Economic Development and the Margins of Trade: Are the Least Developed Countries Different?*

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Abstract

We show that for the least-developed countries (LDCs), the number of exporters is relatively more important than the average exporter size for explaining both export growth and economic development. To guide our analysis, we develop a theoretical model that links the impact of productivity shocks to institutional differences between country groups. Empirically, we find a positive relationship between the extensive margin and economic development for LDCs, but not for middle-income and high-income economies; and, on the intensive margin, the relationship is strongest for high-income countries. The findings imply that the drivers of export growth and economic development for the poorest countries differ significantly from growth drivers in other country groups.

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I Introduction

Two main developments stand out in the growing literature on trade and economic development: More papers now focus on the dynamics of trade, and more scholars now show the separate contributions of the intensive and extensive margins to export growth – how incumbents, exiters and entrants shape aggregate export values (e.g. Fernandes, Freund, and Pierola, 2016; Díez, Mora, and Spearot, 2018). The literature has grown, expanding from early papers on high-income economies (e.g. Bernard, Jensen, Redding, and Schott, 2007; Eaton, Kortum, and Kramarz, 2011), to recent papers that cover countries with a broader range of GDP per capita (e.g. Freund and Pierola, 2015; Fernandes, Klenow, Meleshchuk, Pierola, and Rodríguez-Clare, 2015; Fernandes et al., 2016). This growing literature on trade dynamics suggests that economic development, as measured by GDP per capita, plays a role in supporting exports, so that we observe large differences between the export profiles of high-income countries and the least developed countries.

Our paper focuses on how the relationship between GDP per capita and the margins of trade differ between country groups — least developed countries (LDCs), middle-income countries (MICs) and high-income countries (HICs). The paper's focus is motivated by one stylized fact – income convergence between countries is slow to nonexistent, and by a debate in the literature – on whether the distribution of firms in developing economies follows a pattern marked by a *missing middle*, or a *truncated top*. The debate is relevant to policy and export growth, because the shape of firm size distributions defines the number of firms that will start exporting as an economy grows. Therefore, studying how exports change with economic development using cross-country comparisons – as other studies have done – may provide an incomplete perspective, if as the absence of income convergence suggests, structural differences exist that bar countries from leaving the LDC groups for higher levels, and vice versa. To address this gap, we first examine the relative importance of each margin to export growth and then how these margins (exporter numbers and average exporter size) change with GDP per capita within each country.

To guide our paper, we first develop a one sector, heterogeneous-firm, multi-country model of trade that flexibly specifies different shape parameters for the assumed Pareto distribution of firm productivity in countries at different levels of economic development (low, middle, and high income). Our model closely follows recent work on the subject (Spearot, 2016), but focuses on the interaction of own-country productivity shocks and exports, and in invoking small-country assumptions to isolate the key predictions of the model. The formal framework in our paper helps to show that exports change with aggregate productivity shocks in ways that depend on the level of economic development, as proxied by our country groups. In the model, a positive productivity shock has a direct and indirect effect on trade and its margins. An increase in productivity should *directly* lead to more export entry for lower-income countries relative to high-income countries.

The differences in the shape parameter by level of development features in our explanation of the distortions that create a missing middle in low-income countries. This framework reflects the finding in earlier papers that countries differ in the shape and form of their firm size distributions (e.g., Spearot, 2019). We make additional assumptions to develop the intuition for the *indirect effects* that explain the intensive margin: 1) LDC wage is the numeraire, 2) exporters are small, and 3) a positive correlation between productivity and wages. Accounting for *indirect* effects, we find that the extensive margin should still be more important for LDCs and the intensive margin increases for all non-LDC countries. The findings suggest new thinking for understanding how exports change with GDP per capita in the least developed countries.

We introduce several novel findings, organized around the intensive margin (average exporter size), the extensive margin (the number of exporters), and export concentration. On the intensive margin, we find that once we allow for country and year fixed effects, the correlation between this margin and GDP per capita is strongest for HICs. The pattern of increasing average exporter size with economic development is weakest for LDCs and MICs. However, there is no correlation between alternative measures of the intensive margin (median exporter size and new exporter size) and economic development for LDCs, as predicted by our theoretical model. Furthermore, we show that while the intensive margin, as others have found, is relatively more important than the extensive margin in explaining export growth, the intensive margin's contribution is much more important for HICs and MICs. This difference between LDCs and HICs has notable implications for trade and development policy, as outlined in our comments on how development shapes firm-size distributions.

For the extensive margin, we find the strongest positive correlation with GDP per capita for LDCs, as predicted by our theoretical model. Increasing the number of exporting firms is not associated with higher GDP per capita for high-income countries or middle-income countries. The estimates behind these findings use country and year fixed effects to help address concerns about unobserved drivers of trade patterns. The correlation between the extensive margin and GDP per capita in LDCs may imply that increasing the number of exporters, at least in the short term, needs to be part of export growth policies designed to stimulate economic development for LDCs. The results largely hold when we separate out the results by industry. We do find some sectoral differences, but the differences are quantitative rather than qualitative.[1]

Finally, for export concentration, we find mixed outcomes that depend on how the variable is defined. The export share of the top 5% and top 1% of exporters increases, while the Herfindahl-Hirschman Index (HHI) decreases with GDP per capita; the effect

[1]These sectoral differences are consistent with earlier papers that explain differences in the economic development of countries (e.g. Hausmann and Rodrik, 2003; Hausmann, Hwang, and Rodrik, 2007; Hidalgo, Klinger, Barabási, and Hausmann, 2007). Rather than speculate, we leave the question of why patterns of export margins differ for a separate paper.

disappears once we control for country fixed effects. We should note that these estimates may reflect the low within-country variance of these measures in the years for which we have data. Separating the results by level of economic development, we find that the HHI decreases only for LDCs and the top shares only increase for HICs. The contrast in pattern for the measures of concentration helps to explain how countries add *both* middle-productivity firms and export superstars.

The Exporter Dynamics Database (EDD), a rich collection of firm-level export characteristics from high-income, middle-income and low income countries, is our main data source. The data cover 69 countries between 1997 and 2014, with fewer than ten years for most countries, and the most common years being 2006 to 2012. The database reports the margins of trade, as well as other variables created from firm-level trade data. This paper focuses on the annual firm-level data component of the EDD, collapsed to the country level to get our variables of interest (number of exporters, average exports per firm, etc.). The robustness checks for our main findings use the country-destination file in the database. Cebeci, Fernandes, Freund, and Pierola (2012) and Fernandes et al. (2016) provide detailed descriptions of this World Bank database.

This paper makes two key empirical contributions to the literature on how exports change with economic development. First, to the best of our knowledge, this is the first paper to focus on the margins of trade and economic development for LDCs. In a sense, our work extends Fernandes et al. (2016) by looking for heterogeneous responses to economic development between country groups. We likewise do the same when we decompose exports into the extensive and intensive margins. Putting countries into groups recognizes the possibility of differences between countries – structural, institutional and otherwise, that separate countries into tiers. We group countries into LDCs, MICs and HICs following standard norms, as described in section III. The idea that the link between exports and economic development may not follow the same pattern for LDCs and HICs also resonates with the robust evidence in the literature that countries' incomes per capita are not converging (Durlauf, Johnson, and Temple, 2005; Rodrik, 2011; Subramanian, 2011; Rodrik, 2012). If structural and institutional features keep some economies as LDCs, and others as HICs, our approach avoids those barriers to meaningful cross-country comparisons.

Our second contribution is the set of novel findings from testing within-country variations in the relationship between trade margins and economic development. Others have focused on cross-country comparisons. As outlined in the previous paragraph, it is reasonable to expect that, even with increasing GDP per capita, the features of an economy that drive its export growth may remain unchanged for years. Addressing time-invariant country features that influence the margins of export growth calls for regression specifications with country fixed-effects or similar controls. Thus, our results may explain short-run relationships for countries, while Fernandes et al. (2016) may reflect long-run relationships. In that sense, our papers are complementary.

Furthermore, the paper provides empirical evidence that informs a debate on how growth in developing countries reflects institutional and policy distortions. The two leading arguments in this literature can be styled as: [1] the missing middle and [2] the truncated top. The *missing middle* argument assumes that developing countries are held back by distortions that prevent smaller and mid-sized firms from growing enough to enter and survive in export markets. As countries develop, the distortions decrease and small firms enter the export market, driving down average exporter size and decreasing export concentration. On the other hand, the *truncated top* argument assumes that developing countries are restrained by the relative lack of superstar firms. As countries develop in this second hypothetical framework, superstars grow and enter the export market, driving up average exporter size and increasing export concentration. This discussion includes several notable papers, (e.g. Tybout, 2000; Hsieh and Klenow, 2009; Hsieh and Olken, 2014; Fernandes et al., 2016). Our theoretical and empirical findings are consistent with the argument that the short term challenge facing LDCs is a missing middle. When limited to HICs, our findings resemble the conclusion in Fernandes et al. (2016) that exporter size distributions are truncated at the top. The differences in our findings, as mentioned above, reflect our approach to identifying how exports and exporters change with economic development, as well as our focus on both differences between country groups and within-country differences over time.

