Working Papers in Trade and Development

Learning by exporting: the role of competition

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January 2020
Working Paper No. 2020/02

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Abstract

This paper finds that increased competition in export markets could reinforce firms' learning-by-exporting processes. We investigate competition as a learning channel by employing 25 years' worth of Indonesian garment firms' data. Firms in this labour-intensive industry experienced a long period of a quota regulation under the Multi-Fibre Arrangement (MFA), which governed much of the global trade in garments before its abolition in 2005. This allows us to conduct a quasi-natural experiment type of study on how the MFA affected apparel exporters' performance. Using propensity score matching and difference-in-difference methods, we find that the impact of exporting on total factor productivity during the MFA implementation period is mixed; but after it was abolished, productivity increased by more than 12 percent. This implies that exporters gain a significant learning-by-exporting benefit from competition (that is, without a special facility such as the MFA), and that interventions that protect exporters from such competition might lessen the benefit.

JEL Classification: D22, D24, F13, F14

Keywords: learning-by-exporting, total factor productivity, MFA, developing countries

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1. Introduction

The learning-by-exporting (LBE) hypothesis argues that exposure to export market enables firms to improve their efficiency levels above those of similar firms that do not export. Interactions with buyers and competitors abroad provide channels through which exporters can absorb foreign knowledge and hence increase their performance relative to firms that serve domestic market only. While earlier studies showed mixed evidence of LBE, a number of new case studies in developing countries have provided more evidence in favour of this hypothesis (Bigsten & Gebreeyesus 2009; De Loecker 2007; Du et al. 2012; Van Biesebroeck 2005). Unfortunately, they stop short of exploring the channels through which LBE operates.

Identifying the LBE channel is necessary to examine or to propose policies that aim to improve productivity. If LBE does exist, does it mean that exporting can be seen as a strategy to improve productivity? If exporting can indeed improve firms' performance, should we endorse export promotion policies? Du et al. (2012) suggest that the learning effects from exporting could motivate the government to design export promotion policies that encourage domestic firms to exploit the benefits from exporting. This might explain why Girma, Greenaway and Kneller (2004) claim that almost all governments in the world have a 'mercantilist instinct' to do export promotion activities because they see export as the key to productivity growth.

This paper seeks to engage in these debates by testing the argument of the importance of policy intervention on firms' learning ability as well as by examining the channels through which exporters can increase their productivity.[2] As for the intervention of interest, we treat the implementation of the Multi-Fibre Arrangement (MFA) and its subsequent abolition as

[1] We thank Hal Hill, Prema-chandra Athukorala, seminar participants at Australian National University, University of Adelaide, Universitas Indonesia, EAEA and AASLE Conference for comments and suggestions.

[2] We use the general term 'intervention' to refer to any policy that could directly facilitate export access, but not economy-wide measures such as the exchange rate policy.

a quasi-natural experiment for analysing the LBE hypothesis. The MFA is well-known as a global and massive intervention that governed the world trade of textile and garments since 1974. It greatly affected the competition in the world market. It helped firms from various developing countries, especially in the early implementation of the policy, to access the markets in advanced countries such as the USA and the Europe; even though, in the later period, it limited further expansion for country exporters whose quota were already reached (Hill 1992; Brambilla, Khandelwal & Schott 2010). During the MFA implementation, many developing countries entered the determined specific-quota markets with little competition. However, in 2005 the MFA restrictions were abolished and the battle for unhindered access to the world clothing market was back. The competition has since been intensified; cheap products from all over the world can access markets in the previously-constrained countries without limitation. This large, measured and statistically exogenous change in trade policy provides a natural experiment context that we can use to test the learning effects of exporting.

This paper aims to test an important hypothesis, that is, a policy regime can influence LBE effects. A policy intervention may create a situation that opens up or closes down channels of learning. As mentioned in Blalock and Gertler (2004), buyers might implicitly or explicitly assist exporters in order to obtain good quality products and precise specifications. Meanwhile, intense competition could drive a faster productivity improvement through a more efficient allocation of resources (De Loecker et al. 2016). The intervention and/or trade reforms could intensify or reduce the degree of competition as well as the level of interaction with buyers. In this paper, we focus on the competition effect. Learning through competition has been mentioned in various studies but has not been confirmed in formal empirical analyses. Thus, our hypothesis in the context of the MFA is: exporting under a quota regime leads to smaller learning effects compared to what happens after the quota has been removed since there should be a significant difference in the degree of competition under the two regimes.

Indonesia provides an appropriate setting for our study. The MFA had contributed to the growth of the apparel industry in Indonesia due to the exclusive market access that resulted from the quota facility (Hill 1992).[3] This sector has become a key export-oriented

[3] We use garment, apparel and clothing interchangeably.

industry as well as one of the most important employment generators by absorbing over 12 percent of the manufacturing labour force. After the MFA abolition, Indonesia's export performance has not been growing as strongly as Bangladesh, China or Vietnam, but it has not experienced an export contraction like that of Mexico. Apart from its mediocre export performance after the post-MFA era, Indonesia's productivity performance due to LBE gives a different story. The removal of the quota intervention provides a better opportunity for exporters to improve their productivity.

Comparing the LBE effects of firms in Indonesia's apparel industry in the MFA period (before 2005) and in the period after its effective abolition (after 2005), this study employs 25 years of longitudinal firm-level data from surveys of medium and large establishments from 1990 to 2014.

We apply several empirical strategies. First, we identify the learning effects by comparing exporters with non-exporters that have similar characteristics. Using the propensity score matching (PSM) technique, we match exporters with their non-exporter counterparts, based on foreign ownership, size, capital intensity, import share, firm age, productivity, location, as well as industry characteristics and time effects. This procedure would also be beneficial to control for the self-selection to export phenomenon (Bigsten & Gebreeyesus 2009; Roberts & Tybout 1997).

Second, we conduct a difference-in-difference (DID) approach to examine LBE effects before- and after the MFA abolition. We use total factor productivity (TFP) as the outcome indicator – but only after we apply several strategies to overcome endogeneity problems in the TFP estimation (De Loecker 2007; Van Biesebroeck 2005; Olley & Pakes 1996). As shown by De Loecker (2011), a trade liberalisation could have a downward pressure on prices due to increased competition. The drop in the average prices after the MFA removal would bias the TFP estimation if we simply use the revenues data since the dollar values of export sales might have declined but physical volumes remain or even increase. To reduce this problem, we deflate the output using deflators that reflect the firms' market demands. We use a combination of deflators that reflect domestic prices as well as world prices.

Third, we filter out external factors that might have affected firms' productivity during the 25-year observation period. These include a series of trade reforms in the early

period, Asian Financial Crisis (AFC) in 1998, the commodity boom in the 2000s, China expansion, and changes in labour-related regulations. To guard against biases from these possible confounding factors, we compare the learning benefits of garment exporters in the two observed periods (before and after MFA abolition) with those of footwear exporters. We choose footwear industry as it has very similar characteristics with garment industry and has faced all confounding episodes as garments, but footwear was not subject to the MFA regulations. We provide an analysis to support the claim that these two industries are sufficiently similar.

Finally, considering that it took ten years of preparation and adjustment following the Uruguay Round in 1995 (when the plan for MFA abolition was first announced), we run complementary analysis using only the periods before 1995 and the periods after 2005.

A series of robust results explains that removing the intervention that otherwise protects exporters from competition has improved the learning premium of exporters in the garment sector by 12.5 to 28.1 percent. Furthermore, the LBE effects from competition are higher for larger firms and foreign-owned firms. A series of placebo tests confirms that behavioural change of garment exporters is due to the abolition of the MFA. The finding suggests that exporters learn better in a more competitive situation whereas interventions intended to help them might instead reduce the productivity improvement benefit. These results, therefore, run counter to the support of export promotion interventions.

These findings may have significant implications not only in a single country's policy but also in the multilateral trading system. Even though the MFA preference has been abolished, other types of export preference interventions for developing countries to access developed countries' markets are still allowed by the WTO. Some studies have shown that exports from least-developed countries (LDCs) increase thanks to these programs (see Collier & Venables 2007; Gnangnon & Priyadarshi 2017; Ito & Aoyagi 2018); but none has investigated their impacts on firm's productivity. Therefore, our study offers a framework in this direction.

To the best of our knowledge, this is the first study that tries to examine the LBE effects under a policy intervention. In addition, it sheds light on the channel of learning, something that has not been investigated in the previous literature. The results from this study highlight the significance of competition as a LBE factor.

