China's ascension to the WTO brought about a similar increase in competition for apparel manufactures in Peru. Evidently, larger Peruvian producers became incentivized to reallocate the factors of production and find a niche in high quality goods. Quality levels were determined by the usage of fine domestic textile inputs. These findings indicate that firms responded to competition with both product and supply chain upgrading. To measure competition, the paper focuses on individual firms to see if they were making the same products that China was selling to Peru. In my research, I use a very similar calculation; however, I examine export competition at the country-level.

My research aims to find the relationship identified in the Medina (2017) study across multiple nations that were in competition with China. From looking at a few case study countries, it appears government support of the clothing industry was common (Dey & Kasseeah, 2016; Tilakaratne & Murayama, 2006). Thus, it makes sense to examine the aggregate response to the MFA for all firms in a country. Furthermore, this paper focuses on three different types of upgrading: Product, Process, and Supply Chain upgrading. In the proceeding section, I describe in detail each upgrading strategy and demonstrate the theoretical foundation to suggest

their relationship with international competition. While these three are obviously highly interrelated, I attempt to categorize each type of upgrading with data and determine which response was most pronounced internationally following the MFA phaseout.

A. Product upgrading:

Product upgrading describes quality increases and higher unit prices for manufactured goods (Lopez-Acevedo et al., 2012). Intuitively, instances of increased direct competition reduce a firm's current market share to some degree. As firms recognize threats to their revenues, they may choose to adjust their product lines so as not to compete with a more dominant producer. Competition in low quality segments of the market often makes it optimal for firms to focus instead on higher quality alternatives (Johnson & Myatt, 2003). Applying this result to the global apparel industry, exporting firms should be able to adjust to competition by increasing product qualities or specializing in high-end products. Indeed, after the MFA phaseout, many supplying countries began to specialize in sales of a few select product categories (Sulaiman, 2020).

B. Process upgrading:

Process upgrading is the introduction of new machinery, technologies, or methods of production (Lopez-Acevedo et al., 2012). Implementing these innovations can generate more income and technological learning in the long run which are preconditions for success in many models of endogenous growth. While it is true that general clothing manufacturing doesn't require a huge range of increasingly complex machinery (the same machines can be used to make goods of varying quality), process upgrading can reduce lead times, improve efficiency, and allow firms to produce a diverse basket of quality goods. In addition to low costs, buyers from developed markets are attracted by suppliers with these qualities who can offer a wide range, or "full-package", of services (Lopez-Acevedo et al., 2012; Moazzem & Sehrin, 2016). Process upgrading helps firms stand out amidst low-cost international competition by allowing them to offer an expanded range of services.

C. Supply Chain upgrading:

In the apparel industry, value is added in many stages and intermediate goods are often sourced from abroad. Thus, there are opportunities for vertical integration of the supply chain among domestic industries. Supply chain upgrading describes the process of establishing backward linkages to input industries (Lopez-Acevedo et al., 2012). In the case of clothing manufacturing, textiles are the fundamental input. Firms in countries that develop domestic textile producing capabilities can become less reliant on international sources, handle more complex or specialized orders, and improve speed to delivery. Similar to process upgrading, textile production is a step towards full-package provision. Thus, supply-chain upgrading is a strategy that allows exporting firms to become more competitive internationally. Furthermore, increased capacity for manufacturing domestic textiles is indicative of technological progress. Previous developments have made textile production more complex and capital intensive compared to apparel manufacturing (Goto, 1989). Therefore, by establishing textile capabilities, countries can make huge leaps in the amount of value they add along the supply chain.

III. Historical Background & Case Studies

Apparel manufacturing has many positive consequences in the early stages of economic development. It has been cited as a "gateway into manufacturing" for newly industrializing nations (Lopez-Acevedo et al., 2012; Goto, 1989). Indeed, the barrier to entry for this type of production is comparatively low because it requires cheaper less-skilled labor: a common advantage for developing countries (Goto, 1989). With relatively simple inputs and easy-to-assemble outputs, clothing can quickly become a profitable industry that offers many employment opportunities. Subsequently, firms can grow and continue to move up the value chain since apparel manufacturing activities are highly fragmented. Developing countries also tend to sell most of their clothing manufactures abroad (Goto, 1989). This kind of participation in the global economy via export growth allows firms to access larger foreign markets and benefit from knowledge spillover (Dong-Sung & Moon, 1998). For these reasons, apparel manufacturing has been a highly globalized and competitive industry in recent decades.

The Multifiber Arrangement was an internationally negotiated series of bilateral quotas that was established in 1974 and managed under the General Agreement on Tariffs and Trade (GATT). It was meant to protect the textile & clothing (T&C) industries in developed nations from low cost suppliers in developing nations due to their potential to cause "market disruption" (Goto, 1989; Lopez-Acevedo et al., 2012). These quotas had the unintended consequence of distorting clothing manufacturing around the world. By placing restrictions on larger supplying countries, the MFA indirectly lowered the barrier to entry for other developing economies, encouraging smaller entrants to find a place in the global T&C industry. However, if any of these countries happened to rise the ranks and become larger suppliers, they found their growth stifled by the same quota limitations that they were helped by (Goto, 1989).

