Preliminary – Comments Welcome

The Impact of Used-Clothing Imports on Apparel Production in Africa

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Abstract

What accounts for the failure of African countries to produce and export textiles and apparel? This paper examines the importance of one possible explanation—one that is frequently cited by African country governments. Specifically, it explores the impact of used-clothing imports on apparel production in these countries. These imports begin as used-clothing donations to thrift shops and other organizations in industrialized countries, and end up being sold to consumers in Africa. While African consumers are clearly made better off by the availability of this used clothing, the impact on African producers has been to this point unproven. Given that used clothing is initially provided as a donation, it shares characteristics with food aid, which in all cases assists consumers, but at times clearly harms African food producers. In order to test for a causal link between used-clothing imports and apparel production, an instrumental variables strategy is adopted. Geographic variables such as the distance between two countries are assumed to affect the level of used-clothing trade between countries but not apparel production independent of the used-clothing trade. Following this methodology, used-clothing imports are found to have a negative impact on apparel and textile production in Africa.

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1 Introduction

If East Asia has been the international success story over the last 30 years in terms of economic growth, trade and human development, Africa has been a story of failure. Taiwan, Korea, Singapore, Hong Kong, and now China have moved from exports of textiles and apparel to increasingly sophisticated electronic and industrial goods as their economies have grown, and the fruits of that growth have been broadly shared. In contrast, Africa has stagnated. In particular, onlookers are puzzled by the inability of Africa, despite its low unskilled wage levels and strong supplies of cotton, to produce and export textiles and apparel. On the one hand, African governments have been criticized for a variety of policies that have inhibited growth in general, and some would argue that these policies are responsible for the specific failure in textiles and apparel, as well as the overall failure. On the other hand, African governments have charged that imports of used clothing, in the form of cast-off donations from industrialized countries, have harmed the textile and apparel sectors in Africa. This paper will not provide an evaluation of the first cause–restrictive or misaligned African policies. It will examine the second cause–namely, whether the used-clothing imports have restricted textile and apparel production in African countries.

There has been a dramatic increase in the donation of used clothing to charities in developed countries over the last 20 years. Unable to sell even the majority of this clothing domestically, charities typically sell the used clothing to exporters who send it at a very low cost to developing countries, particularly in Africa (Hansen, 2000). The importance of this trade is seen by example. For the U.S., used clothing is consistently one of the top ten exports by value to African countries (U.S. Dept. of Comm, 2003; USTR, 2001;

USITC, 1999). By volume, its significance is larger. About 16 percent of the containers in container ships with U.S. exports bound for Africa in 1995 were filled with used clothing (Hansen, 2000, p. 120). This massive influx of used clothing has been criticized by African policymakers as harming their domestic textile and garment industries. The used clothing clearly provide benefits to African consumers, and as such the used-clothing imports have been compared to food aid, which, if improperly applied, can considerably harm the farmers whose crop price is devastated by the free food imports (while, of course, obviously helping the consumers of the food). Used-clothing imports are not formal government aid, but they originate as aid (donations), and are provided basically at the cost of transportation, and therefore share key characteristics with aid. Just as the reduced food prices from food aid can hurt the agricultural sector of these countries, the reduced clothing price from used-clothing imports have the potential to hurt the textile sectors of poor countries.[1] This paper will not comment on the benefits to African consumers, but will evaluate the impact of the used-clothing imports on apparel producers.[2]

The methodology will proceed in stages. As a first step, I will use regression analysis to examine the correlation between used-clothing imports (either the inflow or the stock) and apparel production within the country. As a second step, I will also identify the impact of used-clothing imports on garment production causally. This will be done using

[1] One can think of the impact of used-clothing imports in one of two ways. In the overall clothing market, it increases the supply of clothing, thereby reducing the price. Alternatively, in the new clothing market, it reduces the demand (because of the availability of the very close substitute–used clothing). The latter approach will be used in the Background section.

[2] The impact of the used-clothing donations on consumers is clearly another important piece of the story, and will be examined in future research. Unfortunately, examining the impact on consumer welfare is considerably more difficult than analyzing the impact on production, as to date (to my knowledge) household surveys in Africa have not separated consumption of used clothing from other clothing. I am currently advocating for their inclusion in forthcoming surveys so that this question can be addressed.

an identification technique that builds on Frankel and Romer's (1999) use of geographic and other exogenous characteristics to determine the level of trade between countries. For the causal analysis, the total level of used-clothing exports from a country in a given year will be assumed to be exogenously determined by the level of used-clothing donations in the country in that year. Given the available studies of the charitable used-clothing industry (e.g. Hansen, 2000), this seems a very reasonable assumption. Typically, whatever used clothing could not be sold locally in thrift shops was exported. Those donating used clothing have until recently been largely unaware that the bulk of this clothing is exported, and so were certainly not donating with conditions in Africa on their mind.

In brief, the effect of used-clothing imports on apparel and textile production, as measured using the instrumental variables technique, is found to be significant both statistically and in size in a wide variety of specifications, including controls for country-level fixed effects, and the overall size of the manufacturing sector. In this paper, Section 2 gives a background to the theory of what is being measured. Section 3 describes the specification used. Section 4 outlines the data and provides the results. Finally, Section 5 concludes.

2 Background

The impact of used-clothing imports can be theoretically analyzed very simply. Used clothing is a close substitute for domestically-produced apparel. Therefore, the importation of used clothing would result in a downward shift of the demand curve in the new apparel industry. Suppose that the demand curve for new clothing is given by $D = F(P, U)$, and the supply curve is given by $S = G(P)$, with P the price, and U the level of used-clothing imports into the country. Naturally, $\frac{\partial F}{\partial U} < 0$, as with used-clothing imports, people substitute away from domestic clothing production.[3] By differentiating the demand=supply equation with respect to U, it can be easily shown that the elasticity of the price of clothing in the domestic market with respect to the quantity of used-clothing imported is:

$$\eta_{P,U} = \frac{\eta_{D,U}}{\eta_{S,P}\lambda - \eta_{D,P}} \tag{1}$$

where $\lambda = D/S$, which is 1 in equilibrium, and the other terms represent the conventional elasticity definitions. This term basically captures the fact that in response to an increase in used-clothing, the demand curve for domestic clothing shifts (the numerator), and there is also a price response that is captured by the movement along the demand and supply curves to the new equilibrium. Given the signs of the above variables, $\eta_{P,U} < 0$. It then follows immediately that if we let E be the percentage change in domestic demand that is induced by a 1% increase in the volume of used-clothing imports, then:

$$E = \eta_{D,U} + \eta_{D,P}\left(\frac{\eta_{D,U}}{\eta_{S,P}\lambda - \eta_{D,P}}\right) \tag{2}$$

While the second term here is positive, by rearranging the terms it can be shown that $E < 0$. This characterization will naturally hold for a wide variety of models. For illustrative purposes, a simple Cournot model with heterogeneous firms is shown in the appendix. Naturally, more complicated models could be found to model the situation. To this point, it has been assumed that domestic producers do not export, or that the size of the export market is restricted.[4] If domestic apparel producers do freely export, then they will not

[3] As discussed earlier, an alternative way of modelling the used-clothing imports would be to look at the overall market for clothing and see the importation of used clothing as an expansion of the supply of clothing. The conclusions that follow would be the same. However, given that the cost structures for imported used-clothing (which began as donations), and the cost structures for domestic new clothes are considerably different, I believe that treating the used-clothing market as separate, but related, to the domestic new clothing market is most sensible.

[4] That apparel exports from Africa over this period are generally weak (with the exception of Mauritius) is

be affected by the size of the domestic market. Therefore, domestic production would not shrink as a result of used-clothing imports, as firms would merely maintain or increase their exports. In the empirical work, this would result in no relationship between used-clothing imports and domestic apparel production, and therefore can be tested. Similarly, domestic production would also not shrink if the used-clothing imports displaced the imports of new clothing rather than domestic production. Again, in this case, we would see no effect of used-clothing imports on domestic production in the empirical results.

3 Specification

Consider the following econometric model:

$$\log A_{it} = \alpha + \beta \log U_{it} + \gamma \log M_{it} + \delta_i + \xi_{it} \tag{3}$$

where A_{it} is a measure of production in the apparel sector in country i at time t, δ_i is a country fixed-effect to control for time-invariant factors that will affect a country's textile production, U_{it} reflects the used-clothing imports, M_{it} reflects the overall level of manufacturing, and ξ_{it} reflects other influences on a country's level of apparel production.[5] The overall level of manufacturing is included in order to capture trends in, and idiosyncratic shocks to, the overall level of manufacturing within a country that would affect the level of apparel production. As noted in the previous section, the used-clothing imports would depress the price that apparel producers face by increasing the supply of a close substitute,

a well-established fact. We remain agnostic as to the cause of the lack of apparel exports. Reasons proposed have included poor transportation infrastructure and high transaction costs related to the uncertain economic environment (Collier and Gunning, 1999).