2. The implementation of the Multi-Fibre Arrangement

The world trade in textiles and garments had been highly regulated for more than three decades before the MFA was effectively abolished on 1 January 2005. Since the 1950s, the USA imposed Voluntary Export Restraint (VER) for Japanese textiles and the United Kingdom (UK) imposed quotas on products from Hong Kong, India and Pakistan because they had been concerned that import competition had serious adverse effects on their domestic industries. When the production and exports of textiles and apparels from Asian countries continued to grow, developed countries set up a more systematic control mechanism that led to the signing of the MFA under the General Agreement on Tariffs and Trade (GATT) in 1974 (Brambilla, Khandelwal & Schott 2010; Krishna & Tan 1998).

The MFA quotas was first introduced on exports from the three newly industrialising economies (NIEs)—Hong Kong, South Korea and Taiwan—which experienced spectacular export growth on textiles and garments (Hill & Suphachalasai 1992). When the tightened MFA quotas on the NIEs resulted in the spread of garment production to other low-wage countries, such as Bangladesh, India, Indonesia, Sri Lanka and Pakistan, these countries also came under the MFA regime. The MFA, therefore, evolved from a protection tool for developed countries into one facility that allowed small developing countries to access their markets (Brambilla, Khandelwal & Schott 2010). Thus, by the mid-1990s, almost all garment exports from developing countries were subject to MFA quotas. For example, during the period from 1984 to 2004, the USA signed bilateral MFA agreements with 71 countries using 149 three-digit MFA specific-limit groups that had on average 17 harmonised system (HS) products each. These specific country-products-volumes-timeframes quotas were adjusted by importing countries through bilateral negotiations periodically depending on the rate of export growth and the perceived threat to their domestic industries (Krishna & Tan 1998; Hamilton 1984).[4]

[4] The concept of MFA is unique and quite different from other quota concepts. Similar to quota barriers, it is a measure by which the importing country imposes an upper limit on foreign supply. However, it is distinct in that it is targeted to a very specific commodity category at a certain period, is defined in volume rather than in value terms, and is discriminatory by the country of origin (Hamilton 1984) For example, the USA specified four MFA groups of textile and clothing: yarn, fabric, made-ups, and clothing. Each of these groups can be classified into very detailed products, such as women's and girls' trousers, breeches and shorts (cotton); or robes, dressing gowns, etc. (cotton). Every year, each

In 1995, the phase-out process of the MFA began when the trade talks agreed to replace the MFA with the Agreement on Textiles and Clothing (ATC), which arranged the gradual elimination of the quota schemes.[5] The ATC organised a series of phasing out stages at the beginning of 1995, 1998, 2002 and 2005, at which time all the remaining quotas were eliminated (Harrigan & Barrows 2009). However, during the quota removal stages, many importing countries retained the bulk of the quota restrictions to the end of the transition period.

As the 2005 New Year started, quota restrictions were gone. On one hand, exporters had the opportunity to expand its exports without quota limitations. On the other hand, this liberalisation automatically increased the level of competition. This exogenous shock was large, but it was not unanticipated as the exporters had been given 10 years to adjust. Some countries, such as China and Bangladesh, has intensified their apparel export significantly after the quota regime ended. That said, many other developing countries' exports, such as Mexico, have been shrinking. Prices and qualities of products that enter the USA have decreased, especially for those that were constrained before (Harrigan & Barrows 2009).

Indonesia was one of the new exporting countries that obtained benefits to access developed markets through MFA. It could enter the very specific country-products-volumes-timeframes market with almost no competition pressure from other rival countries. Export had increased, and Indonesia became one of the noticeable players in apparel exports with a global export share of around 2 percent. The majority of apparel exports, about 60–80 percent, went to the USA and European countries, most of which were under quota arrangements. Compared to other industries, firms in the garment industry had special treatment and an opportunity to boost their exports. Many firms had been able to access markets in developed countries. Propensity to export and the export intensities were higher

exporting country and the USA negotiated quotas of a mixture of product groups that were valued by kilogram, dozen, or squared metre. Conversion factors for every unit were established into a single term of SME of fabric to define the quota volumes (Brambilla, Khandelwal & Schott 2010).

[5] To keep acronym profusion in check, we will continue to use the MFA term even though the name was changed to the ATC.

compared to those in other sectors. Because of this opportunity, export growth was high in the beginning until it reached its quota limit (see Table 1).

Table 1. Annual growth rates of apparel exports (SITC 84) from Asian developing countries (percentage)

Countries	1980–84	1985–89	1990–94	1995–99	2000–04	2005–09	2010–14
Indonesia	38.20	32.32	24.97	5.86	3.65	5.92	3.72
India	8.82	23.02	11.48	7.07	6.35	11.91	8.83
Bangladesh	--	49.59	27.26	22.56	10.24	14.73	14.02
China	--	31.35	24.27	5.35	15.79	12.57	11.92
Vietnam	--	--	--	--	22.15	15.53	18.86
Cambodia	--	--	--	--	19.60	5.21	17.45

Source. Calculated from UNCOMTRADE, data is unavailable for some years.

The Ministry of Trade made rules to distribute quotas among firms. But the quota allocation system was uncertain, and the regulations were changed over time (Krishna & Tan 1998). There were some requirements to be a registered exporter and every year the government announced which firms got quota allocations for specific products. The government divided exporters into four categories: exporters with past performance or experience; new exporters; economically weak groups and cooperatives; and export-only producers. Each of them had different volume allocations that could change every year. Firms that obtained this privilege could export garments without any restriction or competition pressure except for volume limitations.

There were cases in which firms which got allocated quotas shared (or sold) their quotas to other firms since they were not able to fulfil the quota targets by themselves (Krishna & Tan 1998). The opportunities to access export market in the developed countries through the quota facilities, therefore, spread to many garment firms. In this regard, benefits from MFA quotas were most likely to be received by most garment exporters. Unfortunately, a more detail information on which firms received the allocated quotas, as well as information on shared quotas, was not recorded. This include information on a possibility of political favouritism in allocating quotas as experienced by China (Khandelwal, Schott & Wei 2013)

The revocation of the MFA significantly affected Indonesian firms in several ways. Even though the total apparel export has increased, some firms died or stopped exporting,

while others grew. The number of exporters has declined, and those that survived were able to learn, adjust and compete in the new arena. One of the reasons of the declining performance was that firms now faced the more challenging task of increasing sales as the constraints became binding; they needed to penetrate the non-MFA markets or to upgrade their quality.

Note that MFA was not the only policy that might have affected exports of Indonesian garments. First, the increased support from the government since the mid-1980s—with the introduction of a series of trade reforms to reduce the 'anti-export bias'—as well as the ability to properly respond to change in the real exchange rate (Thee 2009), positively impacted Indonesian firms. The reforms included reduction in the protection of manufacturing sectors, quicker custom procedures, more efficient and flexible financial services, easier licensing requirements, and fewer restriction on foreign investments. Around the same time, the recession after oil boom provided incentives for manufacturing producers to export (Hill 1992). The deregulation package in 1986, which introduced a duty exemption and drawback scheme that enabled exporters to purchase their input at international prices, also benefited export-orientated firms. The import tariffs of garments in Indonesia have gradually been decreased over the year. In 1990s, the MFN tariffs were relatively high with an average of 33.7 percent, while in 2000s the tariffs have been reduced into 14.2 percent on average (see Figure A.1 in the Appendix). Similarly, the tariffs of intermediate inputs of garments have been declined. As shown by Amiti and Konings (2007), the decline of import tariffs, both for final goods and for intermediate inputs, due to trade liberalization could affect productivity.

Second, the Asian Financial Crisis (AFC) in 1997–99 also massively affected the performance of almost all industries, due to the deep economic contraction. A massive capital outflow, a sharp rupiah depreciation and deep financial distress contributed to the contraction of almost 14 percent (Aswicahyono, Hill & Narjoko 2010). A political crisis worsened the condition. As a result, macroeconomic stability collapsed and investment from domestic and foreign sources declined significantly. The manufacturing sector was slowing down. It only started to recover after 2000, but since then the manufacturing performance has been lower compared to before the crisis.

Third, the recent commodity boom in 2000s. Prices of commodities significantly increased during the first decade of the new millennium—a phenomenon that might affect the performance of manufacturing industries due to Dutch disease effects. The real exchange rate is likely to appreciate during the boom and lower the incentives of expansion in non-commodity tradable sectors, including manufacturing.

Fourth, as James, Ray and Minor (2003) argue, China's accession to the World Trade Organization (WTO) has a big impact on Indonesian garment exports. China has a significant competitive advantage in various sectors since it has a highly mobile and relatively cheap labour force as well as economies of scale in their domestic market. The massive expansion of China's exports does not only affect Indonesia but also all countries in the world. China clearly increases the degree of competition in the global market including garments, and it has an impact on Indonesian exporters.