In 1995, the MFA was transitioned to the Agreement on Textiles and Clothing, and many of the quotas were given a 10-year expiration date (Lopez-Acevedo et al., 2012). Starting on January 1st, 2005, clothing manufactures faced significantly fewer institutional barriers to export their goods to the markets of developed nations. China specifically began exporting huge volumes of cheap products to the rest of the world. Worldwide, the share of T&C imports coming from China jumped from 28% in 2004 to 33% in 2005 (Table 1a). During the years following the MFA phaseout, there was a global surplus of clothing manufactures, and firms became price takers in a new buyer driven value chain (Lopez-Acevedo et al., 2012). Buyers from the richer western markets sought larger more capable suppliers to purchase from at scale, which China had in abundance. Consequently, nearly every other country involved in apparel manufacturing faced a significant spike in competition.

Table 1a:

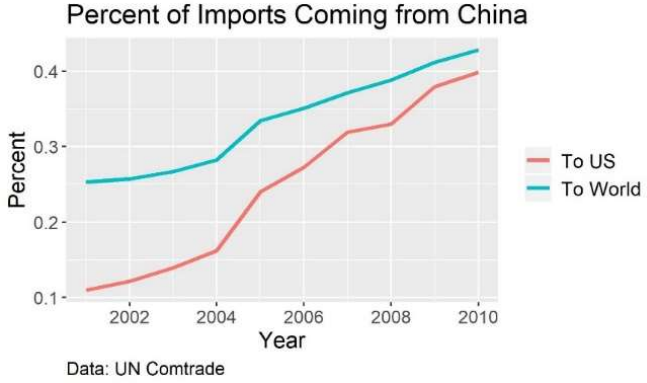


Table 1b:

Country Share of Global Clothing Exports	2002	2004	2006	2008	2010
China	25.7%	28.2%	35.1%	38.8%	42.8%
Bangladesh	2.5%	3.2%	3.6%	3.9%	5.0%
Turkey	4.4%	4.9%	4.5%	4.6%	4.5%
Italy	5.6%	5.4%	4.9%	5.3%	4.3%
India	2.8%	2.9%	3.7%	3.6%	4.0%
Germany	2.6%	2.8%	2.7%	2.8%	2.8%
France	2.3%	2.4%	2.3%	2.4%	2.0%
USA	1.9%	1.2%	1.1%	0.9%	0.8%

Note: Bangladesh's share of global exports dipped to 3.0% in 2005, after the MFA phaseout.

While many non-Chinese suppliers were affected adversely by the phaseout, certain countries anticipated the influx in competition and made strategic adjustments to keep their apparel industries profitable. As shown by my analysis, T&C manufacturers in those economies succeeded by investing in multiple upgrading strategies. Facilities in Bangladesh, Mauritius, and Sri Lanka, where apparel was a significant industry (Table 2), made a variety of efforts to revolutionize their production. Generally, industrial upgrading became a differentiator for firms operating in this highly competitive business environment (Lopez-Acevedo et al., 2012).

Table 2:

Share of Clothing Exports Relative to Total Exports (USD values)	2002	2004	2006	2008	2010
Bangladesh	74.89%	75.37%	70.55%	77.06%	77.19%
Mauritius	54.02%	46.76%	32.82%	34.89%	30.54%
Sri Lanka	47.15%	48.44%	43.11%	40.18%	39.89%

Source: UN Comtrade

There are numerous studies using survey data that describe the upgrading responses of specific countries in reaction to the MFA phaseout. Not every supplying nation reacted in the same way, but there were a few common trends. With my analysis, I attempt to categorize and quantify these responses to allow for cross-country comparison. Notably, the industries in the countries that were successful typically received some form of government support to make the required changes.

A. Bangladesh

Bangladesh is an example of a country that made critical adjustments to keep its clothing manufacturers in business despite the influx of competition from China around the time of the MFA phaseout. Experts anticipated failure due to a lack of perceived competitiveness; however, with a comprehensive upgrading strategy, Bangladesh defied expectations to become the world's 2nd largest clothing supplier (Moazzem & Sehrin, 2016).

