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Abstract – Imported intermediate inputs offer access to lower-priced, higher quality, and a wider variety of inputs that can increase the possibility of producing and selling more diversified products in foreign markets. In this paper, we examine this relationship using a novel manufacturing industry-level data across 26 African countries over the 1995-2016 period. We find strong evidence of a positive relationship between imported intermediate inputs and the variety of exported products. Further analyses in the study indicate that imported intermediate inputs positively affect the variety of exported products because they offer lower-priced, and higher-quality/technology embodied inputs. However, the positive effect of imported intermediate inputs on the variety of exported products depend on industry's absorptive capacity, especially when the inputs are sourced from advanced countries. We discuss the implications of our findings.

Keywords**:** Export Variety; Imported Intermediate Inputs; Technology Acquisition; Africa
JEL Code: F10; F12; F23; O30

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1. Introduction

Producing and exporting a wider variety of products plays a vital role in international trade and the overall economy's performance. In particular, expansion in the range of exported products increases the market share of the exporter, diversifies exports, and protects against trade shocks (Gozgor & Can, 2016). In addition, increases in the range of exported products lead to organizational and technological transfer, which can benefit other industries in the exporting country through knowledge spillovers (Al-Marhubi, 2000; Agosin *et al.,* 2012; Gozgor & Can, 2016). Along this line, existing studies have provided evidence of better export performance (Funke & Ruhwedel, 2001a; 2002; 2005; Hummels & Klenow, 2005; Kehoe & Ruhl, 2013) and productivity gains (Funke & Ruhwedel, 2001b; Feenstra & Kee, 2008; Frensch & Wittich, 2009; Chen, 2011) associated with increases in the variety of exported products. Also, with the current wave of global value chains where tasks are performed in different locations across the globe, producing a wide range of products becomes imperative because multinationals are more likely to invest in regions with a wide range of products and thus easy access to intermediate inputs (Sheng & Yang, 2013).

These benefits associated with exporting a wider variety of products have spurred a body of literature examining its drivers. Following the seminal work of Goldberg *et al*. (2010) that examined the nexus between access to foreign inputs and the variety of products sold locally by firms in India, there has been an upsurge of empirical research on the effect of imported intermediate inputs on the variety of products sold locally or internationally. However, these studies mostly focus on advanced economies (Bas & Strauss-Kahn, 2014; Colantone & Crinò, 2014; Damijan *et al*., 2014; Castellani & Fassio, 2019), while similar studies for developing countries are limited. This gap in the literature is surprising because producing a wider variety of products could be knowledge and technology-intensive, which firms in most developing countries lack. In this case, access to foreign intermediate inputs becomes a panacea for these firms because it enables access to lower-priced, higher quality, and technologically advanced inputs. In addition, it expands firms' access to a wider variety of inputs used in production, which given the imperfect substitution between foreign and domestic inputs, leads to improved productivity gains (Either, 1982; Bas & Strauss-Kahn, 2014; Colantone & Crinò, 2014; Castellani & Fassio, 2019).

In this paper, we fill the above-identified gap in the literature by analyzing the relationship between imported intermediate inputs and the variety of exported products (hereafter referred to as exported variety) in African countries. In particular, we utilize manufacturing industry-level data across 26 African countries over the 1995-2016 period to provide novel evidence on the effects of imported intermediate inputs on exported variety. We measure exported variety as the number of products exported in each country-industry pair per year following Dutt *et al.* (2013), Manova (2013), Bas & Strauss-Kahn (2014), Beverelli *et al.* (2015), and Ndubuisi (2020). Our measure of imported intermediate inputs is from the EORA MRIO I-O database (Lenzen *et al.*, 2013; Aslam *et al.,* 2017) and is measured as the value of imported intermediate inputs at the industry level.

One of the major empirical challenges our analysis faces is endogeneity arising mostly from omitted variable bias and reverse causality. The latter is possible because firms that sell products in foreign markets benefit from direct links with foreign suppliers of intermediate inputs or knowledge about foreign markets given that they source inputs from abroad. We deal with this in three ways. Firstly, we performed our entire analysis by regressing the cotemporaneous exported variety on the predetermined values of imported intermediate inputs. Second, we use the average value of foreign intermediate inputs sourced by other African countries in similar industries as an instrument, which is inspired by prior studies in the trade literature (Autor *et al.,* 2013; Bloom *et al.,* 2016; Bos & Vannoorenberghe, 2019; Colantone *et al.,* 2019). The instrument captures the variation in imported intermediate inputs driven by changes in supply conditions in foreign, but similar, countries that are not driven by domestic industry-specific shocks, which might be endogenous to exported variety. Third, we limit our sample to exported variety to the U.S. and use imported intermediate inputs from other countries but the U.S. as the explanatory variable, thereby expunging the analysis from any endogeneity issues resulting from the importer-exporter relationship. We perform a similar analysis with exported variety to the EU-15 as the outcome variable and imported intermediate inputs from all other countries but the EU-15 as the explanatory variable. In all cases, we find evidence of a strong positive relationship between imported intermediate inputs and exported variety.

Furthermore, to gain insights into the mechanisms through which imported intermediate inputs affect exported variety, we compare the benefits of sourcing intermediate inputs from different countries of origin, distinguishing between developed and developing countries. In line with the existing literature (e.g., Bas & Strauss-Kahn, 2014; Bas & Strauss-kahn, 2015; Feng *et al.,* 2016; Colantone *et al.,* 2020), we interpret intermediate inputs that are sourced from developed countries as higher-quality/technology-embodied inputs while those that are sourced from developing countries are lower-priced inputs. We find that manufacturing industries in African countries are benefiting from both channels. Extant studies tend to underscore absorptive capacity as an essential component of identifying, absorbing, and assimilating new external knowledge and advanced technologies (Gerschenkron, 1962; Abramovitz, 1989; Cohen & Levinthal, 1989; Benhabib & Spiegel, 1994). In particular, these studies have shown that while access to foreign technologies may be beneficial to firms, there should be an adequate level of absorptive capacity for these benefits to materialize. Therefore, we also examine whether the exported variety effects of imported intermediate inputs are contingent on industries' absorptive capacity. Using total imported intermediate inputs, we find suggestive evidence that the impact of imported intermediate inputs on exported variety depends on the industry's absorptive capacity. While this result persists when we consider intermediate inputs sourced from developed countries, we find no such evidence for intermediate inputs sourced from other developing countries. Putting our results in context suggest that absorptive capacity is more important in the absorption and use of new knowledge embodied in intermediate inputs when they are sourced from developed countries whereas it may not matter when they are sourced from developing countries due to the advantages of relational proximity in knowledge spillovers and assimilation.

To the best of our knowledge, this paper is one of the few papers analyzing the effect of imported intermediate inputs on exported variety, especially using a large sample of African countries where foreign intermediate inputs play a pivotal role. Nonetheless, while our study focuses mainly on exported variety, which is a component of trade, it contributes to the nascent literature examining the nexus between imported inputs and different exporting components. In particular, existing studies have examined the impact of imported inputs on export quality (Zhu & Tomasi, 2020), quantity (Feng *et al.,* 2016), decision (Bas, 2012), survival (Boehe *et al.,* 2019), and revenue (Mazzi & Foster-McGregor, 2019), but have had a limited focus on exported variety. More so, evidence on developing countries, Africa, in particular, is lacking. Our study is also related to the literature examining the relationship between imported intermediate inputs and productivity

(Yasar, 2013; Halpern *et al.,* 2015; Okafor *et al.,* 2016; Foster-McGregor *et al.*, 2017), innovation (Liu & Qiu, 2016; Bos & Vannoorenberghe, 2019) and firm survival (López, 2006). We contribute to this literature by providing novel industry-level evidence across selected African countries on the impact of imported intermediate inputs on exported variety.

The rest of the paper is organized as follows. Section 2 summarizes the background literature. The research design, including the data and descriptive statistics are presented in Section 3. Section 4 discusses the results, while Section 5 concludes.

