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Used-Clothing Donations and Apparel Production in Africa†

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Abstract

What accounts for the failure of African countries to step onto the bottom rung of the manufacturing sophistication ladder, that is to produce textiles and apparel? This paper examines the importance of one possible explanation. Specifically, it explores the impact of used-clothing donations on apparel production in these countries. Used-clothing donations to thrift shops and other organizations in industrialized countries typically end up being sold to consumers in Africa. 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 the influx of used clothing into African countries and apparel production there, an instrumental variables strategy is adopted. The *interaction* between the geographic and historical proximity of OECD countries to a given African country and the supply of used-clothing donations in the OECD countries considered to be geographically 'near' to the African country is used to instrument for the used-clothing imports. Following this methodology, used-clothing imports are found to have a negative impact on apparel and textile production in Africa, explaining roughly 40% of the decline in African apparel production and roughly 50% of the decline in apparel employment.

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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 began with production and exports of textiles and apparel and moved to increasingly sophisticated electronic and industrial goods as their economies grew. In contrast over this period, the economies of Africa have in general stagnated. In particular, onlookers have been puzzled by the overall inability of Africa to step onto even the bottom rung of the manufacturing sophistication ladder, to produce and export textiles and apparel, particularly given Africa's low unskilled wage levels and strong supplies of cotton.

The development path taken by the East Asian tigers highlights the important role of apparel production in the early stages of their development. Romalis (2004) has decomposed the growth of the East Asian tigers, documenting how these countries began with production in the most unskilled labour-intensive industries, including textiles and apparel, and shifted to more skill-intensive and capital-intensive industries, as the countries accumulated both physical and human capital. This is consistent with other models of skill and capital accumulation, including Ventura (1997). The important role that apparel production has played in the early stages of most of the now developed countries is also highlighted in Figure 1.[1] This figure involves a nonparametric regression of the size of the apparel sector as share of employment as a function of per capita income. We see an inverted U-shaped pattern, demonstrating that as countries have grown in the past, on average the apparel sector has at first grown, and then later shrunk. Three countries with occasionally extremely large apparel sectors, Hong Kong, Mauritius, and Macao, have been omitted. As we can

[1] The nonparametric regression method is a Nadaraya-Watson kernel estimator, with a normal kernel, and an optimal bandwidth, as defined by Silverman (1986). There are 2367 observations over the years 1963 through 2000. The confidence interval in Figure 1 is calculated using bootstrap methods, assuming independence of observations between countries, but not within a given country. Therefore, the bootstrap samples countries, with all of the observations per selected country included in the bootstrap sample.

see from the figure, we can state with 95% confidence that countries that have grown to income levels above \$11 000 have had at least 1% of their workforce involved in apparel production at some point. This is consistent with the role of apparel as an initial stage of manufacturing, one that uses low-income countries' relatively abundant factor, unskilled labour. As capital and skill have accumulated, resources have shifted from apparel to other more sophisticated manufacturing sectors. To put African countries in context on this graph, over the period of our study, 1981 to 2000, their average level of GDP per capita was \$2200 (0.2×10^4 on Figure 1). Moreover, over this period, the average per capita growth across African countries was -0.14%. African countries were stagnant.

In African countries, the apparel sector has been declining both in an absolute and a relative sense. The apparel share of manufacturing declined an average of 5.3% per year in African countries over the period from 1981 to 2000. While several explanations have been offered for the overall poor performance of African countries, including poor government policies, poor institutions, high transactions costs, poor infrastructure, uncertainty and poor social capital (Collier and Gunning, 1999; Easterly and Levine, 1997; Fafchamps, 2004), it is not immediately apparent that these reasons explain why apparel production has been declining in a relative sense within these countries. However, a visit to a typical African market does offer a potential explanation that is worth testing. Here, one sees large volumes of used clothing that have been sourced as cast-off donations in industrialized countries, and then sent to Africa. In fact, there was a dramatic increase in the donations of used clothing to charities in developed countries over the past 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 to African countries (U.S. Dept. of Comm, 2003; USTR, 2001; USITC, 1999). About 16 % 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 large influx of used clothing has been criticized by African policymakers as harming their domestic garment industries. The used clothing clearly provides 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 dampened, at times severely, by the free food imports (while, of course, obviously helping the consumers of the food). This negative impact of food aid was raised as early as Schultz (1960) and formalized in Fisher (1963). 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 apparel sectors of poor countries. This paper will not comment on the benefits to African consumers, but will evaluate the causal impact of the used-clothing imports on apparel producers.

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 an identification technique that builds on Frankel and Romer's (1999) use of geographic 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. The geographically-determined fraction of these total exports going to each African country will be used to create the instrumental variable for identification.

Specifically, the exogenous variation in used-clothing imports coming into an African country will be identified by the interaction between the supply of used-clothing donations in an exporting OECD country, and the "distance" of that country from the African country, as determined by geographical and historical factors. For example, since for geographic reasons, Germany exports more to Ghana than to Mozambique (the Atlantic coast is closer than the Pacific coast), when the supply of used-clothing exports increases in Germany, more of this supply will be predicted to go to Ghana than to Mozambique. The *difference* between the geographically-predicted *increase* in used-clothing imports in Ghana, and the geographically predicted *increase* in used-clothing imports in Mozambique will identify the impact of used-clothing imports on apparel production. As italicized in the previous sentence, it is the *increases* in the used-clothing imports that matter since a full set of country-specific fixed effects is included in the second stage. As also italicized in that sentence, it is the *difference* betweeen these increases that matters since year-specific fixed effects are also included in the second-stage.

In brief, the effect of used-clothing imports on apparel 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, year fixed-effects, as well as income levels, and the overall size of the manufacturing sector. In terms of magnitude, the imported used-clothing imports are estimated to be responsible for roughly 40% of the decline in apparel production and roughly 50% of the decline in apparel employment in an average African country over the period 1981 to 2000.

While no other paper of which I am aware has explored analytically the relationship between used-clothing donations and textile and apparel production, the impact of used-clothing imports on textile production was raised anecdotally by McCormick et. al. (1997), based on surveys of textile producers in Kenya. They cite the importation of used clothing as the main cause of weak demand in the sector, which along with credit constraints, and "lack of suitable secure premises" form the key barriers to growth for these firms, based on the firm survey responses. Studies that have focused more directly on the importation of donated used-clothing have been limited in number, and descriptive in nature, and include Hansen (2000) and Haggblade (1990).