Bangladesh made significant investments in supply chain upgrading by turning attention to the production of domestic textiles, mainly cotton. Textile and Clothing trade data shows this

trend (Table 5). From 2001 to 2007 the USD values of textile inputs relative to clothing exports decreased steadily. Subsequently, Bangladeshi firms began exporting more value-added items using higher quality fabrics (Moazzem et al., 2016). Firms also began using newer and better machines. Such improvements in capital equipment were matched with better labor productivity in the form of skill-level increases. Firms also expanded the presence of industrial engineering departments to organize production and use inputs more efficiently (Moazzem et al., 2016). As textile capabilities developed and production processes improved, Bangladeshi firms were able to produce a wider range of goods, reduce lead times, and upgrade product qualities. Many made the transition to "full-package" provision (Moazzem & Sehrin, 2016).

The apparel industry in Bangladesh was supported by several public sector initiatives. A few key market access arrangements with EU countries created a consistent and large market for their goods, which further allowed firms the luxury of investing for long term growth rather than short term survival (Moazzem & Sehrin, 2016). The government also made improvements in physical and institutional infrastructure which made buying from Bangladesh significantly easier.

B. Sri Lanka

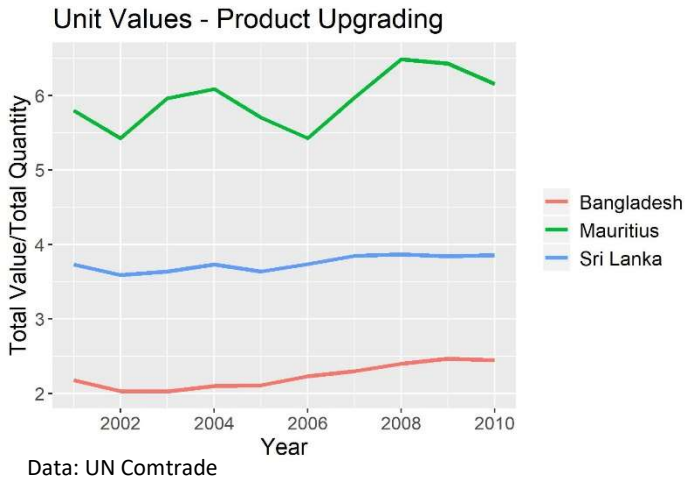
The situation in Sri Lanka is another prime example of competitive forces shaping upgrading efforts in non-Chinese supplying countries. Firms recognized the threat from China and found ways to remain competitive and ensure stable profits. UN trade data shows trends similar to Bangladesh (Tables 3-5). Sri Lanka's apparel industry has been characterized by various forms of government support; this included the formation of a 5-year public plan to deal with the MFA phaseout (Sulaiman, 2020). In pursuit of export growth, the government attempted to attract foreign direct investment and gave incentives to exporting companies. For many years, the average firm in Sri Lanka was contracted out for basic cut-make-trim manufacturing. Although, certain companies were ahead of the curve, developing joint ventures with foreign brands (Sulaiman, 2020).

After the MFA phaseout, many firms were forced to close; however, overall productive capacity increased. To protect the apparel industry, the solution that the government came up with was to move from contract manufacturing to having firms operate as full-package providers. Fabric mills opened to support vertical integration and lead time reduction. Eventually, the average quality of goods also improved. As with Bangladesh, trade agreements played critical role. Firms struck deals with a few large western brands, and the country began to specialize in women's intimate wear and sportswear products (Sulaiman, 2020).

C. Mauritius

Trade data from Mauritius does not indicate as high a degree of upgrading as in Bangladesh or Sri Lanka (Tables 3-5). However, survey results from a 2016 study on responses to the MFA phaseout indicate that some Mauritian firms made adjustments with Chinese competition in mind (Dey Ancharaz & Kasseeah, 2016). In the previously mentioned article, they find no common industry-wide response to the competition; rather, a series of firm-specific changes. These included investments in technology, improved marketing strategies, adjusted product lines, and increased domestic raw material sourcing. It seems that financial support from the government of Mauritius was what kept many manufacturers in business, but it was not enough for most firms to invest in dramatic long-term upgrading.

Table 3a:



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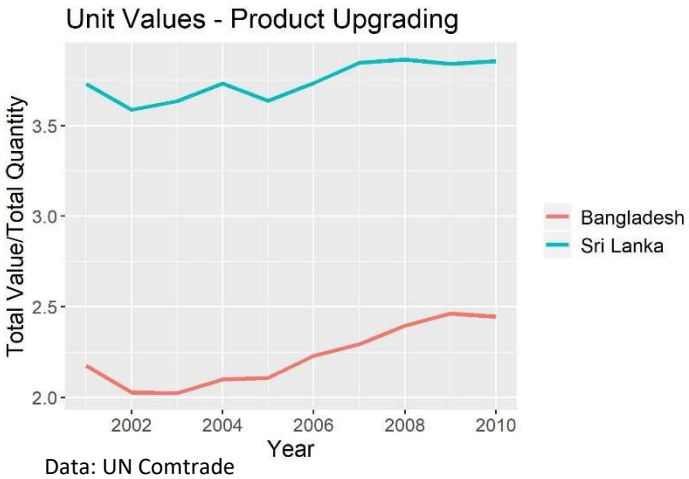


