Rules of Origin and Trade Preference Utilization Among Least Developed Countries

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Abstract

This paper assesses how the utilization of trade agreements responds to rules of origin revisions that allow for more foreign content in exported products. Using the revision of the rules of origin for apparel products under the EU's Generalized System of Preferences as a case study, and a triple-difference empirical framework, the results indicate that rules of origin act as a significant bottleneck to Least Developed Countries' (LDCs) use of trade preferences. However, there is heterogeneity in the response of utilization rates across products and LDCs, which suggests rules of origin revisions may not be a panacea.

JEL codes: F13, F68, L70, O24

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1 Introduction

Since the 1970's, many countries have offered unilateral trade preferences to developing countries. These unilateral preference schemes are known as the Generalized System of Preferences (GSP), and are intended to promote industrialization and accelerate economic growth in developing economies.[1] While the tariff relief offered under GSPs is often generous, the evidence of their effectiveness in promoting export growth is mixed.[2] Rules of origin, which specify the amount of local content or processing required for an exported product to qualify for preferential tariffs, are often cited as a significant barrier to preferential market access (Barber, Gowthaman, and Rose 2004). Rules of origin are imposed within trade agreements to prevent transshipment and tariff fraud. However, in unilateral trade agreements, like GSPs, rules of origin are often used to protect domestic industries from import competition and restrict the use of inputs from third countries (Brenton and Özden 2009).

Given that there is little evidence that restrictive rules of origin have helped stimulate the development of integrated production structures in developing countries (Brenton and Özden 2009), the Doha Round of WTO negotiations have resulted in a growing consensus that rules of origin should be revised for Least

[1] United Nations. n.d. "About GSP." United Nations Conference on Trade and Development. Accessed May 9, 2020. https://unctad.org/en/Pages/DITC/GSP/About-GSP.aspx.

[2] For example, Hakobyan (2020) finds evidence that exports decline when GSP preferences are not renewed, similarly Devault (1996) finds that competitive limits in the United States GSP reduce US imports from developing countries. Still, other studies find that GSPs have little or no effect on beneficiary country exports (MacPhee and Oguledo 1991; Brown 1989; Sapir and Lundberg 1984; Whalley 1990; Eicher and Henn 2011). For example, Eicher and Henn 2011 (2011) find that after controlling for WTO membership and membership in other preferential trade agreements GSPs have a strong negative effect on exports. Ornelas 2016 (2016) reviews and synthesises the literate on the effectiveness of Special and Differential Treatment (SDT) programs for developing countries and finds limited empirical support for these programs creating sustained export growth or stimulating promoting economic growth in developing countries.

Developed Countries (LDCs).[3] However, relative to other trade policy tools, like tariffs and quotas, rules of origin have been historically understudied.[4].

This paper analyzes the relationship between rules of origin liberalization policies and trade preference utilization. The specific context of this study is the revision to the rules of origin associated with the EU's "Everything But Arms" (EBA) agreement, which is the component of the EU's GSP specifically designed for LDCs and grants tariff-free access in most product lines. Other industrializing countries (non-LDCs) may access reduced tariffs under the GSP, but the GSP concessions are much more modest than the EBA. In 2011, the EU relaxed the local content requirement for a number of products, including for apparel products – an important export sector for LDCs – covered under the EBA.[5] Given that the EU's EBA is a unilateral program, the timing and structure of the rules of origin revision were primarily outside of the control of any individual firm or LDC (Tanaka 2020). The rules of origin for the GSP were not revised, meaning non-LDCs still must satisfy the local content requirements for apparel products.

The EU's initial rule of origin required apparel producers to use locally sourced textiles. The rules meant that apparel producers in LDCs could only access the reduced tariff rates in the EU's EBA if apparel products were composed of textiles produced in the LDC as well. Failure to satisfy this rule of origin resulted in the application of non-preferential tariffs, known as Most-Favored Nation (MFN)

[3]Rules of origin revisions were a significant component of the Doha development agenda of the WTO. In particular, rules of origin were a strong focus of the Bali Package of 2013, which aimed at negotiating greater market access for LDCs through reductions of non-tariff barriers.

[4]The lack of empirical attention paid to rules of origin in the economic literature range from their perceived banality (Augier, Gasiorek, and Tong 2005), to their legal complexity (Cadot, Estevadeordal, and Suwa-Eisenmann 2005).

[5]Apparel products accounted for 61.0% of the total exports to EU requesting preferential access in 2010 (Tanaka 2020).

tariffs, on the apparel product. This prohibited apparel producers in LDCs from sourcing textiles from low-cost countries like China and Taiwan. Producing textiles is capital-intensive, and most LDCs do not have textile production sectors large enough to supply apparel production sectors (Frederick and Staritz 2012; Curran and Nadvi 2015; Masum 2016; Habib 2016).[6] As a result, the rules of origin were a significant barrier to market access. Following a series of internal debates with EU stakeholders, the EBA's rules of origin were revised on January 1st, 2011 to allow for more imported content in final apparel products. The revised rules allow apparel producers in LDCs to source textiles globally.[7]

The analysis in this paper takes place in several stages. First, a theoretical model is outlined, and relevant comparative statics are derived. The model shows how firm decisions over which trade program to export under aggregate to a gravity-like structure for aggregate trade.[8] Relaxing rules of origin increases the aggregate utilization of a preferential program by reducing the cost of accessing preferential tariffs.

Next, using the revision to the EU's EBA and a triple-difference empirical framework, the relationship between rules of origin revisions on preference uti-

[6]**Habib** (2016) finds that 65% of apparel firms source knit textiles locally, while only 15% source woven textiles locally. Similarly, Frederick and Staritz 2012 finds that apparel firms in LDCs source between 60-70% of knit textiles locally, but only 12-15% of knit textiles locally. Masum 2016 (2016) finds that Bangladeshi apparel firms source 90% of knit textiles locally, and 40% of woven textiles locally.

[7]In most LDCs, ownership of apparel firms is a mix of domestic-private, foreign-private, and government. While there is heterogeneity across countries, apparel firms in most LDCs owned by private domestic firms. Figure A1 in the appendix displays ownership percentages across a number of LDCs using data from the World Bank's Enterprise Survey.

[8]The firm-level decisions are modeled using the random utility framework, as pioneered by McFadden. This frames firm decisions on how to export products as the outcome of a probabilistic process based on random draws of firm-destination-product shocks from an extreme value distribution. Using the methods in Feenstra (2015), these firm decisions are aggregated up to a structure that resembles the gravity model of trade (Chaney 2018).

lization rates are estimated. The empirical framework exploits variation in policy timing, technical production cost differences between woven and knitted textiles, and exporting country development status to control for potential confounding factors. Effectively, the triple-difference estimates the difference between a diff-in-diff (woven versus knit exports, before and after 2011) for LDCs and non-LDCs.[9] Finally, heterogeneity in the effects of the rules of origin revision across apparel products and LDCs are analyzed.

The results indicate that the rules of origin revision increased EBA utilization rates by 23 percentage points, on average. At the pre-2011 level baseline, this is equivalent to a 50% increase in preference utilization. Naturally, the increase in tariff-free imports into the EU reduced the EU's tax revenue. The rules of origin revision resulted in an 80% decline in tariff revenue from apparel imports from LDCs in the EU. An event study analysis provides evidence consistent with the parallel trends assumption holding. Across products, utilization rates increase more for products with higher non-preferential tariff rates. Across LDCs, utilization rates increased more for countries with lower existing trade barriers.