Trade theory is deeply linked to how trade margins evolve with development, especially in the scenarios that define the *missing middle vs. truncated top* debate. Given a firm-size distribution with firms clustered near the export-entry threshold, Das, Roberts, and Tybout (2007) shows that lower trade costs prompts trade growth on the extensive margin. Similarly, Helpman, Melitz, and Rubinstein (2008) finds that the extensive margin may explain higher trade volumes when trade costs are lowered. The shape of firm-size distributions matter, as long as increasing GDP per capita is linked to institutional changes that lower trade costs. As part of the debate, Fernandes et al. (2015) develop a Melitz-style model of exporting, but with a log-normal distribution of productivity. With this innovation, half of the variation in exports is expected to occur along the intensive margin, (as opposed to how the extensive margin explains all the variation in exports in a Melitz-Pareto model). The idea that the marginal response of exports to trade costs reflects differences in the underlying (theoretical) firm-size distribution enables inquiries into whether the costs imposed on firms in less developed economies create a firm-size distribution with a *missing middle* or a *truncated top*. The theory is therefore very relevant to how firms contribute to the margins of trade as economic development leads to lower institutional distortions or costs.[2]

[2]The margin of trade that captures more growth depends on the nature of costs facing exporters. Lawless (2010) shows that the negative effect of distance on trade is considerably larger for the extensive margin. This is consistent with other papers that also find large effects on the extensive margin (e.g. Bernard et al., 2007; Mayer and Ottaviano, 2008). Eaton, Eslava, Kugler, and Tybout (2007) argues for the importance of the intensive margin, showing that new exporters, while small when they begin exporting, contribute to

Explaining export growth with firm-dynamics provokes questions about how policy makers should promote growth, given how institutional differences affect the margins of growth. Specifically, where in the firm-size distribution should policymakers look to minimize distortions to growth? The question translates to whether countries will grow exports on the *intensive margin* through policies that help to increase average export values for existing exporters, or through policies that support having more exporters (the extensive margin) by promoting the missing middle.

The rest of the paper is organized as follows. Section II provides a theoretical model that links country productivity and exports, in a framework that allows the exports-productivity link to depend on a country's level of economic development. Section III describes the data and provides stylized facts about economic development and margins of trade. Section IV presents the main results, and provides robustness checks. Section V concludes.

II Theory: Exports and Productivity Growth

We develop a one sector, heterogeneous-firm, multi-country model to study the effect of productivity shocks on exports and its margins. Our model closely follows the CES version of Spearot (2016) in its assumptions about productivity and aggregations to the country level (i.e., the shape and location parameters of firm-size distributions vary by country). The key difference in this paper is a focus on the interaction of own-country productivity shocks and exports, and in invoking small-country assumptions to isolate the key predictions of the model. Our model allows us to associate the shape parameter of the assumed Pareto distribution of firm productivity in a country with its level of economic development (low, middle, and high income). We show, based on this assumption, that the extent to which exports change due to productivity shocks (maximum costs at the firm-level in the theory) depend on the level of economic development.

II.1 Consumers

Consumer preferences in all countries are defined by a standard constant elasticity of substitution (CES) utility function over varieties:

$$Q_l = \left(\int_{\omega \in \Omega_l} \left(q^c_{\omega,l} \right)^{\frac{\sigma-1}{\sigma}} d\omega \right)^{\frac{\sigma}{\sigma-1}}, \ \sigma > 1$$

where σ = elasticity of substitution, Ω_l = the set of available varieties in country l, and $q^c_{\omega,l}$ = consumption by the representative consumer of variety ω.

half of total growth within a decade. This is consistent with interpretations of the original Melitz (2003) model that trade growth should rest largely on the extensive margin (e.g. Crozet and Koenig, 2010; Lawless, 2010).

Solving the consumer's problem and aggregating over all consumers, gives us the demand for variety ω:

$$q_l(\omega) = \frac{I_l}{P_l^{1-\sigma}} p(\omega)^{-\sigma}$$

Where I_l is the income of all consumers in country l and P_l is the price index in that country.

II.2 Firms

Firms pay F_E to enter the market and get a cost draw (a), where a is the labor needed to produce one unit; we discuss the distribution governing this cost draw shortly.

Conditional on exporting to market l from j, firms must pay a fixed cost $(w_j F_{jl})$ and iceberg trade costs (d_{jl}). For a firm with unit labor requirement, a, the variable profit from exporting is written as:

$$\pi_{jl}(a) = \frac{I_l}{P_l^{1-\sigma}} \left(\frac{1}{\sigma}\right)^{\sigma} \left(\frac{1}{\sigma - 1}\right)^{1-\sigma} (d_{jl} w_j a)^{1-\sigma}$$

Export revenue is similarly written as:

$$v_{jl}(a) = \frac{I_l}{P_l^{1-\sigma}} \left(\frac{1}{\sigma}\right)^{\sigma} \left(\frac{1}{\sigma - 1}\right)^{1-\sigma} (d_{jl} w_j a)^{1-\sigma} \sigma$$

The productivity cutoff to export from j to l is determined by the zero profit condition; $\pi_{jl}(a^*) = w_j F_{jl}$. Firms with unit costs below a^* will find it profitable to export to this market. For exporter from j, the productivity cutoff to every country l can be defined as follows:

$$a_{jl}^* \equiv \frac{1}{d_{jl}} (\lambda_l w_j)^{-\frac{\sigma}{\sigma-1}} F_{jl}^{-\frac{1}{\sigma-1}}$$

Where $\lambda_l = \left(\frac{I_l}{P_l^{1-\sigma}}\right)^{-1/\sigma} \left(\frac{1}{\sigma-1}\right)^{\frac{\sigma-1}{\sigma}} \sigma$.

Productivity and Aggregation

On entry, firms draw their unit labor requirement a from a Pareto distribution with parameters that vary by country, as in Spearot (2016):

$$g_j(a) = k_j \frac{a^{k_j - 1}}{(a_j^m)^{k_j}} \quad , \quad a \in [0, a_j^m]$$

Our main argument is that countries at different levels of economic development have different firm size distribution parameters. We form our empirical tests around this argument with an expectations of "low" and "high" values of k_j. In principle, the shape parameter of the distribution, as well as the location parameter, change as countries transition from low- to mid- to high-income.[3] Lower values of k are associated with greater productivity dispersion, so that countries drawing from a distribution with a low k parameter will have a lower percentage of low- efficiency firms (firms with high a values). k_j is taken as time-invariant, as a reasonable approximation over the time-spans that we consider. Our assumption of a higher shape parameter for LDCs is rationalized by our findings in Section IV. However, we allow a_j^m to vary both over time as economies develop, and between countries. Lower values of this location parameter mean that the maximum labor-costs per unit decreases, raising the average productivity within a country. a_j^m is the main item of interest in the analysis that follows.

Taking the zero profit condition, we can define total firm exports as a function of the productivity cutoff (a^*): $v_{jl}(a) = w_j F_{jl} \left(a/a^*\right)^{1-\sigma} \sigma$. Thus total country exports, given the firm-size distribution above, can be expressed as:

$$V_{jl} = \underbrace{N_j \left(\frac{a_{jl}^*}{a_j^m}\right)^{k_j}}_{\text{Extensive Margin}} \underbrace{w_j F_{jl} \frac{\sigma k_j}{k_j - \sigma + 1}}_{\text{Intensive Margin}} \tag{1}$$

The extensive margin can increase if the probability of export survival increases, or with more entrants in the domestic market. Prior work (Spearot, 2016) shows that the probability of survival increases with the export cutoff productivity, (as a^* is a function of distance, tariffs, demand, etc.), decreases with the upper bound of the cost distribution (our productivity shock), and decreases with the shape parameter since by definition $a_j^* < a_j^m$. The intensive margin can vary across the levels of economic development if the shape parameters differs; higher k_j, which we assume to be the case for developing countries, means these countries have lower exports per firm. Domestic wages and fixed costs affect both the intensive margin (directly) and extensive margin (through a^*). Importantly, all effects of the cutoff or the upper bound of costs will be proportional to k_j, which will be important for the results to follow.

Developing countries in our framework, given the same a_j^m and a greater k_j parameter, will not only have lower exports, but they will also have lower growth on the trade margins. The intensive margin is $w_j F_{jl} \frac{\sigma k_j}{k_j - \sigma + 1}$; since $\sigma > 1$, countries with higher k values have

[3] This argument is consistent with earlier papers on how distortions to firm size distributions characterize different stages of economic development (e.g., Hsieh and Klenow, 2009; Cadot, Iacovone, Pierola, and Rauch, 2013; Fernandes et al., 2016; Spearot, 2019).

smaller exporters (a lower intensive margin); average exporter size is not a function of a_j^m.

Substituting in the definition of a^* and simplifying, we get our key equation for total exports by country j to country l at time t:

$$V_{jl} = \underbrace{N_j (a_j^m)^{-k_j} \lambda_l^{-\frac{k_j \sigma}{\sigma-1}} d_{jl}^{-k_j} w_j^{-\frac{\sigma k_j}{\sigma-1}}}_{\text{Extensive Margin}} \underbrace{w_j F_{jl}^{-\frac{k_j}{\sigma-1}+1} \left(\frac{\sigma k_j}{k_j - (\sigma-1)} \right)}_{\text{Intensive Margin}} \tag{2}$$

Taking logs:

$$\ln(V_{jl}) = -k_j \ln\left(a_j^m\right) + \psi_j + \phi_l + \eta_{jl} \tag{3}$$

Where $\psi_j = \ln\left[N_j w_j^{-\frac{\sigma k_j}{\sigma-1}+1} \left(\frac{\sigma k_j}{k_j-(\sigma-1)} \right) \right]$ are origin-specific variables.[4] $\phi_l = \ln\left[\lambda_l^{-\frac{k_j \sigma}{\sigma-1}} \right]$ are importer specific components that vary by export destination, product, and time; to ease the discussion of the results, we assume that the exporting countries in question are small, such that destination market shifters (λ_l) do not change with a small shock in an exporting country. Finally, $\eta_{jl} = \ln\left[d_{jl}^{-k_j} F_{jl}^{-\frac{k_j}{\sigma-1}+1} \right]$ are exporter-importer bilateral elements that do not vary with time, e.g, distance, language and time-difference.