Table 4a:

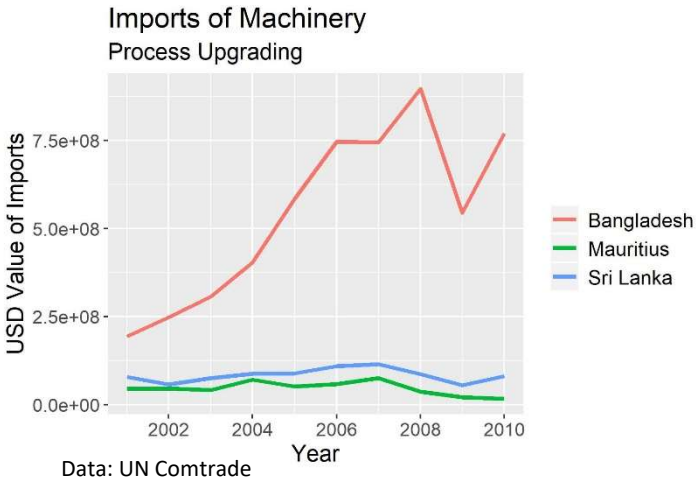


Table 4b:

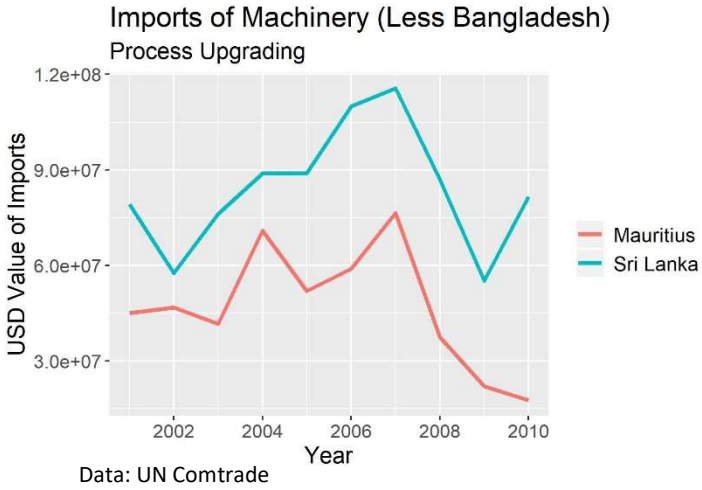
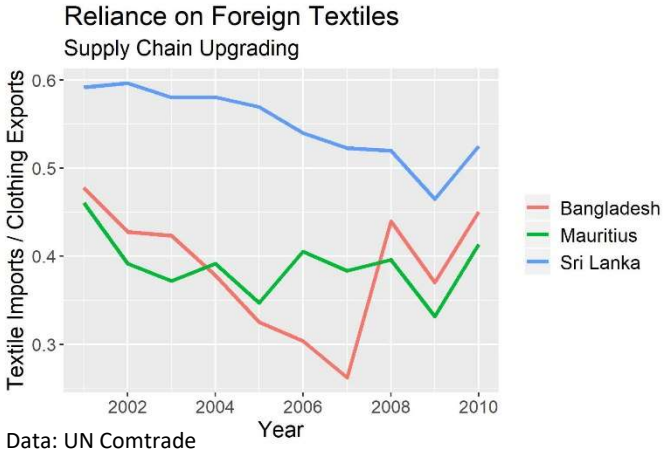


Table 5:



	Backward Linkages to Textiles	Investment in New Technologies/ Production Processes	Improved Product Quality & Specialization in Specific Categories
Bangladesh	Major improvements in textile capacity.	Investments in technologies and machinery has improved labor productivity; matched with improved worker skills.	More diverse basket of goods. Changes in product composition indicate improved productive capacity.
Mauritius		Slight uptake in innovation/ original brand-name manufacturing. Some firms transitioned from labor intensive production to capital intensive.	A subset of firms focused on higher quality/ fancier goods and more value addition.
Sri Lanka	Began forming backward linkages.	Made investments in R&D and better technologies for organizing production processes.	Made partnerships with select western brands. Began to specialize in women's intimate wear/ athletic wear.

Dey Ancharaz, V., & Kasseeah, H. (2016). Surviving Chinese Competition in a Post-Multi-Fibre Arrangement World: Experience of Clothing Exporters from Mauritius. Global Journal of Emerging Market Economies, 8(1), 35-59.

Tilakaratne, W. M., & Murayama, M. (2006). Phasing out of MFA and the emerging trends in the ready made garment industry in Sri Lanka. Employment in Readymade Garment Industry in Post-MFA Era: The Case of India, Bangladesh and Sri Lanka, Chiba: Institute of Developing Economies, 1-30.