[5] To check for robustness, the analysis will be performed with and without the δ_i and M_{it} controls. Also, the above specification implies that the flow of used-clothing imports in a given year is what affects apparel and textile production. Later, I will examine the effect of the overall (depreciated) stock of used clothing on apparel production.

used clothing, whose price only reflects the cost of transportation from industrialized countries to Africa, and not the cost of production. Since we showed that $E < 0$ in the previous section, the effect of these imports would be to decrease production. Therefore, naturally we would hypothesize that either β is zero or β is negative.

Naturally, the problem with simple least-squares estimation of equation (3) is that the used-clothing imports, U_{it} may be correlated with ξ_{it}, the other influences on a country's level of apparel production. The solution lies in an instrumental variable (IV) approach, that is in finding variable(s) that are correlated with U_{it}, but uncorrelated with the residual, ξ_{it}. The instrument used in this case follows the technique of Frankel and Romer (1999). They are interested in understanding the impact of trade on growth, but recognize that these variables may both be correlated with unobservables. To identify the impact of trade on growth, they assume that countries' geographic characteristics would affect the level of trade between them, but not growth independent of the level of trade. For each pair of countries in the world, Frankel and Romer developed a 'predicted' level of trade between them based on geographic characteristics of these countries (including distance between them). Summing over all of these predicted levels of trade, they get a geographically-determined share of a country's trade, which is used to instrument for a country's trade share in the income regression.

In our case, we seek a variable to instrument for the overall level of used-clothing imports in a given African country, and therefore we need to make a further assumption. Specifically, we also assume that the total level of used-clothing exports from a country in a given year is exogenously determined by the level of used-clothing donations in the country in that year. Given the available studies of the charitable used-clothing industry (e.g. Hansen, 2000), this seems a very reasonable assumption. Typically, whatever used clothing could not be sold locally in thrift shops was exported. Moreover, those donating the used clothing have been largely unaware that the bulk of this clothing has been headed for developing countries over the past 20 years. For most of the 1980s and 1990s (and even today), "most people who donate garments to charitable organizations are not aware of how their donations are disposed of." (Hansen, 2000, p. 103) In fact, most people assume that the bulk of the donations are sold in thrift shops. While this perception may have changed slightly in the past few years (and it is not clear that it has),[6] this perception certainly held for the period under study. People were not donating used clothing with conditions in Africa on their mind.[7]

Therefore, following Frankel and Romer, we construct a bilateral trade equation. In our case the trade in used clothing is being predicted by the geographic variables of Frankel and Romer, specifically country sizes (specified as both log population and log area), the distance between them, and whether either country is landlocked, as well as the overall level of used-clothing donations in a given country (which is captured by the overall level of used-clothing

[6]While formal surveys have not been done of a random sample of the overall population regarding where the used clothing goes, my conversations with many well-informed, well-educated individuals (including economists) has made it abundantly clear that, at least until recently, most have been unaware of the final destination of used clothing.

[7]If used-clothing donors had conditions in Africa on their mind, then we might expect an increase in used-clothing donations and exports during times when African economies were suffering. If the overall economies were performing poorly, we might expect that the apparel sectors are also performing poorly, and therefore used-clothing exports would be correlated with poor apparel production independently of the used-clothing trade itself. Again, fortunately, people were not donating with African conditions on their mind.

Still, even if they were, it would be heroic to argue that used-clothing donors were cognizant of the *relative share* of GDP or of manufacturing held by the apparel sector in these countries. Therefore, at times in this analysis, the apparel sector's share of manufacturing or of GDP will be used as the dependent variable to address this potential concern.

exports). Therefore, the specification of the bilateral trade equation is:

$$
\begin{aligned}
(4) \qquad U_{ijt} &= \beta_0 + \beta_1 \log(D_{ij}) + \beta_2 \log(N_{it}) + \beta_3 \log(N_{jt}) \\
&\quad + \beta_4 \log(A_i) + \beta_5 \log(A_j) + \beta_6 L_i + \beta_7 L_j + \beta_8 TU_{jt} + \varepsilon_{ijt}
\end{aligned}
$$

where U_{ijt} represents the per-capita imports of used-clothing from country j to country i in year t, D_{ij} is the distance between them, and A, N, and L describes a country's log area, log population, and whether it is landlocked, respectively (for both exporting and importing countries). The variable TU_{jt} captures the total used-clothing exports from country j in a given year.[8] These variables essentially capture the geographic components of a standard gravity equation for predicting trade, where a standard gravity model would also include the country income levels as predictors of trade. As such, these variables can also be thought of as the 'natural' transport costs of trade. This is how they are interpreted by Limao and Venables (2001), who calculate a gravity model of trade, and include the geographic variables of equation (4), as well as infrastructure variables in order to capture transport costs. When they do include transport costs directly in a regression to predict trade, they use predicted transport costs that have been first regressed on the geographic variables of equation (4), as well as infrastructure variables, in order to get an elasticity of trade with respect to transport costs. They also include the income and other variables of a standard gravity equation. Therefore, their approach is very similar to the one used here, as they have the same geographic variables as instruments–in their case for transport costs, and in our case, directly for the level of used-clothing trade (where the geographic variables are implicitly capturing transport costs). While they also use infrastructure to explain

[8] Frankel and Romer also include a variable for whether the exporting and importing countries are contiguous. This will not be possible for our dataset, as none of the industrialized countries are contiguous with the African countries under examination.

transport costs and therefore trade, we do not, as the infrastructure measures might also affect manufacturing production directly.

However, we should also note that while Frankel and Romer assume that the geographic variables will only affect growth via the trade component, we need to be a bit more subtle in our identification assumption.[9] Standard theory would predict that countries with larger regions of arable land would be relatively more engaged in agriculture, and therefore, relatively less engaged in manufacturing (including apparel manufacturing), for example. In order to control for this directly in the regressions that follow, country-level fixed effects will be included in the regressions in order to capture not only any endowment differences between countries, but also any other fixed factors that have led countries to different levels of apparel production. Therefore, the identification in our case does not come from the size variables in the above regression. Rather, the identification comes jointly from the aforementioned assumption on used-clothing exports coming from used-clothing donations, as well as the assumption that the distance and landlocked variables will not affect the level of apparel production except via their impact on used-clothing trade. It should be immediately noted that other things will also affect the level of used-clothing trade between countries. For example, some African countries have restricted the importation of used-clothing over the

[9] By being more subtle, we are also responding to a variant of the Rodriguez and Rodrik (2001) critique of the Frankel and Romer technique. Rodriguez and Rodrik argue that some geographic variables are going to affect a country's income independent of a country's trade. When they include such variables (notably distance from the equator, and the percentage of a country's land area in the tropics) in the income regression, the significance of the (instrumented) trade variable diminishes. It should be noted that this is an omitted variables critique, rather than an identification critique, per se. Rodriguez and Rodrik do not critique the assumption, for example, that the distance between two countries will affect the trade between those countries and not the level of a country's income independent of that trade. By such an assumption, the Frankel and Romer method of estimating the impact of trade on growth remains identified. The Rodriguez and Rodrik critique is that upon inclusion of the additional geographic variables, this (still identified) impact of trade on income diminishes and becomes insignificant. In the current paper, we implicitly include the geographic variables of concern to Rodriguez and Rodrik by including country-level fixed-effects in some regressions. This is not possible for Frankel and Romer as they have cross-sectional data.

period under examination (1981-2000). As a result, these countries will have even lower levels of used-clothing imports than would be predicted by the trade equation. Such policies reduce the correlation between the constructed used-clothing trade variable and the actual used-clothing trade, but do not affect the validity of the instrument, other than weakening it.[10] Later, we will test whether the instrument is a 'strong' or 'weak' instrument.

In addition, we need to handle an issue that is more problematic here than in the Frankel and Romer case. They simply drop any observations where bilateral trade is zero. While they do not specify how many observations are lost as a result, one can imagine that when examining total trade between pairs of countries, the number of zeros might not be numerous. However, we are examining just used-clothing trade, and there are many zeros. Therefore, a tobit version of the above equation is estimated.[11]

4 Data and Results

The data on trade in used clothing comes from the United Nations COMTRADE trade statistics. Specifically, used clothing is defined at the SITC 5-digit level (in Revision 1 as 26701, and in Revisions 2 and 3 as 26901). Note that it is important that the used clothing is defined at the 5-digit level as the 4-digit classification, 2670/2690, includes textile rags. In the COMTRADE data, for each export-import country pair, both the exporter and the importer provide a report of the trade. Given that we expect the industrialized country reports should be more accurate than African country reports, the industrialized country

[10] Identification is still coming from the geographically-determined component of used-clothing trade, not the component that might be determined by trade policy, or anything else.