This paper contributes to the small, but growing, literature on the impact of rules of origin on trade. For example, several studies use cross-sectional data to analyze how utilization rates differ across trade agreements (Cadot et al. 2006; Hakobyan 2015; Hayakawa and Laksanapanyakul 2017). Other studies find that utilization rates grow as the difference between preferential and non-preferential tariff rates grow (Francois, Hoekman, and Manchin 2005: Manchin 2006; Keck

[9]The triple-difference approach has become a standard component of the empirical trade policy literature. For example, Hakobyan 2020 (2020), Frazer and Van Biesebroeck 2010 (2010), and Besedes, Kohl, and Lake 2020 (2020) use a triple-difference framework to analyze how changes in trade policy influence trade flows.

and Lendle 2012). However, since rules of origin change so infrequently, there have been very few studies that analyze how rules of origin liberalization policies influence trade. The few exceptions have focused on how rules of origin liberalization influence trade values (Andersson 2016; Bombarda and Gamberoni 2013; Conconi et al. 2018), rather than utilization rates, and have not focused on LDCs where rules of origin are particularly burdensome.[10] By focusing on how revisions to existing rules of origin influence trade preference utilization among LDCs, this study provides new insights into the role of international development programs in export growth.

This paper also related to the extensive literature on the impact of trade policy on exports from developing countries. The literature suggests that unilateral preferential trade agreements for developing counties have had mixed effects on export performance (Ornelas 2016), with some studies finding a positive effect on export growth (e.g., Hakobyan 2020; Frazer and Van Biesebroeck 2010; Devault 1996), and others finding no or negative effects (e.g, MacPhee and Oguledo 1991; Eicher and Henn 2011). The mixed results may be partially due to the prevalence of non-tariff and technical trade barriers firms face in developing countries (Hoekman and Nicita 2008). The results in this study indicate that export performance in developing countries depends on preferential tariff rates and policy tools that regulate access to preferential rates. Further, the finding that rules of origin revisions have a more limited impact for LDCs with more significant institutional trade barriers

[10] Tanaka (2020) analyzes how the EU's rules of origin reform influence Cambodian exporters, but does not analyze preference utilization rates. Sytsma (2019) analyzes how Bangladesh apparel firms responded to the EU's rules of origin reform and briefly discusses utilization rates. However, there is no formal analysis of the response of utilization rates in that paper either.

suggests that trade policy aimed at facilitating export growth in LDCs may need to take a holistic approach, rather than merely focusing on tariffs.

The remainder of this paper is organized as follows. Section 2 outlines the theoretical framework and discusses the relevant comparative statics. Section 3 discusses the data used in this study. Section 4 presents the empirical framework and the empirical results. Finally, Section 5 concludes.

2 Theory

This section outlines a theoretical framework that describes how rules of origin influence trade preference utilization rates and produces testable comparative statics. The theory is based on a discrete choice model with linear random utility, where exporters decide which trade regime to use while exporting to a destination. This formulation allows for aggregation up to a representative producer and aggregate demand for trade preferences. The model can be thought of as representing the decision of which trade program to use, conditional on deciding where to export.[11]

Suppose that producers $i = 1, \ldots, N$ can sell products $k = 1, \ldots, K$ to destinations $j = 1, \ldots, J$ under a discrete number of trading regimes $m = 1, \ldots, M$. For example m may allow i to sell to j under specific preferential tariffs. All firms have to option to export under MFN tariffs. This can be thought of as exporting under a program without any preferential tariff rates. The model can be extended to allow for multiple exporting countries, but for the purposes of this study the model can be thought of as being from the perspective of a given source country.

[11] There are additional margins over which exporting firms may respond to a change in rules of origin. For example, utilization rates may also change due to changes on the firm- or product-level extensive margin.

Let the utility function for producer i be:

$$V_{jkm}^{i} = ln\ b_{jkm}(\tau_{jkm}) - \alpha ln[c_{jkm}(r_{jkm}, f(l))] + \epsilon_{jkm}^{i}, \qquad \alpha > 0 \tag{1}$$

where $b_{jkm}(\tau_{jkm})$ is the benefit (i.e. revenue) from selling product k to j under regime m. This benefit is a function of the ad-valorem preference depth τ_{jkm}, which is defined as $\tau_{jkm} = \frac{t_{MFN,k} - t_{jkm}}{1+t_{jkm}}$. Here, $t_{MFN,k}$ is the tariff rate applied if no preferential trade agreement is used and t_{jkm} is the preferential tariff rate applied to product k in destination j if trade program m is used.[12]

Utility also depends on costs, c_{jkm}, which is a function of two factors. First, costs depend on labor costs of the firm, $f(l)$, which corresponds to wages that all firms must pay. More importantly for the context of this study, costs depend on the restrictiveness of the rules of origin associated with trade regime m, r_{jkm}. This term is intentionally kept general. In the context of this study the restrictiveness parameter captures all factors associated with satisfying the apparel rules of origin, which includes sourcing intermediate inputs from higher price domestic suppliers, and the documentation costs associated with satisfying the rules of origin. The restrictiveness parameter can capture other rules of origin as well. For example, r_{jkm} may capture the value-added rules that requires a specific amount of local value added in exported products as in Anson et al. (2005). Costs are increasing in the restrictiveness of the rules of origin: $\frac{\partial c_{jkm}()}{\partial r_{jkm}} > 0$.

While benefits and costs from exporting to j are the same for every producer, the term ϵ_{jkm}^{i} is producer specific. This term captures the idiosyncratic benefit for

[12] Note that the ad-valorem preference depth is decreasing in t_{jkm}. As, the preferential tariff rate falls, the preference depth widens and the benefit from using the trade program grows. If an firm chooses not to export under a preferential program, $t_{jkm} = 0$, and $\tau_{jkm} = t_{MFN,k}$.

firm i from exporting to j under trading regime m that is specific to product k.[13] This term is known to the firm, but unknown to the researcher, as in McFadden (1974), and is drawn randomly from the following extreme value distribution:

$$F(\epsilon_{jkm}^1, \epsilon_{jkm}^2, \ldots, \epsilon_{jkm}^N) = \Pi_{i=1}^N exp(-e^{-\epsilon_{jkm}^i}) \tag{2}$$

Trade regime m will only be chosen if $V_{jkm}^i \geq V_{jkq}^i \;\; \forall q = 1, \ldots, Q$. With firm-level data, a discrete choice model could be estimated based on this set up. In the absence of firm-level data, this set up can be aggregated to an expression that resembles the gravity model of trade. As shown in Feenstra (2015), an aggregate indirect utility function for a representative producer can be derived from this discrete choice framework. Given this set up, the aggregate indirect utility function is given by:

$$G(c_{jk1}, \ldots, c_{jkM}, B_{jkm}) = B_{jkm} \sum_{m=1}^{M} c_{jkm}^{-\alpha} \tag{3}$$

where $B_{jkm} = Nb_{jkm}$ denotes the total benefit of trade regime m. The expected aggregate demand for regime m across producers, X_{jkm}, can be derived from equation 3 by applying Roy's Identity:

$$X_{jkm} = B_{jkm} \frac{\alpha c_{jkm}^{-\alpha-1}}{\sum_{m=1}^{M} c_{jkm}^{-\alpha}} \tag{4}$$

[13]There are a number of unobservable factors that may influence a firms decision on how to export. For example, some firms may be better able to navigate complex legal issues surrounding international transactions, making it easier to use certain trade programs in a given export market. It is well-established in the literature that firm heterogeneity influences export destination decisions (e.g., Eaton, Kortum, and Kamaraz 2011). These factors are unobservable to the researcher, thus are modeled as the random component of firm utility.