Sulaiman, Z. (2020, January 7). Phone Interview.

IV. Empirical Strategy

A. Data

All the figures and empirical work in this article rely heavily on trade data from the UN Comtrade database which has highly disaggregated trade data for 237 countries from 1962 to 2018. The data contains USD value of trade flows segmented by year, country of origin, destination, and HS (Harmonized Schedule) code. Further, there are codes for unique types of clothing products, textile products, and different categories of T&C manufacturing machinery. Codes go up to 10 digits in length; however, I only use 4-digit codes for calculations involving clothing or machinery and 2-digit codes for textiles. This level of specificity in the data is extremely helpful for creating the different measures in my country-level analysis.

The focus of my research is on developing countries that were heavily involved in clothing manufacturing around the time of the MFA phaseout. To create the sample of countries, I use Cline, W. R.'s 2010 study, which pools together a group of notable developing countries that have large manufacturing sectors. From there, I remove Angola and Nigeria, since those countries are not large clothing exporters according to the data, and add Vietnam and Cambodia since they are commonly cited as major suppliers. Unfortunately, in the UN trade data, Taiwan is counted as a part of China. Previous literature commonly notes that Taiwan is a major supplier of both clothing and textiles. This error may skew the measure of competition, and my regression analysis misses the experience of Taiwan.

For the control variables, I use the Penn World Table database which has information on annual real GDP and population (both in millions) for different countries.

B. Measures of upgrading

To measure product upgrading, unit values of a country's clothing exports are used. I simply divide total USD value of clothing exports, $V_{i,t}$, by the listed quantity, $Q_{i,t}$, to calculate the average unit value for country i at time t, $U_{i,t}$. In this measure only, I turn to the Office of Textiles and Apparel (OTEXA) database which has detailed information on the aggregate value and quantity of products exported to the US (The UN database only lists the USD value of trade flows). Because the data is restricted to clothing imported by the US, I must operate under the assumption from the Amitit et al. (2013) study that a country sells its highest quality goods to the US market.

$$U_{i,t} = \frac{V_{i,t}}{Q_{i,t}}$$

To measure for levels of process upgrading I take the total USD value of T&C manufacturing machinery imported by country i in year t, $M_{i,t}$. It is possible for countries to make their own machinery; however, developing economies typically import these sorts of capital equipment.

Finally, to measure supply chain upgrading $S_{i,t}$, I use the ratio of textile imports, $T_{i,t}$, to clothing exports, $C_{i,t}$. A lower score indicates less dependence on foreign textiles or more value addition generally.

$$S_{i,t} = \frac{T_{i,t}}{C_{i,t}}$$

Tables 3, 4, and 5 are created using each measure of upgrading respectively.

C. Measure of Competition

In theory, all nations that exported clothing and textiles around the time of the MFA phaseout felt the effects of heavy competition; however, some may have felt it more than others. For this reason, I implement a simple measure of competition depending on an individual country's export profile to evaluate the effect of variations or changes in competition. Using data for each country on the USD value of exports for individual product categories, the measure accounts for China's market share in a certain category and a country's focus on exporting in that category.

The measure of competition is as follows:

$$100 * \sum_{n=1}^{34} \frac{x_{n,i,t}}{X_{i,t}} * \frac{c_{n,t}}{W_{n,t}} = Competition_{i,t}$$

$i =$ Country ; $n =$ HS code (34 total)
$t =$ Year
$x_{n,i,t} =$ Value of exports of product code n by country i in year t
$X_{i,t} =$ Total value of clothing exports by country i in year t
$c_{n,yt} =$ Value of exports of product code n by China in year t
$W_{n,t} =$ Value of exports of product code n for all countries in year t

For example, suppose we have the following results with simple product categories in year t:

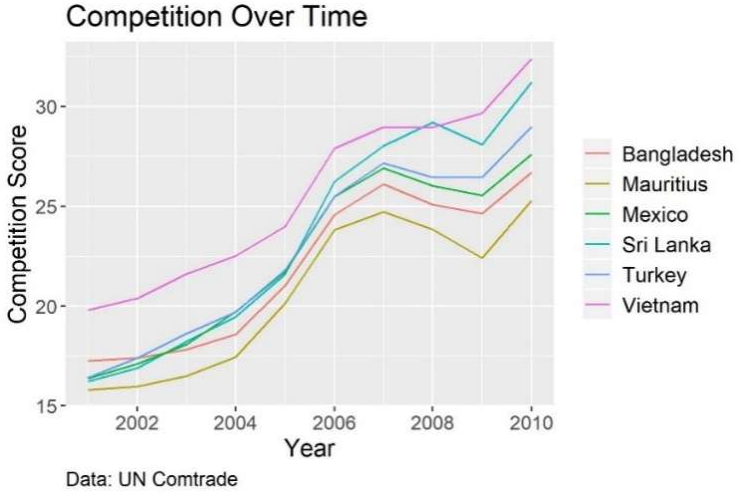
	Shirts	Pants	Socks
China's global market share	20%	30%	10%
Country A export percentages	50%	50%	0%
Country B export percentages	15%	15%	70%

Country A competition in year t = [.5(.2) + .5(.3)]100 = 25
Country B competition in year t =[.15(.2) + .15(.3) + .7(.1)]100 = 14.5
Country A has a higher score, so using this measure, they dealt with more competition.