2. Background Literature

The theoretical and empirical analysis of the economic effects of international trade remains one of the topical areas of economic inquiry. Starting with Either (1979; 1982), a research strand in this literature has emphasized gains from international trade that accrue due to the greater availability of intermediate inputs and are similar to those of consumption goods highlighted by Krugman (1970) and others. The gains of accessing these foreign intermediate inputs to the local economy, say, by spurring economic growth has also been the interest of some theoretical studies (Romer, 1987; Rivera-Batiz & Romer, 1991; Backus *et al.,* 1992). In particular, this literature has discussed the level and growth effects arising when producers access foreign intermediate inputs. The level effect refers to a firm's productivity gain associated with access to foreign intermediate inputs, while the growth effect refers to expanding the firm's product scope (Colantone & Crinò, 2014). While mechanisms underscoring both are similar, our paper's focus is to provide evidence on the latter for a selected sample of African countries. Hence, the discussion that follows is contextualized within the scope of the growth effect.

Producing a wider variety of products often requires combining different inputs and technology that are often outside the bounds of a firm and may not necessarily be available locally.[2] In addition, exporting is associated with additional fixed and variable costs compared to producers who sell only to the domestic market. These costs would be relatively higher for exporters with a

[2] Even where available, it could be of lower quality or is available at a noncompetitive price relative to the foreign counterpart. Hence, access to foreign and domestic inputs allows a firm a wider variety to choose from based on observed and unobserved cost differences.

wider export basket because some costs are product-specific. Along this line, access to foreign intermediate inputs can affect exported variety in three important ways. First, access to foreign intermediate inputs expands the set of inputs a firm can use to produce final goods. Considering the imperfect substitution between foreign and domestic inputs, a firm's access to both domestic and foreign inputs would enable it to realize the optimal configuration of inputs, leading to productivity gains, which could materialize in terms of broader product scope. More so, the productivity gains lower the productivity threshold of entering the export market and the fixed costs of adding new varieties of either existing or new products to the exported variety (Damijan *et al.,* 2014). We call the above, the "variety effect" channel.

The second channel of impact is the "price effect" and works through a reduction in the marginal production cost. For instance, producers may source lower-priced inputs from the global South, leading to a fall in the marginal production cost of final goods. The marginal cost reduction may well result from the fact that the price index of the larger market (i.e., domestic and foreign market combined) is lower than that of the domestic market only (Damijan *et al.,* 2014). In either case, the lower marginal cost would raise the expected export revenue. This would incentivize producers to bear the fixed cost of exporting and/or adding new varieties of existing products to their export scope (Bas & Strauss-Kahn, 2014; Damijan *et al.,* 2014) or the entry of new firms with new products in a bid to gain market niche. Also, access to lower-priced intermediate inputs allows firms to reallocate capital expenditure to technology upgrading, which triggers a new circle of new products, thereby expanding product scope and the exported variety (Damijan *et al.,* 2014, p.1493).

Finally, imported intermediate inputs can affect the exported variety via the so-called "higher quality/technology-embodied" channel (Bas & Strauss-Kahn, 2014; Colantone & Crinò, 2014; Castellani & Fassio, 2019). The conventional view about foreign intermediate inputs, especially when sourced from advanced economies, is that it embodies sophisticated technology. Hence, access to foreign intermediate inputs would enable firms in [developing] countries where advanced technologies are lacking to access them (Eaton & Kortum, 2001; Caselli & Wilson, 2004; Acharya & Keller, 2009; Okafor *et al.,* 2016). As noted earlier, producing a wider variety of products could be knowledge and technology demanding. In this case, access to foreign intermediate inputs reduces firms' production constraints, leading to a wider product scope and a subsequent expansion in exported variety, provided firms have the capabilities to absorb the technological knowledge. Access to higher-quality/technology embodied inputs can also facilitate firms' efforts to upgrade their product portfolios and meet foreign buyers' requirements, thus increasing demand in foreign markets and boosting the exported variety (Mazzi & Foster-McGregor, 2019).

The three mechanisms underscored above suggest that access to foreign intermediate inputs exerts a positive effect on exported variety. Indeed, few existing studies have examined the impact of access to foreign intermediate inputs on the scope of the product sold locally and/or in internationally, finding support for this conjecture. Goldberg *et al.* (2010), the pioneer study in this literature, utilized India's 1991 trade liberalization as an exogenous trade shock and found that new imported inputs helped expand the number of products produced within a firm. The authors also suggest that the growth in the number of products produced within a firm results from the improved availability of imported inputs rather than lower imported input prices. Colantone & Crinò (2014) examined similar relationships using domestic product-level data across 25 European countries and found evidence of a positive relationship between new imported inputs and the production of new domestic products, stemming from the variety and technology effect channels.[3]

Damijan *et al.* (2014) focus on the exported variety effects of imported inputs churning using Slovenian manufacturing firm-level data. Their results confirm a robust positive relationship between net changes in imported inputs churning and net changes in exported variety. Bas & Strauss-Kahn (2014) use French customs data to examine the nexus between imported inputs and export scope, testing the variety, technology/high-quality, and price-effect channels, respectively. Their empirical specification controls for firm total factor productivity as a proxy of the variety-effect channel and imported inputs from advanced (developing) countries as a proxy for the technology/higher-quality (price) effect channels. Their results provide support for the three channels. Feng *et al.* (2016) use Chinese manufacturing firm-level data and find that firms that

[3] Arguing that the product scope effects of imported inputs operate two channels: variety and quality channel, the authors constructed quality-adjusted prices for each imported input. They found that imported inputs boost product creation even when they have the same quality-adjusted prices as the existing intermediate, which they argue is consistent with the "variety effect" channel. In addition, they find that the effect of new imported inputs decreases in their quality-adjusted prices, which they argue is consistent with the quality channel because the decrease in the quality-adjusted price would change the composition of inputs set towards superior varieties.

expanded their intermediate input imports expanded the scope of their exports. Using transaction-level data of the Swedish manufacturing firms' population, Castellani & Fassio (2019) found that new intermediate inputs foster the introduction of new exported products. The authors also found that SMEs benefit the most from access to imported inputs, which they argue supports the idea that larger firms may have other ways to get a hold of better technologies and intermediates inputs in contrast to SMEs.

Contrary to the above empirical studies, in this paper, we make three additions to the literature. First, we depart from the forgoing studies in that we focus on African countries. Intermediate inputs import by advanced economies' firms are often products of offshoring aimed at taking advantage of differences in costs than embodied technologies. While this may affect exports by raising the firm's expected export revenue, firms in developing countries largely depend on foreign intermediate inputs for the embodied technology and the reduced costs, which ultimately impacts the country's industrial transformation, such as expansion in the variety of exported products. Hence, the gain of examining the relationship between intermediate inputs imports and exported variety in developing countries cannot be overemphasized. Feng *et al.* (2016), who focus on China, remains the only study known to us to study the relationship between foreign intermediate inputs and exported variety in a developing country, but the authors do not provide a formal test on the channels of impact.[4] Hence, we make a second contribution by testing the price-effect and technology-embodied-effect channels. The importance of firm (or industry) absorptive capacity in appropriating technologies embodied in foreign intermediate inputs are well documented in the literature focusing on the level effects of imported intermediate inputs (e.g., Yasar, 2013; Foster-McGregor *et al.*, 2017; Okafor *et al.,* 2016). To the best of our knowledge, however, the few existing studies on the "growth effect" of imported intermediate inputs are yet to empirically examine this relationship. Hence, our third addition to the literature is to provide evidence on whether the impact of foreign intermediate inputs on exported variety is conditional on an industry's absorptive capacity.

[4] Moreover, given the industrial transformation of China in past decade, it is not certain whether it makes a good case for developing countries who tend to depend on foreign technologies (including technologies from China) for industrial activities.

3. Research Design

3.1. Data and Model Specification

Our primary research objective is to empirically examine the impact of imported intermediate inputs on exported variety, focusing on African countries. For the empirical measure of exported variety, we follow Dutt *et al.* (2013), Manova (2013), Bas & Strauss-Kahn (2014), Beverelli *et al.* (2015) and Ndubuisi (2020), by using a simple count of the number of "products" a country exports in an industry per year. We focus on seven broad manufacturing industries, including “chemical and non-metal products”, “electrical and machinery”, “food & beverage”, “metal products”, “textiles and apparel”, “transport equipment”, and “wood and paper”.[5] We then define "products" as a 6-digit harmonized system subheadings (H.S.) exported from each industry in a year. The original data we use to construct this variable comes from the BACI-CEPII dataset (Gaulier & Zignago, 2010), which is only available from 1995 onwards. Hence, our analysis starts in 1995 and ends in 2016. The dataset presents bilateral trade data at the 6-digit H.S. To derive the outcome variable, we collapse the importer dimension of the dataset and use an appropriate concordance table to map each product to the corresponding industry.[6] Therefore, the outcome variable is not destination-specific, and our empirical analysis does not require destination-specific variables such as bilateral distance.