We describe two effects of productivity shocks on the margins of exports: the *direct effect*, as we call it, that represents the immediate responses that can be explained by demand, costs and the zero-profit condition, as well as an *indirect effect* that represents follow-on consequences of the changing relationship between the mass of existing firms, wages, and the requirements for exporting.

Direct Effects: [1] If we assume $k_h < k_m < k_l$, a proportional increase in productivity (lower a_j^m) leads to proportionally more exports and more export entry for LDCs relative to HICs/MICs (see Equation 3). [2] Such an increase in productivity would, however, not have an impact on the intensive margin if wages won't change.

When allowing for all general equilibrium parameters to change (through trade balance, free entry, and a labor market clearing condition), in the presence of varying shape parameters, the model becomes intractable to characterize analytically. However, we make three assumptions to develop the intuition and empirical predictions. First, by choice of numeraire, we normalize LDC wages to 1. Consequently, the intensive margin is fixed for LDCs. Second, we assume that the exporting countries in question are small, such that

[4] Firm entry doesn't change in the assumed single sector model, see Spearot (2016).

destination market variables do not change with individual shocks to export markets. Finally, we assume that a positive productivity shock in a given market results in an increase in nominal wages in that market.[5] Accordingly, we focus on how direct effects and indirect effects (through relative wages) change the margins.

Changes in the extensive margin $\left(\widehat{V}_j^{ext}\right)$ with direct and indirect effects are written as:

$$\begin{aligned}
\widehat{V}_l^{ext} &= -k_l \widehat{a}^m \\
\widehat{V}_m^{ext} &= -k_m \widehat{a}^m - k_m \frac{\sigma}{\sigma - 1} \widehat{w}_m \\
\widehat{V}_h^{ext} &= -k_h \widehat{a}^m - k_h \frac{\sigma}{\sigma - 1} \widehat{w}_h
\end{aligned}$$

In comparing countries, the same proportional increase in productivity ($\widehat{a}^m < 0$) predicts a greater increase in exports and more export entry for LDCs. For MICs and HICs, wages will increase relative to the LDC wage numeraire and dampen the export entry effect; that is, if $k_l > k_m, k_h$, then $\widehat{V}_l^{ext} > \widehat{V}_m^{ext}, \widehat{V}_h^{ext}$. This dampening may be great enough that it results in a decrease of market entry for MICs and HICs (something we see for HICs in the empirics).

Changes in the intensive margin $\left(\widehat{V}_j^{int}\right)$ with direct and indirect effects are written as:

$$\begin{aligned}
\widehat{V}_l^{int} &= 0 \\
\widehat{V}_m^{int} &= \widehat{w}_m \\
\widehat{V}_h^{int} &= \widehat{w}_h
\end{aligned}$$

Exporter size increases in MIC and HIC countries, but not in LDCs since wages do not change in the numeraire; that is, $\widehat{V}_l^{int} < \widehat{V}_m^{int}, \widehat{V}_h^{int}$

To summarize, a positive productivity shock should have a differential impact that depends on a country's level of economic development. On the extensive margin, LDCs would see a greater increase in exporter numbers when compared with middle and high income countries. On the intensive margin, exporter size should increase for middle and high income countries, but not for LDCs.

II.3 Discussion of Firm-Size Distribution Parameters and Distortions

The shape (k_j) and location (a_j^m) parameters both help to explain total exports, as well as the margins of trade. These parameters, as detailed above, have implications on the

[5] In ongoing work, Mora and Spearot (2019) show in a three country model that wages rise if the upper bound of productivity falls in that market. In that model, wages in the destination market are the numeraire, and wages in the other countries change relative to the numeraire.

link between economic development and export growth. Real examples could be used to bolster the theoretical discussion about how different shape and location parameters for the firm size distribution affect exports differently for country-groups. That is, in addition to assuming different estimated parameters for firm-size distributions in LDCs, compared with MICs and HICs, we can describe distortions to the firm size distribution created by institutional and structural features of economies. Some of the examples we consider can create missing middles, while others can create truncated tops – the key question for us to answer is which type of distortion is more prevalent.

A missing middle can be created by structural economic features that create additional barriers to survival and growth. Power outages represent an easy example of such a distortion. Firms need electric power to manufacture goods and provide services, and frequent power outages could affect economic growth (Allcott, Collard-Wexler, and O'Connell, 2016; Andersen and Dalgaard, 2013). Most importantly for this paper, the distortion created by public utility power outages are heterogeneous in their impact – the most productive firms can install diesel generators and backup systems, while mid-sized firms that are not well-resourced pay a larger failure for the same systemic failure. What this distortion does is that more firms stay small, and the middle of the size distribution is hollowed out. If lower trade costs lead to more export opportunities for example, more firms could export in this missing middle scenario, but they would be much smaller on average compared to a scenario without missing-middle distortions. Other factors can create the distortions described in this paragraph, including taxation practices and corruption.

"Truncated tops" can also be created by distortive institutional factors. For example, limited access to financial services could mean that producers in a country with only small banks are limited to a certain size. In this scenario, the distortions do not necessarily hold back firms from exporting, but the lack of access to large-scale financing means limits the likelihood of export superstars in the country. In a "truncated top" scenario, economic development would result in increases in average exports per firm, as the firms on the threshold of exporting should be larger on average than the threshold firms in the missing middle scenario.

Putting our descriptions of these distortions together with our formal framework that allows firm-size distributions in different countries to have different shape and location parameters, leads to our proposition about how a broad positive productivity shock would affect the margins of exports in different countries. In the conclusion section, we link the analysis to policy. Specifically, we argue that economic development policies for LDCs need to be country-specific, and not necessarily based on the drivers of export growth and economic development observed in high-income economies.

III Data

To test the predictions of our model, primary data source we use is the Exporter Dynamics Database (EDD), a collection of the basic firm-level characteristics of exports, organized as country-year observations for a broad set of countries. Variables in the EDD include the number of exporters, average exporter size and total exports — these enable the measurement of growth and of the contributions of the intensive and extensive margin. The EDD also describes export diversification, in terms of the Herfindahl-Hirschmann Index (HHI), share of top exporters, as well as the number of products and destinations per exporter. Country of origin and year are also included in the database, among other measures of exporter dynamics.[6]

The database covers the years 1997 to 2014 for 69 countries. Not all countries are represented for all years in the data; the most common years in the data are between 2006 and 2012. Countries like Belgium, Cameroon and Peru have data for more than 15 years, while others like Kuwait, Thailand and Niger have fewer than four. In the data we have 20 LDCs, 38 middle-income countries and 11 high-income countries. The country groups we use follow the United Nations (UN) definitions of LDCs and the World Bank definition of HICs. Countries outside the LDC and HIC categories are classified as middle-income developing countries. Table A.1 in the appendix lists the countries, years covered, and the country groups (LDCs, MICs, HICs).[7]

Real GDP per capita data and other country-year information come from the WDI database (World Bank, 2017). Our measures of market size are GDP (constant 2010 US$) and Consumption (constant 2010 US$), both from the same source. Summaries and regression estimates are limited to the years covered by both data sources: World Bank (2017) provides GDP per capita data for most country-years between 1960 and 2015, and as mentioned, the EDD covers an unbalanced panel between 1997 and 2014. The two sources provide 623 usable country-year observations for the baseline test specifications.

Compared with Fernandes et al. (2016), we use the more recent version of the EDD, with more years of data and a larger number of countries. (We are thankful for the World

[6] A copy of the data is maintained by the World bank at (http://data.worldbank.org/data-catalog/exporter-dynamicsdatabase). Details on how the EDD was sourced, cleaned and compiled are outlined in Fernandes et al. (2016) and Cebeci et al. (2012). The Database provides detail on the export dynamics and composition of aggregate export flows, while protecting information that could be traceable to any specific firm.

[7] The country groups are available at the following links: (http://data.worldbank.org/region/least-developed-countries:-un-classification) and (https://datahelpdesk.worldbank.org/knowledgebase/articles/906519). Both classification schemes are largely driven by GDP per capita. The UN defines countries as LDCs based on a rating system that combines low GDP per capita with macroeconomic vulnerability and low human capacity indices. The World Bank defines a country's classification based on gross national income per capita in a given year, and we used a country's group classification based on the last year of the EDD data. Even though Asian countries and high-income countries are under-represented in the data, the EDD is the largest collection of country-level data indicating the firm-level composition of exports.

Bank's EDD update.) The methodology for collecting and cleaning the data remained the same, as described in Cebeci et al. (2012), enhancing our confidence in interpreting the estimates. Furthermore, as explained in Section I, we focus on country-year observations, given the nature of our research questions, rather than the country-sector-destination, country-destination and country-sector observations featured in previous work.

III.1 Data Summary and Descriptives

Table 1 summarizes the main variables used for the paper. The first panel in the table shows the averages within each of the three country groups, for variables measured across the years available for each country; to avoid biasing these averages for countries with more years of available data, the table shows averages of country-averages. To create this table, each country was first represented with its average value across the years for each variable. Then the averages of these country-averages were reported for the country groups — LDCs, MICs, and HICs. (This explains why the regression tables that follow report 623 observations, but Table 1 uses only 69 observations of country-averages.)

We begin by looking at aggregate export value and its margins separately for the country groups. Describing export margins in separate columns for LDCs, MICs and HICs creates a novel opportunity to address differences in how exports respond to economic growth drivers for countries at different stages of economic development. The rationale is that as countries develop, exports grow when one or both of these margins improve: the number of exporters increase, average exporter size rises, or both average exports and the number of exporters increase. Section I introduces the idea that economic structure and exports differ by stage of economic development - likely due to country-specific features. If country-specific features or other structural barriers prevent economic development for some countries, we should expect to see different patterns for the groups that result. Therefore, the summary table shows the country groups' averages, in addition to measures of dispersion for the key variables within each group.