Finally, the 2003 Labour Law might have affected labour-intensive industries, including garment manufacturing (AIPEG 2016). The law increased protection for labour which increased the costs of permanent employees. Some companies responded to this regulation by hiring more workers on short fixed-term contracts that reduced the incentives to invest in training and skills' upgrading.

In our study, we consider all these external factors. However, these shocks were experienced by all firms in every industry, not only in garments. A more similar situation would have been faced by firms in labour intensive sectors since they have more similar characteristics. Later, we use this condition in our identification strategy.

3. Learning by exporting

LBE addresses a concept in which a firm improves its productivity once it enters foreign markets and gets exposed to knowledge and experience from abroad. Empirically, this mechanism has been identified mainly in developing countries, but is not as clear in the case of advanced countries.[6] One possible explanation is that firms in developing countries are

[6] See some studies for developing countries (i.e. Alvarez & Lopez (2005) for Chile; Blalock & Gertler (2004) for Indonesia; Du et al. (2012) for China; Fernandes & Isgut (2015) for Columbia; Van Biesebroeck (2005) for African countries) find positive learning effects from exporting. The results from developed countries are mixed. Bernard and Jensen (1999) for the USA, Delgado, Farinas and Ruano (2002) for Spain, Greenaway, Gullstrand and Kneller (2005) for Sweden find no effects from exporting, while Baldwin and Gu (2003) for Canada,

more likely to face a significantly larger and more competitive market once they export, which challenges them to upgrade their products, invest in better production processes and technical standards, improve their quality control, management techniques as well as their workers' capabilities (Athukorala & Rajapatirana 2000; De Loecker 2013). These challenges result in productivity improvement. However, firms from more advanced countries are more likely to enter a market that is as (or less) challenging as their domestic market, so that the productivity impact is also minimal (Fernandes & Isgut 2015).

There are two channels of LBE. Firms learn from their interaction with clients or they learn from competition. The first channel refers to implicit and explicit assistance from foreign buyers since they have incentives to share knowledge in order to obtain good quality products and precise specifications. The latter refers to a fiercer competition situation that forces firms to improve their performance.

The hypothesis of LBE cannot be separated by the idea of self-selection into exporting. The self-selection mechanism argues that the distinction between exporting firms and non-exporting firms are already present before they start exporting, but only the more productive firms are able to overcome the cost of entering export markets (Bernard & Jensen 1999, 2004). Starting to export is expensive since firms need to pay sunk costs (Roberts & Tybout 1997). Evidence from many countries has been consistent with the self-selection hypothesis.[7] Theoretically, Melitz (2003) has shown that attitudes towards sunk costs determine firms' decisions to export: only the most efficient firms can break into foreign markets and make stable profits from exporting, whereas the less-productive firms serve only domestic markets and the least productive firms exit the market altogether.[8]

Girma, Greenaway and Kneller (2004) for the UK and De Loecker (2007) for Slovenia suggest the presence of LBE.

[7] See studies from Bernard and Jensen (1999), Clerides, Lach and Tybout (1998), and Aw, Chung and Roberts (2000).

[8] As discussed in Greenaway and Kneller (2007), foreign investors with knowledge of international markets might not have to deal with these start-up costs. In this regard, the FDI regime becomes important, in that allowing for foreign ownership can help reduce the sunk costs problem.

Both the LBE and self-selection hypotheses show the two-way relationship between exporting and productivity; therefore, we cannot ignore either one when analysing how exporters are different from non-exporters.[9] This unique relationship is a challenge for researchers in analysing the causality between exporting and productivity as well as in interpreting the results of empirical estimation. As for our identification strategy, we control for the self-selection effect so that we can focus on the LBE effect.

3.1. Identification strategy: Learning by exporting under a quota intervention

We consider two periods that differ according to whether or not a policy intervention is implemented. These periods are denoted: $MFAabol$, which is equal to zero if the MFA intervention is in effect and one if it has been abolished.

$$prod_{it} = \beta_0 + \beta_1 export_{it-1} + \beta_2 MFAabol + \beta_3 (export_{it-1} \times MFAabol) + \delta Z_{it-1} + \varepsilon_{it} \quad (1).$$

Equation 1 suggests that the productivity of firm i in time t depends on last year's exporting status as well as the implementation (and elimination) of the MFA. The term $prod_{it}$ is the firm level TFP that is estimated using procedures in the Appendix. The term $export_{it-1}$ represents the LBE effects for all period and the interaction term indicates the learning effect when the MFA has been abolished. This β_3 is our coefficient of interest. If it is significant, it shows that the removal of MFA has affected the performance of exporting firms. The term Z_{it-1} represents a series of observable firm-level characteristics in the last year (foreign ownership, import share, size) We also include a textile dummy since some garment firms also produce textiles.[10] The error term ε_{it} can be divided into some unobservable firm characteristics that may affect the firm's performance—time effects and

[9] Exporting firms are systematically different from non-exporting firms in various ways. The former is larger, more productive and more skill- and capital- incentive. They use more varied input mix and pay higher wages than the latter (Bernard et al. 2012). Many studies from various countries have provided evidence. A simple and well-known model by Bernard and Jensen (1999) has been replicated in many articles and case studies.

[10] We include the textile dummy because this kind of firm might have a systematically different performance from that of firms that produce only garments. The former might also control inputs (textile products) to produce better clothing in terms of quality, cheaper price and so on.

a pure random error. The time fixed effect could absorb any confounding factor with yearly variation that might bias the results. This includes the effects of import tariffs as well as real exchange rates.

We apply several combinations of estimations to compare the results, given the potential error bias. In Equation 1, we observe only firms in the garment sector—the focus of this study—so our analysis is arguably free from any industrial effect that might bias the estimation.

The quota regime was abolished starting in early 2005, so we denote 2005 and years after as $MFAabol$ equal to one and the period before 2004 equal to zero. However, since the plan to eliminate the MFA was announced during in 1994 and the phase out process started at the beginning of 1995, we also do estimations that use the period before 1995 ($MFAabol$ =0) and the period after 2005 ($MFAabol$ =1). This is because it is possible that firms had undergone adjustments before the complete elimination of the MFA. The information from Table 2 shows that the fill rate of quota products from Indonesia to the USA decreased gradually after 2000, implying that exporters might have adjusted their constrained–unconstrained product mix combination some years before the MFA really ended.

Table 2. Average quota fill rate of textiles and apparel export to the USA, in percentage

Countries	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Indonesia	83.1	80.8	94.8	96.0	87.7	89.0	83.3	75.0	69.4	62.3
India	89.1	98.6	99.6	99.9	97.8	90.9	79.7	76.7	75.6	68.6
China	80.2	76.8	81.7	80.3	80.3	81.6	78.8	81.8	84.5	
Bangladesh	99.9	99.8	98.5	99.1	99.5	100.0	98.4	90.8	93.3	75.7
Vietnam									99.7	70.4
Cambodia			97.4		79.9	72.3	72.2	66.3	55.3	58.5

Source. Office of Textiles and Apparel (OTEXA)

3.2. Filtering out other possible non-MFA confounding factors

Equation 1 might still have some problems due to the possible effects from other interventions. As noted, a series of trade reforms in the 1980s had benefited exporting firms

and might still have an impact on firms' performance in the 1990s. Furthermore, if we directly compare firm performance before 1994 and after 2005, there might be some other potential biases because the situations in both periods are very different. The AFC in 1998, followed by reformation and decentralisation could induce structural changes and influence a firm's performance. The commodity boom in the 2000s might also have affected manufacturing performance—both productivity as well as the decision to export. Also, we cannot ignore that China's expansion in the global market has influenced firms all over the world, including Indonesia. The fiercer competition could affect a firm's performance and exports. Finally, the 2003 Labour Law as well as other labour-related regulations, such as minimum wage regulations, might also affect the productivity and export participation of labour-intensive industries like garment.

Note however that all these factors should also affect firms in every manufacturing sector, not only the garment industry. Therefore, to reduce biases due to these external interventions, we can compare garments with a particular sector that also experienced all these external interventions, except the MFA.

