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The surprising instability of export specializations☆

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ABSTRACT

We study the instability of hyper-specialization of exports at the 4-digit level in 1998–2010. (1) Specializations are surprisingly un-stable. Export ranks are not persistent, and new top products and destinations replace old ones. Measurement error is unlikely to be the main or only determinant of this pattern. (2) Source country factors are not the main explanation of this instability. Only 16–20% of variation in export growth is accounted for by source country plus source country-product factors that do not vary across destinations. The high share of idiosyncratic variance (source-product-destination residual) of 41–55%, indicates the difficulty to predict export success using source country characteristics. While we are cautious in interpreting factors that are jointly determined in global general equilibrium, our results suggest that destination and product-specific factors importantly matter at least as much as source country factors.

1. Introduction

What are the roads to economic development? Part of the answer lies in success in international trade (Frankel and Romer, 1999).[1] Informed observation of the Asian Tigers and China's recent experience demonstrates this effect. Whatever the sources of export success and comparative advantage may be – technology (Ricardo), endowments (Heckscher and Ohlin), home market effects (Krugman, 1980), the interaction between geography and technology (Eaton and Kortum, 2002) or policies and institutions (Nunn, 2007; Levchenko, 2007) – high income is strongly related to success in exporting and reaping the gains from trade.[2]

In this paper we study the instability of export flows over time, and we pay special attention to top export flows. Hyper-specialization in exports has been previously documented, as we discuss below. Our main contribution, however, is to document the *instability* of exports, with special attention to top exports. This is important because top exports account for most of the value of exports. Yet it is surprising how unpredictable it is which good and which destination make up the top exports.

We analyze instability in a number of non-parametric ways. First, graphically, we illustrate how the ranking of export goods changes over time, from 1998 to 2010, for a set of countries of different levels of development. These detailed charts make clear what kind of products are involved in both hyper-specialization and just how unstable these hyper-specializations are. We use 4-digit HS codes to identify products (there are 1225 such codes), which eliminates most of the concerns that our results are driven by misclassification and reporting error, without

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1 Siscart and Noguer (2005) corroborate the findings of Frankel and Romer (1999) with improved methodology and data.

2 Easterly and Reshef (2016) document other sources of export success in Africa, such as moving up the quality ladder, trade liberalization, foreign ownership, ethnic networks, and personal foreign experience of the exporting entrepreneur, as well as idiosyncratic factors like entrepreneurial persistence, luck, and cost shocks. Some of the successes occur in areas that usually fail. See also Artopoulos et al. (2010) for examples from Argentina.

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Table 1
Export concentration among top 20 goods and flows, distribution within top 20 goods and flows, and power law coefficients. The table reports the average share of top 20 goods and flows (good-by-destination) for all countries in our sample at the 4-digit HS code level. Rankings are defined according to values in 2010. The power law coefficient is given by the regression of the log rank on the log export share. A lower coefficient in absolute value implies higher concentration. Source: COMTRADE.

Rank	Export Shares: Goods (%)			Export Shares: Flows (%)		
	All Goods	Excl. Extractables	Excl. Extractables and Commodities	All Goods	Excl. Extractables	Excl. Extractables and Commodities
1	27.95	23.15	21.45	15.34	11.51	12.16
2	11.35	10.07	9.64	7.77	6.09	5.92
3	6.88	6.46	6.40	5.22	4.36	3.99
4	4.79	4.61	4.63	3.55	3.14	3.03
5	3.49	3.54	3.66	2.88	2.65	2.49
6	2.76	2.89	3.00	2.36	2.15	2.07
7	2.26	2.44	2.55	1.97	1.88	1.81
8	1.95	2.16	2.18	1.75	1.69	1.60
9	1.64	1.88	1.91	1.55	1.47	1.41
10	1.45	1.65	1.71	1.36	1.31	1.28
11	1.29	1.49	1.53	1.23	1.19	1.18
12	1.17	1.34	1.40	1.10	1.11	1.11
13	1.06	1.24	1.30	0.99	1.03	1.03
14	0.97	1.14	1.20	0.92	0.96	0.97
15	0.89	1.05	1.11	0.85	0.90	0.91
16	0.83	0.98	1.05	0.79	0.86	0.86
17	0.77	0.92	0.98	0.75	0.80	0.82
18	0.72	0.86	0.92	0.70	0.76	0.77
19	0.68	0.82	0.87	0.67	0.73	0.73
20	0.64	0.78	0.83	0.63	0.69	0.70
Total	73.56	69.47	68.33	52.38	45.29	44.84
Power Law	−0.78	−0.89	−0.92	−1.03	−1.19	−1.20