To place the apparel sectors in these countries in context, overall, the contribution of the apparel sector to employment in Africa is greater than its contribution to manufacturing. While apparel production in selected African countries comprises roughly 3.1% [2.1%, 1.6%] of manufacturing in the 1970s [1980s, 1990s][2] in value-added terms, apparel employment comprises roughly 5.1% [4.2%, 4.1%] of manufacturing employment. In comparison, manufacturing comprises 10.9% [12.3%, 10.3%] of GDP in these countries.

The theory required to analyze the impact of used-clothing donations is very simple indeed (just as the theory on the impact of food aid is equally simple), and parallels the early work on food

[2] This is calculated from the main UNIDO dataset used in this paper, described more fully in the appendix. To ensure that the data reported in this paragraph is comparable over time, it is calculated in the following way. For all countries that have at least some data available in each of the three decades, averages are taken across all observations in the decade, and then the averages of these averages are reported. The countries for which such data is available includes: Burundi, Cameroon, Ghana, Côte d'Ivoire, Kenya, Malawi, Mozambique, Nigeria, Senegal, South Africa, Zimbabwe, Tanzania, Burkina Faso, Zambia. Mauritius is an extreme outlier in terms of African production, as will be discussed in the Results section, and is not included in these averages.

aid (Fisher, 1963), as well as work on immigrant labour (Johnson, 1980; Altonji and Card, 1991).[3] In a closed economy, used clothing is a close substitute for domestically-produced apparel. Note that an economy may be be effectively 'closed' for any of the variety of reasons outlined above: poor institutions, high transactions costs, poor infrastructure, uncertainty and poor social capital. Such a 'closed' economy is wholly consistent with the importation of used-clothing donations, which are sourced for free, as donations, and therefore can be sold domestically for a profit even after overcoming international transaction costs. If an influx of used clothing has any impact on the domestic industry, we would expect it to result in a downward shift in the demand curve in the new apparel industry. The key question, therefore, is whether this used clothing does have an impact and what the magnitude of this impact is. On the other hand, in an open economy (with zero trade costs), the donated used-clothing imports will not affect domestic production, as domestic production is based on comparative advantage (e.g. factor endowments, technology, or historic experience), and worldwide, rather than domestic, demand. Any single African economy is small by world standards, including in the clothing industry, and therefore will not independently affect worldwide demand. Overall, the question of the impact of used-clothing donations on apparel production in Africa is fundamentally an empirical one, and specifically a test of whether the effect is negligible or negative, and if negative, how large. Since the impact of these donations on African apparel production has not previously been explored, even this simple question is an important one.[4]

[3] The working paper version of this manuscript outlined the general theory, and demonstrated the mechanism for such an effect for a Cournot model of heterogenous firms. Available from the author upon request.

[4] Note that it is theoretically possible to construct a model, including income, where the positive income effect from an increase in the amount of used-clothing available (and resulting decrease in its price) overwhelms the substitution effect into used clothing, so that the demand for new clothing actually increases with the supply of used clothing. However, such a model would require a large decrease in the price of used-clothing (since at all points it is cheaper than the price of new clothing), and incomes are generally low in African countries. The lack of a significant perceived quality difference between new and used clothing in African countries (unlike OECD countries) suggests this is not the case. Moreover, such a model would not apply on the extensive margin for the introduction of used-clothing imports, as it requires a significant quantity of used clothing already being purchased in one's consumption bundle

In this paper, Section 1 discusses the specification used to analyze the impact of used clothing imports, as well as the data. Section 2 provides the results. Finally, Section 3 concludes.

1 Specification and Data

While the static analysis outlined above is sufficient to analyze the impact on new clothing production resulting from the increase in availability of a close substitute (used clothing), this paper also relates to a dynamic literature on structural change that seeks to examine the relative size of various sectors (such as the apparel sector) over the course of development. Exploring the shifts between agriculture, manufacturing, and services industries (as well as their sub-components) was an empirical interest of a number of early development economists (including Chenery(1960), Kuznets (1971), Chenery and Syrquin(1975), Chenery and Syrquin (1988)). These papers saw structural change (defined here as the change in the shares associated with different industries) as part of the process of growth and development, and sought to empirically examine what these changes were without a single, formal theoretical model, with per capita income as the explanatory variable. These papers also explored the change in the relative size of the apparel sector as countries developed, and found that the apparel sector's size at first increased and then later decreased over the course of development, as already noted in Figure 1. More recent papers have used formal models to explain the structural change, but with a smaller number of sectors–typically just agriculture and industry (Murphy, Shleifer and Vishny (1989), Matsuyama (1992), Laitner (2000), Caselli and Coleman (2001), and Gollin, Parente and Rogerson (2002)). The formalized structural change models typically predict a one-to-one relationship between the sectoral share and income level. Therefore, for consistency with the more recent theoretical work, and the older empirical work on

(for the income effect to apply).

structural change, per capita GDP will be included as a right-hand side variable to control for the potential of structural change. While the nonparametric work of Figure 1 would suggest inclusion of a quadratic in income, since all of the African countries have incomes low enough to remain on the increasing portion of the curve, a linear term should suffice.

Therefore, consider the following econometric specification, including the income variable:

$$\log A_{it} = \alpha + \beta \log U_{it} + \gamma \log M_{it} + \lambda Y_{it} + \delta_i + \nu_t + \xi_{it} \quad (1)$$

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, ν_t is a year fixed-effect to control for universal influences to apparel production in a given year, U_{it} reflects the used-clothing imports, M_{it} is the overall level of manufacturing (not including apparel and textile production), Y_{it} is a country's per capita income, and ξ_{it} reflects other influences on a country's level of apparel production. The overall level of (non-apparel) 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, used clothing, whose price only reflects the cost of transportation from industrialized countries to Africa, and not the cost of production. As noted in the previous section, the effect of these used-clothing imports should be negligible in an open economy, and may decrease production in a closed economy. Therefore, we would hypothesize that either β is zero or β is negative.

The problem with simple least-squares estimation of equation (1) 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 expands on the technique of Frankel and Romer (1999). Note that the used-clothing imports into country i in year t is related to the used-clothing exports from country j in year t by the following identity:

$$\begin{aligned} U_{it} &= \sum_j U_{ijt} \\ &= \sum_j \frac{U_{ijt}}{\overline{U_{jt}}} \cdot \overline{U_{jt}} \end{aligned} \tag{2}$$

The first line is just an adding-up condition; imports into country i is the sum of the exports from all countries j into country i. This can then be broken down (in line 2) into the share of country j's used clothing that goes to country i , $\frac{U_{ijt}}{\overline{U_{jt}}}$, times country j's overall exports of used clothing $\overline{U_{jt}}$. The basic idea behind the instrument is straightforward. Provided that we can obtain exogenous variation in each of these factors ($\frac{U_{ijt}}{\overline{U_{jt}}}$ and $\overline{U_{jt}}$) whose product constructs used-clothing imports, we can construct an exogenous instrument for used-clothing imports into country i in period t.