We pick footwear industry as the comparison. Like garment, it is footloose, labour-intensive, and is mainly located in the island of Java. They are both export-oriented industries; and exporters in these two sectors have strong connections with their foreign buyers. Even though they have some unique characteristics, such as mass production in footwear and fashion-intensive segments in garments, their buyers have supervised exporting firms in both sectors in design, fabric, quality, as well as delivery schedules (AIPEG 2016; Thee 2009). More importantly, both have experienced similar external factors mentioned above. The 1980s trade reforms, commodity boom, China effects and labour regulation crises have affected both sectors in arguably similar ways.[11] Since both the MFA implementation and its abolition are in the same period with those other external interventions, and the MFA affects only garments and not footwear, comparing those two

[11] One possible difference between the two sectors during the period of observation might be the import tariffs (see Figure A.1 in the Appendix). However, the tariffs effect can be reduced by applying the time fixed effect and the industrial fixed effect. A robustness check is provided in the Appendix by including tariffs as control variables.

sectors in the model can reduce the bias occurred from other interventions. To examine this, we estimate the following:

$$prod_{it} = \beta_0 + \beta_1 export_{it-1} + \beta_2 MFAabol + \beta_3 garment_i + \beta_4 (export_{it-1} \times MFAabol) + \beta_5 (export_{it-1} \times garment_i) +) + \beta_6 \, (garment_i \times MFAabol) + \beta_7 (export_{it-1} \times MFAabol \times garment_i) + \delta Z_{it-1} + \varepsilon_{it} \quad (2).$$

In Equation 2, $garment_i$ refers to a dummy variable equal to one if firm i is in the garment industry and zero if it is in the footwear industry. We have some forms of interaction variables, but the main focuses are β_5 and β_7. The coefficient β_5 measures how garments differ from footwear; it reflects the LBE effects of garments after controlling for factors and interventions other than MFA. β_7 is the coefficient for the interaction of three variables that indicate the difference of the LBE effects of garment exporters relative to footwear exporters after the abolition of the MFA, compared to when it was still in operation. This coefficient can also be interpreted as the effect of exporting on productivity in the garment sectors after the removal of the quota intervention compared to the implementation periods after controlling for other variables containing non-MFA interventions.

3.3. Reducing self-selection bias

Some earlier LBE studies propose that comparing the productivity improvement of the exporting firms with non-exporting firms might lead to bias, since the selection to be exporting firms is not random. Firms that do export already have different characteristics with firms that serve only domestic market since from the beginning. We control for this self-selection bias. One solution is by comparing only firms with similar characteristics from the two groups through matching procedures. In doing so, we define exporting firms as the treated group and the non-exporting firms as the control group. Some firms in the control group are selected to match with similarly treated firms using firm-level variables to determine how similar the firms in both groups are (Girma, Greenaway & Kneller 2004; Bigsten & Gebreeyesus 2009).

First of all, variables that make a firm more likely to export are identified. The literature suggests foreign ownership, size, capital intensity, import share, firm age and productivity determine the propensity to export (Bigsten & Gebreeyesus 2009; Roberts &

Tybout 1997). The location of firms, as well as the type of industry and time effects, defines the probability of exporting. In this study, the probability to export is estimated using the following export participation equation:

$$EX_{it} = FDI_{it-1} + Size_{it-1} + (K/L)_{it-1} + (VA/L)_{it-1} + Age_{it-1} + Loc_i + Ind_{it} + Year_t + u_{it} \quad (3)$$

where EX_{it} is an export dummy, equal to one if the firm does export in year t and zero otherwise. FDI_{it-1} is the lagged foreign ownership dummy, equal to one if the firm has foreign ownership last year and zero otherwise. $Size_{it-1}$ is the lagged number of employees and $(K/L)_{it-1}$ is the ratio of capital to the number of workers in last year; both are in the Ln term). $(VA/L)_{it-1}$ is the Ln value added per labour in the last year, and Age_{it-1} is the firm's age or the number of years since the firm existed in the data.[12] We include the location dummies (Java and non-Java) of the firms, industry dummies (garment and footwear) and year dummies in the matching procedures.

The propensity score is estimated with a probit model with 'nearest-neighbours' matching applied. The common support condition is imposed. Therefore, only matched observations are then included in estimating the main Equations 1 and 2.

4. Data description

The main source of data is the panel dataset of Industrial Statistic (*Statistik Industri*, SI) that attempts to survey all medium and large manufacturing establishments in Indonesia—firms that have 20 or more workers. The data is collected by the Central Bureau of Statistics (Badan Pusat Statistik, BPS) and captures various categories of information about firms, such as location, inputs and components of production costs, outputs, ownership, export status and export intensity, import status and volume, employment and capital.

We can observe 25 years panel data from 1990 to 2014, but, as explained in the previous section, this study used two different sets of data: 1990–2004 and 2005–14 as well

[12] The survey does not identify the year of a firm's establishment. To proxy a firm's age, we calculate the number of years that the firm exists in the dataset.

as 1990–94 and 2005–14. In the data, we still have the periods of the AFC, 1997–99, and the global financial crisis, 2008–09. We expect that year dummies could absorb data variations due to these crises. As noted, there could be some other factors that might distort the data, but these will be dealt with in our identification strategies to minimise the bias. Since our focus is to see the learning effect from exporting, we ignore firms that export only once in the whole period. That is, we assume that these firms only export for trial-and-error purpose so we do not expect them to learn from exporting. Incorporating them may therefore lead to biased results. There could also be a problem with the data on capital, and we handle this issue as explained in the Appendix.

Table 3 compares the statistics for garments and footwear as well as the periods with the MFA and without the MFA. We expect that the statistics of some control variables for garments before and after the removal of the MFA remain similar. The average proportion of foreign-owned firms remains similar in both periods. As noted, some establishments do both garment and textile activities ('multiproduct firms').

Table 3. Descriptive statistics

	MFA = 0				MFA = 1	
	1990–94		1990–2004		2005–14	
VARIABLES	Mean	Sdt. Dev.	Mean	Sdt. Dev.	Mean	Sdt. Dev.
Garment						
Number of observations	2,419		12,598		15,450	
Ln value added per worker	8.35	0.93	8.65	0.97	9.08	0.93
Ln TFP	3.67	0.55	3.72	0.50	3.94	0.53
Exporting firms (0-1)	0.22	0.41	0.18	0.39	0.14	0.35
Export intensity (0-100)	18.50	36.94	15.41	34.30	10.48	28.51
FDI (0-1)	0.04	0.20	0.05	0.22	0.05	0.22
Import share (0-100)	9.42	24.51	10.47	26.55	8.16	24.21
Total workers	234.04	652.84	206.03	598.34	174.43	587.95
Multiproduct firm	0.57	0.49	0.57	0.50	0.58	0.49
Footwear						
Number of observations	431		1,918		1,960	
Ln value added per worker	8.86	0.88	9.07	0.91	9.59	0.86
Ln TFP	3.99	0.54	3.96	0.45	4.19	0.43
Exporting firms (0-1)	0.33	0.47	0.25	0.43	0.13	0.34

Export intensity (0-100)	25.06	39.33	17.58	34.72	8.39	25.39
FDI (0-1)	0.11	0.31	0.09	0.29	0.08	0.27
Import share (0-100)	24.08	35.21	16.55	30.09	6.38	20.96
Total workers	699.59	1,446.57	644.22	1,539.37	312.46	1,181.93

Source. Statistics Industry (1990–2014) and TFP estimations

4.1. Price difference effects

All data in values in Table 3 are deflated. The main deflator is the sector-specific wholesale price index (WPI) from the BPS. However, there might be bias in the TFP measurement for exporting firms due to price effects. The problem could be higher in a liberalisation setting since prices most likely drop and dollar sales might not reflect the true performance (De Loecker 2011). Since physical quantities are rarely observed, it could be more challenging to measure the TFP accurately. Most studies use sales or output, but the TFP estimates from this strategy may also contain firm-level mark-ups (Amiti & Konings 2007, Keller 2010). Katayama, Lu and Tybout (2009) argue that productivity estimations using this data might not reflect the technical efficiency; but might be correlated with policy shocks and managerial decisions in misleading ways. Deflating firm-level sales could reduce these price effects. However, this approach could still potentially bias the coefficients of inputs if they are correlated with price errors, and it generates productivity estimates that contain price and demand variation (De Loecker 2011). De Loecker et al. (2016) try to control for unobserved prices and demand shocks to separate revenue productivity and physical productivity by using multi-product firm-level data during trade liberalisation episodes.