[11] A standard tobit analysis is used, with the dependent variable censored at 0. Let $y = U$. Then, using the latent variable y^*, we get the standard setup, with $y^* = \{R.H.S.\text{ of equation (4)}\}$, and $y = 0$ if $y^* \leq 0$, and $y = y^*$ if $y^* > 0$.

reports of the used-clothing exports are used. The data covers the period from 1981 to 2000. Specifically, the used-clothing exporting countries are taken to be the OECD countries that are members over the entire period of the survey.[12] Fortunately, these countries reported their exports throughout the period, and so the used-clothing exporters are a stable group.

The data on manufacturing production and apparel production is taken from the UNIDO Industrial Statistics Database 2002. The measure of distance is the great-circle distance between capital cities. Per capita GDP is measured using the purchasing power parity method, and taken from the Penn World Tables, version 6.1. The data on population and area is from the World Bank World Development Indicators database.

As this is the first paper to explore the relationship between used-clothing imports and apparel production, the first step is clearly to establish the existence of a correlation between these variables, before exploring the causation through instrumental techniques. To do this, standard least-squares regressions of apparel production on used-clothing imports are performed in Table 1. Given the panel nature of the data, column (1) reports random-effects regressions. Here, we see a negative correlation between the apparel production and used-clothing imports, with a significant elasticity of roughly -0.29. The random-effects regression requires the assumption that the used-clothing imports variable is not correlated with any unobserved country fixed-effect affecting apparel production. The fixed-effects regression of column (2) allows for the inclusion of country-level fixed effects in the regression. This assumption is more general in that it allows for unobserved reasons why countries would have different levels of apparel production. For example, we might expect that countries with

[12] This drops the Czech Republic, Hungary and Slovakia, Poland and Turkey from the sample of OECD countries.

large areas of arable land might be more likely to have higher agricultural shares of GDP, and lower manufacturing shares (including apparel production) by implication. Allowing for country-level fixed-effects would capture these time-invariant differences between countries. Including the country-level fixed-effects has little effect on the coefficient, with the coefficient now at roughly -0.28. Still, allowing for country-level fixed effects might control for time-invariant factors within a country that affect its level of apparel production, but not for factors that say affect manufacturing as a whole, and change over time. Therefore, in columns (3) and (4), the country's manufacturing output in a given period is included as a further control. This should be able to capture, for example, general macroeconomic effects that result in changes in the overall level of manufacturing within a country, allowing the impact of used-clothing on apparel production to be better captured. The allowance for both country-specific fixed effects and the manufacturing control in column (4) reduces the used-clothing variable to -0.15. While this establishes a significant correlation between used-clothing imports and apparel production, to more firmly establish causation, we will also use the instrumental variable (IV) techniques outlined in the following section.

To construct the instrument, the Tobit form of equation (4) is estimated with the results given in Table 2. The coefficients are generally in line with expectations. The coefficient on distance is large, negative, and significant. The effect of being landlocked is also large, both for exporters and importers. Naturally, countries with a larger stock of used-clothing donations, as captured by the total used-clothing exports, will export more used-clothing. Importing countries with larger populations will trade more used clothing, even at a per capita level. Exporting countries with larger populations will also trade more used clothing. Geographically larger exporting countries will export less, in line with previous studies.

On the other hand, the geographical size of the importer does not seem to matter, as the coefficient on this variable is essentially zero.

Overall, then the geographic characteristics and used-clothing donations (as captured in the total used-clothing exports) are significant determinants of used-clothing trade. In order to use these results to capture the geographic component of a country's used-clothing trade, we aggregate the fitted values from the trade equation. Rewriting equation (4) in a more compact form, and recalling that the estimation uses the tobit model, we get:

$$\begin{aligned} U^*_{ijt} &= \beta' X_{ijt} + \eta_{ijt} \\ U_{ijt} &= 0 \text{ if } U^*_{ijt} <= 0 \\ U_{ijt} &= U^*_{ijt} \text{ if } U^*_{ijt} > 0 \end{aligned} \tag{5}$$

where β is the vector of estimated coefficients, and X_{ijt} is the vector of regressors, including the constant. Then, in order to capture the estimate of the total used-clothing imports into the country, we sum over the predicted levels of used-clothing trade between all country-pairs:

$$\widehat{U_{it}} = \sum_j \widehat{U_{ijt}} \tag{6}$$

These predicted used-clothing per capita trade values can then be used as an instrument for used-clothing imports in the regression of equation (3). The first-stage of this regression is given in Table 3. The instrument is strongly correlated with the used-clothing imports, and the F-statistic on the first-stage regression is quite large (Staiger and Stock, 1997), suggesting that the problem of weak instruments (biasing the IV estimate toward the OLS estimate) is unlikely to be of concern in our estimation.

The IV results are presented in Table 4. It should be noted that the coefficient being estimated should be interpreted as the variable E, and not the elasticity $\eta_{D,U}$, discussed in the earlier section. That is, the coefficient is capturing the overall impact of used-clothing imports on apparel value-added (in percentage change terms). The effect $\eta_{D,U}$ would measure the elasticity of demand for apparel with respect to used-clothing imports, holding prices constant. Clearly, then, we are aiming to capture the overall impact of used-clothing imports on the equilibrium quantity of apparel. There clearly would be a price impact as well. That is, in total, apparel firms respond to the used-clothing imports by lowering both their prices and quantities produced in equilibrium. Here, we only capture the impact on quantity (in the absence of country-level apparel price data). From equation (2), we can easily see that $E < \eta_{D,U}$. That is, if prices were held constant, the effect of the used-clothing imports on apparel demand would be larger, but of course, there is a supply response that reduces prices (and offsets the quantity decrease) in equilibrium.

As in the least-squares results, we see little change between the random-effects and fixed-effects regression, and the coefficients are significant once again. Once the manufacturing controls are included, the impact of used-clothing imports appears to be about -0.28. Therefore, a 1% increase in used-clothing imports results in a 0.28% decrease in apparel production (as well as an unmeasured price decrease).

To check for robustness of the results, the estimation is repeated under different conditions, with the results on the variable of interest provided in Table 5. First, we might be concerned about using the country's overall population as the denominator for value-added. If, for example, demographic shifts decrease the size of the workforce, the apparel per-capita value-added could be decreasing because of this shift rather than decreased production per worker. Therefore, the estimation is performed again using apparel value-added per worker as the dependent variable. The results, shown in line 1a) of Table 5 are virtually the same as Table 4.

More significantly, we might prefer to measure the impact on the apparel sector in terms of share of GDP, rather than at a per-capita level. This focuses on a slightly different measure of the success of apparel production. Per capita apparel production could be decreasing as part of an overall decrease in a country's per capita output (and recessions in per capita output were common in Africa in the 1980s and 1990s). However, such decreases would not be found when measuring apparel production as a share of GDP. The per capita used-clothing impact on the apparel share of GDP is captured in line 2a), and the used-clothing share of GDP impact on the apparel share of GDP is captured in line 2b). Note that for line 2b), this requires the construction of a different instrument from that used in Table 4, or line 1a) or 2a) of Table 5, as the variable being instrumented in 2b) is the import share of GDP, rather than the per capita imports. In 2a) and 2b), we again see that the results are significant, and larger than before, with estimated values of -0.42 or -0.48 including the controls.

We have examined the impact of used-clothing imports on apparel production after controlling for overall manufacturing production (in columns (3) and (4)). We can also examine the impact of the used-clothing imports on the apparel share of manufacturing. This is done in Row 3), using the methods of 2a) and 2b) in 3a) and 3b), respectively. Here, we see that, controlling for country-level fixed-effects, used-clothing imports have a significant effect on the apparel sector's share of manufacturing. A 1% increase in used-clothing imports as a share of GDP will result in a 0.30% decrease in the apparel share of manufacturing.

Furthermore, in addition to their impact on apparel production, we might also expect that used-clothing imports would have an impact on textile production, given the linkages between the textile and apparel sectors, and the possible conversion of used-clothing into textiles (although, as noted before, the imports considered do not include rags). If the domestic apparel industry obtains its supplies in large part from the domestic textile industry, the impact of used-clothing imports on textile production could be significant. Therefore, all of the estimation of Tables 4 and 5 is repeated using textiles, instead of apparel, in Table 6. As we can see, again, the results are in all cases significant, with the magnitudes being comparable to that for the apparel sector.

The major outlier in Africa regarding textile and apparel production is Mauritius. No other African country is able to achieve even Mauritius' minimum level of apparel value-added per capita over the period. Therefore, we could be concerned that Mauritius, as an outlier, might be driving the results. Therefore, the apparel and textile production regressions are all repeated, dropping Mauritius from the estimation. The results are given in Appendix C. In all cases, the measured (negative) impact of used-clothing imports on apparel production is larger, and in all cases it remains statistically significant. In the per capita value-added IV regression including the country-level fixed effects as well as the manufacturing control, the coefficient rises from -0.28 to -0.54. Therefore, Mauritius clearly moderates the overall results. The effects of used-clothing imports on apparel or textile production would be much stronger excluding it. With that caveat in mind, we include Mauritius in the ensuing results.