The table reveals notable differences in the extensive and intensive margins of exports. LDCs have fewer, and smaller exporters. While both the extensive margin and the intensive margin are smaller for LDCs, the extensive margin for LDCs is relatively much smaller. The extensive margin, i.e. the average number of exporters in each country-year ranged from just over 1,000 for LDCs to nearly 30,000 for the twelve high-income countries. The number of exporters matters because if all exporters in all countries shipped the same dollar value of goods, the difference in the number of exporters indicates that high-income countries will export 27 times as much as LDCs. The minimum observed number of exporters was 18, for Timor Leste and the maximum observed was 110,000, for Germany (2009–2012). Similarly, the intensive margin when averaged across countries, ranged from $1.7m for LDCs to nearly $3.8 m for HICs. The minimum average exporter size was $141,000 for

Sao Tome and Principe, and the highest was $11.7 million for Belgium. In sum, average exporter sizes for LDCs are slightly less than those of MICs and about half of those of HICs, but the number of exporters is seven times larger for MICs and almost 30 times larger for HICs.

As expected, LDCs have smaller economies, and are poorer. GDP per capita is on average almost 50 times larger in HICs than in LDCs. For LDCs, GDP in 2010 dollars for the average country-year was $19 billion, with the comparable figure for MICs roughly ten times larger, and 30 times larger for HICs. The tests that follow use logged values of the real GDP and GDP per capita variables.

The variables that describe export concentration yield some of the most interesting contrasts in our data. The share of aggregate exports controlled by the top 5% of exporters seem to suggest that concentration is highest in high-income countries, 85% on average; the top 1% variable shows a similar pattern. However, the HHI of exports is consistently higher for the poorer countries. The average HHI of 0.12 for LDCs is almost ten times larger than the comparable number for HICs and three times larger than the comparable number for MICs. This contrast between HHI and the export share of the top 5% provides vital context for the debate on whether firm size distributions in poorer economies are distorted in ways that create a *truncated top* or leave out a *missing middle*.

The measures of export concentration offer what appears to be conflicting evidence.[8] It may be argued that distortions in low-income economies lead to a *truncated top* for firm size distributions, given the pattern of higher export concentration with GDP per capita. This is if export concentration is measured as the export share of the top 5% of exporting firms, as was done in Fernandes et al. (2016). However, the HHI measure suggests that export concentration decreases with GDP per capita, with the higher export concentrations in poorer countries. The HHI pattern is more consistent with a model of a *missing middle*. This decrease in concentration with economic development matches the pattern in Table 1, where the median exporter size decreases with economic development. These descriptive patterns could simply be due to the differences in exporter numbers. HICs and MICs, having larger numbers of exporters are expected to have lower export HHIs, all other things being equal. On the other hand, the share of exports by the top 5% allows only a limited insight into how exports are allocated between firms, while HHI as a measure uses the full distribution of exporter sizes.[9] Both measures, however, are valuable

[8] The differences may be due to the numbers of exporting firms in each country group. The HHI measure is a lot more sensitive to the number of exporting firms than are the other two measures of concentration – the share of the top 1 and top 5%.

[9] Consider a scenario in which the top three firms in an LDC are responsible for 50% of the country's exports — for a country like Zambia with most exports coming from a few multinationals in the copper business, this scenario is not far-fetched. Export size drops off rapidly after this top three, so that the top 5% of exporters accounts for less than 75% of aggregate exports. In a higher-income country, exports are less concentrated at the very top, but the top 5%, in this case 1,500 firms out of 30,000, account for more than 85% of aggregate exports.

Table 1: Summary Statistics

Variables	LDCs	MICs	HIC
Values			
Real GDP (1mn USD)	18,840	174,733	629,070
GDP per capita (USD)	716	5,904	37,055
Number of exporters	1,102	7,777	31,652
Exports per firm (USD)	1,713,362	2,538,731	3,829,360
Exporter value of median firm (USD)	79,054	59,581	51,008
Export per firm: entrant	248,921	323,549	454,797
Share of Top 5%	0.74	0.82	0.86
Share of Top 1%	0.48	0.56	0.62
Herfindahl-Hirschman Index	0.118	0.045	0.014
Dest. per firm	2.7	2.8	4.4
Prod. per firm	5.0	5.7	7.8
Countries	20	38	11
Minimum Values			
Real GDP (1mn USD)	237	4,678	17,715
GDP per capita (USD)	342	866	13,048
Number of exporters	18	221	5,722
Exports per firm (USD)	140,857	515,682	1,204,122
Exporter value of median firm (USD)	6,405	1,336	13,075
Export per firm: entrant	65,858	58,902	87,349
Share of Top 5%	0.45	0.64	0.78
Share of Top 1%	0.15	0.35	0.45
Herfindahl-Hirschman Index	0.002	0.002	0.004
Dest. per firm	1.5	1.4	2.5
Prod. per firm	1.6	1.7	4.6
Maximum Values			
Real GDP (1mn USD)	114,299	1,879,604	3,450,702
GDP per capita (USD)	1,270	39,378	85,833
Number of exporters	6,995	44,607	110,366
Exports per firm (USD)	4,049,447	7,488,207	11,700,000
Exporter value of median firm (USD)	380,882	277,919	230,154
Export per firm: entrant	621,736	1,587,558	2,413,773
Share of Top 5%	0.94	0.99	0.92
Share of Top 1%	0.77	0.93	0.74
Herfindahl-Hirschman Index	0.396	0.450	0.043
Dest. per firm	7.0	4.6	8.9
Prod. per firm	22.8	13.3	13.3

as they provide a clearer picture of the distribution of market shares.

The last variables in Table 1 suggest that firms in low-income countries appear to be more specialized. Firms in LDCs and MICs export to an average of three destination countries, and export five products on average, while HICs have larger averages — four destination countries and almost eight product categories. We must emphasize that these averages do not reflect the fact that firm sizes and scope vary widely, such that the distribution of these variables are skewed, with the average being typically much higher than the median for each country. The presence of intermediaries, firms that export goods produced by other firms should also be considered in interpreting these variables, as discussed in Fernandes et al. (2016) and Freund and Pierola (2015).

IV Empirics

IV.1 Export Patterns by Stage of Development

Figure 1 shows how the margins of trade and exporter market-share concentration change with GDP per capita – presenting both cross-country variation and within-country variation. The panels of the figure are consistent with the summaries of average values in Table 1. The figures on the left of each panel show cross-country variation — correlations using the average GDP per capita and the average of the relevant variable for each country. The figures on the right show the within-country variation — correlations using the demeaned GDP per capita and the demeaned relevant variable for each country. (The graphs are comparable to Figure 2 in Fernandes et al. (2016), with separate plots for the country groups – LDC, MIC, and HIC.)

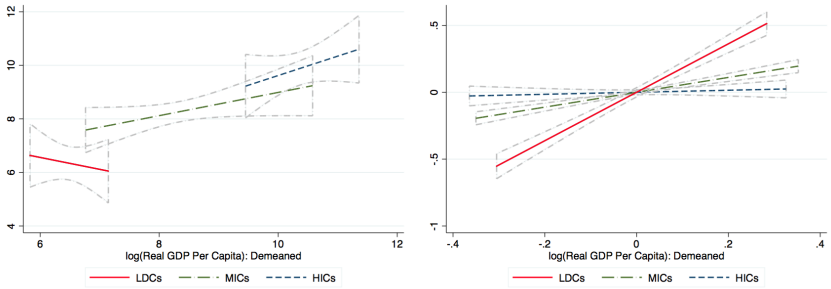
Figure 1 has two distinctive advantages. First, it allows for nonlinear relationship between GDP per capita and our variables of interest. Second, we present both short-run and long-run relationships between economic development and the variables that capture trade margins. This matters because, what holds in a long-term timeline that hypothetically allows an LDC to become a MIC, may not necessary apply in the short term. Our evaluation of short-term within-country variation therefore complements previous studies that emphasize cross-country variation.

The panels show noticeably different patterns for within-country variation vs. cross-country comparisons. The relationships between economic development and the variables depend on how the comparison is made. For the most part, the figures on the left match those in Fernandes et al. (2016), with a few key differences between the country groups. The number of exporters (panel a) increases as countries develop. This pattern, however, is not true for LDCs (although noise in the pattern, as seen by the large confidence intervals, limits the interpretation of the graph for LDCs). Just as with the cross-country

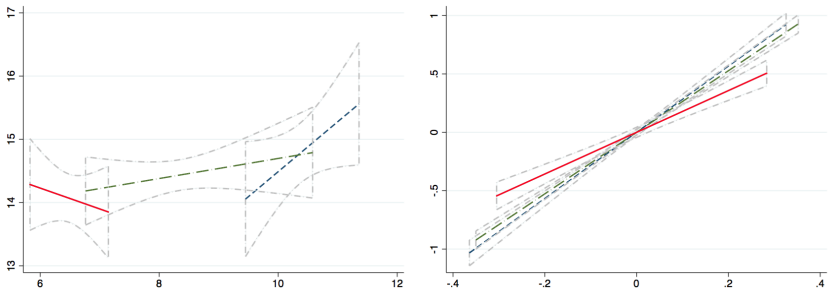
Figure 1: The Margins and Market-Share Concentration of Trade

a Number of Exporters

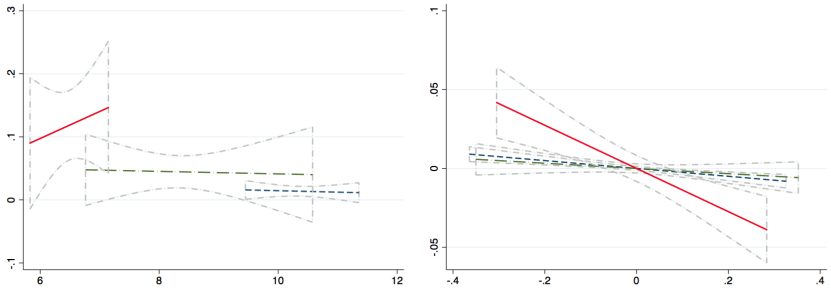
Cross-country variation | Within-country variation