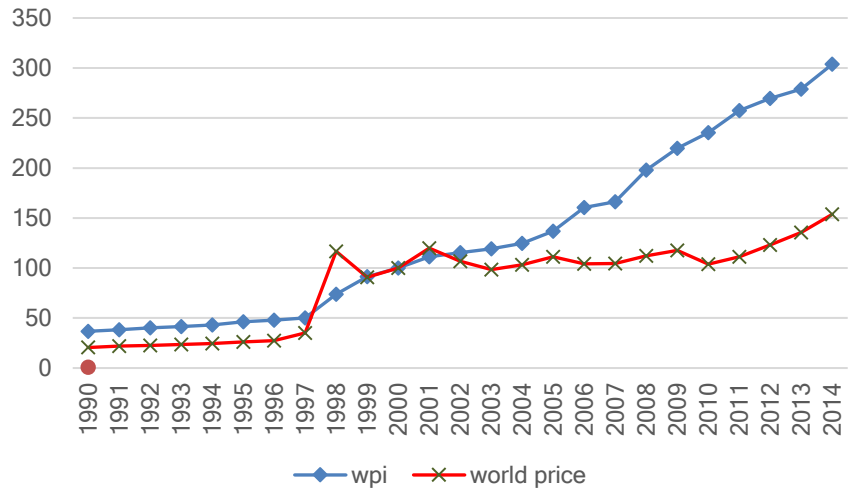
As we do not have the product-level data, we propose a simple alternative way of dealing with the issue by adjusting the exporter's output. Since information on dollar revenues from the domestic market and export market is available, we adjust the output by using a combined deflator obtained from world price and domestic price data. If the total revenue is defined as $Y_{it}^{Tot} = Y_{it}^{Dom} + Y_{it}^{Exp}$, we have a proxy for output with the following expression:

$$y_{it}^{Tot} = \frac{Y_{it}^{Dom}}{p_{it}^{Dom}} + \frac{Y_{it}^{Exp}}{p_{it}^{Exp}} = \frac{Y_{it}^{Dom}}{p^{Dom}} + \frac{Y_{it}^{Exp}}{p^{world}} \quad (4).$$

In Equation 4, the firm physical output is calculated by considering price differences between domestic and export markets. We argue that the latter should be lower in the period of liberalisation. Figure 1 shows a comparison of both prices that support our claim.[13] Using 2000 as the base year, it shows that the world prices had always been lower than WPI especially after the 1997 crisis. The graph reflects a significant inflation difference between these two prices; and ignoring these effects in the estimation may lead to a measurement error problem.

Additionally, in Figure 2, we present the average export unit price of Indonesian apparel since 1990. It clearly shows that the unit price indices were much higher before MFA abolition (precisely before the AFC), which might indicate a quality upgrading phenomenon and/or mark-up. After the period, the export, in terms of dollar value, kg volume and unit price have been moving together.

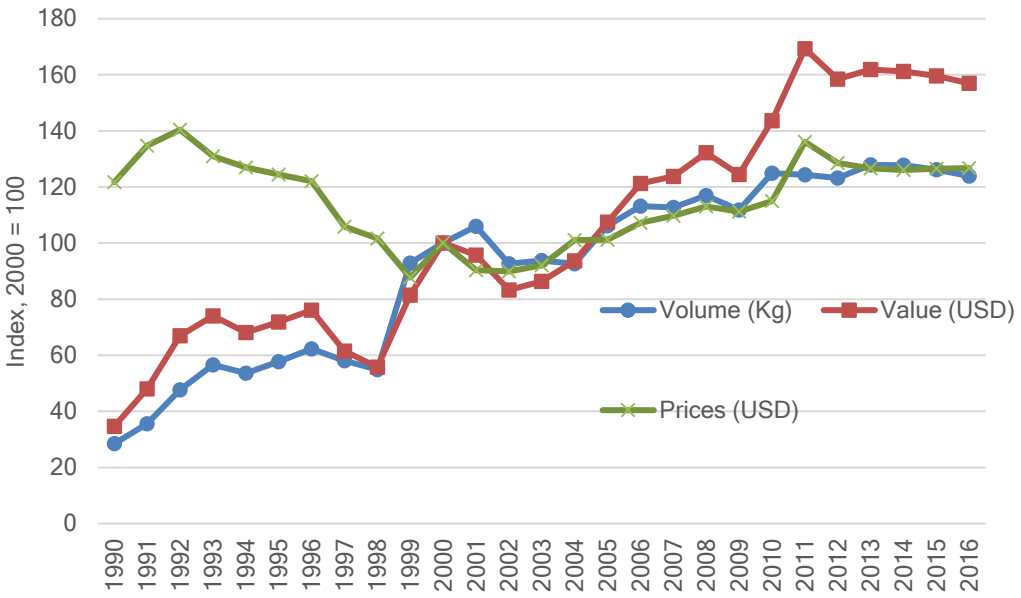
Figure 1. Deflators comparison for garment industry, 2000 = 100, index in IDR



Source. BPS and the USA Import Prices

[13] The USA has always been the main export market of Indonesian garments (and footwear) products. Therefore, we use the USA import prices to represent the world prices.

Figure 2. Indonesia's apparel exports: Volumes, values and unit prices indices (2000 = 100)[1]

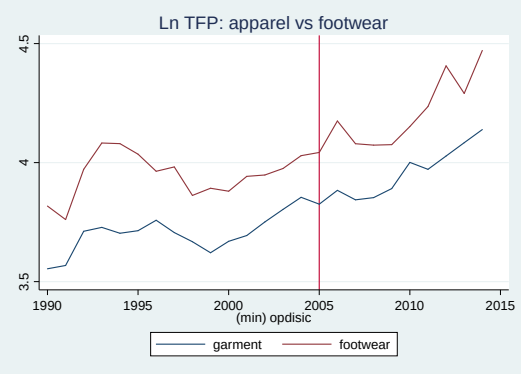


Notes. [1]Export price is in unit price that computed by dividing export value (USD) by weight of exports in Kg.
Source. Calculated from UNCOMTRADE.

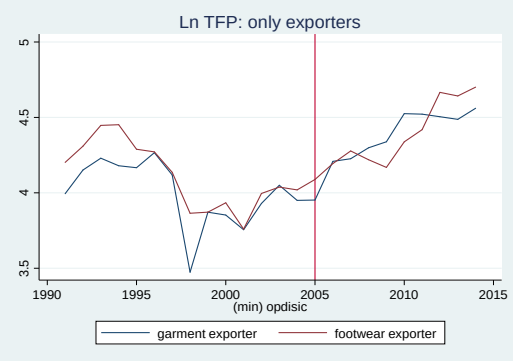
4.2 Comparing two sectors

To ascertain that footwear is the appropriate comparison sector to garments, we include industry characteristics in matching procedures, and we estimate how these two sectors differ in LBE. Figures 3a to 3f show the average performance and average characteristics of the garment and footwear industries during our period of observation. These two sectors have relatively similar trends in total factor productivity (see Figure 3a and 3b for all observations and only exporters, respectively). Both sectors have relatively high but decreasing export intensity of exporters (Figure 3c). However, the export participation for both sectors have been relatively low; only about 10–20 percent of firms that do export (Figure 3d). The employment in garment is a bit lower compare to in footwear (3e). Moreover, in both sectors, the trend of foreign-ownership participation, one of the control variables, seems to move in the same direction during the period of observation (3f). These figures indicate that the two sectors (garments and footwear) are reasonably comparable.

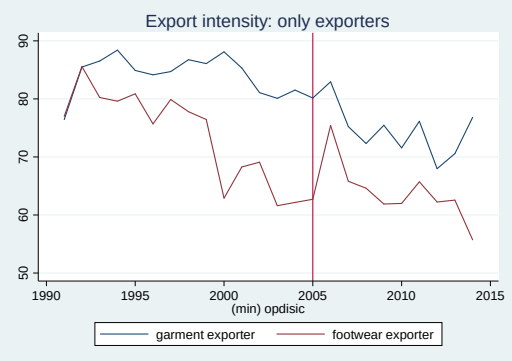
Figures 3a–f. Comparing garment and footwear performance



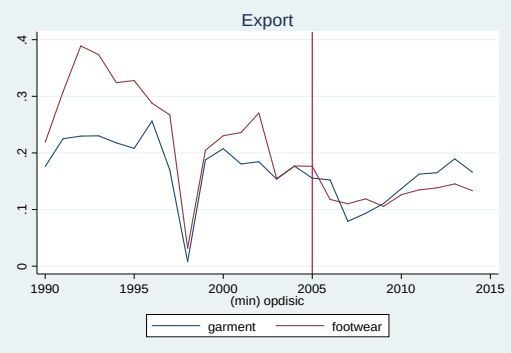
a. Trend of TFP of two sectors



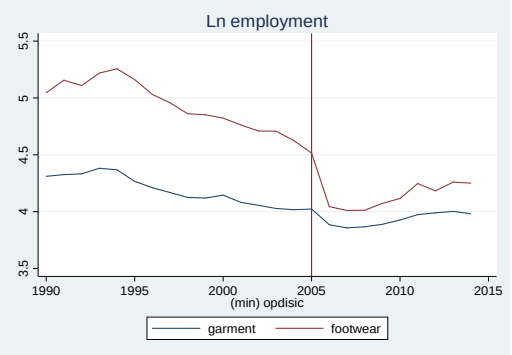
b. Trend of TFP for exporters of two sectors