Regarding the empirical measure of imported intermediate inputs, two approaches have been adopted in the literature. One of the approaches is to use firm-level data with detailed information on the variety of products imported by each firm, which are then mapped to the Broad Economic Categories (BEC) to identify intermediate inputs (e.g., Bas & Strauss-Kahn, 2014; Colantone & Crinò, 2014; Bos & Vannoorenberghe, 2019). The second approach uses a cross-country comparable input-output table containing intermediate inputs sourced by each country-industry pair to produce final goods (e.g., Nishioka & Ripoll, 2012; Foster-McGregor *et al.,* 2017). To our knowledge, detailed firm-level data that are comparable across African countries to pursue the first

[5] We focus only on the manufacturing industry because comparable cross country-industry level data on labor productivity are only available for those industries. We also use aggregated manufacturing industry data because we only observe intermediate inputs at such an aggregated level using the available input-table.

[6] The original data used to construct the BACI-CEPII is from the UN COMTRADE. We preferred the former because the authors have extensively cleaned it. However, one of the shortcomings of the data is that data on some countries such as those belonging to the Southern African Customs Union is aggregated, making one of the major African countries we are interested in impossible to measure. Hence, for this country, we utilize data from UN COMTRADE instead. In particular, we use the mirror approach to derive the export data.

approach are unavailable. Hence, we subscribe to the second approach and source data for constructing imported intermediate inputs from the UNCTAD's EORA MRIO I-O database (Lenzen *et al.*, 2013; Aslam *et al.,* 2017). The dataset is a set of inter-country input-output tables covering 25 industries (excluding the industry on "re-export/import") in 189 countries of the years 1990-2015. It has three components; the intermediate goods demand (matrix), final demand (matrix), and the value added (matrix).

The original data on foreign intermediate goods demand is a 4,725 by 4,725 matrix per year (=25*189). Focusing on the seven sectors mentioned above, we use the data on foreign intermediate demand to construct three major measures of imported intermediate inputs. First, we compute a measure of total imported intermediate inputs, i.e., imported intermediate inputs from the whole world. For the second and third measures, we compute the total imported intermediate inputs from developed (DC) and developing (LDC) countries, respectively. As noted in the introduction, we use indicators on imported intermediate inputs by origin to test the lower-priced and higher-quality/technology embodied channels following Bas & Strauss-Kahn (2014), Bas & Strauss-kahn, (2015), Feng *et al.* (2016), and Colantone *et al.* (2020), among many others. In particular, we interpret intermediate inputs sourced from developed countries as higher-quality/technology embodied inputs, while those sourced from developing countries are interpreted as lower-priced inputs.[7] We acknowledge that using the country of origin of input as proxies of input relative price and quality may face some limitations. Whiles alternative approach that allows the computation of prices and qualities of imported inputs using unit values and the inferred-quality measure developed by Khandelwal *et al.* (2013) may be more informative, we are unable to pursue this approach due to a data limitation. Among others, computation of unit prices and inferred-quality requires product-level data and information on the quantity of imported inputs which are lacking in the UNCTAD's EORA MRIO I-O database.

In what follows, the baseline empirical model that guides our analysis takes the form:

$$lnEV_{c,s,t} = \beta_0 + \beta_1 lnIM_{c,s,t-1} + \delta X'_{c,s,t-1} + \gamma_{c,s} + \gamma_t + \varepsilon_{c,s,t} \qquad (1)$$

[7] Table A1 in the appendix list the different country groups used in our analysis.

where $lnEV_{c,s,t}$ is the log exported variety by country c in industry s and period t, $lnIM_{c,s,t}$ is log imported intermediate inputs. $X'_{c,s,t}$ is a vector of three industry control variables: labor productivity, import penetration, and total industry output.[8] We use the import penetration variable to isolate the effect of foreign intermediate inputs at the industry level from other general openness of the industry. Changes in the number of exported products may also reflect changes in the scale of the industry. Hence we control for total industry output to account for this scale effect. We lag the independent variables by a period to minimize contemporaneous endogeneity. Importantly, the lagged imported intermediate inputs also account for the time needed for knowledge and technology acquired in imported inputs to be used in industrial activities that would lead to a wider range of exported products. We control for country-industry pair ($\gamma_{c,s}$) and year (γ_t) fixed effects, respectively.

We source industry-level data on output and data used to construct labor productivity from the UNIDO INDSTAT2, which provides data on manufacturing industries at the 2-digit level of ISIC Rev.3. Data points for some industries are missing for employment or value-added. To fill in the missing information, we follow Pahl & Timmer (2019) to make the data consistent across industries, over time, and across variables. The value added variable is measured in current basic prices. We follow Rodrik (2013) to express labor productivity at constant prices. For import penetration, we follow Foster-McGregor *et al.* (2016) and compute the index as $\frac{import_{c,s,t}}{(GDP_{c,t}+import_{c,s,t}-export_{c,s,t})}$. Data on industry-level export and import are sourced from BACI-CEPII, while county-level data on GDP come from the world development indicator.

We estimate our baseline equation using OLS, with time and country-industry pair fixed effects. However, to address endogeneity concerns that may arise from omitted variable bias, we also adopt an instrumental variable (IV) approach with country-industry pair fixed effects. A detailed exposition about the IV is given in section 4.2. Finally, to account for the discrete nature of our outcome variables, we also report results using Poisson Maximum Likelihood estimation, with the

[8] Ideally, we use the index on import penetration to isolate the effect of foreign intermediate inputs at the industry level from other general openness of the industry.

dependent variable expressed in levels rather than logs. We also include time and country-industry pair fixed effects in the Poisson model estimation.

[Insert Figure I, 2 and 3 about here]

3.2. Descriptive Statistics

The descriptive statistics show interesting features differing across industries. First, the variety of exported products is unevenly distributed, with Electrical and machinery, Petroleum, chemical, and non-metallic mineral products, Textile and wearing apparel, and Metal products industries outperforming the other industries (Figure 1). Interestingly these are also the industries that receive the largest share of imported intermediate inputs regardless of where they are sourced from, as shown in Figures (2a, b, c). Second, we also observe that the variety of exported products by these industries in Africa has increased over the years covered, except in the Chemical and non-metallic mineral products, Textile and wearing apparel and Wood and furniture industries where the variety of exported products declined, particularly after 2008. However, there have been successful and stable recoveries during the later years of our sample period (Figure 3). In line with our working hypothesis, the descriptive statistics show a positive and strong correlation between imported intermediate inputs and export variety (Figure 4a). There seems to be no difference in this relationship, at least statistically, when inputs are sourced from developed countries (Figure 4b) versus when they come from developing countries (4c), although the correlation in the latter case tends to be higher.

[Insert Figure 4 about here]

[Insert Table I about here]

4. Empirical Results

4.1 Baseline Results

Table I shows the baseline results on the exported variety effects of imported intermediate inputs, using total imported intermediate inputs i.e., we do not distinguish the sources of the imported intermediate inputs. The dependent variable in each column is log exported variety, while estimation is achieved using OLS with time and country-industry pair fixed effects. Column (1) shows the results when we regress the outcome variable only on imported intermediate inputs, conditioning on year and country-industry pair fixed effects. The estimated coefficient of imported intermediate inputs turns out positive and statistically significant at the 1% significance level, suggesting a positive association between imported intermediate inputs and exported variety among manufacturing industries in African countries. In particular, the estimated coefficient suggests that a 1% increase in imported intermediate inputs will increase exported variety by approximately 0.20%. Column (2) shows the results when we include the three time-varying industry variables, labor productivity, import penetration, and output which are all in logs. We find that the estimated coefficient of imported intermediate inputs remains positive and statistically significant at the 1% significance level. In column (3) we include time-varying country fixed effects to test whether our result is driven by such omitted variable. While introducing these fixed effects turn the estimated coefficient of labor productivity statistically insignificant, the estimated coefficient of imported intermediate input remains significantly positive at all conventional statistically significance level. In summary, our baseline results support our conjecture that imported intermediate inputs exert a positive effect on exported variety. Therefore, it is consistent with those reported in the existing literature, albeit focusing largely on advanced economies (Bas & Strauss-Kahn, 2014; Colantone & Crinò, 2014; Damijan *et al.*, 2014; Castellani & Fassio, 2019).