sacrificing a clear notion of differentiation in the product space.

We then show that correlations between export ranks in 1998 and 2010 are surprisingly low, on the order of only 0.3. We analyze the probability of remaining a top export in 2010 conditional on being a top export in 1998, and find that this increases with the level of development, which implies that exports from developing countries tend to be more unstable. This is true whether we study trade flows at the product or at the product-by-destination level (which we will call export "flows"). We illustrate that export instability is not driven primarily by measurement error.

Finally, we analyze the sources of export instability. We decompose the sources of variation in export growth along several dimensions, including the source-by-product dimension, which includes variation in comparative advantage. While analysis and public policy discussion often attribute changes in export performance to the source country, we consider the role of other factors beyond the source country – trends in global demand, global trade trends by product, effects of demand in the destination country (both in general and for specific products in that destination), and effects specific to the source-destination combination (such as the changing importance of distance, the bilateral manifestation of trade agreements, and other bilateral "gravity" forces).

Our results suggest that changes in source-by-product factors (giving rise to variation in comparative advantage) account for only 10–12% of the variation in export growth (subject to some caveats about general equilibrium effects). Only 16–20% of variation in export growth is accounted for by source country plus source-product factors, that do not vary across destinations. At most 13% of the variation is accounted for by purely bilateral factors that do not vary across products. This suggests that explanations for export success that focus only on industry competitiveness in the source country (and the policies that affect this) may be missing much of the origins of success.

It is also notable that variations in fixed effects that do not involve the source country are as important as those that do. We also find that variation in export growth in richer economies and in countries that have more diversified exports across destinations is driven even less by variation in source country forces and bilateral ties. Overall, the results suggest that most of the variability in export growth is not driven by source country factors. Some caution is necessary in making conclusions based on our findings, because we do not fully disentangle general equilibrium linkages. Nevertheless, our results are suggestive that too much export success or failure may be attributed to source countries, as opposed to external and global factors. While local entrepreneurs and firms may be active in locating and reaping these external opportunities, our analysis indicates that these opportunities are not driven by source-country forces *per se*. In line with this, 41% of variation in export growth of top products and 55% for all products can only be attributed to completely idiosyncratic shocks.

By nature, comparative advantage captures more than variation in industry productivities within a country; it also includes the relative position of these productivities *vis a vis* other countries' productivities in the same industries. In this paper we consider industry productivities broadly, being driven by any or all of the following: technology, factor prices in conjunction with factor intensities, product-specific policies, institutions in conjunction with institutional intensities, etc.

The rest of the paper is organized as follows. Section 2 discusses our contribution to the existing literature. Section 3 describes our data. Section 4 presents our results about export concentration and instability. Section 5 analyzes the sources of instability. Section 6 concludes.

2. Relation to the literature

Exports are concentrated in a relatively small number of few goods and, consequently, success in exporting is driven by a few big hits. Table 1 demonstrates that the top 20 goods that a country exports (out of a maximum of 1225 4-digit HS codes) account for 73.56% of total exports. This pattern is not just driven by commodities and extractables that are more prevalent in low income countries such as African ones.[3] African and other non-OECD countries are of particular interest because in our sample they see faster export growth, as demonstrated in Fig. 1 (we describe the data sources below).[4]

[3] See Appendix for list of products that we define as commodities and as extractables. For this we use the reference suggested by the UN.

[4] Easterly and Reshef (2009) also study this phenomenon in manufacturing, across 151 countries.