4.1 Using the Stock of Used Clothing

To this point, the flow of used clothing in a given period has been seen to affect apparel production in that period. While such an approach would clearly make sense in the case of food aid, where food imported in a given year is quite likely to be consumed in that year, this approach might not make as much sense when considering used clothing. If used clothing is a durable good, then what might affect the demand for domestic apparel in a given period is not the flow of used clothing into a country in the current period, but rather the imported used-clothing stock currently present in a country. In this way, used clothing that had been imported in previous periods might still have an effect on apparel production in the current period. Naturally, considerable work has been done in economics on estimating stock values using flows, particularly constructing capital stock series from investment flows. Most studies that construct such stocks use the perpetual inventory method, and there are two major considerations when employing such a method. The first is the issue of initializing the series. In our case, this can be handled fairly well, at least by the literature's standards. Given that the data under consideration is for the period 1981 to 2000, earlier used-clothing flow data can be used to obtain an initial value of the used-clothing stock in 1980. Specifically, the used-clothing import flow data from 1972 to 1980 is used to construct the starting value of the used-clothing stock in 1981. This basically assumes that flows from 1971 or earlier do not affect the stock of used clothing in 1981. The second issue in using the perpetual inventory method is the choice of a depreciation rate. In our case, this amounts to the question of how long used clothing lasts before being replaced. Rather than take a strong prior on this issue, I estimate the used-clothing stock using a variety of depreciation rates for comparison.

In all specifications employed, the stock of used clothing has a significant impact on the level of apparel and textile production. Moreover, the magnitudes of the coefficients are larger in virtually all cases than they were for the used-clothing flow regressions. For illustrative purposes, the results for a depreciation rate of 0.05, and of 0.30 are included in Appendix D and E, respectively. The first corresponds to an assumption that used clothing does not depreciate very much–the life of used clothing can be measured by decades. The second corresponds to an assumption that used clothing depreciates relatively quickly–it should typically last a few years.[13] While all of the results have been replicated for the case of the used-clothing stock variable, I will just highlight a few of the specifications. The first row of Table D2 and E2 provide the results for the depreciation rate of 0.05 and 0.30 for our standard specification. Once the manufacturing control and fixed effect are included, the coefficient is -0.32 when the depreciation rate is 0.05 (Table D2) and -0.39 when the depreciation rate is 0.30 (Table E2). Note that the coefficients on the stock variables are not immediately comparable to the earlier flow coefficients, as they describe the impact of stock changes not flow changes. Overall, in comparing the results of Tables D2 and E2, we see that in virtually all cases, the coefficient is larger for the specification with a depreciation rate of 0.30 than it is for the rate of 0.05, although this difference is virtually never significant.

Naturally, the question arises of which model, the model of used clothing as a 'flow' or the model as a 'stock', better fits the data. To test this, 'encompassing tests' are performed, following Mizon and Richard (1986). These test both whether the 'stock' regressions en-

[13] Note that in the import flow regressions, we have already examined the case where the used clothing depreciates very rapidly. In fact, those regressions can be interpreted as using a used-clothing stock variable with a depreciation rate of 100%. In this case, flows in the current period have no impact on next period's stock.

compass the 'flow' regressions, and vice versa. Specifically, label the regressors of the stock regression model X, and the regressors of the flow regression model as Z, and let Z_1 be the set of variables in the flow regression model that are not in the stock regression model. Then, a test of whether the stock regression model encompasses the flow regression model would be an F-test for the joint significance of γ in the following regression:

$$y = X\beta + Z_1\gamma + \varepsilon \tag{7}$$

Since in all cases, Z_1 is a single variable (the relevant used-clothing import variable), the F-test is equivalent to a t-test of the significance of γ. Therefore, the 'encompassing' tests for the case of OLS are straightforward. For the IV regressions, the 'encompassing' tests are similar in procedure (Smith, 1992). In each of the specifications (random-effects or fixed-effects, with or without the manufacturing control), the only difference between the stock and flow regressions lies in including the stock or flow used-clothing variable. Therefore, in the OLS case, the regression to test whether the flow encompasses the stock model is the same as the regression to test whether the stock model encompasses the flow model. The relevant regression regresses the apparel production on both the flow and stock variables (and manufacturing and fixed-effect controls, depending on the specification). If the flow and stock coefficients are both significant, then we would reject that either model encompasses the other. If both variables are insignificant, then we would not reject that both models encompass the other. If, say, the stock variable, is significant and the flow variable is not, we conclude that the stock model encompasses the flow model, but not the reverse. The results of the encompassing tests are provided in Appendix Table F1. For each of the specifications, the fixed-effects version is used, including the manufacturing controls (except, of course, in the share of manufacturing regression). The test statistics for each of the tests is reported, along with the p-value for the test, with the test's null-hypothesis reported at the top of the column. For the apparel production tests, for both the OLS and IV specifications, we cannot reject that the stock model encompasses the flow model. On the other hand, the test of whether the flow model encompasses the stock model is rejected for the OLS regressions, but is only rejected in one of the (preferred) IV regressions for apparel production. Therefore, for apparel production, there is no robust evidence to accept the stock model over the flow model or vice versa. However, for the textile regressions, the results are somewhat clearer. For both the OLS and IV regressions for all specifications, we cannot reject that the stock model encompasses the flow model. On the other hand, we can reject that the flow model encompasses the stock model in all of the OLS specifications. We can also reject that the flow model encompasses the stock model in 4 out of 6 IV regressions, and in the remaining 2 cases, the p-values are just larger than the 10% cutoff. Overall, then, there is some evidence suggesting that the stock model is preferred in the case of textiles.

Overall, then, the preferred (or 'non-encompassed') specifications are summarized in Table 7. In all cases, the estimates are for regressions including fixed-effects. For rows (1) through (3), they also include manufacturing controls (which are not needed in the share of manufacturing regressions of (4)). The encompassing tests failed to allow us to reject either the flow regressions or the stock regressions for apparel production, and therefore both of these regressions are included in the table. However, for the textile regressions, the encompassing tests allowed us to reject the flow regressions in favour of the stock regressions, and therefore just the stock regressions are included in this case. The stock regressions assume an intermediate depreciation rate of 0.15. Not surprisingly, the intermediate depreciation rate of 0.15 produces results that lie between the results for the depreciation rates of 0.05 and 0.30.

The impact of used-clothing imports on apparel production is given in the first four columns, with the IV results in columns 2 and 4. Here, we see that the variable E described in the earlier section measuring the percentage change in domestic production (and demand) resulting from a 1% increase in used-clothing imports is -0.28 for apparel production per worker when only used-clothing flows are considered, and is -0.37 when used clothing is treated as a stock (row (2)). When the impact is measured as a share of GDP, the effect is larger, with the 1% increase in used-clothing imports share of GDP resulting in a -0.48% decrease in apparel production when the imports are treated as a flow, and a -0.64% decrease when the imports are treated as a stock (row 3(b)). These changes are within country changes, and they control for the overall level of manufacturing in a country. We can also directly measure the impact of the used-clothing imports on the apparel share of manufacturing and find that the measure E in this case is -0.30 for the flow case, and -0.35 for the stock case.

The impact of used-clothing imports on textile production is given in the final column of Table 7. Here, we see that a 1% increase in the per capita stock of used-clothing results in a -0.36% decrease in per worker textile production. A 1% increase in used-clothing stock as a share of GDP results in a -0.59% decrease in textile production's share of GDP. Finally, a 1% increase in the used-clothing stock as a share of GDP results in a -0.35% decrease in textile production's share of GDP.

To determine whether these effects are large, one needs to examine the changes to the used-clothing stock over the course of the sample period. Over the course of the sample, the average annual change in the per-capita used-clothing stock was an 11.1% increase.[14] According to the coefficient point estimates, this would result in a 4.0% annual drop in per capita apparel production, and a 4.1% annual drop in per capita textile production. The effect on GDP shares is slightly larger. The average annual change in the used-clothing stock's share of GDP was 9.1%. This change would result in an 5.8% annual drop in the apparel production share of GDP, and a 3.7% annual drop in the textile production share of GDP. Finally, the impact on the textile and/or apparel share of manufacturing is similar. The average change in the used-clothing import stock's share of GDP would result in a 3.8% drop in the apparel share of manufacturing, and also a 3.1% drop in the textile share of manufacturing.

The impact of the changes in flows of used-clothing imports can also be examined in the case of apparel production.[15] Over the course of the sample, the average annual change in the per-capita used-clothing import flow was an 11.5% increase. According to the coefficient point estimates, this would result in a 3.2% annual drop in per capita apparel production. The average annual change in the used-clothing imports' share of GDP was 8.7%, resulting in an average 4.2% drop in apparel production's share of GDP, and a 2.6% drop in the apparel share of manufacturing.

While naturally there is considerable heterogeneity across countries in terms of the size of used-clothing imports, clearly at the average, the impact of these imports on textile and apparel production was both statistically and economically significant.

[14] This is measured using a depreciation rate of 0.15.

[15] Recall that the stock regressions encompassed the flow regressions in the case of textile production.