[Insert Table II about here]

4.2. Robustness Checks

In this section, we test the robustness of our baseline analysis and report the results in Table II. As a first step, to account for the discrete nature of our outcome variable, columns (1) and (2) of Table II present the results when we use the Poisson model to estimate the baseline equation (1). In general, the result of the variable of interest is qualitatively similar to those reported in Table I.

While our baseline results were obtained by regressing cotemporaneous values of exported variety on the predetermined values of imported intermediate inputs to minimize reverse causality, this may not entirely address the problem if the variable on imported intermediate inputs is highly persistent over time. This is because any unobservable that is correlated with the current level of imported intermediate inputs would also be correlated with its past value, making the prior approach ineffective for dealing with endogeneity. To address this concern, we adopt an instrumental variable (IV) approach. We follow earlier studies in the empirical trade literature (Autor *et al.,* 2013; Bloom *et al.,* 2016; Bos & Vannoorenberghe, 2019; Colantone *et al.,* 2020) and instrument imported intermediate inputs in country *c* and industry *s* with the proportion of imported intermediate inputs in similar industries by other African countries.[9] The instrument is meant to capture the variation in the share of imported intermediate inputs driven by changes in supply conditions in foreign, but similar, countries that are not driven by domestic industry-specific shocks, which might be endogenous to exported variety.[10]

Columns (3) and (4) of Table II report the second stage results of the IV estimation. In particular, column (3) shows the result when we use our instrument in a model where imported intermediate inputs is the only independent variable, while column (4) shows the result when we use our instrument in a model where imported intermediate inputs, labor productivity, import penetration, and output are all independent variables. In both columns, we find that the estimated coefficients of imported intermediate inputs remain positive and statistically significant at the 1% significance level. However, the size of the estimated coefficient is substantially larger, indicating that previous estimates may be biased downwards. Figures 5a and b graph the first-stage regressions of results reported in columns (3) and (4), respectively. As one would expect, in both cases, we observe a strong positive predictive power of the proportion imported intermediate inputs by other African countries.

Next, as a second approach to deal with the endogeneity especially those arising from reverse causality, we limit our sample to exported variety to the U.S. and use imported intermediate inputs from other countries but U.S. as the explanatory variable, thereby expunging the analysis from any endogeneity issues resulting from the importer-exporter relationship. We perform a similar analysis with exported variety to the EU-15 as the outcome variable and imported intermediate inputs from all other countries but the EU-15 as the explanatory variable.[11] The results for these

[9] Column 2 in Table A1 in the appendix lists the African countries we use in computing the instrument.
[10] We assume that African countries are similar in terms of institutions, macroeconomic conditions, etc. Hence, we use the proportion of imported intermediate inputs to capture the trend.
[11] The EU-15 include Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and United Kingdom.

analyses are reported in columns (5) to (8) using both OLS and Poisson estimators. Columns (5) and (6) report the results for exported variety to the EU-15. While the outcome variable in column (5) is $log\ (1 + exported\ variety)$, it is exported variety in levels in column (6).[12] We add a constant in the log transformation because some country-industry pairs did not export to the EU-15 market. For those combinations, we replace the missing values with zero and add a constant in the log transformation since the log of zero is undefined. As the results in the two columns indicate, imported intermediate inputs have a positive and statistically significant effect on exported variety. Columns (7) and (8) report the results for exported variety to the U.S. As in the two consecutive previous columns, while the outcome variable in column (7) is $log\ (1 + exported\ variety)$, it is exported variety in levels in column (8). The results in both columns are consistent with our baseline result in suggesting a positive impact of imported intermediate inputs on exported variety.

4.3. Extended Analysis

4.3.1. Examining the Channels of Impact

We now explore the different channels through which imported intermediate inputs affect exported variety. We follow Bas & Strauss-Kahn (2014) and distinguish the sources of foreign intermediate inputs, between imported intermediate inputs sourced from developed (as a proxy for the higher-quality/technology-embodied channel) and developing countries (as a proxy for the lower-price channel). The results of this analysis are reported in Table III. The dependent variables in all the columns are $log\ exported\ variety$. The OLS results on the estimated coefficient of imported intermediate inputs from developed countries (DC) and developing countries (LDC) are both significantly positive at the 1% significance level, as reported in columns (1) and (3). On the other hand, Columns (2), (4), and (5) report the second stage results of the IV estimation. As in the previous section, we instrument imported intermediate inputs in industry s in country c that are sourced from developed (developing) countries with the proportion of imported intermediate inputs in each industry by other African countries sourced from developed (developing) countries. The results are qualitatively similar to those obtained using OLS, with the results indicating that manufacturing industries in African countries are benefiting from both channels. Therefore, our results are consistent with Bas & Strauss-Kahn (2014) that find evidence of a positive effect of

[12] Nonetheless, in an unreported result, we find that dropping the zero observations does not change our results in qualitative terms.

imported intermediate inputs on exported variety arising from both the lower-price and higher-quality/technology-embodied effect channels.

[Insert Table III about here]

4.3.2. The Role of Absorptive Capacity

Our analysis so far has focused on a linear relationship between imported intermediate inputs and exported variety. By so doing, it assumed that the positive effects of imported intermediate inputs on exported variety are automatic. However, existing studies have underlined absorptive capacity as an essential component of identifying, absorbing, and assimilating new external knowledge and advanced technologies (Gerschenkron, 1962; Abramovitz, 1989; Cohen & Levinthal, 1989; Benhabib & Spiegel, 1994). In particular, these studies have shown that while access to foreign technologies may be beneficial to a firm or industry (depending on the unit of analysis), there should be an adequate level of absorptive capacity in order for the benefits to materialize. Indeed, insights from the literature focusing on the scale effect of imported intermediate inputs have corroborated this conjecture (Yasar, 2013; Okafor *et al.,* 2016; Foster-McGregor *et al.*, 2017). In a similar fashion and as discussed in the background literature, producing a wider variety of products or upgrading existing products, which ultimately bear on exported variety, could be knowledge and technology demanding. While access to foreign intermediate inputs tends to reduce these firms' production constraints, lacking the requisite absorptive capacity may impede the firm in reaping this benefit even where foreign technologies are available. Against this backdrop, in this section, we go beyond the linear relationship to examine whether the effect of imported intermediate inputs on exported variety depends on the industry's absorptive capacity.

Prior studies that empirically modeled absorptive capacity either used the proportion of skilled workers, relative productivity, or some innovation variable such as R&D (*e.g.,* Yasar, 2013; Foster-McGregor *et al.*, 2017; Mazzi & Foster-McGregor *et al.*, 2019).[13] In the absence of having industry-level indicators on education or innovation variables for the countries in our sample, we follow the empirical approach of using relative productivity as a proxy of an industry’s absorptive capacity. Since absorptive capacity is about the ability of firms to improve their productivity

[13] For an extensive review of the literature on the measurement of absorptive capacity, see Harris & Yan (2019).