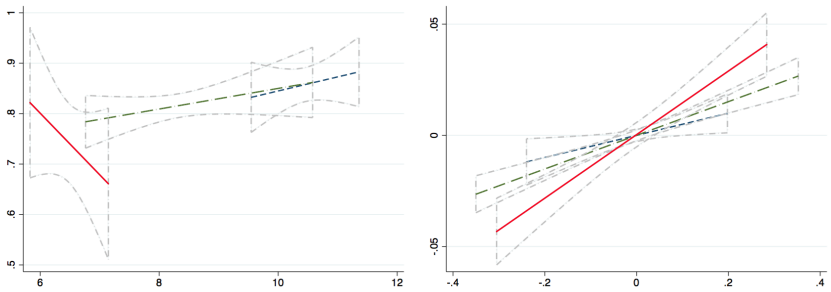
b Average Export Value per Firm



c Herfindahl-Hirschman Index



d Export Share of Top 5% of Firms



Note: For the cross-country figures (the left hand side) we first create a country's average for the variable and then correlate this average with each country's average GDP per capita, and for the within-country figures (the right hand side) we subtract from each observation the country average for the same variable and then correlate these observations with the demeaned GDP per capita. The margins of trade are in logs.

comparison figures on the left, the top right panel of Figure 1 also shows a strong, positive relationship between increases in real GDP per capita and exporter numbers. Remarkably, it is primarily for LDCs that the relationship between the extensive margin and economic development is positive and statistically significant. Furthermore, differences between the country groups show up at the intensive margins (panel b). In the second panel of the figure , the relationship between the intensive margin and GDP per capita is slightly stronger for HICs and MICs.[10]

Figure 1 also shows measures of exporter market-share concentration (panel c and d). In panel c), where export concentration is measured as HHI, we see an overall decrease in concentration with GDP per capita. The differences between the country groups are notable: Concentration decreases for LDCs with economic development (the opposite of what the cross-country variation figures show), and there appears to be no relationship between export concentration and GDP per capita for MICs and HICs. This differs largely from the pattern in the last panel of the figure (which appears consistent with the plot in Fernandes et al. (2016) that uses the top 5% exporter's market share as a measure of export concentration). The different measurements of exporter market-share concentration provide opposing conclusions: HHI decreases with economic development, but the export share of the top 5% increases with economic development. While not shown, the positive correlation observed in panel d) is driven almost entirely by the largest firms, the top 1% of exporters. We delve further into this difference in Section IV.3 of the paper.

Margins of Trade and Export Growth

To support the preliminary evidence observed above, we document the contributions of the margins of trade to export growth. To do this, we follow Bernard, Jensen, Redding, and Schott (2009) in decomposing total exports into the extensive and intensive margins. Then we regress the logarithm of total exports on the logarithm of the intensive and extensive margins of trade. As expected, the coefficients on the extensive and intensive margins sum to one, with each coefficient representing the share of the overall variation in trade explained by each margin.

Table 2 provides results that are consistent with previous papers, while supporting the novel contributions of this paper. With the needed country fixed effects, about two-thirds of export growth comes from the intensive margin or increases in average exporter size, from columns 3 and 4 of the table. (Without the fixed effects in columns 1 and 2, it appears that about 75% of export growth is on the extensive margin or exporter numbers). Column 3 highlights the novelty of this paper in showing differences by country-group.

[10]Plotted but not shown, are graphs for total exports and median exporter size. Those graphs are not shown to conserve space. A similar figure is observed for entrants, exiters, and successful entrants using average exports per firm (Appendix Figure A.1) and median exports per firm (Appendix Figure A.2). The main takeaway is that the importance of the intensive margin of new exporters for export growth in LDCs diminishes when using alternative measures of the intensive margin.

Table 2: Margins of Trade and Export Growth

Dep. Var. ⇒	**Margin**		**Margin**		**Margin**	
	Extensive	**Intensive**	**Extensive**	**Intensive**	**Extensive**	**Intensive**
ln(Exp)	0.726***	0.274***	0.279***	0.721***	0.463***	0.537***
	(0.015)	(0.015)	(0.047)	(0.047)	(0.048)	(0.048)
ln(Exp)*MICs					-0.274***	0.274***
					(0.059)	(0.059)
ln(Exp)*HICs					-0.356***	0.356***
					(0.087)	(0.087)
Country FE	No	No	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	623	623	623	623	623	623
Num. of clusters			69	69	69	69
Adjusted R^2	0.851	0.449	0.415	0.826	0.525	0.859

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; robust standard errors, cluster at the country level, shown in parenthesis. Both total exports ($Exp.$) and the margins of trade are in logs. MIC equals 1 if the country is a middle income country and HIC equals 1 if the country is a high income county; $LDCs$ are the omitted group where relevant.

The table clearly shows that the intensive margin of export growth is much more important for HICs and MICs, than for LDCs. For LDCs, the baseline category in the regression, there is little difference between the contributions of the extensive (46%) and intensive margins of trade (54%). Meanwhile, export growth for countries in the high-income and middle-income group comes almost entirely from the intensive margin (almost 90% in HICs and about 80% in MICs), with these differences, as shown in the table, being statistically significant. In sum, analyses using the within-country variation - in both Figure 1 and Table 2, indicate that the growth margins of LDCs, MICs, and HICs are different.

IV.2 From Theory to Empirics

The empirics follow the paper's focus on productivity shocks, and the prediction of the model in Section II. We abstract away from policy changes that alter the bilateral trade parameters and product-specific shocks, to focus on productivity changes at the country-level that alter the firm-size distribution.[11] Nonetheless, our approach serves to address how the policy changes that are not modelled affect exports in the long-run, as firms move into or out of exporting.

The total exports of country j in period t as outlined in Section II:

$$\ln\left(V_{jt}\right) = \beta_0 + \beta_1 \ln\left(Y_{jt}^{pc}\right) + \alpha_j + \delta_t + u_{jt} \tag{4}$$

[11] As a robustness check, we replicate the estimates using data disaggregated beyond the country-level.

Exports in (4) depend on: (1) origin-country productivity shocks (Y_{jt}^{pc}), (2) factors affecting demand world-wide at time t (δ_t), and (3) factors specific to the exporter (α_j). Real GDP per capita (Y_{jt}^{pc}) will serve as the proxy for productivity (a_{jt}^{m}) in the data. α_j represents country fixed effects, to control for country-specific characteristics that may correlate with the dependent variable. δ_t represent calendar year fixed effects; this controls for variables that affect all countries in a given year, e.g. the Great Recession years, which are covered in the data. As expected, j indexes the country, and t the calendar year.

The empirics, building on the model framework, test whether or not the relationship between productivity shocks and exports varies by level of economic development. As discussed in Section II, if the shape parameters varies by level of economic development (that is, $k^h < k^m < k^l$), we expect that a positive productivity shock would have a greater impact in low income countries and the least impact for high-income countries. To test this prediction, the focus of our estimates will be on the following baseline model:

$$V_{jt} = \beta_0 + \beta_1 \ln\left(Y_{jt}^{pc}\right) + \beta_2 MIC_i \cdot \ln\left(Y_{jt}^{pc}\right) + \beta_3 HIC_i \cdot \ln\left(Y_{jt}^{pc}\right) + \alpha_j + \delta_t + u_{it} \qquad (5)$$

In Equation (5), V_{jt} captures the outcome variable of interest —the various measures of trade and its margins. These include: [1] total export, [2] traditional measures of the margins of trade (*average exporter size and the number of exporting firms*), [3] extended measures of the intensive margin (*export value of the median firm and average exports per entrant*), and [4] measures of exporter market-share concentration (*Herfindahl-Hirschman Index, export share of the top 5% of firms, and export share of the top 1% of firms*). Section III includes definitions for these variables. $\ln\left(Y_{jt}^{pc}\right)$ is the log real GDP per capita (GDP per capita at constant 2010 US$) for each country j in year t. MIC_j equals one if the country is a middle-income country, and zero otherwise; HIC_j equals one if the country is a high-income country, and zero otherwise. As mentioned earlier, Appendix Table A.1 shows the list of countries in the data sample and their country groups.

LDCs are the focus of this paper and, thus, the comparison group. Thus, β_1 shows the correlation between real GDP per capita and the margins of trade for LDCs. $MIC_j \cdot \ln\left(Y_{jt}^{pc}\right)$ captures the difference between LDCs and MICs as real GDP per capita changes, and $HIC_j \cdot \ln\left(Y_{jt}^{pc}\right)$ captures this same difference for LDCs and HICs. Thus, β_2 and β_3 are the estimators of interest. Lastly, u_{jt} is the error term. Market size is not in the main empirical model because we use country fixed effects. Including a market size variable in such a specification may conflate the estimated effects of market size, with the effects of changes in market size. Our initial rationale for excluding a market size variable from our empirical specification, is that exports are a notable share (and a bigger share for many LDCs) of most measures of market size (such as GDP). Leaving market size out of the baseline specification *avoids the bias* that comes with putting exports on both sides of the equation. To address concerns that exports or exporter numbers may be growing, simply

because of aggregate economic growth, the robustness checks include specifications that proxy for market size.