First, we assume that the total level of used-clothing exports from a country in a given year ($\overline{U_{jt}}$) is exogenously determined by the level of used-clothing donations in the country in that year. The primary scholarly research into the used clothing industry is Hansen (2000). She performed primary research on the sourcing of used clothing in Netherlands, Belgium, Canada and the United States, as well as secondary research of articles and reports to document that the majority of used clothing that is donated to the charitable shops and organisations is destined for export. Generally, whatever cannot be sold in the local thrift shops is sent for export. 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 organisations 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),[5] this perception certainly held for the period under study. People were not donating used clothing with conditions in Africa on their mind.[6,7]

The share of used-clothing from a given OECD country to a given African country $\frac{U_{ijt}}{U_{jt}}$ cannot be assumed to be exogenous. Typically, the distribution happens in the following way. While the mechanism varies somewhat from country to country, in Europe and North America, the basic setup is the same (Hansen, 2000). The thrift stores, who, particularly until recently, have been the dominant collectors of used clothing, sort it. Some of it is sold locally in thrift shops, and the rest is packed (and possibly sorted by type) before sale to exporters. Exporters then transport the used clothing to an African country where they sell the used clothing to wholesalers, who in turn, sell it to retailers who distribute it to the final consumers. At times, the used clothing is distributed for free in the African country, but this is not the norm. Usually, it is sold. However, while the

[5] 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.

[6] 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 the apparel sector as a fraction of GDP or of manufacturing in these countries.

[7] While people were clearly not donating with conditions in Africa on their mind, their used-clothing donations might be spuriously correlated with African apparel production under the following conditions. Suppose that the availability of cheap clothing from a third source (e.g. China) increases over this period, and this (e.g. Chinese) competition both reduces apparel production in Africa, and induces citizens of OECD countries to donate more clothing to charities. Then used-clothing donations become indirectly correlated with the average level of apparel production in African countries. To handle this possibility, year fixed-effects are included in equation (1) to control for any time-varying influences affecting all African countries, including for example, the level of Chinese exports to Africa and to the OECD in a given year.

price does reflect markups for the thrift shop collector, the exporter, and the African wholesaler and retailer, the final price is still free of the cost of producing the article of used clothing, and this fact continues to keep its price very low. Now, while it is reasonable to assume that those donating the used clothing were not donating with the relative health of the apparel sectors in these countries on their mind, the same cannot be said for the exporters. Conditional on the overall supply of used clothing, they may have been sending a larger share of the used clothing to countries where domestic apparel production had failed for any number of reasons relative to other sectors. Therefore, the instrumental variables technique is designed explicitly to handle this kind of potential endogeneity, as well as less obvious sources of endogeneity, related for example to changes in African government policy. For a given industrialized country in a given year, the share of used clothing going from that country to each of the African countries will be predicted on the basis of geographic and historical characteristics alone. These geographically-predicted shares of the used-clothing trade will be used to construct the instrument for used-clothing imports into African countries.

Specifically, the geographic and historical factors used to predicted the used-clothing trade include the following. While the great-circle distance between capital cities has been found to be a significant (negative) predictor of trade between countries, in our case, the trade involves exports from OECD countries to the single region, Africa. Since the bulk of OECD countries are in Europe, great-circle distance is not as significant a determinant of trade. On the other hand, we might expect European countries and the U.S. to be more likely to export to countries on Africa's Atlantic coast, and Japan and Australia to be more likely to export to countries on Africa's Indian Ocean coast. For this reason, I include a dummy for country-pairs that share the Atlantic ocean (AO_{ij}), and another for country-pairs that share the Pacific/Indian Ocean (PO_{ij}). In addition, I include a dummy variable for whether the country is landlocked (L_i), as well as the country's population (N_i) and area (A_i). Finally, dummy variables are included for whether two countries shared a colonial relationship (C_{ij}). Together then, the level of used-clothing exports U_{ijt}, from country j into country i in year t, as a fraction of the total level of used-clothing exports, $\overline{U_{jt}}$ from country j in year t is expressed in the trade equation as:

$$\begin{aligned} \frac{U_{ijt}}{\overline{U_{jt}}} &= \beta_0 + \beta_{1t}(AO_{ij}) + \beta_{2t}(PO_{ij}) + \beta_{3t}(C_{ij}) \\ &\quad +\beta_{4t}(L_i) + \beta_{5t}\log(N_{it}) + \beta_{6t}\log(A_i) + \varepsilon_{ijt} \end{aligned} \tag{3}$$

Note that only the characteristics of importing countries are included in the trade equation, since the dependent variable is the *share* of exports from a given OECD country. Note also that we will not restrict the effects of any of these variables to be constant over time, but rather allow the coefficients to vary by year. This allows the effect of geographic variables to vary over time, allowing, for example, for distances to shrink over time. Other variables that are sometimes included in gravity-type equations for predicting trade are the income levels of the two countries, but these factors are more difficult to argue as being exogenous or pre-determined, and so are not included in the above regression.

Overall, then, the trade shares, $\widehat{\frac{U_{ijt}}{\overline{U_{jt}}}}$, predicted by the variables in equation (3) are combined with the used-clothing export supplies, $\overline{U_{jt}}$, to obtain the geographically-predicted supply of used clothing into country i using the equation:

$$\widehat{U_{it}} = \sum_j \widehat{\frac{U_{ijt}}{\overline{U_{jt}}}} \cdot \overline{U_{jt}} \tag{4}$$

These geographically-predicted used-clothing imports are used to instrument for the used-clothing imports in equation (1). Note that in the second stage estimation, since both year-effects and country fixed-effects are included in the estimation, the identification is entirely coming from the interaction between the export supply from each OECD country and its "geographic proximity" to each African country. While the geographic proximity is allowed to vary over time, this is constrained to occur in a common way across all countries, and therefore this time-varying effect will be "purged" by the year effects in the second stage.