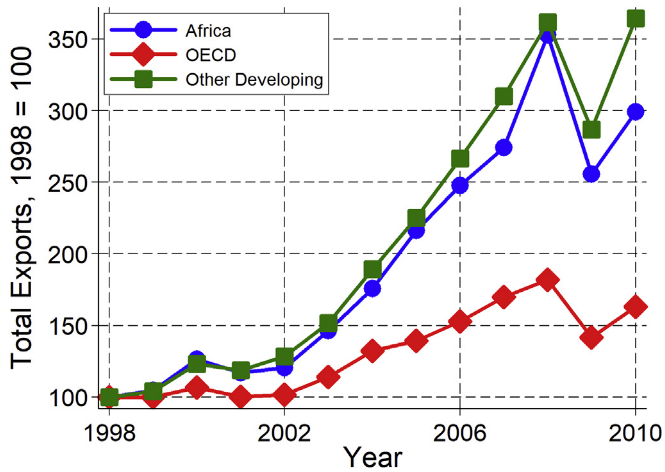

Fig. 1. Export growth has been stronger in Africa and other developing countries, relative to OECD member countries. Each line depicts the average index of total exports for a subgroup of countries.
Source: COMTRADE.

Our novel results on the instability of top export products may have important implications for industrial policy and trade protection. The erratic evolution of exports over time questions the efficacy of protection policies that aim to promote exports by protecting or subsidizing the industrial base. For example, Hausmann and Rodrik (2006) argue that development occurs through a process of discovery of what a country is good at producing. Hausmann and Rodrik (2006) argue that this process involves positive information externalities that are not internalized by private actors, and, therefore, advocate a subsidy for discovery. This is in line with how Cadot et al. (2014) interpret their findings on export big hits, where they find little "crowding out" of firms that follow a pioneer exporting firm. However, if external demand (not technology) shocks are an important source of volatility of exports, then maybe it is less important – or even impossible – to target specific industries. Hausmann et al. (2007) argue that a country's development converges to the level of countries that export similar goods. This captures a long-standing concern in development that some countries are trapped by their own characteristics into export patterns that are harmful to development. For example, the "Prebisch-Singer Hypothesis" argues that poor countries are stuck with producing and exporting commodities that are subject to declining terms of trade.[5] However, if specialization across both destinations and products is so unstable, then perhaps what a country exports the most is not entirely an exporter-specific factor that dooms the country to a sub-optimal outcome, nor does it seem that countries are trapped in any one sub-optimal specialization.

Our results indicate that it is the combination (or interaction) of source-product and destination-product that matters. The implication is that a country may succeed in promoting exports only if it can become competitive in a product that is demanded by a (near enough, with low import barriers) country demanding that product.

The concentration of exports has been noticed by other scholars. Eaton et al. (2007) find that Colombian exports are driven by a small number of very large (and relatively stable) exporting firms. Bernard et al. (2007) document high concentration across U.S. exporting firms. Freund and Pierola (2015) show that this phenomenon is general, and can be found among 32 countries of varying levels of development. Panagariya and Bagaria (2013) show that concentration of exports and imports across products is strikingly similar, which is surprising because theory predicts that comparative advantage forces would lead to much less concentration on the import side relative to concentration in exports. Relative to these papers, we add the destination dimension of concentration, document the instability of the specializations, and analyze the dimensions of volatility.

Cadot et al. (2011a) estimate that export concentration evolves as a U-Shape with economic development, being high at initial stages of development, low in the interim, and high concentration again for rich countries.[6] Cadot et al. measure concentration using a Theil index, which is strongly influenced by differences between the largest values versus smaller values.[7] In contrast, we examine export shares, which is arguably a more transparent and natural measure of concentration. We focus on the export shares of top exported goods or flows, which is the most important part of the distribution. In line with Cadot et al., we find that concentration is highest in the least developed countries, but we do not find strong evidence in favor of a reversal in the reduction in concentration after some level of development.