In effect, this measure captures competition solely with China. However, I argue that this is an effective measure because China's rapid export growth to become the largest international clothing supplier posed a threat to suppliers of all types of apparel.

Table 6 displays this "competition score" over time for a few select countries:

Table 6:



D. Regression Models

I address my hypothesis in two different ways by utilizing two separate types of regressions. The first is a cross-country analysis to see if countries that faced differing levels of competition at a certain cross section of time experienced different magnitudes of upgrading. Second is a within-country analysis to determine whether a change in competition within a given country resulted in a change in upgrading investment for that country.

For my cross-country analysis I use a simple OLS regression model:

$$\Delta Y_i = \beta_0 + \beta_1 Competition_{i,t} + \beta_2 Indsize_{i,t} + \beta_3 ln(rGDP_{i,t}) + \beta_4 Population_{i,t} + u_{i,t}$$

$Competition_{i,t}$ is the measure of competition for country i in year t. $Indsize_{i,t}$ represents the importance of clothing industry exports relative to a country's total exports. It is calculated by taking a simple ratio (Table 2). Controls for real GDP and population are also included, and $u_{i,t}$ is an error term. The dependent variable ΔY_i represents the change in the current measure of upgrading from year t to year t+1. I rotate out the 3 measures of upgrading in multiple regressions.

According to the literature, we should expect that for countries that faced higher competition in the years after the MFA phaseout, upgrading occurred at a higher rate relative to those countries that faced less competition. Thus, I hypothesize that the β_1 term will be significantly positive for the measures of product and process upgrading, but negative for supply-chain upgrading.

Next, I use a country fixed effects regression to measure the impact of a change in competition on the different measures of upgrading:

$$ln(Y)_{i,t} = \beta_0 + \beta_1\, ln(\, Competition_{i,t-1}) + \beta_2 indsize_{\mathrm{i,t}} + a_i \; + u_{i,t}$$

Again, for $Y_{i,t}$, I use the 3 measures of upgrading. $ln(\, Competition_{i,t-1})$ represents the log measure of competition for country i lagged by one year. As with the OLS model, I include controls for industry size, and add controls for real GDP and population in subsequent fixed-effects regressions.

Controlling for country-fixed effects may prove to be the more relevant regression model because it deals with country-specific changes in competition. The apparel industries in the sample countries likely face vastly different institutional circumstances. Compared to the first OLS model, a fixed effects regression coefficient tells a slightly different story, but it is still useful for my research question.

V. Results

Results from the OLS regressions are varied and mostly insignificant. The model could benefit from more controls from various data sources. However, only using the trade data and controls for GDP and population, it appears that product upgrading occurred most often for countries dealing with more Chinese competition. I run OLS regressions for 3 years: 2004, 2005, and 2006. The competition score for each year is used as the independent variable in the

respective test. Thus, the 2005 and 2006 results should be the most telling because they represent the competitive situation after the MFA was phased out.

Table 7:	2004	2005	2006
	dmachineim	dmachineim	dmachineim
Competition	.0365	-.0102	-.0270 **
	(.0262)	(.0099)	(.0074)
indsize	-.1490	.3889 **	-.0930
	(.3148)	(.1861)	(.1959)
ln(rgdp)	-.1079 **	.0903 *	-.0007
	(.0441)	(.0461)	(.0310)
population	.0013 ***	0	-.0003 **
	(.0001)	(.0001)	(.0001)
Constant	.6780	-.8429	.8718
	(.6536)	(.6481)	(.3472)
Observations	46	46	46
R-Squared	.2550	.2169	.2283

Interestingly, the only largely significant coefficient found for competition was for the 2006 regression of the change in machinery imports from 2006-2007 on the level of competition, and the results were in the opposite direction as hypothesized.

Table 8:	2004	2005	2006
	dunitvalue	dunitvalue	dunitvalue
Competition	-.0165	.0375 *	.0160
	(.0432)	(.0200)	(.0690)
indsize	-.4982	.1240	-.5550
	(.3786)	(.1769)	(.7629)
ln(rgdp)	-.1268	.0290	.0796
	(.0809)	(.0279)	(.0506)
population	.0003	0	-.0007 *
	(.0003)	(.0001)	(.0003)
Constant	2.022	-1.1708	-.9958
	(.8563)	(.5734)	(1.7030)
Observations	46	46	46
R-Squared	.1206	.2412	.0290

When using change in unit values as the dependent variable, the regression on competition in 2005 produced weakly significant results in the hypothesized direction.