5 Conclusion

Initially, the collective wisdom held that sending free food to developing countries could do nothing but help these countries, by increasing their incomes. The discovery that food aid could harm food producers in poor countries was as much a discovery as it was important. Furthermore, just as food aid clearly benefits the consumers of food, used-clothing imports clearly benefit the consumers of used clothing, by making available lower cost apparel. Examining the impact of used-clothing imports on textile and apparel *production* has been the purpose of this paper, and this impact has particular relevance, given the importance of textile and apparel production in the dynamic process of industrialization. This paper has established, through an instrumental variables approach, that used-clothing imports had a significant negative impact on the textile and apparel production sectors in sub-Saharan African countries.

The first step of the paper was to establish the presence of a (negative) correlation between used-clothing imports and apparel production in Africa. This correlation had not been established previously, and so is interesting in its own right. Then, in order to identify the causal impact of used-clothing imports on apparel and textile production, instrumental variables were used. Specifically, geographic variables were assumed to affect the level of trade between the countries, but not the level of apparel production of the importing country, independent of that trade. In addition, based on descriptive studies of used-clothing donations to charities, the used-clothing exports from the industrialized country were assumed to be determined by the level of used-clothing donations in that country. Using these assumptions the impact of the used-clothing imports on apparel production in African countries could be computed. The flow of used-clothing imports, as well as the accumulated stock of used-clothing imports were found to have an economically and statistically significant effect on both textile and apparel production in a wide variety of specifications.

6 Appendix A - Simple Cournot Model

Assume that demand is given by $Q = F(p, U)$. Then, provided that conditional on U, Q is monotonic in p (the usual demand assumption), then we can get an inverted demand function of the form $p(Q, U)$. Then, the profit function for firm j is given by:

$$\pi_j = p(Q, U)\ q_j - C_j(q_j) \tag{8}$$

The firm will maximize this profit through the choice of q_j. Firms are heterogenous in terms of their costs. This will give a first order condition of:

$$p(Q, U) + q_j \frac{\partial p}{\partial Q} - C_j^{'}(q_j) = 0 \tag{9}$$

The second-order condition for profit maximization will be:

$$2\frac{\partial p}{\partial Q} + q_j \frac{\partial^2 p}{\partial Q^2} - C_j^{''}(q_j) < 0 \tag{10}$$

From equation (9), using the Implicit Function Theorem we get that:

$$\frac{\partial q_j}{\partial U} = - \frac{\frac{\partial p}{\partial U}}{2\frac{\partial p}{\partial Q} + q_j \frac{\partial^2 p}{\partial Q^2} - C_j^{''}(q_j)}$$

By the second-order condition, the denominator is negative. Furthermore, the numerator is negative, given the calculation $\eta_{p,U}$ calculated in the main text of the paper. As a result, the overall effect of an increase in the imports of used clothing is to decrease the quantity produced within each firm. It should be noted that $\frac{\partial q_j}{\partial U}$ is clearly a marginal effect. While in a Cournot setting, each firm would respond to the used-clothing imports by decreasing their quantity produced, this would only apply to small changes in U, the used-clothing imports. In reality, as the used-clothing imports underwent a larger increase from say

U_1 to U_2, the profits of some firms (from (8)) would now be negative (given their cost C_j), and they would exit production. In fact, it is even possible that some firms would increase production as a result of the exit of other firms, but aggregate production would unambiguously decrease. Empirically, we are working with aggregate production numbers, and will not be able to differentiate between decreased production resulting from firm exit, and decreased production within firms.

7 Appendix B - The Data

The data on used-clothing exports from OECD countries to African countries comes from the U.N. Comtrade database. For each export from an OECD country to an African country, there are potentially two reports of the export, one from the OECD country reporting the export, and one from the African country reporting the import. The OECD country report is used for two reasons. The first is that while the OECD countries that are members throughout the period 1981-2000 also report their exports throughout the period, the African country reports are missing for some countries and years. Using African reports then would diminish the size of the sample. The second reason is that we expect measurement error to be smaller in the OECD countries' reports than the African countries' reports. Given that the used-clothing imports will be summed across all OECD exporters for each African country in each year, it is important that the set of OECD countries in the sample remain stable. Fortunately, as just mentioned, the OECD countries do report their exports for all years of the period of interest (1981-2000). Two brief caveats are worth mentioning. First, from 1981 to 1998, Belgium and Luxembourg report their combined exports to the U.N., while in 1999 and 2000, they report their exports separately. Therefore, for the purpose of the trade estimation, Belgium and Luxembourg is treated as a single unit for the period from 1981 to 1998, and as separate countries from 1999 to 2000. From 1981 to 1998, the populations and areas of Belgium and Luxembourg are combined for the trade regression. Also, during this period, West Germany united with East Germany to create Germany, and similarly the appropriate variables are used for the respective years. On the importing side, while the South African Customs Union (SACU - consisting of South Africa, Botswana, Namibia, Swaziland, and Lesotho) is reported as an export destination for the period from 1981 to 1999, exports are reported separately to each of the constituent countries for the year 2000. For the SACU countries, then, for the period from 1981 to 1999, the volume of used-clothing imports to SACU is apportioned to each constituent country according to its population share. Practically, only South Africa reports apparel production throughout the period, and so this basically amounts to apportioning the lion's share (almost 90% of population) of the SACU used-clothing imports to South Africa.

The variable of interest, used clothing, has SITC code 26701 (Rev. 1) and 26901 (Rev. 2 and 3). This coding captures used-clothing, and not textile rags (26702 in Rev. 1 and 26902 in Rev. 2 and 3). In the specifications that use per capita used clothing, the volumes of used clothing are obtained directly from the U.N. Comtrade database. The volumes are directly reported and not computed through deflating value measures. In the specifications that employ the used clothing's share of GDP, the value of used clothing imported in current dollars is measured as a fraction of the country's GDP measured in current dollars (on a purchasing power parity basis). Similarly, for the used-clothing import share of manufacturing, the value of used-clothing imports in current dollars is measured as a fraction of the manufacturing value-added in current dollars.

The data on textile and apparel production was taken from UNIDO's Industrial Statistics Database (2002). The apparel sector corresponds to ISIC Code 322, while the textile sector corresponds to Code 321. Data on the apparel (textile) sector share of GDP is calculated the ratio of apparel (textile) value-added (in current dollars) to GDP in current dollars (on a purchasing power parity basis). Data on the apparel (textile) value-added share of manufacturing is calculated as the ratio of apparel (textile) value-added (in current dollars) to manufacturing value-added (in current dollars). Data on the per capita value-added is deflated using textile and apparel price series, respectively, from the U.S. Bureau of Labor Statistics website (www.bls.gov).

Data on used-clothing exports were available for all the OECD countries for all years from 1981 to 2000, enabling the trade predictions to occur from a consistent base. However, the apparel production data from UNIDO was more sporadic in availability, and was clearly the binding constraint on data availability. Therefore, the production data is an unbalanced dataset, with data available from the following countries (number of years in brackets): Benin (1), Botswana (12), Burkina Faso (3), Burundi (7), Cameroon (14), Central African Republic (7), Congo (8), Côte d'Ivoire (14), Ethiopia (7), Former Ethiopia (9), Gabon (2), Ghana (10), Kenya (19), Lesotho (5), Madagascar (8), Malawi (18), Mauritius (18), Namibia (1), Niger (9), Nigeria (11), Rwanda (3), Senegal (17), Seychelles (4), Sierra Leone (5), South Africa (20), Swaziland (10), Tanzania (9), Togo (2), Uganda (1), Zambia (4), Zimbabwe (19).

Therefore, the sub-Saharan African countries which are missing entirely from the above dataset due to a lack of production data are the following: Angola, Chad, Comoros, Republic of Congo, Djibouti, Equatorial Guinea, The Gambia, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Mozambique, São Tomé & Príncipe, Somalia, and Sudan. Of these, the majority of these countries (Angola, Chad, Republic of the Congo, Djibouti, Liberia, Mali, Mozambique, Somalia, and Sudan), including the five largest countries (Angola, Mali, Mozambique, Somalia, and Sudan) all suffered from civil war during part or all of the period under study (as defined by Sambanis, 2000) . The countries that are *not* in the sample that did *not* suffer from civil war include Comoros, Equatorial Guinea, Gambia, Guinea, Guinea-Bissau, Mauritania, Niger, São Tomé & Príncipe, and Seychelles.

The creation of the used-clothing stock follows the perpetual inventory method, using the depreciation rates as outlined in the text and tables. In order to create an instrument for this used-clothing stock in the IV regressions, the instruments used for the used-clothing flow variables are used. That is, the flow instruments (the predicted results from the first stage of the instrumental variables regression) are used as the flow variables for the purposes of creating an instrument for the used-clothing stock variable, following the perpetual inventory method.