Finally, redefining $\sigma = 1 + \alpha$, the utilization rate of trade regime m in product k is given by $\frac{X_{jkm}}{\sum_m X_{jkm}}$:

$$U_{jkm} = \frac{X_{jkm}}{X_{jk}} = \frac{B_{jkm}}{\sum_{m=1}^{M} B_{jkm}}[\frac{c_{jkm}^{-\sigma}}{\sum_{m=1}^{M} c_{jkm}^{-\sigma}}] \tag{5}$$

From equation 5, the response of the preference utilization rate to a change in rules of origin is given by:

$$\frac{\partial U_{jkm}}{\partial r_{jkm}} = \frac{B_{jkm}}{\sum_{m=1}^{M} B_{jkm}} * [-\sigma c_{jkm}^{-\sigma-1} \frac{\partial c_{jkm}}{\partial r_{jkm}} \sum_{q \neq m} c_{jkq}^{-\sigma}] * [\sum_{m} c_{jkm}^{-\sigma}]^{-2} < 0 \tag{6}$$

which is negative because $\sigma > 1$ and costs are increasing in rules of origin restrictiveness. Thus, relaxing the double transformation policy for LDCs should result in higher preference utilization rates of the EBA (the associated trade regime).

Taking the second partial derivative with respect to the ad-valorem preference depth τ_{jm}, results in the following expression:

$$\frac{\partial^2 U_{jkm}}{\partial r_{jkm} \partial \tau_{jkm}} = \frac{\partial B_{jkm}}{\partial \tau_{jkm}} * [\sum_{q \neq m} B_{jkq}] * [\sum_{m} B_{jkm}]^{-2} * [\theta] < 0 \tag{7}$$

where $\theta = [-\sigma c_{jkm}^{-\sigma-1} \frac{\partial c_{jkm}}{\partial r_{jkm}} \sum_{q \neq m} c_{jkq}^{-\sigma}] * [\sum_m c_{jkm}^{-\sigma}]^{-2}$. Because $\theta < 0$ and benefits are increasing in τ_{jkm}, trade preference utilization increases more for products with higher ad-valorem preference depth when rules of origin are relaxed.

3 Data

The data used in this project come from the EU's Eurostat imports by tariff regime database. Information on the annual value of apparel imports into EU countries by the tariff regime they entered the union under between 2001 and 2018 are collected for all LDCs and non-LDC developing countries. For all non-LDC developing countries, every HS6-level products within the HS-61 (knitted apparel) and HS-62 (woven apparel) headings are eligible for GSP preferences. For LDCs, these same apparel products are eligible for EBA preferences. The GSP tariff rates for non-LDCs are approximately 9%, while the EBA tariff rates for LDCs are 0%. Failing to satisfy the rules of origin results in MFN tariffs of approximately 12% being applied to apparel products for both LDCs and non-LDC developing countries. The non-LDC countries in the data are India, Indonesia, Malaysia, Thailand, Kenya, Nigeria, Marshall Islands, Micronesia, Nauru, Niue, Tajikistan, Ukraine, and Uzbekistan.[14] These countries will act as an additional control group in the empirical specification as the rules of origin revision did not apply to them. Prior to 2011, both LDCs and non-LDCs were required to use locally sourced fabric in exported apparel products.

I calculate utilization rates as the value of GSP- or EBA-eligible imports requesting benefits upon entry into the EU relative to the total value of imports into the EU. Specifically, the utilization rate of trade preferences by exporter i selling product k to EU country j in year t is:

[14]There are other countries that qualify for the GSP but not EBA, however only these exported apparel products to the EU over the period 2011 to 2018.

$$u_{ijkt} = \frac{X_{ijkt}^{Requested}}{X_{ijkt}^{Total}}$$

For example, Bangladesh sold €70843 worth of sweaters (HS 611019) to Denmark in 2015. This product from Bangladesh is eligible for EBA tariff rates.[15] The value of imports of this product into Denmark from Bangladesh that requested preferential tariffs under the EBA was €49881. Thus, the utilization rate of the EBA for Bangladeshi exports of sweaters to Denmark in 2015 is roughly $\frac{49881}{70843}$, or 70.4%.

Table 1 presents the summary statistics of utilization rates in 2010, the year before the rules of origin revision. The overall utilization rate of the preferential tariffs offered by EU countries to developing countries in apparel products is roughly 47%. Knitted apparel products have a utilization rate of 51% while woven products have a utilization rate of 43%. This is consistent with the restrictions placed on exporters by the rules of origin which were more difficult to satisfy for woven apparel. Producing woven textiles is a more capital-intensive process than producing knit textiles, and most LDCs rely heavily on imported woven textiles for their woven apparel products (Frederick and Staritz 2012).

The utilization rate of for LDCs, who are the only countries with access to the EBA, is almost 60%, but again utilization rates are higher for knitted apparel than woven apparel. For non-LDC developing countries, who only have access to GSP preferences, the overall utilization rate is lower, roughly 40%. Woven and knitted apparel products from these countries utilize the GSP preferences at a similar rate. The fact that utilization rates are lower for non-LDCs is not surprising. In theory,

[15]There are no apparel products with MFN rates of 0%.

Table 1: Utilization Rates

		N	Mean	St. Dev.	Min	Max
Overall						
u_{ijkt}		253437	0.47	0.45	0	1
	woven	131,079	0.43	0.45	0	1
	knit	122,358	0.51	0.46	0	1
LDCs						
u_{ijkt}		90,559	0.58	0.46	0	1
	woven	42,502	0.52	0.47	0	1
	knit	48,157	0.64	0.45	0	1
Non-LDC						
u_{ijkt}		162,778	0.40	0.44	0	1
	woven	66,577	0.38	0.43	0	1
	knit	74,201	0.42	0.44	0	1

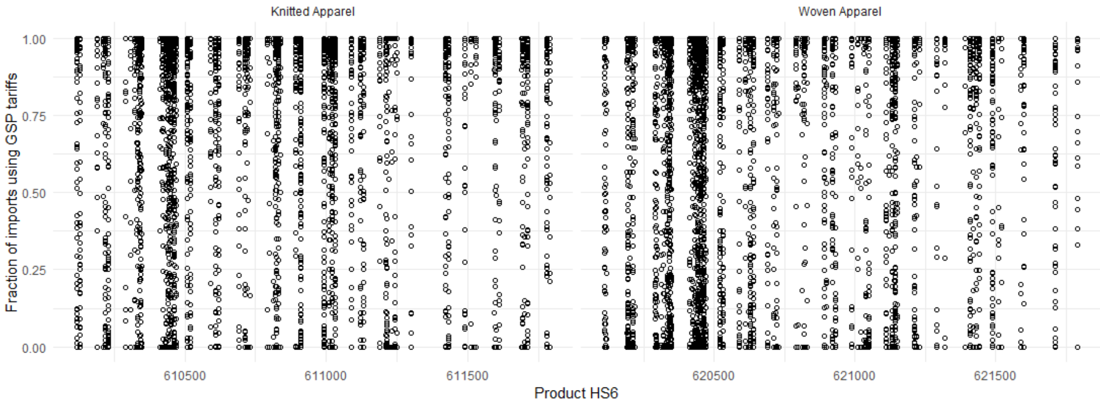
Notes: This table displays the summary statistics for the utilization rates of the EU's GSP. The data is broken down by apparel product type (woven or knitted), and by exporter (LDC or non-LDC).

the benefits from requesting a given trade regime are increasing in the difference between MFN rates and preferential tariff rates. GSP tariff rates are lower than MFN rates, but not substantially so. For most apparel products, the GSP tariff rate for non-LDCs is roughly 9.6%, while the MFN tariff rate is roughly 12%. This 2 percentage point difference is much smaller than the 12 percentage point difference for LDCs.