Table 9:

	2004	2005	2006
	dtextratio	dtextratio	dtextratio
Competition	-.0330	-.0181	-.0104
	(.0231)	(.0192)	(.0193)
indsize	-.3210	-.0959	-.3100
	(.2817)	(.3109)	(.2592)
ln(rgdp)	-.0048	.0711	-.0192
	(.0551)	(.0716)	(.0445)
population	-.0001	-.0004 *	.0001
	(.0002)	(.0002)	(.0002)
Constant	.8338	-.3461	.6247
	(.8307)	(1.0938)	(.5995)
Observations	46	46	46
R-Squared	.0902	.0476	.0523

Finally, using the one-year change in textile ratio as the dependent variable produced no significant results. The R-squared values for these regressions were notably low, indicating that a better measure should be implemented for future analysis.

Results for the country-fixed effects regressions were more pronounced and consistent:

Table 10:

	(1)	(2)	(3)
	ln(machineim)	ln(machineim)	ln(machineim)
ln(competition)_t-1	.9882 ***	.7769 ***	.8164 ***
	(.2573)	(.2632)	(.2682)
indsize	1.4441	1.6788	1.6149
	(1.9391)	(1.9492)	(1.9161)
rgdp		8.06e-07 ***	7.64e-08
		(1.82e-07)	(9.39e-07)
population			.0163
			(.0176)
Constant	15.1199	15.4262	14.4859
	(.8867)	(.8844)	(1.3687)
Observations	269	269	269
Number of groups	46	46	46
R-Squared	0.1941	0.2374	0.2458

Evidently, process upgrading was the dominant strategy for escaping Chinese competition. Table 10 shows that a one percent change in lagged competition score was associated with a near one percent change in the value of imported machinery. These results were significant, even when controlling for other variables.

Table 11:

	(4)	(5)	(6)
	ln(machineim)	ln(machineim)	ln(machineim)
ln(competition)_t-1	.5336	.2407	.3900
	(.3299)	(.3464)	(.3898)
indsize	1.045	1.1295	1.1645
	(2.3466)	(2.3536)	(2.2984)
rgdp		8.19e-07 ***	-4.48e-07
		(2.03e-07)	7.51e-07
population			.0267 *
			(.0137)
Constant	16.9137	17.3858	15.2647
	(1.2293)	(1.2291)	1.9511
Observations	190	190	190
Number of groups	33	33	33
R-Squared	0.0640	0.1390	0.1701

In subsequent regressions, I restrict the sample to include countries exporting more than 100,000,000 USD of clothing. For safety, I also eliminated imports of washing machines from my calculation of process upgrading. In both cases, results were affected (Table 11).

Table 12:

	(7)	(8)	(9)	(10)	(11)	(12)
	Unit Value	Unit Value	Unit Value	Textile Ratio	Textile Ratio	Textile Ratio
ln(competition)_t-1	1.1134	1.3509	1.3618	-43.6887	-46.8799	-49.2632
	(.8454)	(.8988)	(.8738)	(29.0953)	(29.9496)	(30.5816)
indsize	-13.1728	-13.4402	-13.4578	-83.1475	-79.5557	-75.6952
	(10.2428)	(10.4587)	(10.5365)	(58.91084)	(57.6716)	(58.4994)
rgdp		-9.07e-07	-1.11e-06		0	.0001
		(7.45e-07)	(2.49e-06)		(0)	(0)
population			.0045			-.9814
			(.0436)			(2.1193)
Constant	2.4482	2.1012	1.844	175.696	180.3578	236.7881
	(2.6564)	(2.6435)	2.5536	(91.7681)	(92.6764)	(157.0307)
Observations	269	269	269	269	269	269
Number of groups	46	46	46	46	46	46
R-Squared	0.0376	0.0391	0.0392	0.0150	0.0154	0.0166

Regarding product and supply chain upgrading, results from the initial fixed-effects regressions were in the hypothesized direction but were insignificant (Table 12). Also, R-Squared values were extremely low leading me to believe that the sample countries that did not have as big of a clothing industry may have caused a lot of variance, especially for the measure of supply chain upgrading: the "Textile Ratio". As illustrated in Table 5, for larger supplying nations, this textile ratio stayed within 0 and 1.