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Table 1 - Used-Clothing Trade and Apparel Production - Least Squares Results

	(1) Random-Effects	(2) Fixed-Effects	(3) Random-Effects	(4) Fixed-Effects
Constant	-5.036	-4.484	-3.688	-3.686
	(.416)	(.062)	(.227)	(.128)
Used Clothing Imports per capita	-0.291	-0.278	-0.168	-0.148**
	(.054)	(.055)	(.049)	(.057)
Manufacturing Value-Added per capita			1.267	1.143
			(.117)	(.173)
With fixed effects		+		+
N	217	217	205	205
R-squared	0.102	0.118	0.752	0.304

Notes: All of the variables are in logarithms. The dependent variable is (log) per capita value-added in apparel production. Standard errors are in parentheses. Columns (1) and (3) are random-effects regressions. Columns (2) and (4) are fixed-effects regressions, with a fixed-effect per country.
All coefficient estimates are significant at the 1% level.

Table 2 - The Used-Clothing Trade Equation

Constant	-2.033
	(1.495)
log(distance)	-2.134
	(.152)
log(population)	0.364
importer	(.058)
log(area)	0.019
importer	(.044)
log(population)	1.181
exporter	(.056)
log(area)	-0.731
exporter	(.047)
log(total used clothing exports)	0.028
exporter	(.001)
landlock	-1.377
importer	(.117)
landlock	-3.143
exporter	(.225)
Sample Size	20448
Log-likelihood	-25048.7

Notes: The following coefficients are the result of the tobit estimation outlined in the text, with per capita used clothing imports as the dependent variable. Standard Errors are in parentheses.

Table 3 - The Relation between Actual and Constructed Used-Clothing Trade

Constant	-2.621
	(.595)
log(Constructed Per Capita Used-Clothing imports)	1.116
	(.197)
F-stat	32.03

Notes: The dependent variable is the log(per capita used-clothing imports) in a given year. Standard errors are in parentheses.

Table 4 - Used-Clothing Trade and Apparel Production - IV Results

	(1) Random-Effects	(2) Fixed-Effects	(3) Random-Effects	(4) Fixed-Effects
Constant	-4.981	-4.519	-3.890	-3.808
	(1.503)	(.066)	(.704)	(.163)
Used Clothing Imports	-0.489	-0.487	-0.278**	-0.276**
per capita	(.095)	(.100)	(.112)	(.118)
Manufacturing Value-Added			1.005	0.979
per capita			(.198)	(.220)
With fixed effects		+		+
N	217	217	205	205
R-squared	0.102	0.052	0.760	0.284

Notes: All of the variables are in logarithms. The dependent variable is (log) per capita value-added in apparel production. Standard errors are in parentheses. Columns (1) and (3) are random-effects regressions. Columns (2) and (4) are fixed-effects regressions, with a fixed-effect per country.
All unmarked coefficient estimates are significant at the 1% level. Coefficients marked * are significant at the 10% level, and coefficients marked ** are significant at the 5% level.

Table 5 - Used-Clothing Trade and Apparel Production - IV Results - Different Specifications

Specification	(1) Random-Effects	(2) Fixed-Effects	(3) Including Manufacturing Control Random-Effects	(4) Including Manufacturing Control Fixed-Effects
1) Dependent variable log (Apparel Value-added per worker)				
a) Per capita used clothing	-0.493	-0.491	-0.284**	-0.283**
	(.094)	(.099)	(.114)	(.122)
2) Dependent variable log(Apparel Value-Added Share of GDP)				
a) Per capita used clothing	-0.546	-0.544	-0.424	-0.422
	(.095)	(.100)	(.135)	(.143)
b) Used-Clothing Imports Share of GDP	-0.628	-0.626	-0.490	-0.483
	(.108)	(.113)	(.153)	(.160)
3) Dependent variable log(Apparel Value-Added Share of Manufacturing)				
a) Per capita used clothing	-0.272	-0.264		
	(.086)	(.090)		
b) Used-Clothing Imports Share of GDP	-0.310	-0.303		
	(.098)	(.103)		

Notes: All of the variables are in logarithms. Standard errors are in parentheses. Columns (1) and (3) are random-effects regressions. Columns (2) and (4) are fixed-effects regressions, with a fixed-effect per country.
The first-stage regression for 1a), 2a) and 3a) is given in Table 2. The instrument used in specification 2b), 3b) is a constructed used-clothing value-added share of GDP variable, resulting from a tobit regression of used-clothing value-added share of GDP on the geographic variables outlined in the text. The F-stat for this first-stage regression is 46.19. All unmarked coefficient estimates are significant at the 1% level. Coefficients marked * are significant at the 10% level, and coefficients marked ** are significant at the 5% level.

Table 6 - Used-Clothing Trade and Textile Production - IV Results - Different Specifications

Specification	(1) Random-Effects	(2) Fixed-Effects	(3) Including Manufacturing Control Random-Effects	(4) Including Manufacturing Control Fixed-Effects
1) Dependent variable				
log(Textile Value-Added per capita)				
Indep: Per capita used clothing	-0.438	-0.435	-0.239	-0.239
	(.079)	(.074)	(.071)	(.074)
2) Dependent variable				
log(Textile Value-Added per worker)				
Indep: Per capita used clothing	-0.443	-0.441	-0.253	-0.243
	(.080)	(.074)	(.080)	(.076)
3) Dependent variable				
log(Textile Value-Added Share of GDP)				
a) Per capita used clothing	-0.462	-0.473	-0.331	-0.346
	(.073)	(.073)	(.092)	(.094)
b) Used-Clothing Imports Share of GDP	-0.525	-0.540	-0.354	-0.392
	(.082)	(.083)	(.108)	(.107)
4) Dependent variable				
log(Textile Value-Added Share of Manufacturing)				
a) Per capita used clothing	-0.184	-0.192		
	(.057)	(.059)		
b) Used-Clothing Imports Share of GDP	-0.206	-0.217		
	(.065)	(.067)		

Notes: All of the variables are in logarithms. Standard errors are in parentheses. Columns (1) and (3) are random-effects regressions. Columns (2) and (4) are fixed-effects regressions, with a fixed-effect per country.
The first-stage regression for 1),2),3a),4a) is given in Table 2. The instrument used in specification 3b), 4b) is a constructed used-clothing value-added share of GDP variable, resulting from a tobit regression of used-clothing value-added share of GDP on the geographic variables outlined in the text. The F-stat for this first-stage regression is 46.19
All coefficient estimates are significant at the 1% level.

Table 7 - Used-Clothing Trade and Apparel and Textile Production - Summary
Including Manufacturing Controls and Fixed Effects

	Apparel				Textile	
	Flow		Stock		Stock	
Specification	OLS	IV	OLS	IV	OLS	IV
1) Dependent variable log(Apparel/Textile Value-Added per capita)						
Indep: Per capita used clothing	-0.148**	-0.276**	-0.310	-0.359**	-0.168	-0.363
	(.057)	(.118)	(.090)	(.162)	(.057)	(.099)
2) Dependent variable log(Apparel/Textile Value-Added per worker)						
Indep: Per capita used clothing	-0.149	-0.283**	-0.317	-0.374**	-0.168	-0.361
	(.057)	(.122)	(.092)	(.169)	(.058)	(.099)
3) Dependent variable log(Apparel/Textile Value-Added Share of GDP)						
a) Per capita used clothing	-0.205	-0.422	-0.422	-0.583	-0.260	-0.587
	(.061)	(.143)	(.104)	(.218)	(.069)	(.144)
b) Used-Clothing Imports Share of GDP	-0.283	-0.483	-0.508	-0.636	-0.312	-0.587
	(.068)	(.160)	(.107)	(.219)	(.071)	(.143)
4) Dependent variable log(Apparel/Textile Value-Added Share of Manufacturing)						
a) Per capita used clothing	-0.166	-0.264	-0.311	-0.332	-0.162	-0.320
	(.051)	(.090)	(.080)	(.123)	(.052)	(.085)
b) Used-Clothing Imports Share of GDP	-0.211	-0.303	-0.354	-0.348	-0.197	-0.350
	(.058)	(.103)	(.085)	(.127)	(.054)	(.086)

Notes: All of the variables are in logarithms. Standard errors are in parentheses.
In rows 1), 2), and 3), the regressions include fixed-effects, as well as manufacturing controls (i.e. manufacturing per capita value-added, per worker value-added, and share of GDP in 1),2),3) respectively.) In row 4), the regressions include fixed-effects.
The first-stage regression for 1),2),3a),4a) is given in Table 2. The instrument used in specification 3b), 4b) is a constructed used-clothing value-added share of GDP variable, resulting from a tobit regression of used-clothing value-added share of GDP on the geographic variables outlined in the text.
For all of the stock regressions, the assumed depreciation rate is 0.15.
All unmarked coefficient estimates are significant at the 1% level. Coefficients marked * are significant at the 10% level, and coefficients marked ** are significant at the 5% level.