Breaking the data down further reveals a substantial amount of heterogeneity in utilization rates, both across products and across exporters. The heterogeneity in utilization rates across products is displayed in Figure 1. This figure shows the utilization rates across all exporting countries by product in 2010. For some products the utilization rate is close to 100% for all exporters, while for others there is much more variation in utilization rates. Figure 2 shows the heterogeneity in average utilization rates across products by exporting country. Utilization rates are lower for African countries. Angola and Mozambique have utilization rates of zero percent. South Asian countries tend to have the highest utilization rates.

Figure 3 displays the average utilization rates over time for woven and knitted products, and LDCs and non-LDCs. On the left, the utilization of GSP preferences for non-LDCs remains relatively constant throughout the sample period. Similarly, the difference in utilization rates between woven and knitted apparel for these countries also remains constant. For LDCs, there is a much larger gap in utilization rates between woven and knitted apparel prior to 2011. After 2011, the utilization rate increases substantially for woven apparel products, but does not appear to respond for knitted apparel products. Again, this is consistent with the lack of woven textile production in LDCs, which made it difficult for woven apparel producers to satisfy the EU's rules of origin (Frederick and Staritz 2012).

Figure 1: Utilization Rates by Product

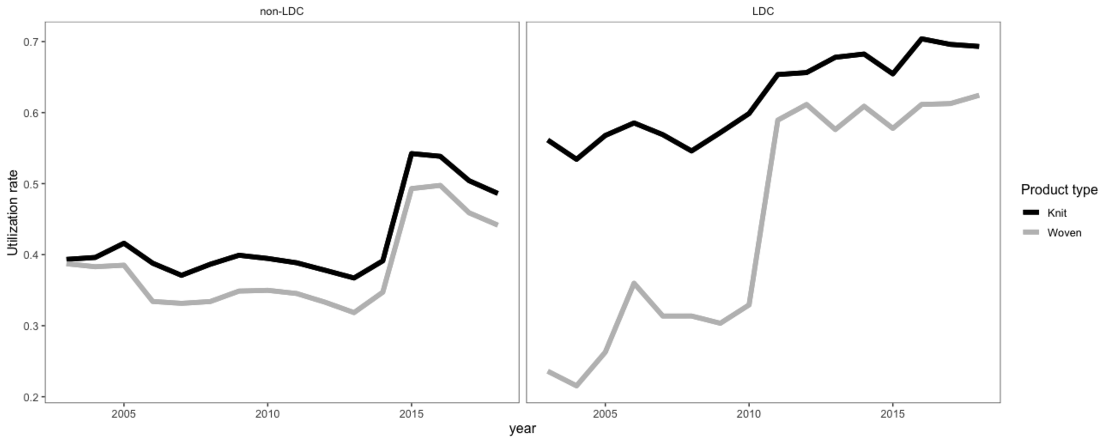


Notes: This figure plots the utilization rate for all all apparel products. Each point represents the export of the product to an EU country by a given exporter in 2010.

Figure 2: Average Utilization Rates by Exporter

Notes: This figure displays the average utilization rate of the EU's Everything But Arms (for LDCs) and GSP (for non-LDCs) for apparel products by exporter.

Figure 3: Utilization Rates



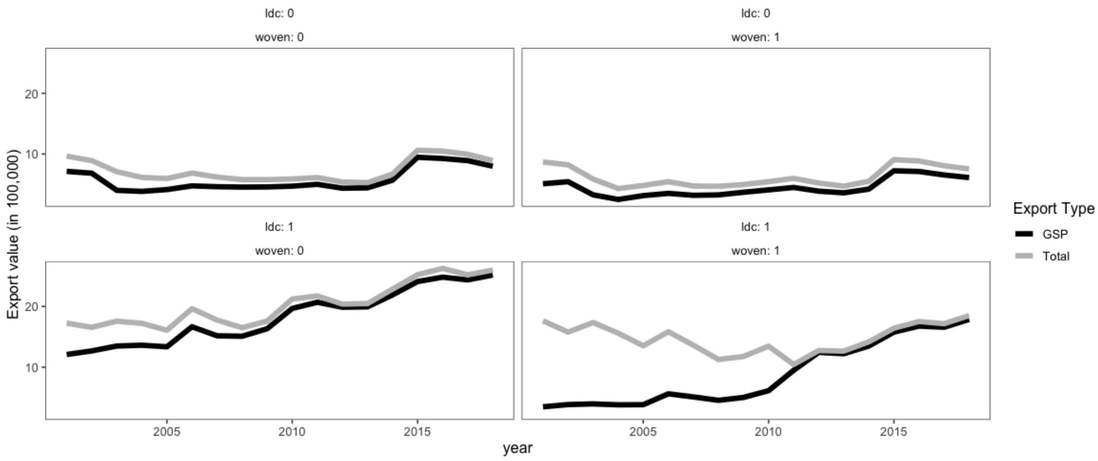
Notes: This figure displays the average utilization rate of the EU's Everything But Arms agreement for apparel products by year. The data are broken down by product type (woven versus knitted apparel) and exporter type (LDCs versus non-LDCs).

A similar pattern is present in Figure 4, which plots export values over time. Again, countries are broken into LDCs and non-LDCs, and products are broken into woven and knitted. The blue lines represent total export value and the green lines represent export value that entered the EU under GSP (or EBA) tariffs. For non-LDCs and for knit apparel from LDCs, there appears to be no change in export values after the rules of origin revision. Woven apparel export revenue for LDCs, on the other hand, does appear to respond strongly to the rules of origin revision.

4 Empirical model and application

The theoretical model, in Section 2, is framed around the decision to use a preferential trade agreement, which occurs at the firm level. Benefits of utilizing a trade

Figure 4: Export value



Notes: This figure displays the average export value for apparel products by year. Each panel displays the trends in total export value to the EU and the value that entered under the EU's GSP. In the Case of LDCs, the GSP value is equivalent to the Everything but Arms agreement value.

agreement come in the form of reduced tariffs in the destination market. The costs of utilizing a trade agreement come in the form of regulatory burdens, the local cost of intermediate inputs, and other exporter-specific factors (i.e. firm productivity). The data used in this paper is at the industry-level, thus the firm level decisions are not directly observable. As a result, analyzing the effects of the rules of origin revision on utilization rates of the EBA requires careful consideration of several potential confounding factors.

As an initial test, I estimate a difference-in-differences specification that takes advantage of variation in policy timing and in the costs of producing different types of textiles. Specifically, the production of knitted textiles is relatively inexpensive, even in capital-poor countries, while woven textiles are expensive to produce and dye (Frederick and Staritz 2012). Because knitted textiles are less expensive to make locally, exports of knitted apparel products were more likely to utilize the EBA under the initial rules of origin. Thus, even without information on local textile prices, a lower bound of the effect of revising the rules of origin can be inferred by examining the utilization rates of the EBA across different types of apparel products.

I estimate the following specification using data only on LDCs:

$$u_{ijkt} = \beta_1 + \beta_2 Post_t + \beta_3 Woven_k + \beta_4 (Post_t * Woven_k) + \epsilon_{ijkt} \tag{8}$$

where u_{ijkt} is the utilization rate for exporting LDC i in destination market j for product k in year t. The two right hand side variables are dummy variables. $Post_t$ takes the value of one if the year is 2011 or later, and $Woven_k$ takes the value of one if product k is a woven apparel product, and zero if k is a knit product. Here, woven apparel products are the "treatment" group, while knit apparel products act as a control group.