It should be noted that many other things will also be affecting the levels of used-clothing imports and the levels of apparel production aside from our instruments. For example, some African countries have restricted the importation of used-clothing over the 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.

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). 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 (and they are also more complete) than African country reports, the industrialized country 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. Fortunately, these countries reported their exports throughout the period, and so the used-clothing exporters are a stable group. The used-clothing export trends for selected countries are reported in Figure 2.

The data on manufacturing production and apparel production is taken from the UNIDO Industrial Statistics Database 2002. 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. The data on colonial relationships comes from information in The World Guide 1999/2000.

2 Results

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 variables techniques. To do this, standard least-squares regressions of apparel production on used-clothing imports are performed in Table 1. In column (1), we see a negative correlation between the apparel production and used-clothing imports, with a significant elasticity of roughly -0.45. In column (2) we include a GDP variable to control for structural change, as outlined earlier, with little change in the results. Inclusion of country fixed-effects in column (4) decreases the magnitude of the effect to roughly -0.34. Once the time-effects are included in column (5), the magnitude of the coefficient drops considerably. Inclusion of a full set of year and country fixed-effects reduces considerably the degrees of freedom available in the estimation, and may also exacerbate any measurement error present, as is typically the case in fixed-effects models. Inclusion of the manufacturing variable reduces the coefficient a bit further to -0.132. Note that the manufacturing variable used is exclusive of the textile and apparel share of manufacturing, in order to remove any mechanical correlation between this variable and the dependent variable. A quadratic in GDP is included in the final column, but this is not found to be significant. This is consistent with the relationship between apparel share of GDP and income in Figure 1, combined with the fact that the African countries' income levels correspond to the increasing portion of this curve. While these specifications establish 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 previous section.

To construct the instrument, equation (3) is estimated with the results given in Table 2. The coefficients are generally in line with expectations. The most significant determinant of used-clothing trade is the existence of a historic colonial relationship between the countries. In addition, sharing an ocean, particularly the Atlantic, also increases trade, while landlocked African countries get less used-clothing trade.

In order to obtain a total predicted level of used-clothing imports into a given country i in a given year, we use these predicted trade shares from equation (3) as weights in a sum of all of the total exports of all exporting countries, as directed in (4). These predicted used-clothing trade values can then be used as an instrument for used-clothing imports in the regression of equation (1).

The IV results are presented in Table 3. Note that the instrument has been constructed as the left-hand side of equation (4), but normalized to the importer's per capita level, and measured in logarithms. The coefficient on the used-clothing variable remains significant, and precisely estimated. Once all of the controls are included in the final column, the impact of used-clothing imports is estimated at approximately -0.61. Therefore, a 1% increase in used-clothing imports results in a 0.61% decrease in apparel production. While the manufacturing coefficient is not significant, for completeness it is retained in all future specifications.

The estimation is repeated under different conditions, with the results on the variable of interest provided in Table 4.[8] In the first row of Table 4, the result with the apparel value-added share of

[8] A variety of other specifications and robustness checks were employed in the working paper version of this paper. In addition, the trade equation can be estimated using import and export-country fixed-effects. For second stage

GDP as the dependent variable, from Table 3, is repeated. The second row examines the impact of used-clothing imports on the overall level of apparel production (not measured as a share of GDP or a per capita basis). In this case, the independent variable is the log of the total used-clothing imports (not normalized by population or GDP), and therefore the instrument used is also not normalized by population or GDP. Rather, it is taken directly as the logarithm of the left-hand side of equation (4). Here, again, we see that the result is significant, with a magnitude of roughly -0.68, suggesting the elasticity of the absolute magnitude of apparel production with regards to the absolute magnitude of used-clothing imports is comparable to the normalized impact (-0.61). Then, in the third row of Table 4, we examine the impact on apparel employment (normalized by population size), and find a significant although slightly smaller elasticity.

Since textiles are a significant input into apparel production, we might wonder whether used-clothing imports also resulted in a reduction in textile production. This is tested in rows (4) and (5), which are symmetric to rows (1) and (2) for apparel. The results do not provide any evidence for an impact on textile production, which is not surprising, given the second-order impact of a backward linkage. Naturally, since both apparel output (row (1)) and apparel employment (row(3)) are reduced, workers and other productive resources are freed from the apparel sector, and may be used elsewhere in the economy. In rows (6) through (8), we explore whether these resources shift to other sectors of manufacturing, by using non-apparel manufacturing as a dependent variable. While we do not find evidence of such a shift, this may partly reflect the relatively small share that apparel holds in manufacturing, and the difficulty in finding statistical significance of these

specifications that do not include country fixed-effects, this requires the additional assumption that these fixed-effects are exogenous to apparel production. However, for the base specification, this assumption is not required. The results are provided in Appendix Table A. Since the results in this case are larger for the base specification, but less robust overall, we continue to use the less restrictive assumptions of equation (3), as opposed to a trade equation specification that includes country fixed-effects. Thanks are due to an anonymous referee for suggesting this approach.

relatively small shifts. For example, since on average roughly 5% of manufacturing employment is in apparel, if all of the apparel workers found work in other manufacturing, we would expect that the coefficient on non-apparel employment in row (8) to be slightly below +0.05. Although the coefficient estimated is negative, a coefficient of +0.05 is well within the confidence interval. Therefore, unfortunately, the data do not allow us to discern whether labour and other resources shift to other manufacturing sectors. For a similar reason, we do not discern an impact on manufacturing overall, as demonstrated in rows (9) through (11). This could either reflect a re-allocation of resources within manufacturing, or simply the fact that apparel is not a large enough sector to capture an effect in the aggregate.

To this point, the flow of used clothing in a given period has been seen to affect apparel production in that period. However, 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. Using a similar methodology, I construct used-clothing stocks from the used-clothing flows over the period (details are in the data appendix). The results for the stock specification are in the final two rows of Table 4. While the coefficients are sizeable in the stock specification, they are also not statistically significant. Therefore, the flow specification is used for the remainder of the analysis.

The major outlier in Africa regarding apparel production is Mauritius, by far the most successful apparel producer. To explore the possibility that Mauritius might be driving the results, these apparel production regressions are repeated, dropping Mauritius from the estimation, with the results given in Appendix Table B. Since the results change little from Table 4, we can conclude that the inclusion of Mauritius neither drives nor moderates the results we obtain.