The expected sign for β_1, β_2, and β_3 depends on the variable of interest and the model of how economic development shapes firm and exporter size distributions. Based on the model in Section II, we expect that total exports and the extensive margin would increase with GDP per capita ($\beta_1 > 0$), and this effect is greater for LDCs than non-LDCs ($\beta_2 < 0$, and $\beta_3 < 0$). In the model, there is no direct effect of a productivity shock on the intensive margin. However, under the stated assumptions, a positive productivity shock could impact the intensive margin indirectly through wage increases; As stated earlier, there should be no correlation ($\beta_1 = 0$) between a productivity shock and the intensive margin for LDCs (the wage in LDCs is the numeraire), but the association should be more positive than for non-LDCs ($\beta_2 > 0$, and $\beta_3 > 0$). The expectation from the model in Section II is more consistent with the missing middle argument for LDCs; there is slight difference from this argument, average exports per firm decrease in traditional arguments. While our model suggests that the effects of a positive shock vary by a country's level of economic development, the traditional arguments for the truncated top vs. missing middle don't make such a distinction. As such, our theoretical and empirical findings go beyond the debate between the truncated top and missing middle debate.

IV.3 Estimates

GDP per Capita and the Margins of Trade

Table 3 shows the relationship between GDP per capita and total exports (as well as the relationships with the intensive and extensive margins of trade). For each outcome variable we run a regression without country fixed effects (Columns 1, 4, and 7). Estimates of cross-country variation are the results that most closely resemble the specification in Fernandes et al. (2016). Column (1) shows that total exports and economic development are highly correlated across countries and, unsurprisingly, that both the extensive (Column 4) and the intensive margin (Column 7) contribute to this growth. These results are consistent with the findings in Table 4 of Fernandes et al. (2016), and its implication that truncated firm-size distributions may be holding back exports for countries with low GDP per capita.

We include country fixed-effects in Columns (2), (5), and (8), and the results show little change. The coefficient on GDP per capita increases in size while retaining its positive sign for exports as a dependent variable. However, the estimated relationship between GDP per capita and extensive margin regression loses statistical significance. Other papers interpret similar findings to conclude that the key to economic development is increasing average exporter sizes; that is, by helping successful exporters grow into export superstars, rather

Table 3: The Margins of Trade: LDCs vs MICs and HICs

Dep. Var.⇒	ln(export value)			ln(num. exporters)			ln(avg. exp. per firm)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln($RGDP_{PC}$)	1.01***	1.42***	2.07***	0.76***	0.44	1.40***	0.24***	0.99***	0.67**
	(0.04)	(0.26)	(0.58)	(0.03)	(0.29)	(0.46)	(0.02)	(0.22)	(0.31)
MIC*ln($RGDP_{PC}$)			-1.01			-1.41***			0.39
			(0.64)			(0.46)			(0.40)
HIC*ln($RGDP_{PC}$)			-1.27*			-2.20***			0.93**
			(0.76)			(0.56)			(0.40)
Country FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Num. of obs.	623	623	623	623	623	623	623	623	623
Num. of clusters		69	69		69	69		69	69
Adjusted R^2	0.548	0.781	0.795	0.506	0.251	0.431	0.254	0.708	0.715

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; robust standard errors, cluster at the country level, shown in parenthesis. GDP per person is in 2010 US dollars. MIC equals 1 if the country is a middle income country and HIC equals 1 if the country is a high income country; $LDCs$ are the omitted group where relevant.

than supporting small firms to raise the number of exporters. A possible explanation is that the difference between columns 4 and 5 points to the importance of country-specific economic features and relationships in explaining how increasing average income is linked to the extensive margin of trade.

Finally, we interact real GDP per capita with the country-group dummies for MICs and HICs to see how the relationship depends on the stage of development as predicted by the model. Exports and GDP per capita are linked for all countries (Column 3). While the association is strongest for LDCs, the difference with middle-income and high-income countries is not statistically significant. This difference by country group, however, becomes significant once we split exports into its margins. On the extensive margin (Column 6), economic development comes with increased exporter numbers for LDCs, while the association is less for MICs and even more so for HICs. In fact, there is no association between the extensive margin and GDP per capital for MICs and a negative association for HICs, as seen in Appendix Table A.2. The intensive margin yields coefficients that are smaller in size than those observed for the extensive margin, but LDCs still have a positive and statistically significant correlation with GDP per capita (Column 9). More importantly, the association is stronger for HICs and this difference is statistically significant.

GDP per Capita and Measures of the Intensive Margin

Table 4 shows the relationship between GDP per capita and additional measures of the intensive margin. It replicates the intensive margin results from Table 3, but includes the median export value for firms and the average export value for entrants. If exporter size distributions have a truncated top, not only should the average exporter size increase, but so should the median value. Additionally, if there was a truncated top, the average entrant's export value should also increase. As the firm size distribution becomes less truncated hypothetically, the subset of firms that become new exporters should be larger and have higher per-firm export values. The estimates using these alternative variables for the intensive margin reinforce the finding that as LDC countries develop, their new exporters are *not* larger, and the median surviving exporter size stays flat. The finding as indicated in the introduction, is more consistent with an argument for a missing middle than for claims of a truncated top. For HICs, on the other hand, there is a strong and positive correlation between these three variables and economic development (See Appendix Table A.2).

The estimates in Column 4 of Table 4 show that even before controlling for the country of origin, the median value is not increasing with GDP per capita. Column (7) shows a positive correlation between average exporter size for entrants and real GDP per capita, although the relationship is weaker than the association for the overall intensive margin (Column 2). These results change in magnitude, but not statistical significance, once

controls for the country of origin are introduced (Columns 5 and 8). However, the paper's focus is on the relationship for LDCs and whether the correlation differs by country group.

Different results emerge once real GDP per capita is interacted with the HICs and MICs variables, the country groups that capture stages of economic development. In Column 6 of Table 4, the coefficient on median exporter size is actually negative for LDCs, but the estimate is not statistically significant. Here MICs and HICs have very different results relative to those of LDCs. The median exporter size increases with GDP per capita for middle-income countries and even more so for high-income countries (see Appendix TableA.2), with both differences being statistically significant (see Table 4). Declining median exporter size with higher levels of economic development for LDCs appears more consistent with a scenario built on a firm-size distribution with a missing middle. As more firms engage in trade with rising incomes in a hypothetical missing-middle scenario, the median exporter should be smaller in size, especially if entrants are not larger than incumbent exporters because, as we hypothesize, institutional and structural factors keep many of the potential entrants smaller than they should be. Column 9 provides evidence that average exporter size for entrants increases with development, but the coefficient is not statistically different from zero for LDCs. While both MICs and HICs have a positive association between this exporter size and GDP per capita (see Appendix Table A.2), the only statistically significant difference that is that between LDCs and HICs.

GDP per Capita and Export Concentration

Another testable prediction for the truncated top and the missing middle arguments builds on the relationship between exporter market-share concentration and GDP per capita. In Table 5, we provide three measurements for concentration of exports: [1] the export share of the top 5% of exporters, [2] the export share of the top 1% of exporters, and [3] the Herfindahl-Hirschman Index. Subtle differences between the measures of export concentration can help to address the aforementioned arguments. Broadly speaking, an increase in export concentration would be interpreted as support for a model of the truncated top. On the other hand, we would interpret a decrease in this correlation as support for a model of the missing middle. However, interpreting these results call for careful consideration of what each variable captures, and how sensitive they are to other variables.

The HHI measure is sensitive to the number of exporting firms, much more so than are the other two measures of concentration – the share of the top 1 and top 5%. For a country with a small number of exporters, HHI is usually high, regardless of the parameters of the firm-size distribution. In such an LDC with low exporter numbers, the increase in exporter numbers with GDP per capita should lead to a reduction in the observed HHI, even while the share of the top 5% is increasing. The contrasting effects of exporter numbers and average size growth can therefore provide results with opposite signs for HHI vs. other

Table 4: The Intensive Margin of Exports: LDCs vs MICs and HICs

Dep. Var.⇒	ln(avg. exports per firm)			ln(avg. exp. per firm): Median			ln(avg. exp. per firm): Entrant		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln($RGDP_{PC}$)	0.24***	0.99***	0.67**	0.01	0.71	-0.17	0.15***	1.46**	0.45
	(0.02)	(0.22)	(0.31)	(0.03)	(0.47)	(0.69)	(0.03)	(0.56)	(0.92)
MIC*ln($RGDP_{PC}$)			0.39			1.65**			1.04
			(0.40)			(0.69)			(0.95)
HIC*ln($RGDP_{PC}$)			0.93**			2.53**			3.14***
			(0.40)			(1.14)			(1.06)
Country FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Num. of obs.	623	623	623	608	608	608	540	540	540
Num. of clusters		69	69		68	68		66	66
Adjusted R^2	0.254	0.708	0.715	0.041	0.250	0.308	0.100	0.123	0.142

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; robust standard errors, cluster at the country level, shown in parenthesis. GDP per person is in 2010 US dollars. MIC equals 1 if the country is a middle income country and HIC equals 1 if the country is a high income country; $LDCs$ are the omitted group where relevant.