(Harris & Yan, 2019: p.747), to the extent that industry productivity in a laggard country is closer to the productivity of the frontier, then it is likely that the industry has a higher technical ability to internalize external knowledge. To this end, we set the U.S labor productivity in each industry per year as the global productivity frontier, and construct an index of industry relative absorptive capacity (ABC) as follows:

$$lnABC_{c,s,t-1} = ln\left(\frac{LP_{c,s,t-1}}{LP^{US}_{c,s,t-1}}\right) \qquad (2)$$

Where ABC is absorptive capacity, $LP_{c,s,t}$ is country *c* labor productivity in industry s, $LP^{US}_{c,s,t-1}$ is the U.S labor productivity in industry s. To test for the presence of non-linearity between imported intermediate inputs and exported variety, we begin by substituting the labor productivity variable in our baseline equation (1) with the newly constructed index on industry-level absorptive capacity, further interacting it with the variable on the imported intermediate inputs.[14] The new empirical model that guides this analysis is given as follows.

$$lnEV_{c,s,t} = \beta_0 + \beta_1 lnIM_{c,s,t-1} + \beta_2 lnABC_{c,s,t-1} + \beta_3 lnIMP_{c,s,t-1} + \beta_3 lnQ_{c,s,t-1} + \delta_0 (lnIM \times lnABC)_{c,s,t-1} + \gamma_{c,s} + \gamma_t + \varepsilon_{c,s,t} \quad (3)$$

Where IMP and Q are industry-level measures of import penetration and total output, all other variables are as defined in equations (1) and (2).

[Insert Table IV about here]

Table IV show the results of the interaction variable between imported intermediate inputs and industry absorptive capacity. Column (2) shows the results on the interaction variable between total intermediate input and absorptive capacity. The estimated coefficient of the variable is significantly positive, indicating the importance of absorptive capacity in assimilating the

[14] We drop labor productivity in equation 3 since it will be highly correlated with labor productivity. However, in Table A3 in the appendix, we report results using labor productivity, and find results that are qualitatively similar. We, however, opt for the results using relative labor productivity since it is a more common measure of absorptive capacity in the literature.

technologies embodied in the imported intermediate inputs, which tend to be higher for industries that have experienced an improvement in their labor productivity level relative to the global productivity frontier. Columns (4) and (6) differentiate the sources of imported intermediate inputs, with column (4) showing the results for the interaction variable between absorptive capacity and intermediate inputs sourced from developing countries, while column (6) show the results on the interaction variable between absorptive capacity and intermediate inputs sourced from developed countries. As the results indicate, the interaction variable is statistically significant at all conventional levels in column (4) while it is not in column (6), suggesting that absorptive capacity is more important when intermediate inputs are sourced from developed countries and less so when sourced from developing countries. These results lead to the further conclusion that while manufacturing industries in Africa are gaining from both the lower-price and higher-quality channels of imported intermediate inputs, the gains from the higher-quality channel (i.e. intermediate inputs sourced from developed countries) are higher, the higher the industry's absorptive capacity.

Our finding on the importance of absorptive capacity for the absorption of new knowledge embodied in intermediated inputs is consistent with established literature. In this literature, technological gap between two countries, say, A and B (where country A is the technology sourcing country from country B) might either reduce country B’s propensity to transfer technology to country A or the capacity of country A to absorb new technologies from country B. Therefore, building absorptive capacity is crucial in the transfer and assimilation of new knowledge and technology (Cohen & Levinthal, 1989). However, the concept of relational proximity in knowledge spillovers and assimilation introduced by Basile *et al.* (2011, p.21) also makes it possible for countries sourcing technologies to benefit from new available knowledge regardless of the level of absorptive capacity. Among others, relational proximity here is defined as “the similarities of two areas in terms of shared behavioral codes, common culture, and technological capabilities”. Relational proximity facilitates cooperative learning processes through which knowledge accumulation takes place. Given that most countries in Africa share some similarities with other developing countries in the areas mentioned above, it is not surprising that we find little or no importance for the role of absorptive capacity in the assimilation of knowledge coming from other developing countries.

5. Conclusion

In this paper, we examined the impact of imported intermediate inputs on the variety of exported products using industry-level data across 26 African countries over the 1995-2016 period. We find strong evidence of a positive relationship between imported intermediate inputs and the variety of exported products. We conducted several robustness checks, including using IV methods, and find that our results remain unchanged qualitatively. To gain insights into the mechanisms through which imported intermediate inputs affect the variety of exported products, we tested two channels that have been underscored in the literature namely, the "lower-price effect" and "higher quality/technology-embodied" channels. In particular, we asked whether imported intermediate inputs affect the variety of exported products by expanding access to lower-priced inputs and/or higher-quality/advanced-technology-embodied inputs. The results from the analyses indicate that manufacturing industries in African countries are benefiting from both channels. Finally, empirical analyses testing whether the observed positive effects of imported intermediate inputs depend on the absorptive capacity of an industry confirms that it is although it may not matter when it is sourced from developing countries due to the advantages of relational proximity in knowledge spillovers and assimilation.

From an industrial and trade policy perspective, our results suggest that imported intermediate inputs could be an important source of manufacturing industry upgrading for African countries, but there is a need to upgrade the industry's internal technological capabilities in order to effectively and efficiently gain from foreign intermediate inputs especially when those inputs are sourced from developed countries. Therefore, policies aimed at removing restrictions on access to foreign intermediate inputs, say, by liberalizing input tariffs should be accompanied by policies that enhance the internal capabilities of domestic firms.

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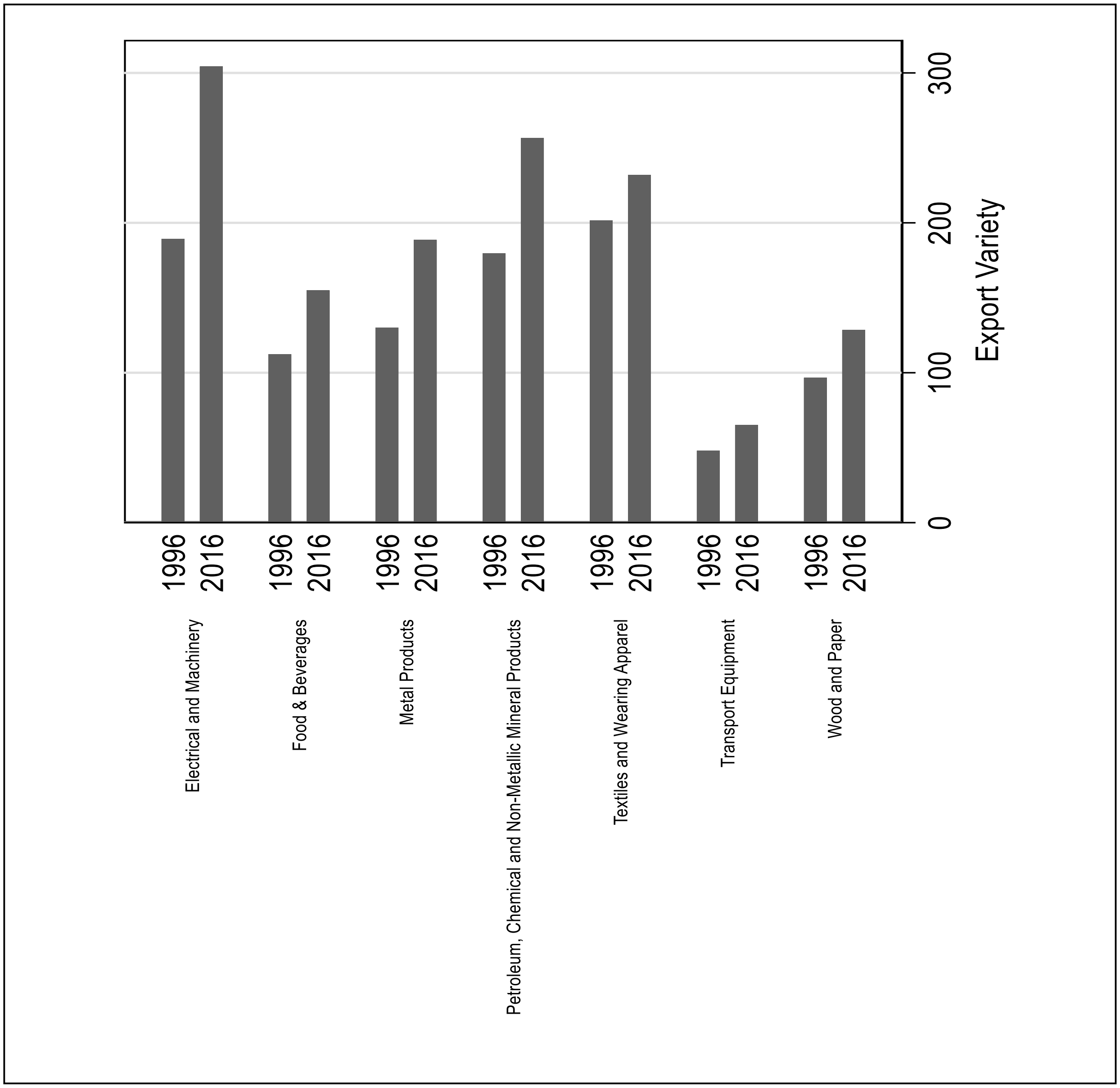
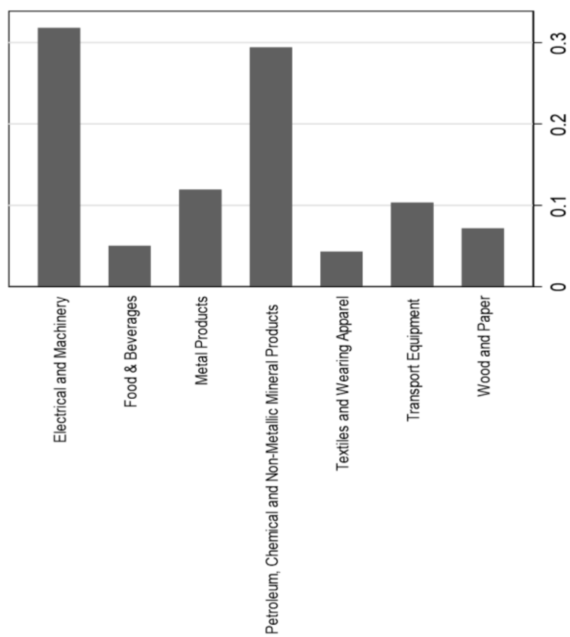
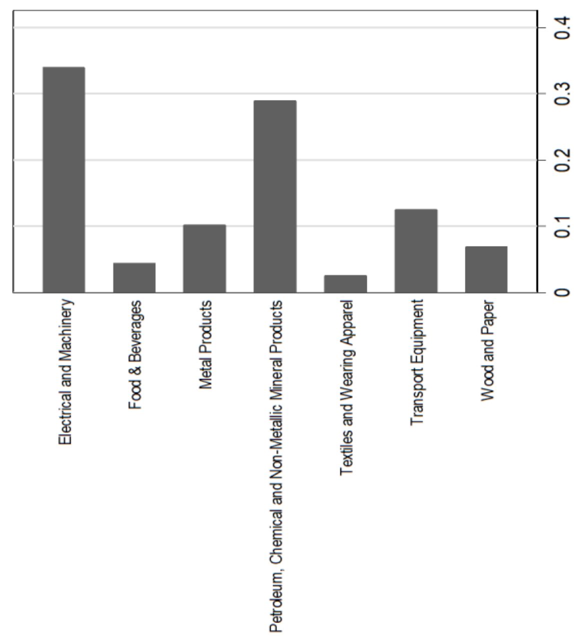