Appendix Table C1 - Used-Clothing Trade and Apparel Production
Dropping Mauritius - Least Squares Results

	(1) Random-Effects	(2) Fixed-Effects	(3) Random-Effects	(4) Fixed-Effects
Constant	-5.219	-4.898	-3.936	-4.045
	(.378)	(.063)	(.218)	(.189)
Used Clothing Imports	-0.364	-0.361	-0.198	-0.199
per capita	(.056)	(.059)	(.052)	(.070)
Manufacturing Value-Added			1.146	0.980
per capita			(.122)	(.223)
With fixed effects		+		+
N	199	199	188	188
R-squared	0.082	0.180	0.723	0.277

Notes: All of the variables are in logarithms. The dependent variable is (log) per capita value-added in apparel production. Standard errors are in parentheses. Columns (1) and (3) are random-effects regressions. Columns (2) and (4) are fixed-effects regressions, with a fixed-effect per country.
All coefficient estimates are significant at the 1% level.

Appendix Table C2 - Used-Clothing Trade and Apparel Production
IV Results - Different Specifications
Dropping Mauritius

Specification	(1) Random-Effects	(2) Fixed-Effects	(3) Including Manufacturing Control Random-Effects	(4) Including Manufacturing Control Fixed-Effects
1) Dependent variable log (Apparel Value-added per capita)				
a) Per capita used clothing	-0.676	-0.676	-0.512	-0.536**
	(.105)	(.112)	(.194)	(.216)
2) Dependent variable log (Apparel Value-added per worker)				
a) Per capita used clothing	-0.672	-0.672	-0.520	-0.548**
	(.105)	(.111)	(.196)	(.220)
3) Dependent variable log(Apparel Value-Added Share of GDP)				
a) Per capita used clothing	-0.690	-0.690	-0.691	-0.691
	(.107)	(.114)	(.193)	(.205)
b) Used-Clothing Imports Share of GDP	-0.789	-0.780	-0.746	-0.736
	(.126)	(.128)	(.204)	(.209)
4) Dependent variable log(Apparel Value-Added Share of Manufacturing)				
a) Per capita used clothing	-0.315	-0.312		
	(.094)	(.099)		
b) Used-Clothing Imports Share of GDP	-0.354	-0.353		
	(.105)	(.111)		

Notes: All of the variables are in logarithms. The dependent variable is (log) per capita value-added in apparel production. Standard errors are in parentheses. Columns (1) and (3) are random-effects regressions. Columns (2) and (4) are fixed-effects regressions, with a fixed-effect per country.
The first-stage regression for 1),2),3a),4a) is given in Table 2. The instrument used in specification 3b), 4b) is a constructed used-clothing value-added share of GDP variable, resulting from a tobit regression of used-clothing value-added share of GDP on the geographic variables outlined in the text. The F-stat for this first-stage regression is 46.19.
All unmarked coefficient estimates are significant at the 1% level. Coefficients marked * are significant at the 10% level, and coefficients marked ** are significant at the 5% level.

Appendix Table C3 - Used-Clothing Trade and Textile Production
IV Results - Different Specifications
Dropping Mauritius

Specification	(1) Random-Effects	(2) Fixed-Effects	(3) Including Manufacturing Control Random-Effects	(4) Including Manufacturing Control Fixed-Effects
1) Dependent variable				
log(Textile Value-Added per capita)				
Indep: Per capita used clothing	-0.570	-0.575	-0.288	-0.287
	(.090)	(.083)	(.094)	(.100)
2) Dependent variable				
log(Textile Value-Added per worker)				
Indep: Per capita used clothing	-0.573	-0.575	-0.293	-0.292
	(.090)	(.083)	(.104)	(.102)
3) Dependent variable				
log(Textile Value-Added Share of GDP)				
a) Per capita used clothing	-0.572	-0.579	-0.464	-0.477
	(.080)	(.082)	(.118)	(.122)
b) Used-Clothing Imports Share of GDP	-0.645	-0.651	-0.488	-0.514
	(.089)	(.093)	(.130)	(.130)
4) Dependent variable				
log(Textile Value-Added Share of Manufacturing)				
a) Per capita used clothing	-0.210	-0.215		
	(.061)	(.064)		
b) Used-Clothing Imports of GDP	-0.235	-0.239		
	(.067)	(.071)		

Notes: All of the variables are in logarithms. The dependent variable is (log) per capita value-added in apparel production. Standard errors are in parentheses. Columns (1) and (3) are random-effects regressions. Columns (2) and (4) are fixed-effects regressions, with a fixed-effect per country.
The first-stage regression for 1),2),3a),4a) is given in Table 2. The instrument used in specification 3b), 4b) is a constructed used-clothing value-added share of GDP variable, resulting from a tobit regression of used-clothing value-added share of GDP on the geographic variables outlined in the text. The F-stat for this first-stage regression is 46.19.
All coefficient estimates are significant at the 1% level.

Appendix Table D1 - Used-Clothing Trade and Apparel Production -
Dependent Variable: log(Apparel Value-Added per capita)
Using Used-Clothing Stock - Depreciation of 0.05

	(1) Random-Effects	(2) Fixed-Effects	(3) Random-Effects	(4) Fixed-Effects
Constant	-12.981	-12.580	-8.175	-8.703
	(1.232)	(1.268)	(1.088)	(1.392)
Used Clothing Stock	-0.578	-0.581	-0.319	-0.351
per capita	(.084)	(.089)	(.074)	(.095)
Manufacturing Value-Added			1.213	1.028
per capita			(.124)	(.176)
With fixed effects		+		+
N	210	210	202	202
R-squared	0.149	0.186	0.755	0.329

Notes: All of the variables are in logarithms. The dependent variable is (log) per capita value-added in apparel production. Standard errors are in parentheses. Columns (1) and (3) are random-effects regressions. Columns (2) and (4) are fixed-effects regressions, with a fixed-effect per country.
Details on calculating the used-clothing stock are in the data appendix.
All coefficient estimates are significant at the 1% level.

Appendix Table D2 - Used-Clothing Trade and Apparel Production
IV Results - Different Specifications
Using Used-Clothing Stock - Depreciation of 0.05

	(1)	(2)	(3)	(4)
			Including Manufacturing Control	
Specification	Random-Effects	Fixed-Effects	Random-Effects	Fixed-Effects
1) Dependent variable				
log (Apparel Value-added per capita)				
a) Per capita used clothing stock	-0.632	-0.644	-0.232*	-0.323**
	(.117)	(.120)	(.120)	(.141)
2) Dependent variable				
log (Apparel Value-added per worker)				
a) Per capita used clothing stock	-0.636	-0.649	-0.237*	-0.334**
	(.116)	(.118)	(.122)	(.145)
3) Dependent variable				
log(Apparel Value-Added Share of GDP)				
a) Per capita used clothing stock	-0.676	-0.681	-0.449	-0.508
	(.115)	(.117)	(.171)	(.180)
b) Used-Clothing Stock Share of GDP	-0.778	-0.731	-0.532	-0.539
	(.111)	(.118)	(.172)	(.179)
4) Dependent variable				
log(Apparel Value-Added Share of Manufacturing)				
a) Per capita used clothing stock	-0.285	-0.311		
	(.106)	(.112)		
b) Used-Clothing Stock Share of GDP	-0.328	-0.320		
	(.103)	(.115)		

Notes: All of the variables are in logarithms. Standard errors are in parentheses. Columns (1) and (3) are random-effects regressions. Columns (2) and (4) are fixed-effects regressions, with a fixed-effect per country.
The first-stage regression for 1a), 2a), 3a), 4a) is given in Table 2. The instrument used in specification 3b), 4b) is a constructed used-clothing value-added share of GDP variable, resulting from a tobit regression of used-clothing value-added share of GDP on the geographic variables outlined in the text. The F-stat for this first-stage regression is 46.19.
Details on calculating the used-clothing stock are in the data appendix.
All unmarked coefficient estimates are significant at the 1% level. Coefficients marked * are significant at the 10% level, and coefficients marked ** are significant at the 5% level.

Appendix Table D3 - Used-Clothing Trade and Textile Production
IV Results - Different Specifications
Using Used-Clothing Stock - Depreciation of 0.05

	(1)	(2)	(3)	(4)
			Including Manufacturing Control	
Specification	Random-Effects	Fixed-Effects	Random-Effects	Fixed-Effects
1) Dependent variable				
log(Textile Value-Added per capita)				
Indep: Per capita used clothing stock	-0.546	-0.551	-0.397	-0.330
	(.091)	(.093)	(.081)	(.085)
2) Dependent variable				
log(Textile Value-Added per worker)				
Indep: Per capita used clothing stock	-0.553	-0.556	-0.380	-0.331
	(.088)	(.092)	(.076)	(.086)
3) Dependent variable				
log(Textile Value-Added Share of GDP)				
a) Per capita used clothing stock	-0.663	-0.645	-0.532	-0.510
	(.086)	(.089)	(.114)	(.118)
b) Used-Clothing Stock Share of GDP	-0.631	-0.663	-0.465	-0.509
	(.085)	(.090)	(.114)	(.118)
4) Dependent variable				
log(Textile Value-Added Share of Manufacturing)				
a) Per capita used clothing stock	-0.317	-0.293		
	(.073)	(.075)		
b) Used-Clothing Stock Share of GDP	-0.263	-0.320		
	(.071)	(.077)		

Notes: All of the variables are in logarithms. The dependent variable is (log) per capita value-added in apparel production. Standard errors are in parentheses. Columns (1) and (3) are random-effects regressions. Columns (2) and (4) are fixed-effects regressions, with a fixed-effect per country.
The first-stage regression for 1),2),3a),4a) is given in Table 2. The instrument used in specification 3b), 4b) is a constructed used-clothing value-added share of GDP variable, resulting from a tobit regression of used-clothing value-added share of GDP on the geographic variables outlined in the text. The F-stat for this first-stage regression is 46.19.
Details on calculating the used-clothing stock are in the data appendix.
All coefficient estimates are significant at the 1% level.