Table 5: Export Concentration: LDCs vs MICs and HICs

Dep. Var.⇒	Share of top 5%			Share of top 1%			Herfindahl-Hirschman Index		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln($RGDP_{PC}$)	0.03***	0.04	0.09	0.04***	-0.00	0.15	-0.02***	-0.05	-0.12*
	(0.00)	(0.03)	(0.06)	(0.00)	(0.08)	(0.09)	(0.00)	(0.04)	(0.07)
MIC*ln($RGDP_{PC}$)			-0.09*			-0.13			0.13*
			(0.05)			(0.10)			(0.06)
HIC*ln($RGDP_{PC}$)			-0.23***			-0.59***			0.08
			(0.08)			(0.13)			(0.06)
Country FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Num. of obs.	602	602	602	615	615	615	623	623	623
Num. of clusters		68	68		67	67		69	69
Adjusted R^2	0.114	0.180	0.223	0.155	0.099	0.244	0.061	0.025	0.053

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; robust standard errors, cluster at the country level, shown in parenthesis. GDP per person is in 2010 US dollars. MIC equals 1 if the country is a middle income country and HIC equals 1 if the country is a high income country; $LDCs$ are the omitted group where relevant.

measures of export concentration, as observed in Section III.

Using the market share of the top exporters as a measure of concentration gives a positive relationship between concentration and economic development when we don't control for the country of origin (Column 1 for Top 5% and Column 4 for Top 1%), but using the HHI gives a negative relationship (Column 7). Interestingly, all of these measurement lose statistical significance when we control for the country of origin (see Column 2 for the top 5%, Column 5 for Top 1% and Column 8 for HHI).[12] The results, however, depend on the stage of economic development, which becomes clear when country groups are interacted with real GDP per capita. For the top 5% variable (Column 3) and top 1% (Column 6) variables, there is a positive, but insignificant relationship between concentration and economic development for LDCs, and, more importantly, the difference is negative and statistically significant for the difference estimates with HICs and even for the difference in the Top 5% estimates with MICs.[13]

Note that only the richest countries see an overall decrease in concentration with increases in GDP per capita (see Appendix Table A.2). For LDCs, we see a negative relationship (with a 10% level of significance) between economic development and exporter market-share concentration, as measured by HHI (Column 9). The difference estimate is positive and statistically significant for MICs and positive, but not statistically significant, for HICs. Only the LDCs see an overall decrease in HHI with increases in GDP per capita (see Appendix Table A.2). As outlined earlier in the section, the contrast between HHI and the top share measures reflects the sensitivity of HHI to exporter numbers, given that LDCs see more movement on the extensive margin with economic development.

IV.4 Robustness Checks

We performed robustness checks that address potential challenges to the baseline specification; our findings are robust to these alternative specifications. We refer readers to the (longer) online version of the paper (Mora and Olabisi, 2020) for these robustness checks, which we only summarize here. First, we run regressions separately for each product sector to show that the main results apply to a majority of sectors. (See Tables A3 and A4 in the

[12] This may be a result of the limited variation in these variables over the short term.

[13] To test the sensitivity of the HHI measure to exporter numbers, we simulated draws from a Pareto distribution (with 1000 repetitions), and repeated the draws (using the same distribution parameters, $\alpha = 1, \beta = 1$), for samples with different sizes. One sample size was 1,000 firms, to match the average number of LDC exporters in Table 1, while the other samples ranged from 2,000 to 30,000 firms, to match the average number of HIC exporters. For each sample size, we calculated averages across the 1000 repetitions for our three indexes of concentration. We compared the HHI, top 1% share and top 5% share estimates of the larger samples with our baseline sample of 1000 – a number selected to match the average exporter count for LDCs. The top 1%(5) share stayed relatively unchanged with sample size, in the range of 0.7(0.5) to 0.8(0.6), as long as the Pareto distribution parameters did not change. The HHI index on the other hand, fell dramatically from 0.11 for the sample of 1000, to 0.08 for the sample of 30,000.

online version). The additional results also answer concerns that the relationship between GDP per capita and trade margins may be explained away by changes in the market size. We use proxies for market size that reflect the size of national economies, without putting exports on both sides of the equation. (See Table 6, Table 7, and Appendix Tables A5 to A9 of the online paper). The results include estimates using country-destination data with controls for economic size, much like Fernandes et al. (2016). Finally, in Appendix Tables A10 to A14 of the online paper, we show that our main findings are robust to how country groups are defined, to non-linear relationship types, and to exclusions of the smallest exporters.

V Conclusion

In this paper, we show that one size does not fit all. We provide new evidence that for countries at different stages of development, the relationships between GDP per capita and the margins of trade also differ. GDP per capita growth for LDCs is linked to a stronger response on the extensive margin (the number of exporters), while the intensive margin (average exporter size) and export concentration are less correlated with economic development for LDCs. For high-income countries, development has a stronger correlation with average exporter size. The findings are relevant to policy: first, in showing that the patterns of growth and development in LDCs differs from other developing countries, and second, in implying that growth policies should be tailored to the state of each economy. What works in South Africa, for example may not work for Zambia, just as what works in Mexico may not work in Haiti.

To frame our findings, we develop a heterogeneous-firm model of trade that allows us to associate the shape parameter of the assumed Pareto distribution of firm productivity in a country with its level of economic development (low, middle, and high income). Using this formal framework, we show that the extent to which exports change with aggregate productivity shocks depend on the level of economic development. More precisely, a positive productivity shock has direct and indirect effects on trade and its margins. The direct effect works largely on the extensive margin; LDCs would have more export entry relative to high-income countries. By making additional assumptions we find indirect effects, which affect both the intensive and extensive margins; the extensive margin should still be more important for LDCs and the intensive margin increases for all non-LDC countries. The findings suggest new thinking for understanding how exports change with GDP per capita in the least developed countries.

The evidence in the paper is relevant to the debate on how distortions to resource allocation in developing countries impact firms, including exporters. The two leading arguments in this literature are that the distortions create: [1] a missing middle, or [2] a

truncated top. The missing middle argument holds that developing countries are held back by costly distortions that prevent smaller and mid-sized firms from growing, and growing enough to enter and survive in export markets. As countries develop and the costs of trade decrease, smaller firms enter the export market, driving down average exporter size and decreasing export concentration for countries with a missing middle. On the other hand, the truncated top argument assumes that what holds back developing countries is the relative paucity of superstar exporters, such that as countries develop, superstars grow in number and enter the export market, driving up average exporter size and increasing export concentration. We find evidence that a missing middle is the greater challenge holding back exports for LDCs.

The paper opens up several opportunities for additional work. First, our preliminary evidence on the *missing middle* vs. *truncated top* debate could be parsed out further, given a broader firm-level dataset covering more countries. The results are qualitatively consistent across broad product groups in our sector-by-sector analysis, but the quantitative differences between sectors deserve to be explored in a future paper. Finally, while this paper's stated goal is documenting the existence of differences in the relationship between trade margins and GDP per capita for country groups, it is important to explain 'why' the patterns change. Thus, we expect future work with empirical analyses of the potential causes of differences in the margins of trade observed for countries at different stages of economic development - the distortions that shape the size distributions of firms and exporters.

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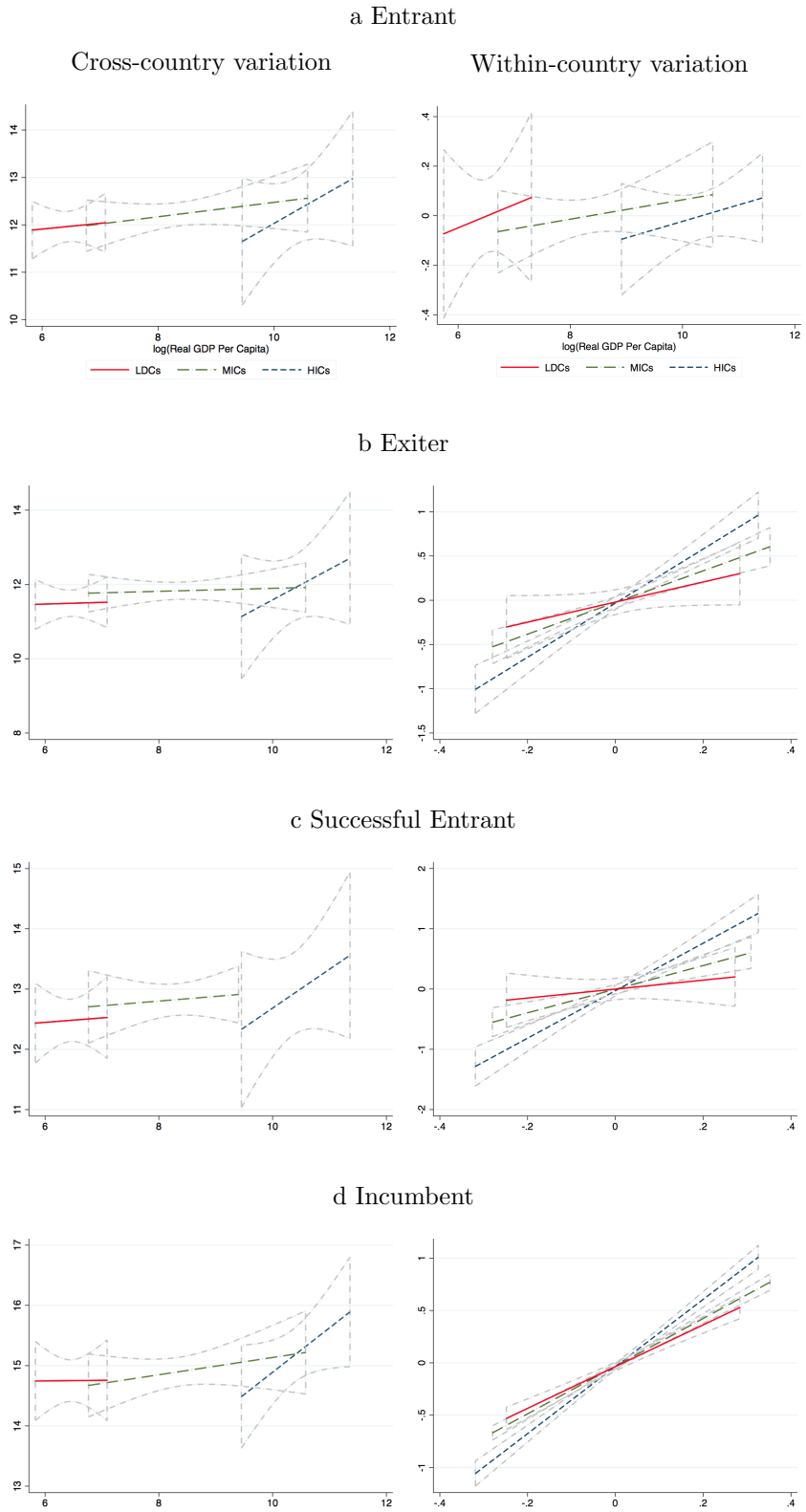
Appendix A