Figure 1: Export Variety in African countries in the sample, by industry





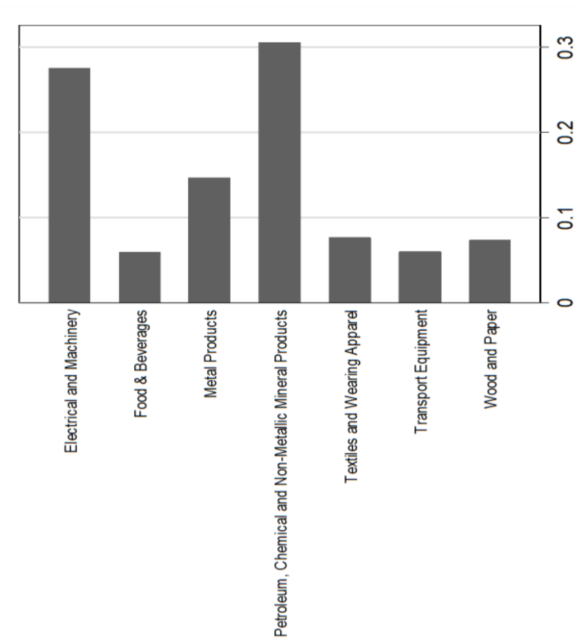


Figure 2a
Share of total Imported Intermediate Inputs

Figure 2b
Share of Imported Intermediate Inputs from DC

Figure 2c
Share of Imported Intermediate Inputs from LDC

***Note*:** Figure 2 shows share of imported intermediate inputs by industries across the sample period 1996-2016.

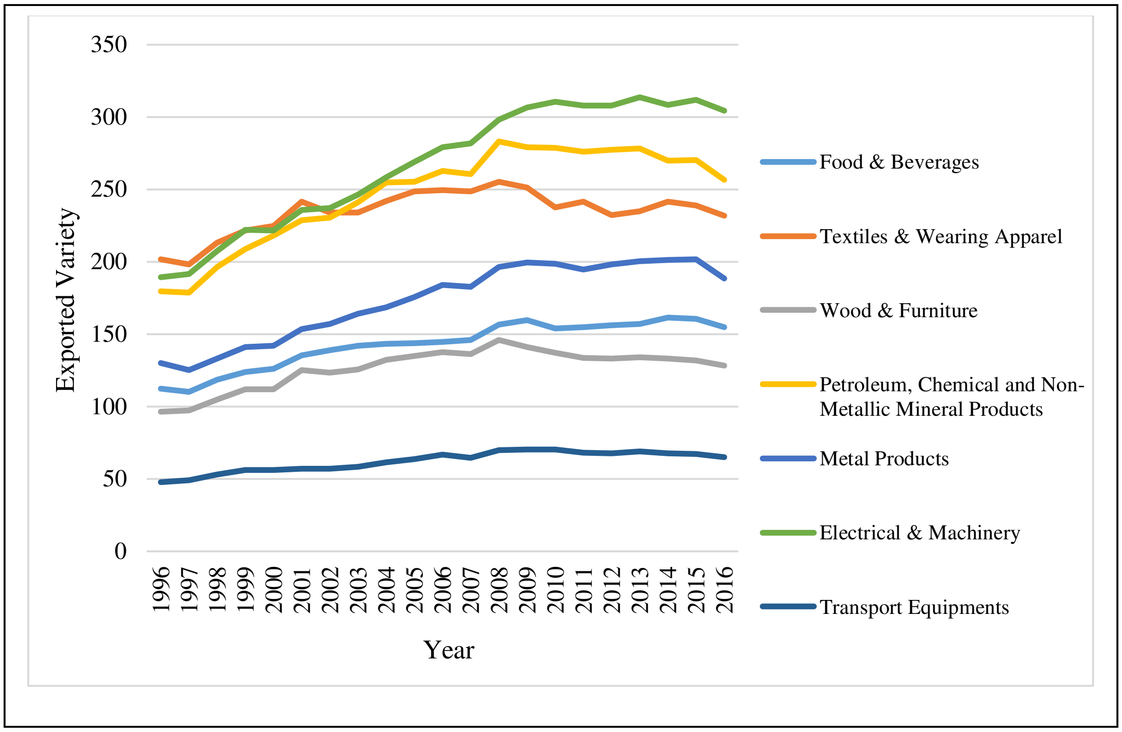
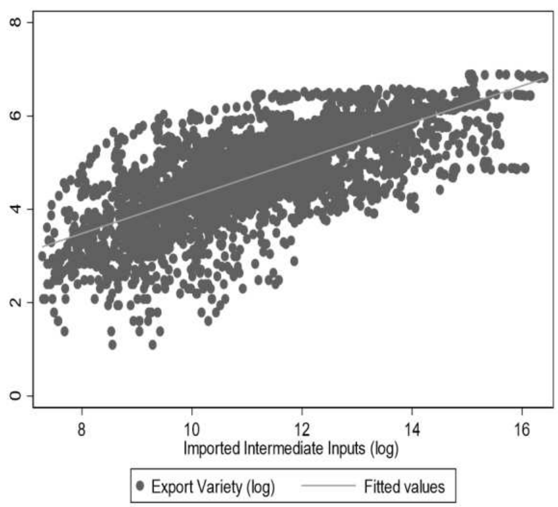
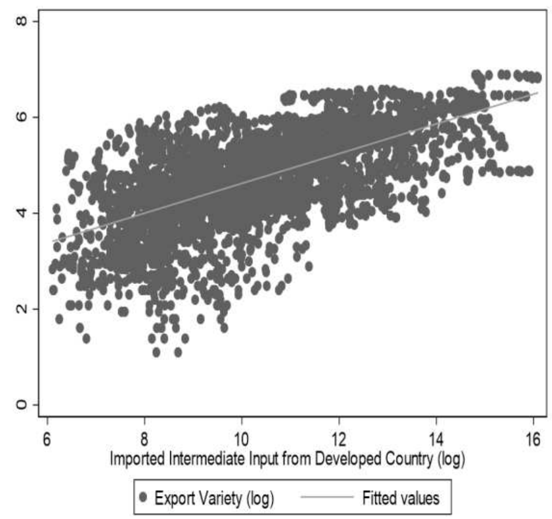