In equation 8, β_4 captures the effect of the rules of origin revision on utilization rates. However, comparing the utilization rates for woven and knitted apparel products exported from LDCs to the EU does not account for product-specific demand shocks. For example, given the fickle nature of fashion trends, there may be some years when woven apparel is in high demand in the EU relative to knit apparel. As a result, the utilization rate of the EBA may be driven by demand factors. Year fixed effects will account for some of this variation, however if a demand shock occurred at the same time as the rules of origin revision it will not be possible to disentangle the effect of the policy change from the effect of a demand shock on utilization rates.

To remedy this endogeneity concern, information on the utilization rates of non-LDC developing countries is used to create additional control groups. For developing countries that did not qualify for the EBA the rules of origin were not changed. In order for exporters in these countries to qualify for preferential tariffs under the GSP the use of locally sourced textiles was still required after 2011. Thus, for this group of countries the revision to the rules of origin in 2011 should not have differentially affected the utilization rates of woven and knitted apparel. Comparing differences in utilization rates between woven and knitted apparel products from LDCs to differences in utilization rates between woven and knitted apparel products from non-LDCs controls for endogenous demand shocks at the product- and country-group level.

Using the additional variation in utilization rates for non-LDCs, equation 8 is estimated on non-LDCs only to create a "control difference-in-differences". Then by comparing the results from estimating 8 on LDCs versus non-LDCs underlying product- and country-specific shocks are differenced out. The result is a triple-difference analysis with the following specification:

$$\begin{aligned} u_{ijkt} = \beta_1 + \beta_2 Post_t + \beta_3 Woven_k + \\ \beta_4 LDC_i + \beta_5 (Post_t * Woven_k) + \beta_6 (Post_t * LDC_i) + \\ \beta_7 (Woven_k * LDC_i) + \beta_8 (Post_t * Woven_k * LDC_i) + \epsilon_{ijkt} \end{aligned} \tag{9}$$

where, LDC_i is a dummy variable that is equal to one if country i is an LDC, and zero otherwise. Equation 9 exploits variation along three dimensions: (1) time periods (pre and post 2011); (2) exporters (LDCs and non-LDCs); and (3) products (woven and knit apparel). Thus, the triple difference (DDD) effect of the rules of origin revision on utilization rates is given by:

$$DDD = \beta_8 = (u_{Post,Woven,LDC} - u_{Pre,Woven,LDC}) - (u_{Post,Knit,LDC} - u_{Pre,Knit,LDC}) -$$
$$(u_{Post,Woven,non-LDC} - u_{Pre,Woven,non-LDC}) - (u_{Post,Knit,non-LDC} - u_{Pre,Knit,non-LDC})$$

The assumptions underlying equation 9 can be relaxed by replacing the interacted dummy variables with interacted fixed effects. For example, the $WOVEN_k * POST_t$ interaction can be controlled for using product-year fixed effects. This is similar to the specifications in Frazer and Van Biesebroeck (2010) and Hakobyan (2020). Additionally, destination-year fixed effects can be included to control for demand shocks. Finally, rather than simply controlling for exporter-product fixed effects to account for the $WOVEN_k * LDC_i$ dummy variable interaction, exporter-product-destination fixed effects can be included to account for heterogeneity in utilization rates at a more detailed level. Thus, my preferred specification becomes:

$$u_{ijkt} = \gamma_{it} + \delta_{jt} + \theta_{kt} + \phi_{ijk} + \beta_1(Post_t * Woven_k * LDC_i) + \epsilon_{ijkt} \tag{10}$$

where exporter-year (γ_{it}), destination-year (δ_{jt}), product-year (θ_{kt}), and exporter-destination-product (ϕ_{ijk}) fixed effects are included.

4.1 Results

Table 2 presents the results from estimating the equations in the previous section. The results from estimating equation 8 are presented in column 1. In this specification, only LDC countries are used to estimate the parameters and errors allow for clustering at the product-level. The results indicate that the rules of origin revision increased utilization rates by 20 percentage points for woven apparel relative to knit apparel for LDCs. Column 2 of the table presents the results of estimating equation 8 using only data on non-LDCs. As expected, the rules of origin revision did not have a meaningful effect on utilization rates for non-LDC countries.

Column 3 of Table 2 presents the results from estimating equation 9. This specification uses the full sample of LDC and non-LDC countries. Here, the effect of the rules of origin revision on utilization rates is estimated to be roughly 21 percentage points. The estimate of the parameter on $Post_t * Woven_k * LDC_i$ is the difference between the estimates of $Post_t * Woven_k$ in columns 1 and 2 of the table. Column 4 of the table presents the estimates from equation 10, which includes the sets of interacted fixed effects. Errors allow for clustering at the product-level.[16] The results are very similar to the results in columns 1 and 3; the rules of origin revision increased utilization rates by roughly 23 percentage points. When evaluated at the pre-2011 mean, this 23 percentage point increase is equivalent to a 50 percent increase in trade preference utilization rates.[17]

The increase in the utilization of the EBA for apparel products means that there were fewer imports of apparel under MFN tariffs in the EU, and as a result,

[16]The results are robust to allowing the errors to cluster over other dimensions. Table A1 displays the results when the errors are allowed to cluster at the product-year level, the destination-year level, and two-way clusters at the product-year and destination-year level. In all cases, the confidence intervals are smaller than when errors allow for clustering at the product level. Thus, to be conservative with inference, product-level clustering is used in the preferred specification.

[17]Equation 10 is also robust to estimated using a fractional logit specification to account for the bounded nature of utilization rates and the relatively large mass of observations at zero and one. Other models, like a Tobit model with upper and lower levels of truncation are not appropriate in this context because the underlying latent variable cannot be greater than one or less than zero.

tariff revenues fell. Column 5 of Table 2 displays the change in tariff revenue in the EU following the rules of origin revision. The results in this column are estimated using the same triple-difference framework specified in equation 10 but uses product-level tariff revenue as a dependent variable (rather than the utilization rate). To adjust for skeweness and retain the useful information contained in zero-valued observations, tariff revenue is transformed using an inverse hyperbolic sine function.[18] The results in column (5) indicate that the relaxation of the EU's rules of origin resulted in an a 80% decline in import tax revenue, on average.[19] When evaluated at the 2010 average tax revenue for woven apparel, this comes to approximately €64 million (approximately $75 million in 2020 USD).

4.2 Event-Study Framework

Next, an event-study framework is used to analyze the effect of the rules of origin revision on utilization rates. This entails replacing the $Post_t$ dummy variable in equation 10 with individual year dummy variables. This approach allows for an analysis of the underlying dynamics in the response of utilization rates over time. The event-study version of equation 10 is given by:

[18] The inverse hyperbolic sine is a form of log transformation, defined as $log(y + \sqrt{y^2 + 1})$. Unlike a typical log-transformation, the inverse hyperbolic sine is defined where $y = 0$, making it a common tool when working with skewed data (Bellemare and Wichman 2020). There are observations in the data where an importing EU country made zero tax revenue on an imported apparel product. A simple log-transformation of the tax revenue variable would remove these observations. That being said, the results are robust to the use of the natural log of tax revenue as well.