To this point, we have measured the average elasticity of apparel production/employment with respect to used-clothing imports. However, we might expect that this effect is not constant across different levels of used-clothing imports. To explore this possibility, a nonparametric regression of apparel value-added share of GDP against per capita used-clothing imports is performed in Figure 3, using essentially the same methodology as Figure 1. This is the unconditional relationship, without any additional controls, and without attempting to identify causation. Still, it appears that used-clothing imports are uncorrelated with apparel production at import levels below 0.1kg/capita. At import levels above that, apparel production declines significantly. To put this number in context, while t-shirts come in a variety of weights, a premium t-shirt weighs approximately 0.2 kg, while a light t-shirt can weigh considerably less than 0.1 kg. A standard dress shirt weighs something near 0.4 kg, while a pair of blue jeans weighs closer to 1 kg. Unfortunately, since we know the total mass of used clothing imported, and not the mass by categories of clothing, we cannot measure distinct elasticities for the impact of different used-clothing categories on apparel production. Still, the results here suggest that in the countries and time periods where the imports of used-clothing were kept below roughly 1 light t-shirt per person in terms of weight, the apparel sector did not decline.

Of course, the relationship in Figure 3 must be understood as a correlation, and in this paper, we have worked hard to construct an instrument to handle the endogeneity of used-clothing with respect to apparel production. As is well known, the standard linear IV estimator is essentially a two-stage estimator, where the first stage includes a linear regression of the endogenous regressor on all of the exogenous regressors (including the instrument). The analog technique does not work in the nonparametric context, as discussed, for example, in Blundell and Powell (2003). However, another method to handling the endogeneity has been used by Newey, Powell, and Vella (1999), and is analogous to the control function approaches to two-stage least squares estimation to handle endogeneity.[9] To see specifically how it applies to the current set-up, consider the following form of our base specification:

$$\log A = g(U) + \boldsymbol{\beta}\mathbf{X} + \xi \tag{5}$$

where the effect of the control variables of equation (1) (including the GDP and manufacturing controls, as well as the time and country effects) is now summarized in the vector $\mathbf{X}$ and the coefficient vector $\boldsymbol{\beta}$, and the subscripts are omitted for the moment. Our challenge is to address the endogeneity of the used-clothing regressor, U. A key assumption implicit in the above specification is the standard assumption that the error term, ξ, is additively separable from the nonparametric function. Re-label our instrument for used-clothing imports as Z, so that:

$$U = r(Z) + \boldsymbol{\beta}_2\mathbf{X} + \nu \tag{6}$$

, where r is a nonparametric function. The additional assumptions required on the error terms for the Newey, Powell and Vella (1999) procedure are that $E[\xi|\nu, Z] = E[\xi|\nu]$, and $E[\nu|Z] = 0$. The first stage in the estimation procedure involves the semiparametric regression of equation (6) to obtain the fitted residuals, $\widehat{\nu}$. The second step involves the following semiparametric regression:

$$\log A = g(U) + \boldsymbol{\beta}\mathbf{X} + h(\widehat{\nu}) + \eta \tag{7}$$

that is the regression of $\log A$ on the nonparametric functions, $g(U)$, $h(\widehat{\nu})$, as well as $\mathbf{X}$. As in Newey, Powell, and Vella (1999), we use series estimators to estimate the g and h functions. In our case, a seventh-degree polynomial for each appears to suffice.

[9] An early reference for the parametric control function approach is Dhrymes (1970).

The resulting estimate of $g(U)$ is given in Figure 4. The confidence intervals are calculated pointwise, using block bootstrap methods, sampling by country. The non-linearity present in the simple nonparametric results again appears to be present, and appears to begin at a similar point, around 0.1 kg per person. While there is also some evidence of a negative impact of used-clothing imports on apparel production at extremely low levels of these imports, the confidence intervals are much too wide at this level to make this assertion. On the other hand, the decrease in apparel production beyond the 0.1 kg/capita point is statistically significant. That is, while a horizontal line can be drawn within the confidence interval up to the 0.1kg/capita point, shortly beyond that point, such a line would lie outside the confidence intervals. Since this specification controls for the endogeneity of used-clothing imports, based on this figure, we can make the causal conclusion that levels of used-clothing imports beyond 0.1kg per capita result in a decrease in apparel production. While the appropriate test for significance of this relationship comes from the confidence intervals, the magnitude of the relationship is given by the average slope along the region of the support above 0.1kg/capita point. This slope is -1.05. This is very similar in magnitude to the comparable slope calculated for the simple nonparametric regression of Figure 3, which was -1.10. That is, beyond 0.1 kg/capita of used-clothing imports, there appears to be a roughly unitary elasticity between used-clothing imports and apparel production. This is naturally larger than the results of Table 3, which capture the average magnitude of the overall impact of used-clothing donations across all the points of the support of the distribution.

To this point, we have estimated the average elasticities of apparel production and employment regarding used-clothing imports, and examined the levels at which these imports had the greatest effect with the non-parametric regressions. In order to be more precise on the overall impact of used-clothing imports, these results should be placed in the context of the decline in apparel production over the sample period, which is done in Table 5. In the average African country, apparel production declined on average 13% per year, with used-clothing imports responsible for roughly 40% of the decline (using the linear-IV estimate of the causal impact, weighting each country equally). Used-clothing imports had a greater relative impact on apparel employment. In the average African country, apparel employment declined 9.6% per year during this period, with roughly half of the decline a result of used-clothing imports.

Therefore, the impact is certainly sizeable. To find that a single cause is responsible for roughly 40% of the decline in production in one industry, and roughly 50% of the decline in employment in that industry suggests that one has found a major source of decline in the apparel industry in Africa over the period 1981-2000. However, I am certain that the a priori expectations of some readers (and African apparel producers) placed the impact of used-clothing donations even higher than this. For example, the impact was not constrained to be less than 100%. We can imagine a context where other factors were having a positive impact on the apparel industry and were causing it to grow. In such a context, the impact of used-clothing on apparel production could have been even larger than the decline actually observed (resulting in an elasticity larger than -1), since other factors were supporting apparel production. If this was one's prior, then the impact we find is not as considerable. On the other hand, while the apparel industry is a single industry, the theoretical and historical importance of this industry has already been noted in the papers cited in the Introduction, as well as Figures 1 and 2 referenced there. While the theoretical models and historical experience for Africa may differ from those for other regions, other regions have certainly found the apparel sector to play an important role in the early stages of development.

3 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. Any overall conclusions regarding national welfare would need to combine the impact on consumption with the impact found here. To this point, the impact on consumption has been unmeasurable as household surveys have not separated the purchases of used clothing from that of new clothing.