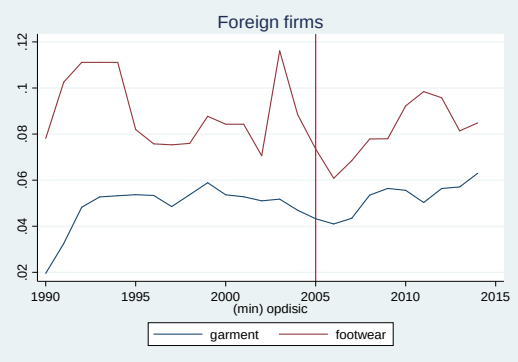
c. Trend of export intensity



d. Trend of export participation



e. Trend of employment



f. Trend of foreign owned participation

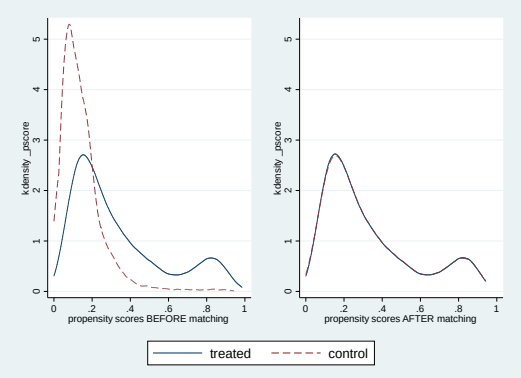
5. Results

5.1. Matching procedures

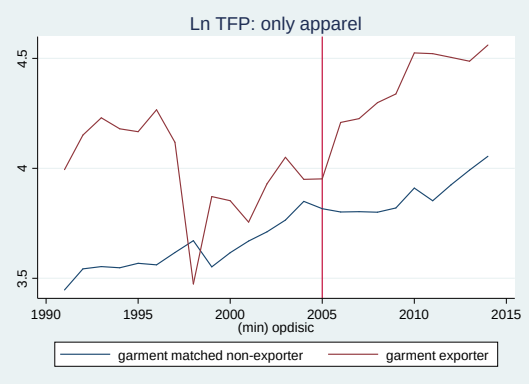
As noted, to reduce the selection bias from exports, we apply propensity score-matching procedures prior to the main equation (Equations 1 and 2). We match exporters with their non-exporter counterparts with similar characteristics. The results from the matching show that foreign ownership, firm age, capital per labour (K/L), value-added per worker and import share are significant in determining export participation. The industry dummies are also significant, but the location (Java vs non-Java) is not significant. A small number of observations are dropped due to this process.

Figure 4a shows the results distribution of exporters and non-exporters before and after matching. Figure 4b presents the naïve TFP difference between exporters and non-exporters after matching. The figure shows that before the AFC there was a huge productivity difference between exporters and their matched non-exporters. We argue that this due to various non-MFA confounding factors that contributed to performance difference between exporters and non-exporters. Subsequently, the performance gap was smaller from then until 2005. One possibility is the due the decrease in average export performances after AFC. After the removal of the MFA, the gap between the two groups has been widening. Later, we argue that after the quota abolition, exporters gain additional productivity increased due to competition.

Figures 4a–b. Results from matching procedures



a. Kernel density before and after matching



b. The naïve TFP difference between matched exporters and non-exporters

5.2. Results from the main equations

Table 4 shows the results from the model in Equation 1. In the first two columns, we include all observations in the common support from the matching procedure. The first column shows results when we consider the adjustment effects after the announcement of the abolition of the MFA. There is a significant evidence of LBE for the whole period with coefficient 17.6 percent but not after the MFA abolition. Consistent with the interpretation from Figure 4b, the performance differences between exporters and non-exporters are wider in the period before AFC. This makes the LBE effect after 2005 is negative but not significant compared to before 1995.

In the second column we compare the performance before and after 2005. Similar with the first column, we also found the evidence of learning for the whole period, but the effects are larger after the MFA abolition. The results suggest that the LBE effect after a more liberalized period is 12.8 percent. We argue that this productivity improvement is due to the competition effect.

Table 4. Productivity improvement after MFA abolition

Dependent variable: Ln(TFP)	(1)[a]	(2)[b]	(3)[a]	(4)[b]
Export $_{it-1}$ x MFA abolition	-0.0187	0.128***	-0.0627	0.128***
	(0.0441)	(0.0231)	(0.0535)	(0.0273)
Export $_{it-1}$	0.176***	0.0419**	0.184***	0.0163
	(0.0411)	(0.0186)	(0.0516)	(0.0237)
MFA abolition = 1	0.557***	0.516***	0.580***	0.534***
	(0.0374)	(0.0328)	(0.0434)	(0.0372)
FDI $_{it-1}$	0.0731	0.0293	-0.00517	-0.0517
	(0.0514)	(0.0393)	(0.0644)	(0.0502)
Import share $_{it-1}$	-0.0004	-0.0003	-0.000488	-0.000528**
	(0.00032)	(0.00025)	(0.000351)	(0.000268)
Multiproduct $_{i}$	-0.109	-0.0892	-0.134	-0.102
	(0.0888)	(0.102)	(0.0877)	(0.107)
Ln total worker $_{it-1}$	0.021	0.0046	0.00819	-0.00757
	(0.0150)	(0.0142)	(0.0180)	(0.0178)
Constant	3.552***	3.645***	3.585***	3.669***
	(0.0800)	(0.0836)	(0.0903)	(0.0979)
Firm-fixed effects	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes
Observations	13,988	22,079	11,770	18,014
Only incumbent firms [c]	No	No	Yes	Yes
R-squared	0.101	0.104	0.097	0.110
Number of firms	2,314	2,517	1,936	2,057

[a] Considering the adjustment period after the announcement of MFA abolition on Uruguay Round in 1995; only comparing the productivity improvement before 1995 and after 2005.
[b] Incorporating all period from 1990-2014. Thus, we compare before and after 2005.
[c] Only incorporating firms that were on business on period before and after MFA abolition.
Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

During the 25-year period of observations, some firms may die, and some may be born. Some firms may have stopped to exports after the MFA abolition, and some other firms may have started to access foreign markets. Therefore, there is a possibility that we compare groups of different firms during the two periods. To control for this extensive margin of exporting, it would be better if we compare the learning effects of the same exporters to reveal evidence about how they were different during these two periods. Considering this, the last two columns of estimates in Table 4 only cover those who continue exporting during the period of observation, the "incumbents". We compare the estimates that consider only the pre-1995 and post-2005 periods (Column 3) and those that account for all period i.e. 1990-2004 (Column 4). The results in Column 3 show that the LBE effect is positive with

coefficient 18.4, but the effect is not significant after the MFA abolition. This result is similar compared to the one in Column 1. Meanwhile, the result in Column 4 shows that the productivity improvement due to export is only significant after the MFA abolition. By focusing only for incumbents' firms, we find that the productivity improvement occurs after the competition increased due to the removal of the quota barrier.[14]

Table 5. Productivity improvement after MFA abolition by reducing bias from other non-MFA interventions

Dependent variable: Ln(TFP)	(1)[a]	(2)[b]
Export $_{it-1}$ x Garment x MFA_abolition	0.281***	0.125*
	(0.105)	(0.0749)
Export $_{it-1}$ x Garment	-0.159*	-0.0341
	(0.0902)	(0.0365)
Export $_{it-1}$	0.327***	0.0750**
	(0.0805)	(0.0318)
Constant	3.573***	3.657***
	(0.0976)	(0.0942)
Other variables	Yes	Yes
Firm fixed effects	Yes	Yes
Year dummy	Yes	Yes
Observations	15,814	25,027
R-squared	0.107	0.108
Number of firms	2,611	2,867

[a] Considering the adjustment period after the announcement of MFA abolition on Uruguay Round in 1995; only comparing the productivity improvement before 1995 and after 2005.
[b] Incorporating all period from 1990-2014. Thus, we compare before and after 2005.
Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 5 presents the results from Equation 2 where we take into account other non-MFA interventions by including footwear sector as a control. Columns 1 and 2 in Table 5 provide results for the difference-in-difference-in-difference (DDD) estimates. Column 1 provides the results if we define the MFA implementation and abolition as before 1995 and after 2005, while Column 2 defines the MFA milestone is in 2005. All specifications indicate

[14] We add some control variables at the firm level in the estimations in Table 4. However, since we apply firm fixed effect, we expect that the coefficients of these variables are not significant.