Figure 3: Evolution of Export Variety in Africa, by Industry





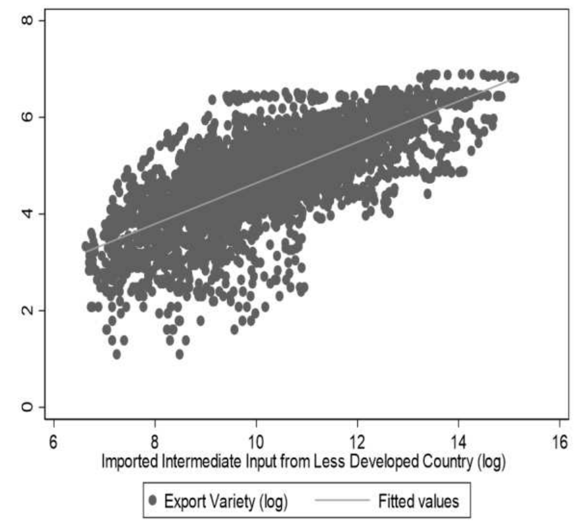


Figure 4a
Exported variety and total imported intermediate input

Figure 4b
Exported variety and intermediate input from DC

Figure 4c
Exported variety and intermediate input from LDC

Note: Figure 4 shows the relationship between exported variety and imported intermediate inputs across industries in our sample for the period, 1996-2016

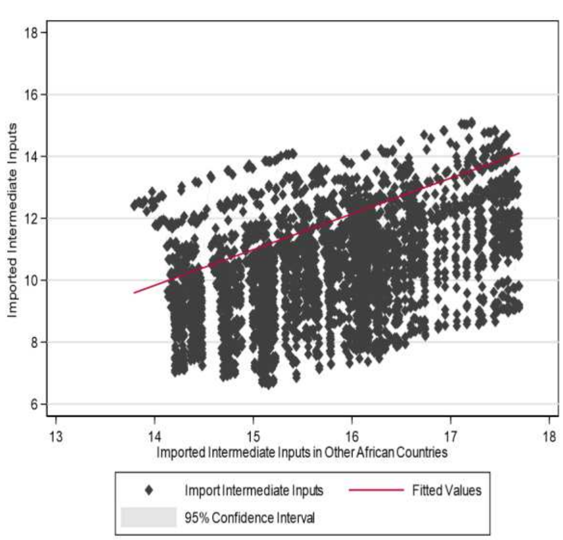


Figure 5a
First-Stage Regression: Unitvariate Model

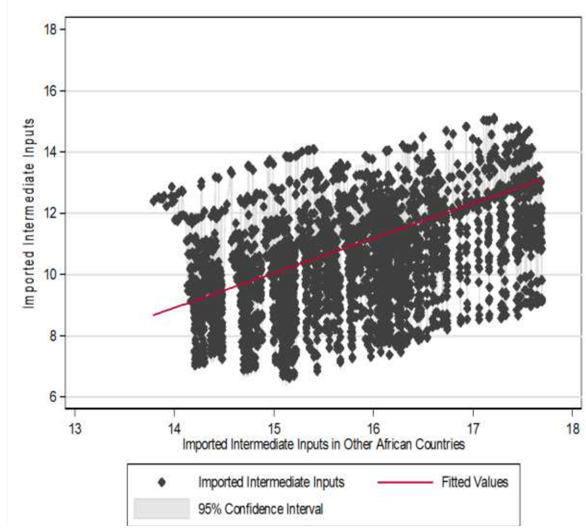


Figure 5b
First-Stage Regression: Multivariate Model

Table I. Baseline Regression: Imported Intermediate and Exported Variety

	(1)	(2)	(3)
Log Intermediate Imports [*t-1*]	0.1954***	0.1709***	0.2656***
	(0.034)	(0.033)	(0.055)
Log Labor Productivity [*t-1*]		0.0140***	0.0013
		(0.004)	(0.002)
Log Import Penetration [*t-1*]		0.0450***	0.0228**
		(0.014)	(0.010)
Log Output [*t-1*]		-0.0003	-0.0007
		(0.001)	(0.001)
Constant	1.8417***	2.5115***	1.4310**
	(0.409)	(0.430)	(0.699)
Observations	3,780	3,712	3,712
R-squared	0.93	0.93	0.98

*** p<0.01, ** p<0.05, * p<0.10. Robust standard errors in parentheses.

Note: The dependent variable in each column is the log-exported variety [i.e., number of 6-digit H.S. products] in per each country-industry-year combinations. Columns (1)-(3) contain unreported country-industry and year fixed effects, while column (3) further includes time-varying country fixed effects.

Table II. Imported Intermediate Inputs and Exported Variety: Baseline Robustness Checks

	Poisson		IV		OLS	Poisson	OLS	Poisson
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Intermediate Imports [t-1]	0.2692***	0.2580***	0.2445***	0.2160***				
	(0.027)	(0.027)	(0.008)	(0.011)				
Log Non EU-15 Intermediate Imports [t-1]					0.0688*	0.1141***		
					(0.038)	(0.029)		
Log Non U.S. Intermediate Imports [t-1]							0.1549**	0.2454***
							(0.060)	(0.063)
Log Labor Productivity[t-1]		0.0204***		0.0199***	0.0010	0.0010	0.0012	-0.0077
		(0.005)		(0.005)	(0.004)	(0.006)	(0.008)	(0.007)
Log Import Penetration [t-1]		0.0052		0.0400***	0.0831***	0.0466***	0.0037	-0.0412**
		(0.011)		(0.014)	(0.017)	(0.011)	(0.024)	(0.021)
Log Output [t-1]		0.0006		0.0002	-0.0012	-0.0010	0.0004	0.0052
		(0.001)		(0.001)	(0.001)	(0.001)	(0.001)	(0.003)
Constant	1.0916***	0.9977***	1.4666***	2.0245***	3.9269***	3.0664***	-1.1533	-2.8998***
	(0.328)	(0.357)	(0.113)	(0.185)	(0.473)	(0.382)	(0.786)	(0.830)
Observations	3,780	3,712	3,780	3,712	3,712	3,712	3,712	3,712
R-squared	-	-	0.92	0.92	0.92	-	0.87	-

*** p<0.01, ** p<0.05, * p<0.10. Robust standard errors in square brackets.

Note: Columns [1]-[2] report the Poisson model results, where the outcome variables in both columns are exported variety [i.e., number of 6-digit H.S. products] in levels per each country-industry-year combinations. Columns [3] and [4] are second stage results of IV estimation, where we used the proportion of imported intermediate inputs in other African countries as an instrument in their respective first stage estimations. The outcome variables in both columns [3] and [4] are log exported variety. The dependent variables in Columns [5] and [6] is exported variety to the EU-15, while the dependent variables in columns [7] and [8] is exported variety to the U.S. The dependent variable in columns [5] and [7] are log-transformed as $log(1 + exported\ variety)$, while the dependent variables in columns [6] and [8] are in levels. All reported regression results contain unreported country-industry and year fixed effects.