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, the *interaction* between the proximity of OECD countries to a given African country and the supply of used-clothing donations in the OECD countries considered to be geographically 'near' to the African country was used to instrument for the used-clothing imports.

Using this instrument, the paper established that used-clothing imports had a significant negative impact on the textile and apparel production sectors in sub-Saharan African countries, being responsible for roughly 39% of the annual decline in apparel production, and roughly half of the annual decline in apparel employment. While this magnitude is considerable, it is also less than 100%, suggesting that other factors also hampered African apparel production. Another important finding was that the impact of used-clothing imports was significantly non-linear. Imports of less than 0.1kg per capita had virtually no impact on apparel production, but above the 0.1 kg per capita threshold, the impact became substantial and significant, suggesting that if one limits the importation of used clothing to the weight of one light t-shirt per person (or one-quarter of an Oxford shirt or one-tenth of a pair of blue jeans), it is possible to have limited imports of used clothing without a significant impact on the domestic apparel industry.

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Figure 1
Apparel Share of Workforce and Per Capita Income

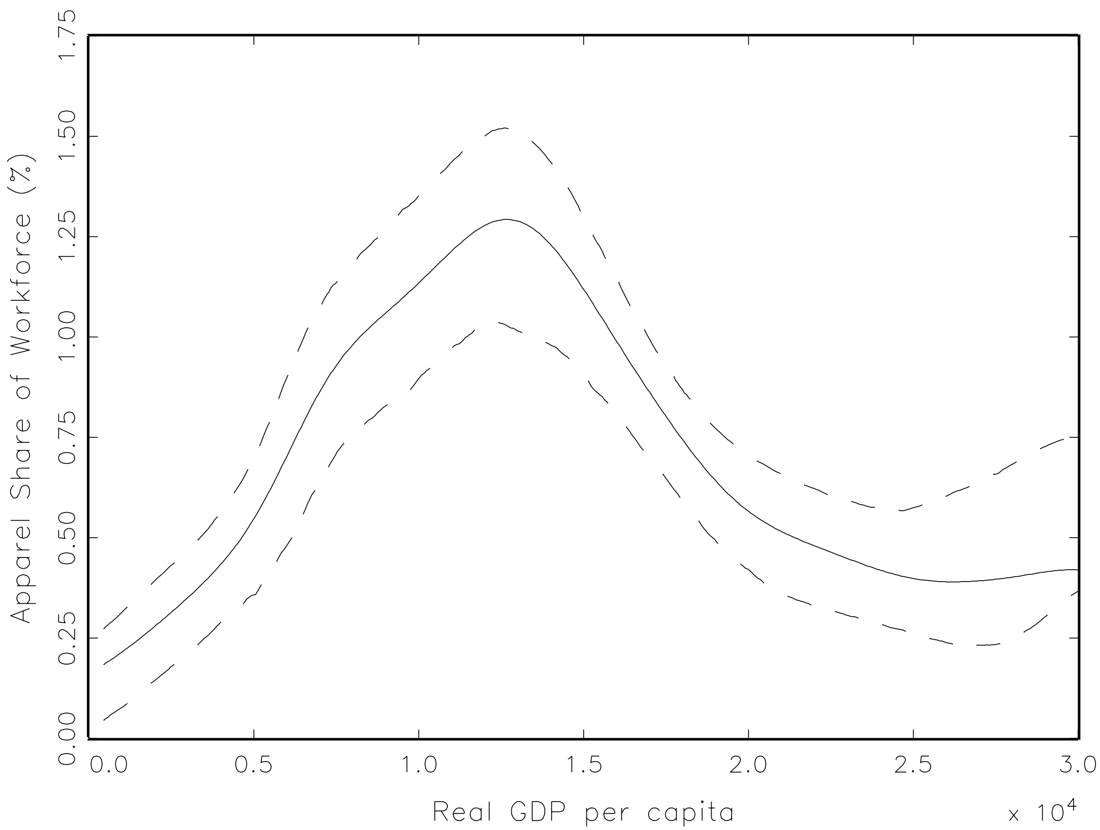

Figure 2 - Used-Clothing Export Trends - Selected Countries

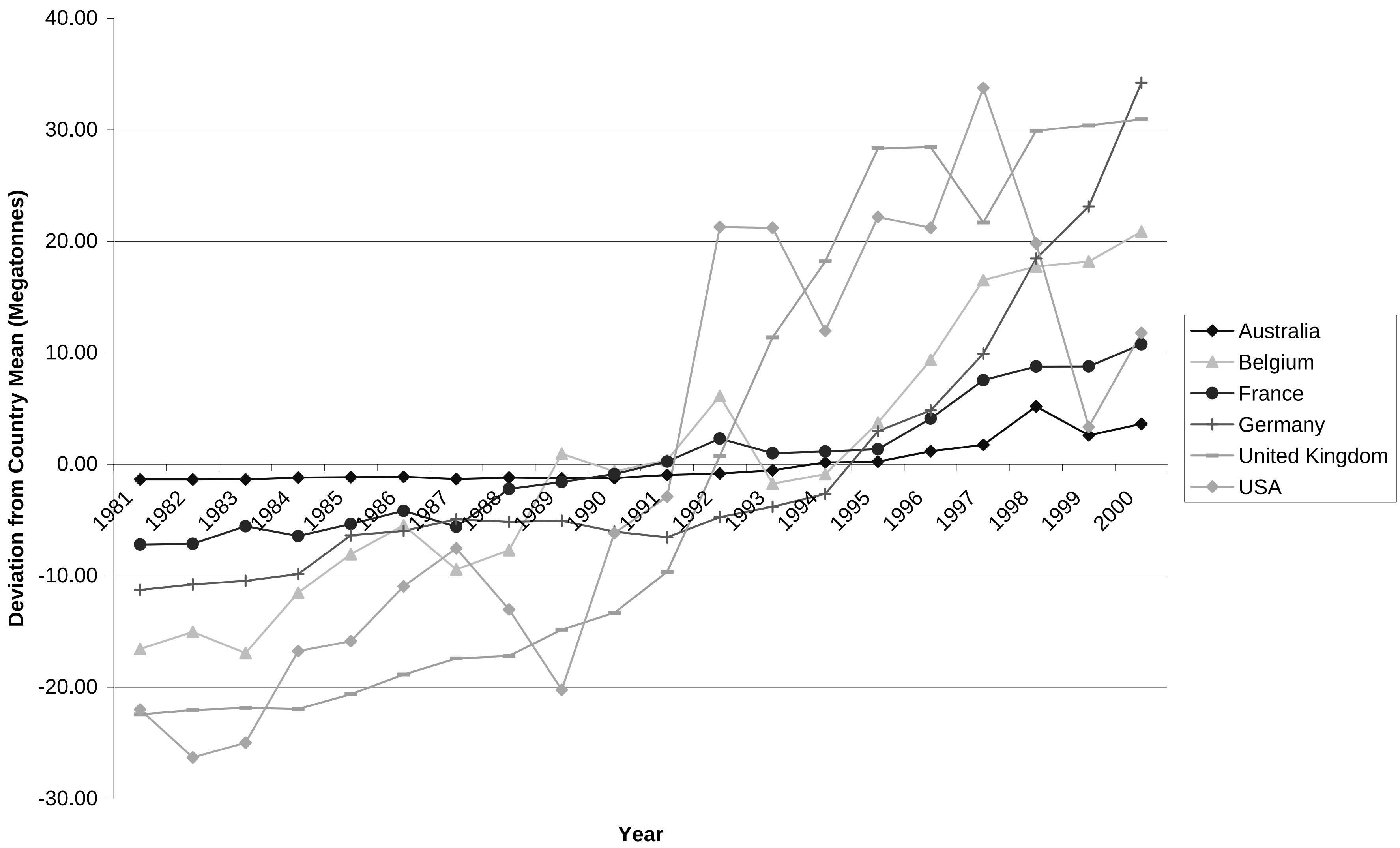

Figure 3
Apparel Share of GDP and Used−Clothing Flows
Nonparametric regression

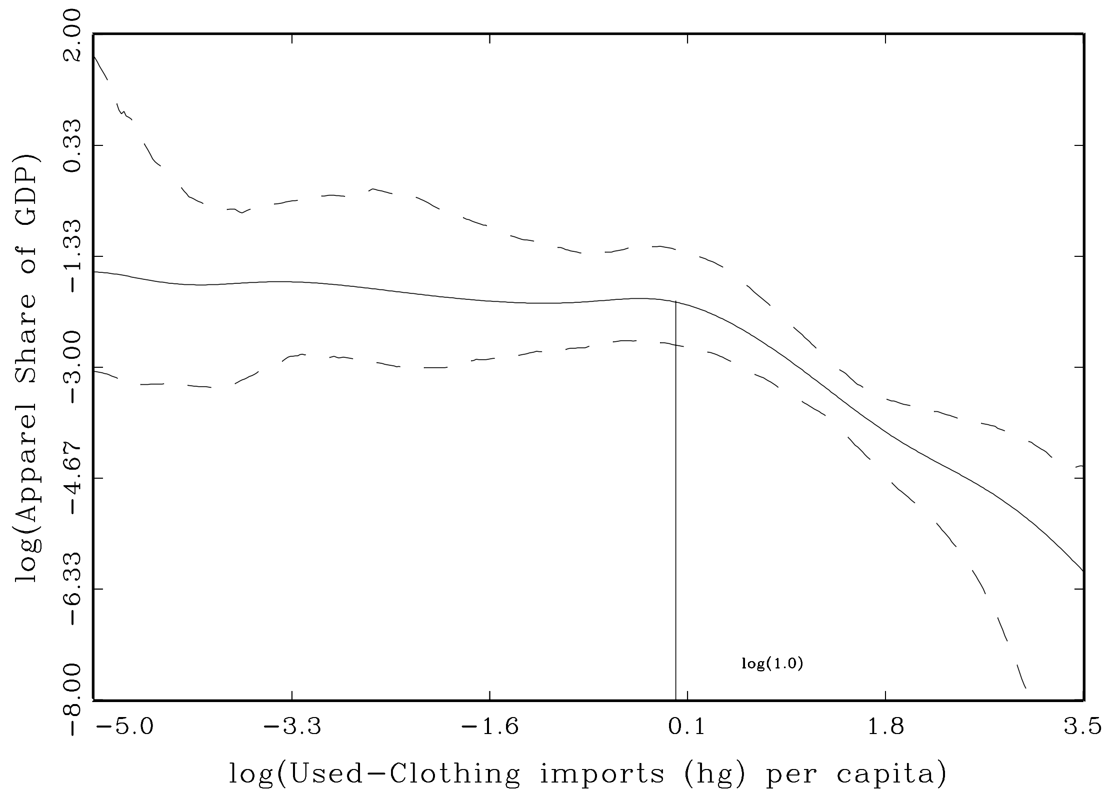

Figure 4
Apparel Share of GDP and Used–Clothing Flows
Nonparametric regression – Control Function