The novel part of our work is documenting and then analyzing the instability of exports. One source of exports volatility are demand shocks. Indeed, Eaton et al. (2011) estimate that demand is important for understanding the distribution of exports across firms in France, but they do not address volatility of demand (their model is designed for a cross section of export flows, and their estimation reflects this). Another potential source of volatility is technology. Trade models typically capture technological dispersion either as a power law (e.g., Baldwin, 2005; Helpman et al. 2008) or a Frechet distribution (Eaton and Kortum, 2002). Both of these distributions feature so-called "fat" tails. For theoretical tractability, in this class of models the distribution of exports (and of production) is allowed to vary only by location in the Frechet case, or is invariant in the power law case.[8] Both shape and concentration of the distribution of exports seem to matter theoretically for aggregate fluctuations in "granular" economies with fat tails (e.g. Gabaix, 2011; di Giovanni and Levchenko, 2012; di Giovanni et al., 2014). We take an unrestricted, nonparametric approach to describing concentration and volatility of exports.

In another strand of related work, Besedes and Prusa (2006a) find that most trade relationships where the U.S. is an importer are short lived: Once started, they exhibit "negative duration", and African trade relationships with the U.S. are even shorter lived. This could give rise to volatility, due to entry and then exit. Besedes and Prusa (2006b) find that homogenous goods have much higher hazard rates, which can help explain the difference in relationship duration for Africa. Cadot et al. (2011b) show that new export relationships from African countries (data from Malawi, Mali, Senegal, Tanzania) are more likely to last longer if there are other firms already exporting the same product, or to the same destination. However, these papers are about new export relationships, and only into the U.S. In contrast, we examine a broad set of countries, and do so over longer periods. Moreover, we focus on instability at the very top of the export distribution, which is where instability matters the most.

The most closely related paper to our work is Hanson et al. (2015). They use a gravity model to estimate source-country variation in industry productivities across industries, and find that the growth process underlying this variation exhibits mean-reversion and is consistent with a stationary distribution due to source-by-industry shocks. Levchenko and Zhang (2011) compute industry-level productivities in manufacturing

[5] See Harvey et al. (2010) and Arezki et al. (2013), who find mixed historical evidence on the validity of the Prebisch-Singer Hypothesis.

[6] This result is reminiscent of Imbs and Wacziarg (2003), who document a similar pattern for industrial production, not just exporting.

[7] Depending on the same underlying distribution, Theil and mean log difference can show different trends over time.

[8] Helpman et al. (2004) model different variances of economic activity through differences in the Pareto slope coefficient. This helps them explain the tradeoff between serving foreign markets via exporting versus foreign direct investment. We also exploit the relationship between the size of the Pareto slope coefficient and variance below.

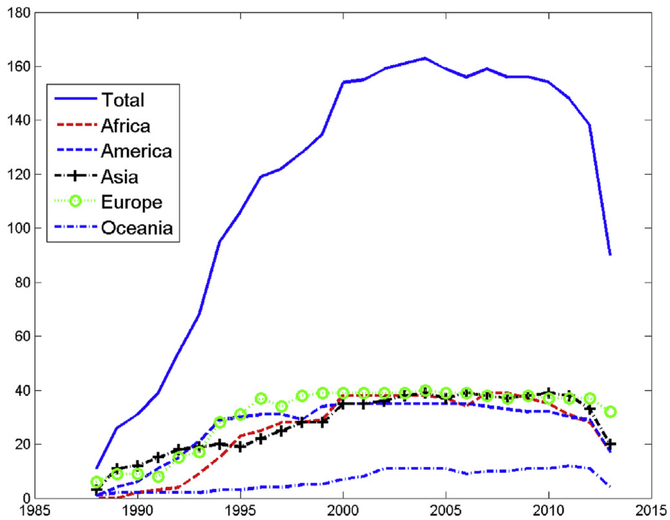

Fig. 2. Number of countries sampled in COMTRADE per year, total and by continent.