Table III. Imported Intermediate Inputs and Exported Variety: The Price and Quality Channel

	OLS	IV	OLS	IV	IV
	(1)	(2)	(3)	(4)	(5)
Log LDC Intermediate Imports [*t*-1]	0.1110***	0.1840***			0.6574***
	(0.030)	(0.009)			(0.136)
Log DC Intermediate Imports [*t*-1]			0.1226***	0.2653***	0.2912*
			(0.031)	(0.013)	(0.149)
Log Labor Productivity[*t*-1]	0.0146***	0.0203***	0.0142***	0.0184***	0.0110**
	(0.004)	(0.005)	(0.004)	(0.005)	(0.005)
Log Import Penetration [*t*-1]	0.0453***	0.0440***	0.0437***	0.0418***	0.0732***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.015)
Log Output [*t-1*]	-0.0003	0.0002	-0.0002	0.0003	-0.0001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Constant	3.4549***	2.8106***	3.0821***	1.4885***	-5.1910**
	(0.340)	(0.173)	(0.405)	(0.198)	(2.092)
Observations	3,712	3,712	3,712	3,712	3,712
R-squared	0.93	0.92	0.93	0.92	0.91

*** p<0.01, ** p<0.05, * p<0.10; Robust standard errors in square brackets.

Note: The dependent variable in each column is the log-exported variety [i.e., number of 6-digit H products] in per each country-industry-year combinations. LCD = Developing countries, while DC= Developed countries. Columns [2], [4] and [6] are second stage results of IV estimation where in the first stage estimation we instrument imported intermediate inputs in industry *s* in country *c* that are sourced from developed [developing] countries with the proportion of imported intermediate inputs in each industry by other African countries sourced from developed [developing] countries. All reported regressions contain unreported country-industry and year fixed effects.

Table 1V. Imported Intermediate Inputs, Exported Variety and Absorptive Capacity

	(1)	(2)	(3)	(4)	(5)
Log Intermediate Imports [*t*-1]	0.1753***				
	(0.019)				
Log LDC Intermediate Imports [*t*-1]		0.1126***	0.1163***	0.1126***	0.1175***
		(0.020)	(0.021)	(0.020)	(0.020)
Log DC Intermediate Imports [*t*-1]		0.0908***	0.0916***	0.0908***	0.0729***
		(0.020)	(0.020)	(0.020)	(0.020)
Log Intermediate Imports [*t*-1] *Log ABC [*t*-1]	0.0036**				
	(0.002)				
Log LDC Intermediate Imports [*t*-1] *Log ABC [*t-1*]			-0.0015		
			(0.002)		
Log DC Intermediate Imports [*t*-1] *Log ABC [*t-1*]					0.0052***
					(0.001)
Log ABC [t-1]	-0.0120	0.0319***	0.0473**	0.0319***	-0.0270*
	(0.019)	(0.004)	(0.019)	(0.004)	(0.016)
Log Import Penetration [*t*-1]	0.0643***	0.0700***	0.0699***	0.0700***	0.0702***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Log Output [*t-1*]	-0.0020***	-0.0022***	-0.0023***	-0.0022***	-0.0021***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	3.5843***	3.5132***	3.4657***	3.5132***	3.6599***
	(0.305)	(0.257)	(0.268)	(0.257)	(0.261)
Observations	3,712	3,712	3,712	3,712	3,712
R-squared	0.93	0.93	0.93	0.93	0.93

*** p<0.01, ** p<0.05, * p<0.10; Robust standard errors in square brackets

Note: The dependent variable in each column is the log-exported variety [i.e., number of 6-digit H.S. products] per each country-industry-year combinations. LCD = Developing countries, while DC= Developed countries. ABC = Absorptive capacity as measured in equation 2. All reported regressions contain unreported country-industry and year fixed effects.

Appendix

Table A1. Countries employed in the analysis

Sample Countries	Other African Countries		Advanced Countries
Algeria	Gabon	Zimbabwe	Australia
Burkina Faso	Comoros	Cameroon	Austria
Burundi	Sudan	Mozambique	Belgium
Cameroon	Sao Tome & Principe	Senegal	Canada
The central African Republic	Equatorial Guinea	DR Congo	Denmark
Cote d'Ivoire	Guinea-Bissau	Madagascar	Finland
Egypt	Niger	Seychelles	France
Eritrea	Mauritania	Malawi	Germany
Ethiopia	Guinea	Burkina Faso	Greece
Gabon	The Gambia	Angola	Iceland
Ghana	Zambia	Congo	Ireland
Kenya	Libya	Cote d'Ivoire	Italy
Madagascar	Uganda	Rwanda	Japan
Malawi	Algeria	Nigeria	Luxembourg
Mauritius	Tunisia	Mauritius	Netherlands
Morocco	Tanzania	Mali	New Zealand
Mozambique	Ghana	Kenya	Norway
Niger	Togo	Benin	Portugal
Nigeria	Chad	Djibouti	South Korea
Senegal	Sierra Leone	Egypt	Spain
South Africa	Morocco	Liberia	Sweden
Tanzania	Ethiopia	Burundi	Switzerland
Tunisia	Central African Republic	Eritrea	United Kingdom.
Uganda	South Africa		U.S.A
Zambia	Somalia		
Zimbabwe	Cape Verde		

Note: "Sample Countries" include the 26 African countries we consider in our analysis.
"Other African Countries" include all other African countries we utilized their proportion of imported intermediate inputs to construct an instrument. "Advanced Countries" include countries that we consider intermediate inputs sourced from them are of higher quality or advanced technology embodied. We treat all other countries as destinations for lower-priced inputs.

Table A2. Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Exported Variety (ln)	3,780	4.781	0.983	1.099	6.894
Exported Variety EU-15 (ln)	3,780	3.770	1.182	0	6.482
Exported Variety US (ln)	3,780	2.295	1.394	0	6.001
Imported Intermediate Inputs (ln)	3,780	11.283	1.781	7.275	16.406
Imported Intermediate Inputs DC (ln)	3,780	10.511	2.051	6.102	16.090
Imported Intermediate Inputs LDC (ln)	3,780	10.327	1.656	6.623	15.117
Non EU-15 Intermediate Imports (ln)	3,780	10.736	1.698	6.998	15.746
Non US Intermediate Imports (ln)	3,780	11.252	1.775	7.231	16.308
Labor Productivity (ln)	3,712	14.295	4.330	-14.564	39.108
Relative Absorptive Capacity (ln)	3,712	3.108	3.322	-2.554	27.020
Import Penetration (ln)	3,780	-12.522	1.027	-16.379	-7.937

Table A3. Imported Intermediate Inputs, Exported Variety and Absorptive Capacity

	(1)	(2)	(3)	(4)
Log LDC Intermediate Imports (*t*-1)		0.0695***	0.0832***	0.1091***
		(0.026)	(0.021)	(0.035)
Log DC Intermediate Imports (*t*-1)		0.0956***	0.0744***	0.0608**
		(0.020)	(0.024)	(0.028)
Log Intermediate Imports (*t*-1)	0.1486***			
	(0.023)			
Log Intermediate Imports (*t*-1)*Log Labor Productivity (*t-1*)	0.0017*			
	(0.001)			
Log LDC Intermediate Imports (*t*-1)* Log Labor Productivity (*t-1*)		0.0009		-0.0018
		(0.001)		(0.002)
Log DC Intermediate Imports (*t*-1)* Log Labor Productivity (*t-1*)			0.0014*	0.0025*
			(0.001)	(0.001)
Log Labor Productivity (*t*-1)	-0.0000	0.0092	0.0048	0.0119
	(0.011)	(0.011)	(0.008)	(0.011)
Log Import Penetration (*t*-1)	0.0694***	0.0738***	0.0742***	0.0738***
	(0.012)	(0.012)	(0.012)	(0.012)
Log Output (*t*-1)	-0.0018***	-0.0019***	-0.0019***	-0.0019***
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	2.7687***	2.8081***	2.8697***	2.7516***
	(0.305)	(0.297)	(0.269)	(0.299)
Observations	3,712	3,712	3,712	3,712
R-squared	0.88	0.88	0.88	0.88

*** p<0.01, ** p<0.05, * p<0.10; Robust standard errors in square brackets

Note: The dependent variable in each column is the log-exported variety [i.e., number of 6-digit H.S. products] per each country-industry-year combinations. LCD = Developing countries, while DC= Developed countries. All reported regressions contain unreported country-industry and year fixed effects.