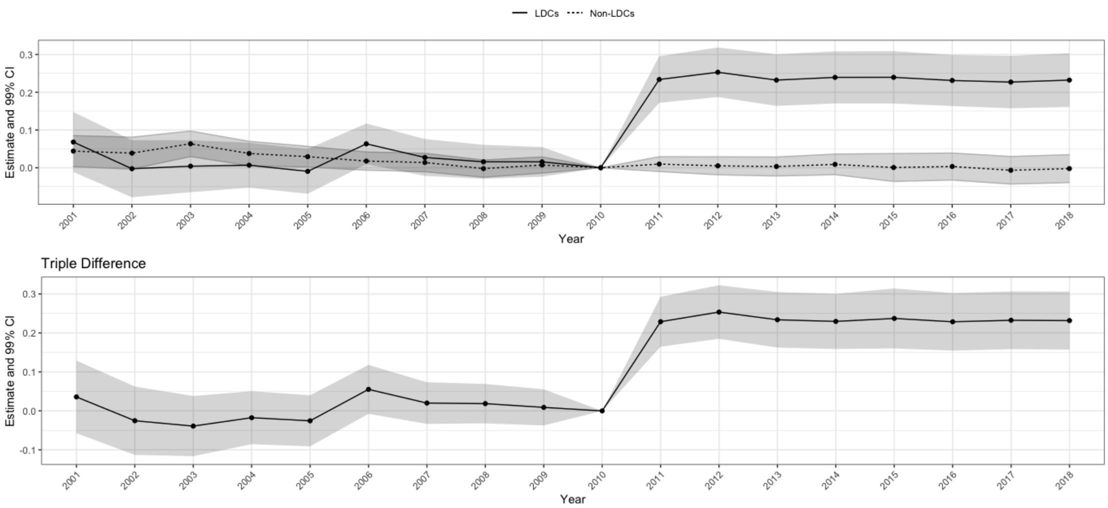
[19] The coefficient on a dichotomous variable with an inverse hyperbolic sine outcome is approximated with $exp(\hat{\beta}) - 1$ (Bellemare and Wichman 2020).

Table 2: Effect of rules of origin revision on utilization rates

	(1)	(2)	(3)	(4)	(5)
$POST_t$	0.12***	0.02**	0.02**		
	(0.02)	(0.01)	(0.01)		
$WOVEN_k$	−0.28***	−0.04***	−0.04***		
	(0.02)	(0.01)	(0.01)		
LDC_i			0.15***		
			(0.01)		
$POST_t * WOVEN_k$	0.20***	−0.01	−0.01		
	(0.03)	(0.01)	(0.01)		
$POST_t * LDC_i$			0.10***		
			(0.02)		
$WOVEN_k * LDC_i$			−0.24***		
			(0.02)		
$POST_t * WOVEN_k * LDC_i$			0.21***	0.23***	−1.62***
			(0.03)	(0.02)	(0.22)
Constant	0.56***	0.41***	0.41***		
	(0.02)	(0.01)	(0.01)		
importer-year FE				Y	Y
exporter-year FE				Y	Y
product-year FE				Y	Y
exporter-importer-product FE				Y	Y
N	90,659	162,778	253,437	253,437	253,437
R^2	0.07	0.002	0.06	0.66	0.67
Adjusted R^2	0.07	0.002	0.06	0.58	0.59

Notes: This table presents the results from estimating equations 8, 9, and 10. The dependent variable in the first five columns is the product-level utilization rate, while the dependent variable in the final column is the product-level tariff revenue. Column 5 is estimated using a fractional logit specification while all other columns are estimated with OLS. Errors allow for clustering at the product level in all specifications.

Figure 5: Event-Study Framework



Notes: This figure displays the estimates of the β_t's in equation 11. The top panel displays the results for LDCs and non-LDCs difference-in-differences separately, while the bottom panel displays the triple difference results. 99% confidence intervals are shown by the shaded region.

$$u_{ijkt} = \gamma_{it} + \delta_{jt} + \theta_{kt} + \phi_{ijk} + \sum_{t=2001/2010}^{t=2018} \beta_t(Year_t * Woven_k * LDC_i) + \epsilon_{ijkt} \quad (11)$$

where 2010 is used as the base year. A difference-in-differences event-study framework for LDCs and Non-LDCs separately, where equation 11 is estimated using only LDCs or only non-LDCs, as in columns (1) and (2) in Table 2 is also estimated. The results of estimating equation 11 are shown graphically in Figure 5. The top panel of the figure presents the LDC and Non-LDC specific estimates, while the triple-difference is presented in the bottom half of the figure.

The results in Figure 5 highlight an important aspects of the empirical approach. The effect of the rules of origin revision is quite pronounced among LDCs, as is evident in the LDC line in the top panel. The only year prior to 2011 in which there is there a statistically significant difference in utilization rates between woven and knit apparel for LDCs is 2006. There appears to be no response among non-LDCs. Thus, the results do not appear to be driven by a small increase in utilization rates for LDCs and a large decline in utilization rates among non-LDCs. The finding that the LDC difference-in-difference is quite similar to the triple-difference (shown in the bottom panel) is expected. Even in the raw data, shown in the right panel of Figure 3, the impact of the rules of origin revision for woven but not knit exports from LDCs is apparent.

As shown in the bottom panel of Figure 5, the difference between the pre-2011 LDC difference-in-differences and non-LDC difference-in-differences are not statistically different from zero. This is consistent with the parallel trends assumption holding in the triple difference context. In other words, the results in the bottom panel of the figure are consistent with the identifying assumption holding: in the absence of the rules of origin revision, the difference in utilization rates for woven and knitted apparel in LDCs would have evolved parallel to the difference in utilization rates for woven and knitted apparel in non-LDCs.

4.3 Heterogeneity across products

Next, the heterogeneity in the effect of the rules of origin revision across products based on differences in MFN tariff rates is examined. Regardless of whether a country is an LDC or not, failing to satisfy the rules of origin results in the MFN tariff being applied to the imports. Presumably, the larger the difference between the MFN rate and the preferential rate, the greater the incentive for exporting firms to satisfy the rules of origin. If this is the case, the revision of the rules of origin should increase the utilization rate for products with higher MFN tariffs more than for products with lower MFN tariffs. Tariff rate data at the HS8 level is collected from the World Trade Organization's Consolidated Tariff Schedules database (CTS).[20] MFN tariff rates for apparel products range from 6.3% to 12%.

To examine heterogeneity across products, equation 8 is estimated for LDCs while allowing the difference-in-differences effect to vary based on each products MFN tariff rate. This creates a new triple-difference model, where variation comes from the timing of the policy change, woven versus knitted products, and products with higher versus lower MFN tariffs. For all LDCs, the EBA tariff rates for all apparel products are 0%, which makes the effective preference depth (given by τ_{jkm} in the theoretical model) equivalent to MFN rates.[21] Specifically, the difference-in-differences effect is interacted with the standardized (by z-score) tariff rate, as recommended in Balli and Sørensen (2013) to deal with bias that arises with continuous interacted variables. The specification is shown below:

$$u_{ijkt} = \gamma_{it}+\sigma_{jt}+\theta_{ijk}+\beta_1(Woven_k*Post_t)+\beta_2(Post_t*t_k)+\beta_3(Post_t*Woven_k*t_k)+\epsilon_{ijkt} \tag{12}$$

where t_k is the standardized MFN tariff rate for product k. Importer-exporter-product, importer-year, and exporter-year fixed effects are included in the specifi-

[20] http://tariffdata.wto.org

[21] This specification is limited to LDCs because of the fact that LDCs and non-LDCs face different preference margins when exporting to the EU, which would effectively create a "quadruple-difference" model. The results are quantitatively and qualitatively similar when non-LDCs are included, although the interpretation becomes more difficult given the variation in preference depth with country groups for the same products. The LDC and non-LDC specifications of equation 12, and the quadruple difference are presented in Table A2.

cation to control for baseline utilization rates and country specific trends. Because tariff rates vary at the HS8 product level and the utilization rate data is at the HS6 level, the average, minimum, and maximum HS8-level MFN tariffs within an HS6 heading are used as the t_k variable in equation 12. The marginal effect of the rules of origin revision on utilization rates is given by $\beta_1 + \beta_3 * t_k$.