and also estimate mean-reversion in industry productivities. Neither Hanson et al. (2015) nor Levchenko and Zhang (2011) address other sources of exporting variability and compare among them. Another closely related paper is Gaubert and Itskhoki (2016), who study firm-level granular origins of comparative advantage. While the dynamic version of their model can mimic changes in industries' comparative advantage, they do not address the sources of firms' large productivity or demand shocks. In contrast, our analysis of the sources of export growth variability includes all possible dimensions, including product-specific, as well as destinations. This is important: one of our main findings is that source-by-product (or industry) variation – the focus of Levchenko and Zhang (2011), Hanson et al. (2015) and Gaubert and Itskhoki (2016) – is not a large source of instability in exports over time. Destination-related (including demand) factors matter more.[9]

3. Data description

We obtain data on goods exported by over 100 countries from the United Nation's COMTRADE database.[10] We use trade flows at the 4-digit HS code level, which keeps sufficient diversity of products, while minimizing the risk of measurement error due to the possibility of misclassification and changes in classifications over time. These risks increase as we disaggregate more (e.g., 6-digit level), especially for less developed countries.[11] For each of these goods we have information on bilateral exports by year. Fig. 2 shows that the sample of countries included each year is not constant. The sample increases constantly until the early 2000s and starts decreasing abruptly after 2010. Importantly, the selection of countries is not random as less developed countries are less likely to be present both in early and late years. Given these concerns, we focus our analysis on the years 1998–2010.

Keeping only countries which have trade data on both 1998 and 2010 leaves a sample of 127 countries. We combine the trade data with information on real PPP GDP per capita from the Total Economy Database (TED) and transform all prices to constant 2012 US dollars using the CPI index from the Federal Reserve Bank of St. Louis (FRED).[12] For some of our analysis we define two additional categories of goods – extractables and commodities – because of the (partly correct) belief that the poorest countries export mainly in these two categories. For this we use the reference suggested by the United Nations. The lists of goods included in each category are available in the Appendix.

4. Facts about export concentration and instability

4.1. Concentration of exports

In this section we show that the degree of concentration of exports is surprising for all countries. Table 1 shows that, on average, the single largest export category accounts for almost 28% of total exports. The top 20 exports account for 73.56% of total exports, and this figure is still extremely high even after excluding commodities and extractable goods.[13]

The pattern of concentration within the top 20 exported goods can be captured by fitting a line to log ranks (vertical axis) and log export shares (horizontal axis). Such "power laws" are remarkably successful in describing concentration at the tails of the distribution of many economic (and other) phenomena (for example, see Newman, 2005 and Gabaix, 2016).[14] This is true in our data as well. The last line in Table 1 reports the point estimate of the log rank regressed on log share across countries and groups of products. A smaller coefficient in absolute value implies higher concentration. These small coefficients, below unity in absolute value, indicate extremely high levels of concentration that are only slightly larger in absolute value when excluding commodities and extractables.[15]

We carry out the same analysis for what we call a "flow", defined as a particular product shipped to a particular destination, with very similar results. We illustrate this in the second set of columns in Table 1. Some differences are noticeable between the results that take into account the destination dimension and those that do not. First, the overall share of top 20 flows is smaller than for goods, which is to be expected. Second, concentration, as measured by the power law coefficient, is only slightly lower. These results are hardly affected when we exclude commodities and extractables.[16]

We further explore the degree of diversification of exports across destinations by summarizing concentration for the entire distribution. First, we calculate the Herfindahl index across destinations for each product exported from each country (higher index implies higher concentration). We then calculate the (trade value) weighted average of this index for each exporting country and year. We call this statistic the export Destination Concentration Index.

[9] Redding and Weinstein (2018) study sources of revealed comparative advantage in U.S. imports. They find that 90% of the time-series variation is accounted for by variation in quality/appeal and in variety, while the remainder 10% is driven by variation in prices. However, they do not assign these to either source country (exporters) factors or to destination (U.S.) factors. For example, variation in product quality can be associated either to firm investments or to shifts in consumer demand, and similarly for variety and equilibrium prices.

[10] The data is publicly available at http://comtrade.un.org/db/default.aspx.