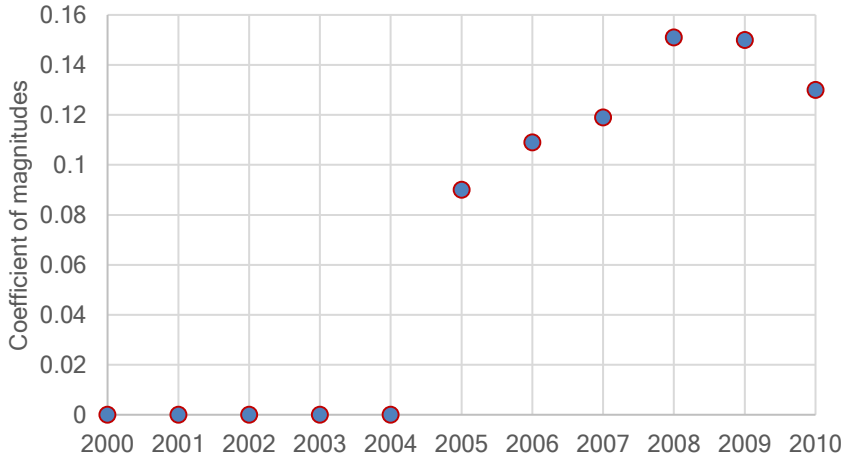
positive and significant impacts of exporting on productivity after the abolition of the MFA and after controlling for other variables containing non-MFA interventions. The LBE effect is 28.1 percent if we control for the adjustment period and it is 12.5 percent if we include all period of observation. The LBE effect for all sectors is positive indicating that firms do learn to improve their productivity after exporting. However, the LBE effect of the garment sector which had been highly regulated is negative or insignificant. This might indicate that suppressed competition during the MFA implementation has hindered productivity improvement in the protected sector.

5.3. Placebo tests

There is a possibility that the behavioural change of exporters of garments is not due to the abolition of the MFA. We thus conduct a placebo test by shifting the lower and upper cut-off of the MFA time to change the group of control and treatment observations. We compare the LBE effect of apparel firms before the lower cut-off with the LBE effect after the upper cut-off. In the first scheme, we define the years of 2000–04 as the lower cut-off, and 2005 as the upper cut-off. We expect that the results of comparing these two groups would be insignificant because they are not the actual cut-off years for the abolition of the MFA. Subsequently, we define 2005 as the lower cut-off year, and 2006–10 as the upper cut-off years. The results of these specifications should be significant suggesting that the LBE effect of apparel firms in any year after 2005 are significantly different from that before 2005.

Figure 5 shows our coefficient of interest in Equation 2 by moving the lower (upper) cut-off of the intervention removal year. As expected, the results are not significant when shifting the cut-offs following the first scheme (lower cut-off), and are significant for the upper cut-off. These results support the argument that the MFA abolition in 2005 can be associated with a transformation of the garment industries' performance in Indonesia.

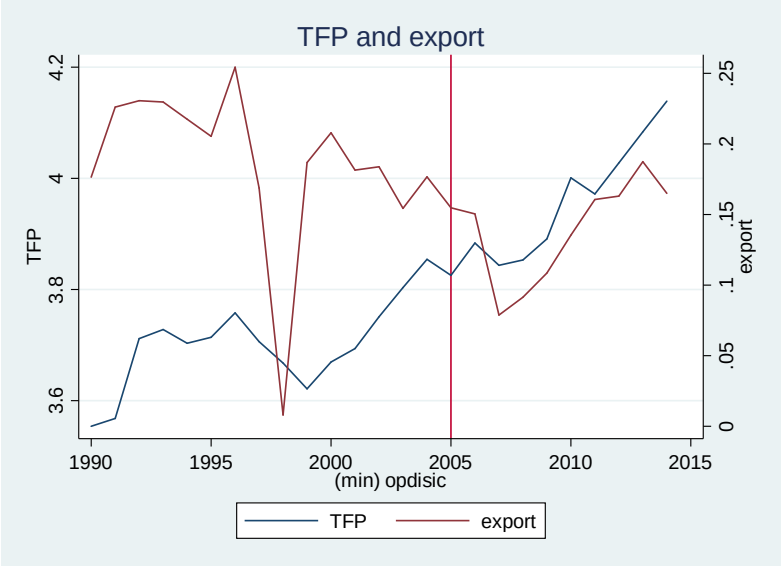
Figure 5. Placebo test: moving the lower (upper) cut-off of the intervention removal year



5.4. Test for structural break

It is possible that along our 25-year observation there is important structural break. So we run a test for structural break at predetermined year of 2005. The test rejects the null hypothesis of no structural break. These results support the argument that the MFA abolition at the beginning of 2005 can be associated with a transformation of the garment industry performance in Indonesia. Subsequently, we perform another test to detect the year of break. The test rejects the null hypothesis of no structural break and detects a break in 2006. This condition might reflect a late response of firms when facing the increased competition after the MFA abolition.

Figure 6. Structural break of productivity and export



5.5. Extensions: Size and ownership effects

We compare how performance differs across firms of different sizes to check whether the ability to learn from competition depends on sizes. Following the BPS definition, we define medium-size firms as those with 20 to 99 workers and large firms as those that have more than 100 workers. Columns 1 and 2 in Table 6 provide the results for medium firms and larger firms respectively. Medium firms, which are the majority in the garment sectors had not experienced a significant productivity improvement after entering export markets. A learning effect occurred after the MFA abolition suggesting a positive effect from competition despite only at 10 percent level.

On the other hand, large firms experienced a positive LBE effects for the whole period of observation. Moreover, the productivity improvement increased after the MFA abolition. This might suggest that larger firms are more likely to gain the productivity increased benefit from exporting in the more competitive situation, while smaller firms struggle to gain that benefit.

Table 6. Size and ownership effects

Dependent variables: Ln(TFP)	1 Medium firms	2 Large firms	3	4

	(20–99 employees)	(>=100 employees)	Firms with foreign ownership	Fully domestic firms
Export $_{it-1}$ x MFA_abolition	0.0714*	0.155***	0.183**	0.131***
	(0.0376)	(0.0346)	(0.0826)	(0.0246)
Export $_{it-1}$	0.0454	0.0508**	0.0763	0.0329*
	(0.0335)	(0.0227)	(0.0624)	(0.0195)
MFA_abolition =1	0.524***	0.492***	0.374**	0.00631
	(0.0387)	(0.0676)	(0.166)	(0.0149)
Constant	3.570***	3.915***	3.840***	3.623***
	(0.0585)	(0.149)	(0.306)	(0.0859)
Firm fixed effects	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes
Observations	17,080	4,997	1,060	21,032
R-squared	0.085	0.168	0.216	0.102
Number of firms	2,217	594	165	2,462

Note. Using all period and comparing before and after 2005. Robust standard errors in parentheses, p** p<0.01, ** p<0.05, * p<0.1

Column 3 and 4 in Table 6 compares the results for observations of firms that have foreign ownership and fully domestic firms. The results show that the LBE effect for all periods is significant for the latter but not for the former. These findings support Du et al. (2012) who compare the LBE effect from domestic firms and foreign firms in China. This might suggest that foreign-owned firms already have a higher performance from the beginning and exporting does not necessarily increase their productivity. Meanwhile, fully domestic firms might start with relatively lower productivity. Entering export markets might introduce domestic firms to new situations and challenges that force these firms to improve their products, production process and so on.

However, after the MFA abolition, both types of firms show increased productivity. When the competition escalated, all firms might put efforts to improve their performance so they could keep their business. Another interesting finding is that foreign-owned firms have a higher magnitude than domestic firms. This can also be seen for larger firms compared to medium firms. These indicate that foreign firms (and larger firms) generally have more resources to improve their capability to compete than fully domestic firms (medium firms).

6. Concluding remarks

This paper has investigated how a policy intervention may affect the LBE mechanism and the main channel of LBE comes from the effect of competition. Employing 25 years of Indonesia's firm-level data, we use the implementation (and the subsequent abolition) of the MFA as the intervention and apply a quasi-natural experiment analysis.

This paper argues that policy intervention may create a situation that opens up or closes down the channels of learning. It can intensify or reduce the degree of competition as well as the level of interaction with buyers. We run tests for the former and find a positive effect of an increased competition on firms learning. The impact of exporting on total factor productivity is 12.5–28.1 percent due to competition effects. This suggests that it is important to keep the competitive environment to gain higher productivity effects. Policy interventions that protect exporters from competition might lessen the LBE benefits.

In addition to a single country's policy, these findings could also have significant implications to the multilateral trading system. Even though the market intervention under MFA preference has been abolished, other types of export preference interventions for developing countries to access developed countries' markets are still allowed by the WTO under the Generalised System of Preference (GSP), Duty Free Quota Free (DFQF), the EU's Everything but Arms (EBA) and the USA's African Growth and Opportunities Act (AGOA). Some studies have shown that export from least-developed countries (LDCs) can increase thanks to these programs (see Collier & Venables 2007; Gnangnon & Priyadarshi 2017; Ito Aoyagi 2018); but none has investigated the impact on the firm's productivity. Our study shows a possibility that these programs could reduce the level of competition to access export markets, which in turn is an important learning channel from exporting.