Table 13:

	(13)	(14)	(15)	(16)	(17)	(18)
	Unit Value	Unit Value	Unit Value	Textile Ratio	Textile Ratio	Textile Ratio
ln(competition)_t-1	2.0633 ***	2.5088 ***	2.5328 **	1.2718	1.0700	.5987
	(.6903)	(.8862)	(.9983)	(.9017)	(.9296)	(.9098)
indsize	-11.8028	-11.9321	-11.9264	.0104	.0690	-.0416
	(10.2216)	(10.3111)	(10.3105)	(2.8311)	(2.7811)	(2.7361)
rgdp		-1.25e-06	-1.45e-06		0	0
		(7.94e-07)	(2.24e-06)		(0)	(0)
population			.0043			-.0844
			(.0342)			(.0522)
Constant	.2839	-.4341	-.7740	-2.5500	-2.2244	4.4683
	(2.2679)	(2.3622)	3.8193	(2.9783)	(2.9688)	(4.5321)
Observations	190	190	190	190	190	190
Number of groups	33	33	33	33	33	33
R-Squared	0.2	0.2119	0.2119	0.0841	0.0915	0.1560

After restricting the sample as in regressions 4-6, results became significant when using unit values as the dependent variable (Table 13). However, results were still insignificant using the textile ratio.

VI. Conclusion

Competition in international markets need not be a bad thing for developing economies involved in export manufacturing. It all depends on the severity of the competition and the adaptability of exporting firms. As described in this study, competition following the MFA phaseout actually induced industrial upgrading in certain countries producing apparel. Evidently, firms can survive international competition and thrive by differentiating themselves from other low-cost suppliers. Making these improvements in productivity could have positive consequences for long-term development.

According to my analysis, process upgrading was the most pronounced worldwide response to competition for non-Chinese supplying countries. While significant results were found, this study could be improved in several ways. Mainly, the measurements of upgrading could absolutely use adjusting. Process upgrading is more complex than just importing machinery. If one could obtain data on the technological level of the imported machinery, that would help clarify results. Measuring capital per worker would also be of use in this context. Regarding product upgrading, simple unit values capture a lot of other economic conditions rather than product quality. A more concrete measure of export quality would be helpful. Finally, supply chain upgrading could use a more nuanced measure to evaluate investment in the textile industry. Future research could also describe outcomes for countries who invested in upgrading.

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Data:

UN comtrade : United Nations.

https://comtrade.un.org/data/

OFFICE OF TEXTILES AND APPAREL (OTEXA)

https://otexa.trade.gov/msrpoint.htm

Penn World Table:

https://www.rug.nl/ggdc/productivity/pwt/

Appendix:

Sample Countries:

Argentina	Czechia
Bolivia (Plurinational State of)	Hungary
Brazil	Poland
Chile	Slovakia
Colombia	Turkey
Costa Rica	Algeria
Ecuador	Egypt
Mexico	Israel
Peru	Jordan
Venezuela	Morocco
Bangladesh	Syria
Cambodia	Tunisia
~~China~~	Cameroon
~~China, Hong Kong SAR~~	CÃ´te d'Ivoire
India	Ethiopia
Indonesia	Ghana
Rep. of Korea	Kenya
Malaysia	Madagascar
Pakistan	Mauritius
Philippines	Senegal
Singapore	South Africa
Sri Lanka	United Rep. of Tanzania
Thailand	Togo
Viet Nam	Zimbabwe

HS Codes for T&C Manufacturing Machinery:

8444: Machines for extruding, drawing, texturing or cutting man-made textile materials.

8445: Machines for preparing textile fibres; spinning, doubling or twisting machines and other machinery for producing textile yarns; textile reeling or winding (including weft-winding) machines and machines for preparing textile yarns for use on the machines of heading no. 8446 and 8447.

8446: Weaving machines (looms).

8447: Knitting machines, stitch-bonding machines and machines for making gimped yarn, tulle, lace, embroidery, trimmings, braid or net and machines for tufting.

8448: Auxiliary machinery for use with machines of heading 8444, 8445, 8446 or 8447 (for example, dobbies, Jacquards, automatic stop motions and shuttle changing mechanisms); parts and accessories suitable for use solely or principally with the machines of this heading or of heading 8444, 8445, 8446 or 8447 (for example, spindles and spindle flyers, card clothing, combs, extruding nipples, shuttles, healds and heald-frames, hosiery needles).

8449: Machinery for the manufacture or finishing of felt or nonwovens in the piece or in shapes, including machinery for making felt hats; blocks for making hats; parts thereof.

8450*: Household- or laundry-type washing machines, including machines which both wash and dry; parts thereof. **Removed in regressions 4-6 &**

8451: Machinery (other than machines of heading 8450) for washing, cleaning, wringing, drying, ironing, pressing (including fusing presses), bleaching, dyeing, dressing, finishing, coating or impregnating textile yarns, fabrics or made up textile articles and machines for applying the paste to the base fabric or other support used in the manufacture of floor coverings such as linoleum; machines for reeling, unreeling, folding, cutting or pinking textile fabrics; parts thereof

8452: Sewing machines, other than book-sewing machines of heading 8440; furniture, bases and covers specially designed for sewing machines; sewing machine needles; parts thereof.