[11] Easterly and Reshef (2016) demonstrate that mis-reporting at the HS 6-digit level is prevalent for developing countries, but much less so at the 4-digit level.

[12] For CPI we use the CPIAUCSL series from FRED, https://research.stlouisfed.org/fred2/. When using data on GDP per capita our sample is further reduced to 112 countries because TED does not report this information for 15 of the countries for which we have trade data.

[13] Table A1 in the appendix illustrates that African countries have more concentrated exports than OECD countries, on average. This relationship holds more generally: Higher income (GDP per capita in PPP units) is associated with lower shares of top 20 exported goods.

[14] Helpman et al. (2004) also use power coefficients to capture concentration.

[15] Power law coefficients less than one in absolute value (such as those in Africa) have the bizarre property that the mean of the underlying distribution is infinite. However, we are not claiming that the entire distribution fits a power law, only the tail of the top 20 categories.

[16] Table A2 in the appendix illustrates that the reduction in concentration when excluding commodities and extractables is much smaller for African countries versus OECD members. This illustrates another dimension of concentration: African exports are more concentrated across destinations within exported goods than OECD exports.

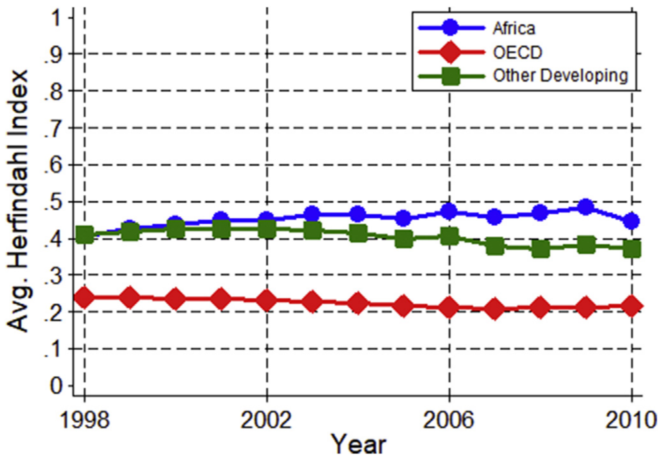

Fig. 3. Weighted average of export Destination Concentration Index (Herfindahl index over destinations for exports at the 4-digit HS code level, where weights are volumes in 1998). The figure reports the average index for all countries' trading partners in each region.
Source: COMTRADE.

Fig. 3 groups countries by their development stage. OECD countries are more diversified over destinations than African or other developing countries.[17] Differences in concentration are very persistent: We do not observe strong trends in this measure of concentration, despite significant changes in income for most countries during this period.

When we regress our measure of concentration across destinations on log GDP per capita, we get a negative and highly statistically significant coefficient: Richer countries are more diversified. Similarly, when we regress concentration across destinations on log total exports, we get a negative and highly statistically significant coefficient: Countries that export more do so in a less concentrated fashion.[18]

In summary, all countries have surprisingly extreme power laws in top export products and top flows, but there is also variation among them. The steepest (most negative) slopes and least concentration are for countries that are in these (overlapping) categories: Higher income and higher total exports. The destination specialization is also confirmed by surprisingly high Herfindahls by destination for the typical export product, although again the concentration is less for countries with higher income, and more overall exports.

4.2. *Instability of top exports*

Our most interesting and novel finding is the instability of exports. In Fig. 4 we illustrate this phenomenon for four countries: Tanzania, Ghana, Germany and The United States.[19] For each of these countries we rank the top 10 exported products (4-digit HS code) in 1998 and in 2010. Then, we show how the ranking of each top 10 export good changes from 1998 to 2010, and, vice versa, what the rank of each top 10 export good in 2010 was in 1998. Fig. 4 illustrates the great extent of churning of ranks in export data; it also demonstrates that instability is pervasive, both in developed and developing countries.[20]

We address a concern that we could be exaggerating instability; perhaps there is just a lot of measurement error, such as misclassification of products over time. Fig. 4 provides some reassurance that misclassification is not the primary factor in the results on instability. The replacement of former top goods by new ones generally features very different goods – they are generally not in adjacent categories that are likely to be subject to reclassification from one to another. We address other types of measurement error below.