The results from estimating equation 12 are presented in Table 3, where the column title displays whether average, minimum, or maximum HS6 tariffs are used.[22] The results indicate that the utilization rates increased by roughly 20 percentage points for products with the average tariff level, and that a one standard deviation in MFN tariffs increased utilization rates by an additional 5 to 7 percentage points, depending on the specification.[23]

4.4 Heterogeneity across LDCs

Do exporter characteristics impact how much LDC utilization rates responded to the rules of origin revision? In LDCs where engaging in international trade is difficult – due either to inadequate "hard" infrastructure, like roads, or "soft" infrastructure, like institutions – changes in rules of origin may not have as large of an effect on preference utilization. The existing literature suggests that hard and soft infrastructure impact trade flows (Dutt and Traca 2010; Sequeira and Djankov 2014; Francois and Manchin 2013), which indicates they may also mediate the extent to which preferential tariffs are used by LDCs.

[22]The average tariff is the trade-weighted average HS8 tariff among products within the HS6 heading. The minimum and maximum tariff are the minimum and maximum HS8 tariff within an HS6 heading.

[23]There does not appear to be any additional heterogeneity in utilization rates across products based on trade elasticticies. Using data on product-specific trade elasticities from Broda and Weinstein (2006), estimates from equation 10 with an additional interaction for each product k's are not statistically significant at traditional levels.

Table 3: Heterogeneity across products

	(1) Average tariff	(2) Minimum tariff	(3) Maximum tariff
$POST_t * WOVEN_k$	0.217^{***}	0.220^{***}	0.215^{***}
	(0.023)	(0.023)	(0.022)
$POST_t * t_k$	-0.036	-0.018	-0.040^{*}
	(0.029)	(0.019)	(0.022)
$POST_t * WOVEN_k * t_k$	0.064^{*}	0.049^{*}	0.068^{**}
	(0.035)	(0.028)	(0.029)
exporter-importer-product FE	Y	Y	Y
exporter-year FE	Y	Y	Y
importer-year FE	Y	Y	Y
Observations	90,659	90,659	90,659
R^2	0.664	0.664	0.664
Adjusted R^2	0.569	0.569	0.569

Notes: This table displays the results of estimating equation 12. The column title refers to whether the average, minimum, or maximum HS8 tariff within the HS6 product group is used. Errors allow for clustering at the product (HS8) level.

To analyze the heterogeneity across exporters in the response to the rules of origin revision data from the World Bank's "Ease of Doing Business" index are utilized. The Ease of Doing Business is based on local laws, regulations, and administrative burdens, and is complied by the World Bank with the help of legal practitioners with the goal of providing an objective measure of regulations faced by firms in a given country. The Doing Business data contain several variables that capture regulatory environment as it pertains to global trade. Data on these trade-related variables from 2010, the year before the rules of origin revision, are utilized in this study.

Table 4 displays the summary statistics for the trade-related Doing Business variables. These include, the number of documents required to export and import, the cost to export and import, and the time it takes to export and import. Data are available for 31 of the 35 LDCs. However, the 4 LDCs for which the Doing Business data are not available comprise only 1.3% of total export value from LDCs. For the average LDC, exporting and importing requires preparing roughly 8 to 9 documents. The costs of importing and exporting – measured in USD per container – is roughly $2,500, on average, and it takes between 37 and 41 hours to clear customs in the average LDC.

The Doing Business data are used to estimate estimate the following specification:

$$u_{ijkt} = \gamma_{it} + \sigma_{jt} + \theta_{ijk} + \beta_1(Woven_k * Post_t) + \beta_2(Post_t * Woven_k * X_i) + \epsilon_{ijkt} \quad (13)$$

Table 4: Summary of Ease of Doing Business variables

Statistic	Mean	St. Dev.	Min	Max
# of documents required to export	8.032	1.683	5	11
# of documents required to import	9.323	2.508	5	17
Cost to export (per container)	2.448	1.478	0.818	5.882
Cost to import (per container)	2.979	1.804	0.829	7.186
Time to export (in hours)	37.581	15.472	17	75
Time to import (in hours)	41.000	18.811	18	100

Notes: This table displays the summary statistics for the Ease of Doing Business variables used in estimating equation 13.

where X_i is a Doing Business variable from Table 4. The regulatory burden variables are de-meaned, following the advice in Balli and Sørensen (2013) to deal with bias that arises with continuous interacted variables. Equation 13 is estimated using data on LDCs only because the Doing Business variables are not available for a large number of non-LDC countries. Hence, there is no additional LDC dummy variable.[24] The marginal effect of the rules of origin revision on utilization rates is given by $\beta_1 + \beta_2 * X_i$, where β_1 represents the effect at the average level of X_i.

The results from estimating equation 13 are shown in Table 5. Each column uses a different measure of regulatory cost. Across all specifications, the results indicate that higher regulatory burdens associated with trade dampen the impact of rules of origin liberalization on preference utilization rates. The documentation costs appear to have the largest effect on utilization rates, with each additional document reducing utilization rates by roughly 12 to 14 percentage points.

[24]However, the results are robust to the triple-difference specification, with an additional interaction term for Doing Business variables. Results are available upon request.

Table 5: Heterogeneity by exporter

	(1)	(2)	(3)	(4)	(5)	(6)
$POST_t * WOVEN_k$	0.142***	0.155***	0.205***	0.170***	0.209***	0.223***
	(0.016)	(0.018)	(0.021)	(0.019)	(0.022)	(0.025)
$POST_t * WOVEN_k$*Documents to Export$_i$	−0.118***					
	(0.015)					
$POST_t * WOVEN_k$*Documents to Import$_i$		−0.143***				
		(0.018)				
$POST_t * WOVEN_k$*Cost to Export$_i$			−0.0001***			
			(0.00002)			
$POST_t * WOVEN_k$*Cost to Import				−0.0001***		
				(0.00002)		
$POST_t * WOVEN_k$*Time to Export$_i$					−0.012***	
					(0.002)	
$POST_t * WOVEN_k$*Time to Import$_i$						−0.007***
						(0.002)
exporter-importer-product FE	Y	Y	Y	Y	Y	Y
exporter-year FE	Y	Y	Y	Y	Y	Y
importer-year FE	Y	Y	Y	Y	Y	Y
Observations	83,842	83,842	83,842	83,842	83,842	83,842
R^2	0.650	0.650	0.650	0.650	0.650	0.649
Adjusted R^2	0.560	0.560	0.559	0.559	0.559	0.559

Notes: This table displays the results from estimating equation 13. The Ease of Doing Business variables are described in Table 4. Errors allow for clustering at the product-level.

5 Conclusion

This paper analyzes how preferential trade agreement utilization rates respond when rules of origin are relaxed. Using the EU's revision to the rules of origin for apparel products from LDCs as a natural experiment, the results indicate the relaxing rules of origin to allow for more foreign content in exported products has a substantial effect on preference utilization rates. On average, the rules of origin revision resulted in an increase in the utilization rate of the EU's EBA by 50%. Heterogeneity in the results indicates that products with higher non-preferential tariffs saw larger gains in preference utilization rates. Further, the gains in utilization rates differ across LDCs. LDCs with lower non-tariff barriers, as measured using the WTO's Ease of Doing Business survey, saw larger gains in utilization rates.