Figure A.1: Average Exporter Size by Firm type

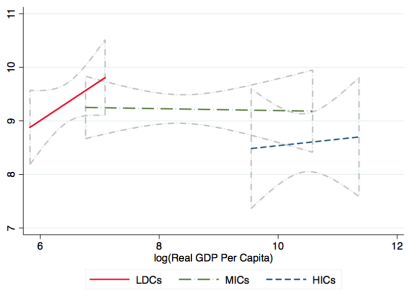


Note: For the cross-country figures (the left hand side) we first create a country's average for the variable and then correlate this average with each country's average GDP per capita, and for the within-country figures (the right hand side) we subtract from each observation the country average for the same variable and then correlate these observations with the demeaned GDP per capita. All variables are in logs.

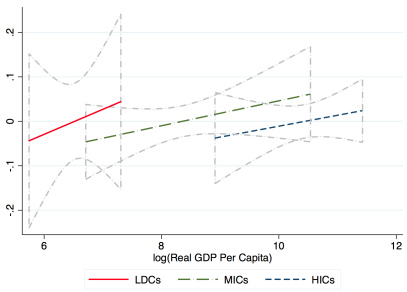
Figure A.2: Median Exporter Size

a Entrant

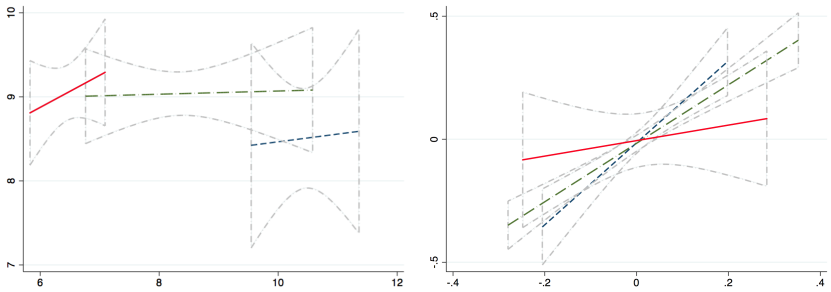
Cross-country variation



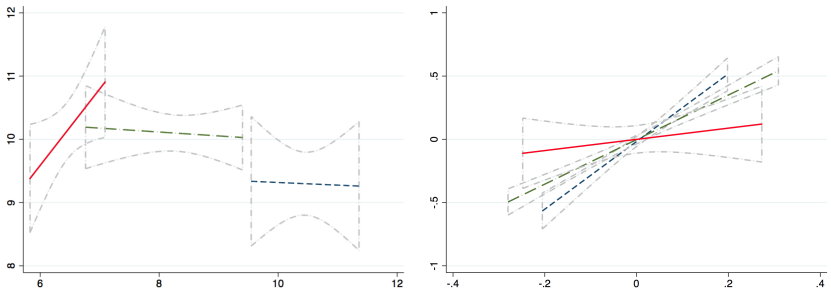
Within-country variation



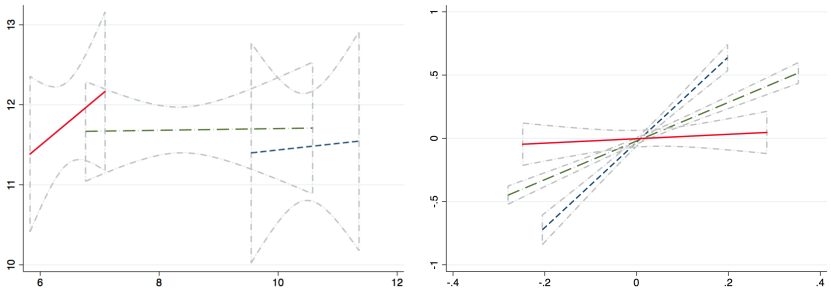
b Exiter



c Successful Entrant



d Incumbent



Note: For the cross-country figures (the left hand side) we first create a country's average for the variable and then correlate this average with each country's average GDP per capita, and for the within-country figures (the right hand side) we subtract from each observation the country average for the same variable and then correlate these observations with the demeaned GDP per capita. All variables are in logs.

Table A.1: Countries by Income Category

Country	Code	First year	Last year	Country	Code	First year	Last year
Least Developed Countries (LDCs)							
Burkina Faso	BFA	2005	2012	Niger	NER	2008	2010
Bangladesh	BGD	2005	2014	Nepal	NPL	2011	2014
Ethiopia	ETH	2008	2012	Rwanda	RWA	2001	2012
Guinea	GIN	2009	2012	Senegal	SEN	2000	2012
Cambodia	KHM	2000	2009	Sao Tome and Principe	STP	2014	2014
Lao PDR	LAO	2006	2010	Timor-Leste	TLS	2006	2012
Madagascar	MDG	2007	2012	Tanzania	TZA	2003	2012
Mali	MLI	2005	2008	Uganda	UGA	2000	2010
Myanmar	MMR	2011	2013	Yemen, Rep.	YEM	2008	2012
Malawi	MWI	2006	2012	Zambia	ZMB	1999	2011
Middle Income Countries (MICs)							
Albania	ALB	2004	2012	Kyrgyz Republic	KGZ	2006	2012
Bulgaria	BGR	2001	2006	Kuwait	KWT	2009	2010
Bolivia	BOL	2006	2012	Lebanon	LBN	2008	2012
Brazil	BRA	1997	2014	Sri Lanka	LKA	2013	2013
Botswana	BWA	2003	2013	Morocco	MAR	2002	2013
Chile	CHL	2003	2012	Mexico	MEX	2000	2012
Cote d'Ivoire	CIV	2009	2012	Macedonia, FYR	MKD	2001	2010
Cameroon	CMR	1997	2013	Mauritius	MUS	2002	2012
Colombia	COL	2007	2013	Nicaragua	NIC	2002	2014
Costa Rica	CRI	1998	2012	Pakistan	PAK	2002	2010
Dominican Republic	DOM	2002	2014	Peru	PER	1997	2013
Ecuador	ECU	2002	2014	Paraguay	PRY	2007	2012
Egypt, Arab Rep.	EGY	2006	2012	Romania	ROU	2005	2011
Gabon	GAB	2002	2008	El Salvador	SLV	2002	2009
Georgia	GEO	2003	2012	Swaziland	SWZ	2012	2012
Guatemala	GTM	2005	2013	Thailand	THA	2012	2014
Iran, Islamic Rep.	IRN	2006	2010	Turkey	TUR	2002	2013
Jordan	JOR	2003	2012	Uruguay	URY	2001	2012
Kenya	KEN	2006	2014	South Africa	ZAF	2001	2012
High Income Countries (HICs)							
Belgium	BEL	1997	2013	Norway	NOR	1997	2014
Germany	DEU	2009	2012	New Zealand	NZL	1999	2010
Denmark	DNK	2001	2012	Portugal	PRT	1997	2012
Spain	ESP	2005	2014	Slovenia	SVN	1997	2011
Estonia	EST	1997	2011	Sweden	SWE	1997	2006
Croatia	HRV	2007	2012				

The classifications are available at these links: LDC classifications and High-Income Country classifications. Countries that are neither in the LDC and HIC categories are classified as middle-income countries. Country classification is based on classification in the last year of data availability.

Table A.2: The Margins of Trade: LDCs vs MICs and HICs

Dep. Var. ⇒	Exp	Exten.	Mean	Median	Entrant	Top 5%	Top 1%	HHI
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LDC*ln($RGDP_{pc}$)	2.07***	1.40***	0.67**	-0.17	0.45	0.09	0.15	-0.12*
	(0.58)	(0.46)	(0.31)	(0.69)	(0.92)	(0.06)	(0.09)	(0.07)
MIC*ln($RGDP_{pc}$)	1.05***	-0.01	1.06***	1.47***	1.49***	0.00	0.02	0.01
	(0.32)	(0.22)	(0.27)	(0.44)	(0.55)	(0.02)	(0.06)	(0.02)
HIC*ln($RGDP_{pc}$)	0.79**	-0.80**	1.60***	2.35**	3.59***	-0.14**	-0.43***	-0.04
	(0.37)	(0.32)	(0.22)	(0.99)	(0.48)	(0.06)	(0.08)	(0.02)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Num. of Obs.	623	623	623	608	540	602	615	623
Num. of Clusters	69	69	69	68	66	68	67	69
Adjusted R^2	0.795	0.431	0.715	0.308	0.142	0.223	0.244	0.053

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; robust standard errors, cluster at the country-destination level, shown in parenthesis. GDP per person is in 2010 US dollars. LDC equals 1 if the country is a least developed country, MIC equals 1 if the country is a middle income country and HIC equals 1 if the country is a high income country. *Exp.* is total exports, *Exten.* is the number of exporters, *Mean* is average exports per firm, *Median* is the median exporter size, and *Entrant* is average export per entering firm. All of these are in logs.