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Appendix

A.1. Productivity estimation

Consider a Cobb-Douglas production function (in logs) for firms i at a time t where y_{it} is output, l_{it} is labour, k_{it} is capital and m_{it} is material inputs as follows:

$$y_{it} = \beta_l l_{it} + \beta_k k_{it} + \beta_m m_{it} + \omega_{it} + v_{it} \quad \text{(A.1)}$$

where ω_{it} captures productivity and v_{it} is the standard $i.i.d$ error term capturing unanticipated shocks to production and measurement error. We can derive the total factor productivity (TFP) $\hat{\omega}_{it}$ as a residual $\hat{\omega}_{it} = y_{it} - \hat{\beta}_l l_{it} - \hat{\beta}_k k_{it} - \hat{\beta}_m m_{it}$.

If the ω_{it} is uncorrelated with the regressor, the productivity function can be estimated using ordinary least squares (OLS). However, the correlation between the factors and possible unobserved effects that include productivity may affect the coefficients of the factors, thus biasing the estimated TFP. If the unobserved effects are time-invariant firm characteristics, then a fixed-effect estimation could reduce the bias. However, there is another source of endogeneity that might not be solved.

Another issue that may appear in estimating production function parameters is due to the relationship between productivity shocks and the probability of exit from the market. We can solve this problem by following a method suggested by Olley and Pakes (1996). Furthermore, If export status is correlated with inputs, then omitting the export dummy from the production function regression could yield inconsistent input coefficients and productivity estimates. In that case, incorporating export status in the function might reduce the bias. Profit maximisation yields an investment demand function that depends on state variables capital and productivity, as well as export participation, an additional state variable, as suggested by De Loecker (2007) and Amiti and Konings (2007), $I_{it} = i(k_{it}, \omega_{it}, export_{it})$. Inverting the investment function gives an expression of productivity as a function of state variables: capital, decision to export and investment, $\omega_{it} = h(k_{it}, I_{it}, export_{it})$. By substituting the productivity expression in (1), we can express the production function as:

$$y_{it} = \beta_l l_{it} + \beta_m m_{it} + \phi(k_{it}, I_{it}, export_{it}) + v_{it} \quad \text{(A.3).}$$

This paper uses Equation A.3 to estimate the TFP using the procedures discussed in Yasar, Raciborski and Poi (2008).

A.2. Dealing with the missing capital stock data

The capital stock data could be problematic given there are many missing observations for various years. In the raw data, some observations have no information about capital. For 2006, there is no record about the capital stock at all. To deal with these issues, we undertook the following steps. For some of the steps in cleaning the capital data, we follow Blalock and Gertler (2004). All firms with no capital data in any year were dropped. As for 2006, we interpolated the capital stock data based on the values in 2005 and 2007. One consequence is that all firms with missing capital stock data for both 2005 and 2007 were not included in the study. Next, firms with missing capital data in three or more continuing years were also removed. For those with missing data for up to two consecutive years, we again applied interpolation. And finally, firms with negative capital data were removed. These procedures reduce observations by about 48 percent. The final number of observations was 28,048 for garments and 3,878 for footwear.

We test for potential attrition bias and the result (Table A.1) shows that there are no significant differences in exports, foreign ownership and import share variables before and after the attrition, but the test shows that larger firms are the removed observations.

Table A.1. Test for attrition bias

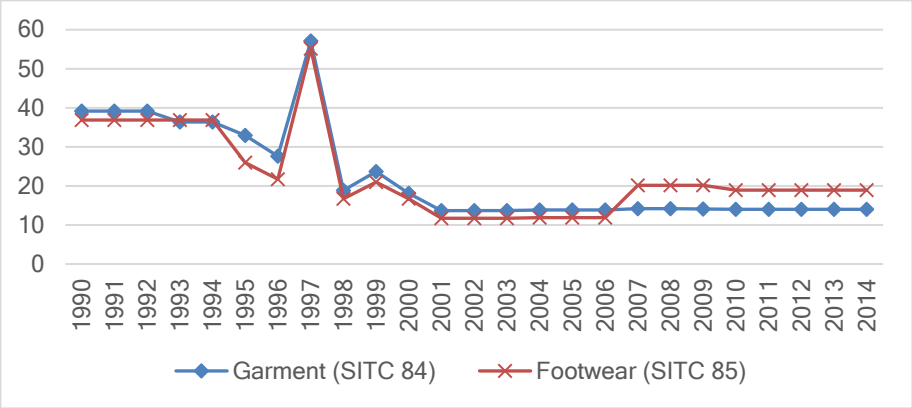
	1
VARIABLES	Pr(attrition)=1
Export	0.00504
	(0.392)
FDI	0.0263
	(0.272)

Import share	0.00325
	(0.00210)
Ln value added per worker	0.377***
	(0.107)
Ln total worker	0.219**
	(0.109)
Ln output	-0.0778
	(0.0921)
Export intensity	-0.00408
	(0.00471)
Java	1.225***
	(0.425)
Constant	-4.205***
	(0.892)
Year dummy	Yes
Random effects	Yes
Observations	55,222
Number of firms	5,061

Notes. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

A.3. Import tariffs

Figure A.1 Applied import tariffs (MFN)



Source. TRAINS database.

A.4. Robustness check

Table A.2. Robustness check: include import tariff as a control (Equation 1) Dependent variable: Ln(TFP)	(1)[a]	(2)[a]	(3)[a]	(4)[a]
Export $_{it-1}$ x MFA_abolition	-0.0889***	-0.0187	0.107***	0.129***
	(0.0308)	(0.0441)	(0.0180)	(0.0231)
Export $_{it-1}$	0.422***	0.176***	0.224***	0.0418**
	(0.0289)	(0.0411)	(0.0135)	(0.0186)
MFA_abolition = 1	-0.0671	-0.247	-0.0653	0.217
	(0.379)	(0.534)	(0.349)	(0.594)
Tariffs	-0.0261*	-0.0319	-0.0246*	-0.0119
	(0.0150)	(0.0212)	(0.0138)	(0.0235)
FDI $_{it-1}$	0.172***	0.0758	0.156***	0.0298
	(0.0264)	(0.0516)	(0.0183)	(0.0394)
Import_share $_{it-1}$	-0.000820***	-0.000399	-0.00113***	-0.000359
	(0.000162)	(0.000321)	(0.000123)	(0.000254)
Multiproduct $_{i}$	-0.131***	-0.109	-0.131***	-0.0897
	(0.00840)	(0.0888)	(0.00656)	(0.102)
Ln_total_worker $_{it-1}$	0.0445***	0.0212	0.0503***	0.00447
	(0.00496)	(0.0150)	(0.00358)	(0.0142)
Constant	4.411***	4.802***	4.368***	4.112***
	(0.589)	(0.834)	(0.542)	(0.928)
Firm-fixed effects	No	Yes	No	Yes
Year dummy	Yes	Yes	Yes	Yes
Observations	13,988	13,988	22,079	22,079
R-squared	0.181	0.101	0.184	0.104
Number of firms		2,314		2,517

[a] Considering the adjustment period after the announcement of MFA abolition on Uruguay Round in 1995; only comparing the productivity improvement before 1995 and after 2005.
[b] Incorporating all period from 1990-2014. Thus, we compare before and after 2005.

Note. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table A.3. Robustness check: include import tariff as a control (Equation 2)

Dependent variable: Ln(TFP)	(1)[a]	(2)[a]	(3)[b]	(4)[b]
Export $_{it-1}$ x Garment x MFA_abolition	0.244***	0.276***	0.0898*	0.126*
	(0.0843)	(0.105)	(0.0493)	(0.0744)
Export $_{it-1}$ x Garment	0.0213	-0.154*	0.171***	-0.0346
	(0.0747)	(0.0900)	(0.0298)	(0.0365)
Tariffs	-0.000858	0.00552	0.000270	0.00484
	(0.00370)	(0.00422)	(0.00345)	(0.00363)
Constant	3.561***	3.358***	3.566***	3.475***
	(0.150)	(0.208)	(0.132)	(0.177)
Other variables	Yes	Yes	Yes	Yes
Firm fixed effects	No	Yes	No	Yes
Year dummy	Yes	Yes	Yes	Yes
Observations	15,814	15,814	25,027	25,027
R-squared	0.184	0.107	0.183	0.108
Number of firms		2,611		2,867

[a] Considering the adjustment period after the announcement of MFA abolition on Uruguay Round in 1995; only comparing the productivity improvement before 1995 and after 2005.
[b] Incorporating all period from 1990-2014. Thus, we compare before and after 2005.

Note. Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.