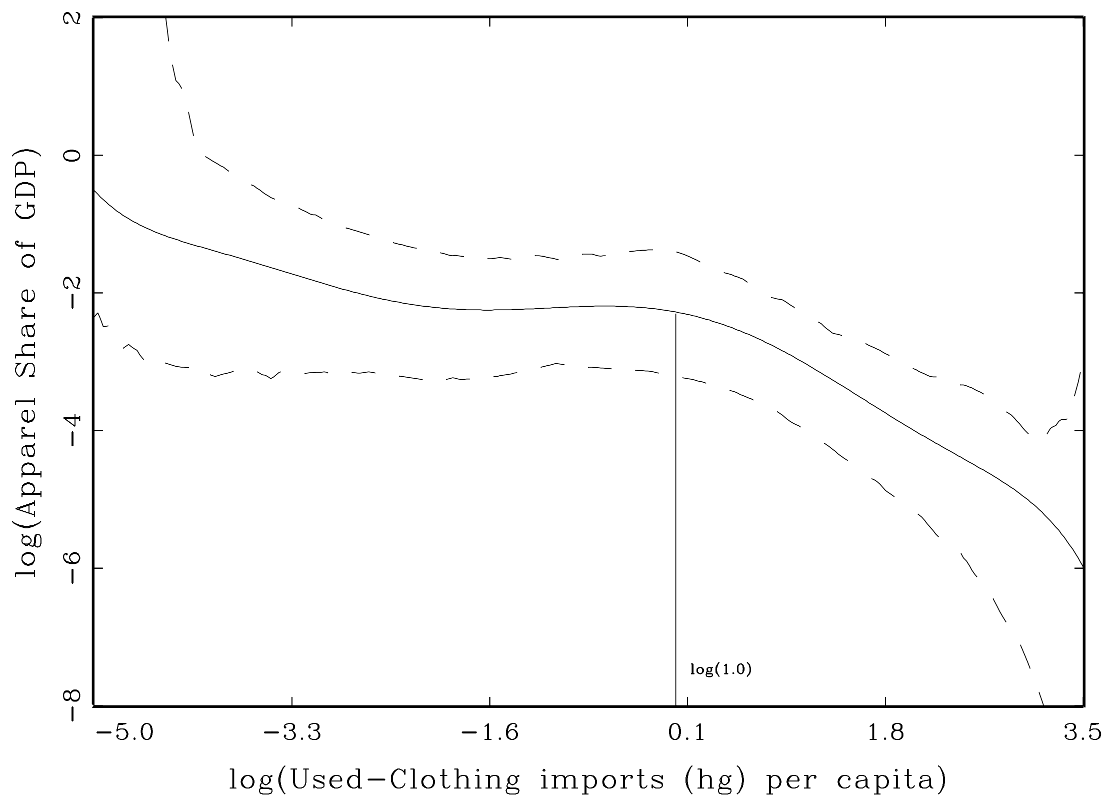

Table 1
Used-Clothing Trade and Apparel Production - Least Squares Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
log (Used Clothing Imports per capita)	-0.453***	-0.478***	-0.424***	-0.343**	-0.163*	-0.132*	-0.123*
	(.131)	(.092)	(.092)	(.116)	(.094)	(.072)	(.069)
GDP per capita (PPP)		0.364***	0.372***	0.330***	0.364***	0.276**	0.943
		(.049)	(.044)	(.066)	(.094)	(.131)	(.916)
(GDP per capita (PPP))^2							-0.039
							(.053)
log (Non-Apparel Manufacturing Share of GDP)						0.459	0.473
						(.572)	(.579)
With country fixed-effects				+	+	+	+
With time fixed-effects					+	+	+
N	212	212	192	192	192	192	192
R-squared	0.243	0.602	0.592	0.608	0.630	0.821	0.822

Notes: The dependent variable is (log) apparel value-added share of GDP. Robust standard errors, which are clustered at the country level, are in parentheses. The manufacturing value-added share of GDP variable refers to the sum of all non-textile, non-apparel manufacturing. Coefficient estimates marked *, **, and *** are significant at the 10% level, 5% level, and 1% level respectively.

Table 2
The Used-Clothing Trade Equation

colony	0.024**
	(.000)
Share Atlantic Ocean	0.003**
	(.001)
Share Pacific/Indian Ocean	0.0004*
	(.002)
log(population)	0.001*
	(.010)
log(area)	0.0002*
	(.001)
Landlocked	-0.003**
	(.000)
Sample Size	16439
R-squared	0.0733

Notes: The above regression is a least-squres regression of the used-clothing exports to country i as a share of total used-clothing exports from country j as the dependent variable. The impact of each of the regressors above is allowed to vary over time. Therefore, the coefficient shown above is the average impact of the variable measured across the years of the dataset. Below each coefficient is the p-value for an F-test that the variable has no impact in any of the years of the data. Based on the p-values of the F-test, coefficient estimates are marked * and ** for significance at the 5% and 1% levels, respectively.

Table 3
Used-Clothing Trade and Apparel Production - IV Results

	(1)	(2)	(3)	(4)	(5)
log (Used Clothing Imports per capita)	-0.551**	-0.650**	-0.613**	-0.619*	-0.606**
	(.234)	(.257)	(.259)	(.334)	(.287)
GDP per capita (PPP)	0.367***	0.394***	0.387***	0.382***	0.367**
	(.043)	(.113)	(.104)	(.108)	(.167)
log (Non-Apparel Manufacturing Share of GDP)					-0.057
					(.731)
Country fixed-effects		+	+	+	+
Time fixed-effects				+	+
N	212	212	192	212	192
R-squared	0.596	0.622	0.782	0.843	0.794
First Stage:					
log(Constructed Per Capita Used-Clothing imports)	0.493***	1.766***	1.812***	4.208***	4.323***
	(.113)	(.177)	(.185)	(.957)	(.974)
F-stat	19.21	99.54	96.39	19.35	19.72

Notes: The dependent variable is (log) apparel value-added share of GDP. Robust standard errors, which are clustered at the country level, are in parentheses. All columns are IV regressions. The coefficient on the instrument in the first-stage regression is given in the relevant column in the lower half of the table, as well as the relevant F-statistic. The manufacturing value-added share of GDP variable refers to the sum of all non-textile, non-apparel manufacturing. * Significant at the 10% level, ** 5%, *** 1%.

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

Dependent Variable:	
1) log(Apparel Value-Added Share of GDP)	-0.606**
	(.287)
2) log(Apparel Value-Added)	-0.681**
	(.301)
3) log (Apparel Employees per capita)	-0.501*
	(.256)
4) log(Textile Value-Added Share of GDP)	-0.013
	(.197)
5) log(Textile Value-Added)	-0.047
	(.208)
6) log(Non-Apparel Manufacturing Value-Added Share of GDP)	0.064
	(.113)
7) log(Non-Apparel Manufacturing Value-Added)	-0.043
	(.112)
8) log(Non-Apparel Manufacturing Employees Per Capita)	-0.015
	(.111)
9) log(Total Manufacturing Value-Added Share of GDP)	0.064
	(.123)
10) log(Total Manufacturing Value-Added)	-0.049
	(.124)
11) log(Total Manufacturing Employees Per Capita)	0.063
	(.059)
Using Used-Clothing Stock Variable:	
12) log(Apparel Value-Added Share of GDP)	-1.025
	(.692)
13) log (Apparel Employees per capita)	-0.856
	(.680)

Notes: Robust standard errors, which are clustered at the country level, are in parentheses. All regressions include country fixed-effects, year fixed-effects, and controls for real per capita GDP (PPP). The regressions also include appropriate controls for non-textile, non-apparel manufacturing (i.e. manufacturing share of GDP, manufacturing per capita value-added and manufacturing employees per capita in 1), 2), and 3), respectively). Coefficient estimates marked *, **, and *** are significant at the 10% level, 5% level, and 1% level respectively.

Table 5
Measuring the Impact of Used-Clothing Imports
on Apparel Production

	Average Change in Production Resulting from Used-Clothing Imports	Overall Average Change in Production
Dependent Variable:		
1) log(Apparel Value-Added Share of GDP)	-0.052 (38.8%)	-0.133
2) log(Apparel Employees per capita)	-0.047 (49.4%)	-0.096