Appendix Table E1 - Used-Clothing Trade and Apparel Production -
Dependent Variable: log(Apparel Value-Added per capita)
Using Used-Clothing Stock - Depreciation of 0.30

	(1) Random-Effects	(2) Fixed-Effects	(3) Random-Effects	(4) Fixed-Effects
Constant	-11.939	-11.274	-7.499	-7.493
	(1.160)	(1.176)	(1.052)	(1.289)
Used Clothing Stock	-0.473	-0.460	-0.254	-0.252
per capita	(.074)	(.078)	(.067)	(.082)
Manufacturing Value-Added			1.231	1.078
per capita			(.125)	(.178)
With fixed effects		+		+
N	210	210	202	202
R-squared	0.148	0.159	0.755	0.314

Notes: All of the variables are in logarithms. The dependent variable is (log) per capita value-added in apparel production. Standard errors are in parentheses. Columns (1) and (3) are random-effects regressions. Columns (2) and (4) are fixed-effects regressions, with a fixed-effect per country.
Details on calculating the used-clothing stock are in the data appendix.
All coefficient estimates are significant at the 1% level.

Appendix Table E2 - Used-Clothing Trade and Apparel Production
IV Results - Different Specifications
Using Used-Clothing Stock - Depreciation of 0.30

	(1)	(2)	(3)	(4)
			Including Manufacturing Control	
Specification	Random-Effects	Fixed-Effects	Random-Effects	Fixed-Effects
1) Dependent variable				
log (Apparel Value-added per capita)				
a) Per capita used clothing stock	-0.644	-0.667	-0.231*	-0.387**
	(.136)	(.138)	(.139)	(.180)
1) Dependent variable				
log (Apparel Value-added per worker)				
a) Per capita used clothing stock	-0.648	-0.672	-0.237*	-0.406**
	(.134)	(.137)	(.141)	(.190)
2) Dependent variable				
log(Apparel Value-Added Share of GDP)				
a) Per capita used clothing stock	-0.697	-0.721	-0.504	-0.646
	(.134)	(.136)	(.225)	(.255)
b) Used-Clothing Stock Share of GDP	-0.929	-0.858	-0.685	-0.775
	(.135)	(.150)	(.217)	(.282)
3) Dependent variable				
log(Apparel Value-Added Share of Manufacturing)				
a) Per capita used clothing stock	-0.284**	-0.339		
	(.118)	(.128)		
b) Used-Clothing Stock Share of GDP	-0.369	-0.374		
	(.114)	(.138)		

Notes: All of the variables are in logarithms. Standard errors are in parentheses. Columns (1) and (3) are random-effects regressions. Columns (2) and (4) are fixed-effects regressions, with a fixed-effect per country.
The first-stage regression for 1a), 2a),3a),4a) is given in Table 2. The instrument used in specification 3b), 4b) is a constructed used-clothing value-added share of GDP variable, resulting from a tobit regression of used-clothing value-added share of GDP on the geographic variables outlined in the text. The F-stat for this first-stage regression is 46.19.
Details on calculating the used-clothing stock are in the data appendix.
All unmarked coefficient estimates are significant at the 1% level. Coefficients marked * are significant at the 10% level, and coefficients marked ** are significant at the 5% level.

Appendix Table E3 - Used-Clothing Trade and Textile Production
IV Results - Different Specifications
Using Used-Clothing Stock - Depreciation of 0.30

	(1)	(2)	(3)	(4)
			Including Manufacturing Control	
Specification	Random-Effects	Fixed-Effects	Random-Effects	Fixed-Effects
1) Dependent variable				
log(Textile Value-Added per capita)				
Indep: Per capita used clothing stock	-0.567	-0.581	-0.462	-0.375
	(.111)	(.112)	(.105)	(.113)
2) Dependent variable				
log(Textile Value-Added per worker)				
Indep: Per capita used clothing stock	-0.561	-0.573	-0.391	-0.366
	(.099)	(.106)	(.085)	(.110)
3) Dependent variable				
log(Textile Value-Added Share of GDP)				
a) Per capita used clothing stock	-0.746	-0.708	-0.699	-0.648
	(.111)	(.110)	(.173)	(.173)
b) Used-Clothing Stock Share of GDP	-0.640	-0.754	-0.475	-0.658
	(.098)	(.114)	(.143)	(.175)
4) Dependent variable				
log(Textile Value-Added Share of Manufacturing)				
a) Per capita used clothing stock	-0.385	-0.331		
	(.093)	(.092)		
b) Used-Clothing Stock Share of GDP	-0.230	-0.362		
	(.079)	(.094)		

Notes: All of the variables are in logarithms. The dependent variable is (log) per capita value-added in apparel production. Standard errors are in parentheses. Columns (1) and (3) are random-effects regressions. Columns (2) and (4) are fixed-effects regressions, with a fixed-effect per country.
The first-stage regression for 1),2),3a),4a) is given in Table 2. The instrument used in specification 3b), 4b) is a constructed used-clothing value-added share of GDP variable, resulting from a tobit regression of used-clothing value-added share of GDP on the geographic variables outlined in the text. The F-stat for this first-stage regression is 46.19.
Details on calculating the used-clothing stock are in the data appendix.
All coefficient estimates are significant at the 1% level.

Table F1 - Encompassing Tests of Stock vs. Flow Regressions

	Apparel				Textiles			
	Test of Stock Encompassing Flow		Test of Flow Encompassing Stock		Test of Stock Encompassing Flow		Test of Flow Encompassing Stock	
Specification	OLS	IV	OLS	IV	OLS	IV	OLS	IV
1) Dependent variable								
log(Apparel Value-Added per capita)								
Indep: Per capita used clothing	-0.440	0.250	-2.240**	-0.630	0.020	1.010	-2.140**	-1.550
	(.662)	(.804)	(.026)	(.526)	(.987)	(.310)	(.034)	(.121)
2) Dependent variable								
log(Apparel Value-Added per worker)								
Indep: Per capita used clothing	-0.460	0.270	-2.260**	-0.660	0.010	0.990	-2.100**	-1.620
	(.645)	(.785)	(.025)	(.506)	(.993)	(.324)	(.037)	(.106)
3) Dependent variable								
log(Apparel Value-Added Share of GDP)								
a) Per capita used clothing	-0.980	-0.600	-2.450**	-1.710*	-1.070	-0.230	-2.100**	-4.290***
	(.330)	(.548)	(.015)	(.088)	(.284)	(.818)	(.037)	(.000)
b) Used-Clothing Imports	-1.170	0.300	-2.540**	-0.850	-1.080	1.010	-2.320**	-1.760*
Share of GDP	(.244)	(.767)	(.012)	(.394)	(.279)	(.311)	(.021)	(.079)
4) Dependent variable								
log(Apparel Value-Added Share of Manufacturing)								
a) Per capita used clothing	-0.610	0.000	-2.170**	-0.310	-0.340	1.190	-1.850*	-1.710*
	(.540)	(.999)	(.031)	(.753)	(.734)	(.234)	(.066)	(.087)
b) Used-Clothing Imports	-0.610	-0.120	-2.160**	-0.220	-0.120	1.220	-2.200**	-1.730*
Share of GDP	(.541)	(.907)	(.032)	(.823)	(.905)	(.221)	(.029)	(.083)

Notes: All of the variables are in logarithms. The dependent variable is (log) per capita value-added in apparel production.
In this table, the numbers reported are test statistics of the null hypothesis stated at the top of each column. The values in parentheses are p-values for the test statistics.
All cases reported are fixed-effect regressions, including the appropriate manufacturing control.
Test statistics marked *, **, and *** are significant at the 10% level, 5% level, and 1% level respectively.
In the IV regressions, two-stage methods are used. For example, for the second column results, in the first stage, the used-clothing flow variable is regressed on the relevant used-clothing flow instrument. The predicted values from this regression are included in a second-stage used-clothing stock regression that instruments for the used-clothing stock using the predicted used-clothing stock. The relevant test statistic is the t-statistic on the predicted used-clothing flow variable in this case.