The results of this study have significant policy implications. First, the revision of rules of origin for LDCs has been a major policy goal over the past several years. However, little is known about how much relaxing rules of origin would improve preference utilization rates. This study shows that allowing exporters in LDCs to use a greater amount of imported content in exported products results in large gains in preference utilization. This result suggests that relaxing rules of origin may help achieve the UN's Sustainable Development Goal of integrating LDCs into the global economy (Rosa 2017).

The heterogeneity in the results provide additional insight into the use of rules of origin as a policy instrument. Not all LDCs benefited the same amount when the EU's rules of origin were revised. The results indicate that revising rules of origin for LDCs may not be a panacea. Other trade reforms, particularly reforms that ease the formal and informal burdens faced by exporters in LDCs, would be complimentary to rules of origin revisions.

The results in this paper open the door to other policy-relevant questions. For example, how much do restrictive rules of origin impact foreign direct investment? It is possible that some of the heterogeneity in the response across LDCs to the EU's rules of origin revision is driven by different openness to FDI. FDI has been shown to have positive spillover effects in local economies (Kokko, Zejan, and Tansini 2001; Ciani and Imbruno 2017). Thus, the relaxation of rules of origin may result in lower levels of FDI as less local content is required in exported products, and this could have broad implications for local economies.

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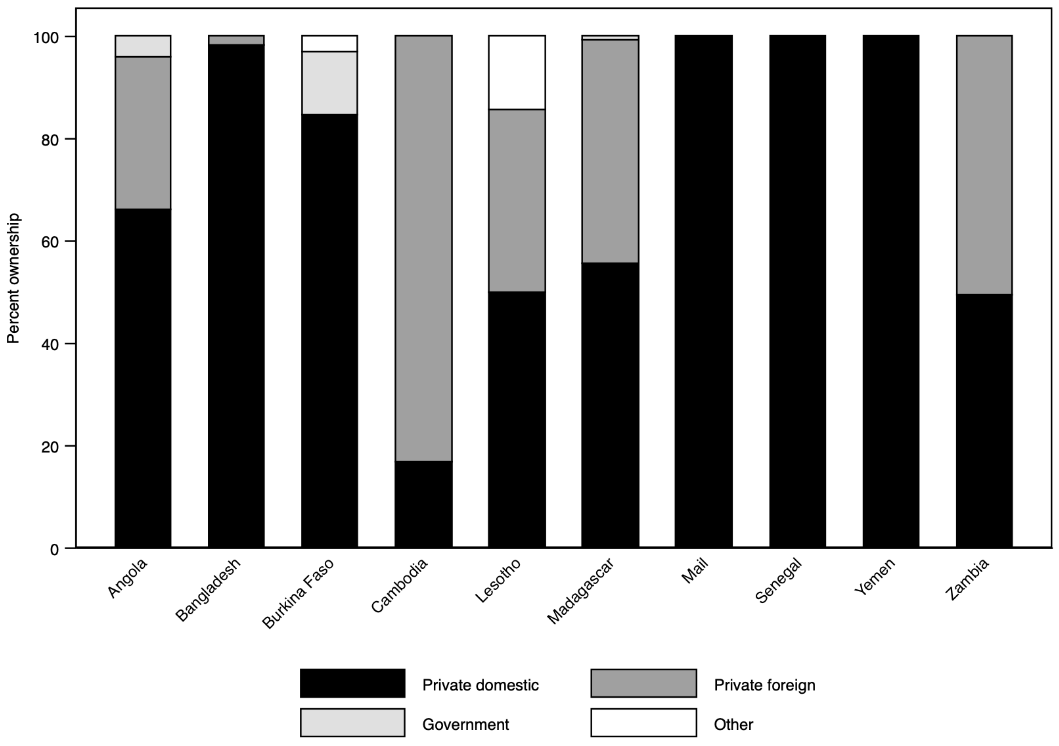
Figure A1: Apparel firm ownership percentages



Notes: This figure displays the average percent ownership by different stakeholders among apparel firms in LDCs. The data come from the World Bank's Enterprise Survey. The Enterprise Survey is conducted annually, but not all countries are represented in each year. Thus, the year closest to 2010 is used.

Table A1: Alternative specifications

	(1)	(2)	(3)
$POST_t * WOVEN_k * LDC_i$	0.229***	0.229***	0.229***
	(0.009)	(0.012)	(0.013)
N	253,437	253,437	253,437
R^2	0.658	0.658	0.658
Adjusted R^2	0.579	0.579	0.579

Notes: This table presents the results from estimating equation 10 while allowing the errors to cluster at different levels. In the first column, errors allow for clustering at the product-year level. In the second column, errors allow for clustering at the destination-year level. Finally, in the third column errors allow for two-way clustering at the product-year and destination-year level.

Table A2: Heterogeneity by preference depth

	LDC	Average Non-LDC	DDDD	LDC	Minimum Non-LDC	DDDD	LDC	Maximum Non-LDC	DDDD
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$WOVEN_k * POST_t$	0.221^{***}	-0.014^{*}	-0.013^{***}	0.223^{***}	-0.014	-0.013^{***}	0.219^{***}	-0.011	-0.010^{*}
	(0.023)	(0.008)	(0.004)	(0.022)	(0.008)	(0.004)	(0.022)	(0.008)	(0.005)
$POST_t * \tau_{ik}$	-0.033	0.005^{***}	0.005^{***}	-0.017	0.004^{***}	0.004^{**}	-0.037^{*}	0.016	0.017
	(0.026)	(0.001)	(0.002)	(0.018)	(0.001)	(0.002)	(0.020)	(0.012)	(0.012)
$WOVEN_k * POST_t * \tau_{ik}$	0.059^{*}	0.009	0.010	0.045^{*}	0.038	0.039^{**}	0.062^{**}	-0.011	-0.012
	(0.032)	(0.009)	(0.006)	(0.026)	(0.026)	(0.017)	(0.027)	(0.012)	(0.012)
$WOVEN_k * POST_t * LDC_i$			0.235^{***}			0.237^{***}			0.229^{***}
			(0.010)			(0.010)			(0.011)
$POST_t * LDC_i * \tau_{ik}$			-0.041^{***}			-0.022^{**}			-0.059^{**}
			(0.015)			(0.009)			(0.023)
$WOVEN_k * POST_t * LDC_i * \tau_{ik}$			0.051^{***}			0.006			0.078^{***}
			(0.017)			(0.020)			(0.024)
exporter-year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
destination-year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
exporter-product-destination FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	90,133	160,597	250,730	90,133	160,597	250,730	90,133	160,597	250,730
R^2	0.664	0.616	0.644	0.664	0.616	0.644	0.664	0.616	0.644
Adjusted R^2	0.570	0.552	0.573	0.570	0.552	0.572	0.570	0.552	0.572

Notes: This table presents the results from estimating equation 12 for LDCs and non-LDCs, as well as a "quadruple-difference" specification (DDDD). The variable τ_{ik} is the z-score of the preference depth, which varies by product and exporter type (LDC versus non-LDC) as is calculated as $\tau_{ik} = \frac{t_{MNF,k} - t_{ik}}{1 - t_{ik}}$, where $t_{MFN,k}$ is the MFN tariff rate for product k, and t_{ik} is the preferential tariff rate for k.