For example, in Tanzania (Fig. 4-A), the top 3 exports in 1998 were nuts, coffee, and fish; these 3 shifted down to be #6, #7, and #8 in 2010. Conversely, copper, manganese, and precious metal ore were virtually nonexistent exports in 1998, but by 2010 occupied the second through fourth ranks in Tanzanian exports. The new #2 export, manganese, is a good example of concentration of destinations, as Tanzania's supplies went in 2010 only to China (65%), Japan (23%), and Germany (12%). It is also an example of a strong product effect, as total trade in manganese vastly expanded from only $308 million in 1998 to $4.2 billion in 2010.

In Ghana (Fig. 4-B), the #1 and #2 exports in 1998, cocoa and gold, switched places, with a huge increase for gold. Aluminum plates in Ghana went from #18 in 1998 to #3 in 2010. Manganese had the same kind of increase in Ghana as it did in Tanzania, going from $17 million to $119 million from 1998 to 2010, but Ghana's top destination for this product was Ukraine instead of China.

Although we will show that there is somewhat less instability for higher income countries relative to poorer ones, it is still surprisingly high. In Germany (Fig. 4-C), there is more stability in the top 4, but #5 (computers) declined to #9 in 2010, #6 (integrated circuits) went to #16, and #7 (motor vehicles for goods transport) declined to #21. Those export ranks were replaced by "blood, antisera, vaccines, toxins and cultures" (#91 to #5), and printing machinery (#12 to #6).

The United States (Fig. 4-D) illustrates even more instability than Germany. Aircraft was the top export in 1998 but fell to a rank of #143 in 2010, while the related category of aircraft parts fell from #7 to #40. "Oils petroleum, bituminous, distillates, except crude" rose from #25 in 1998 to #1 in 2010. Parts for office machines fell from #5 to #15, while "Medicaments, therapeutic, prophylactic use, in dosage" rose from #26 to #7.

Goods that show a fall in more than one country (such as computers or integrated circuits, all falling in the US, Germany and Japan) or a rise (printing machinery in Germany and Japan) could be reflecting worldwide product trends, a possibility that our analysis below will allow us to address. In the Appendix we illustrate that when ranks change, this is accompanied with huge swings in value, necessitating using log base 10 scales to be able to compare values in 1998 to values in 2010 (Figs. A2-A and A2-B). In another exercise in the Appendix (Table A5), we illustrate, through changes in the imports and exports of cut flowers, the possibilities for source, destination, and product to interact. There was a big overall increase in cut flowers trade, with the USA the biggest destination increase, which in turn benefited nearby flower exporters like Colombia and Ecuador. We explore source, product, and destination effects more formally in the last section.

In Table 2 we draw a more systematic portrait of instability. For each country in our sample we rank the top exported goods (4-digit HS code) both in 1998 and 2010. We then keep only those goods that were among the top (for alternative cutoffs, i.e. top 5, top 10, top 20, top 50 and top 100) in 1998. If a good is not exported in 2010, we assign it a 2010 rank of N+1, where N is the total number of goods exported in the corresponding country in 2010. Although not an ideal solution for disappearing products, it is not an issue for top 10, top 20 and top 50 goods, and rarely an issue otherwise, because if a top good is exported in 1998 it is almost always exported in 2010. We then compute the average across all countries of the Pearson correlation between ranks in 1998 and in 2010.[21] The average number of goods that a country exports in 1998 is reported in the last column of Table 2.

[17] This is mainly driven by European countries' higher diversification. Figures that separate European countries from the rest are available upon request.

[18] See Table A3 for regression results underlying these statements.

[19] In the Appendix we report additional figures for Uganda and Japan in Fig. A1.

[20] We do not report similar figures for top 20 products to ease the exposition, but these convey the same message.

[21] This is equivalent to computing Spearman rank correlations between the values of goods that were ranked in 1998 and their values in 2010.

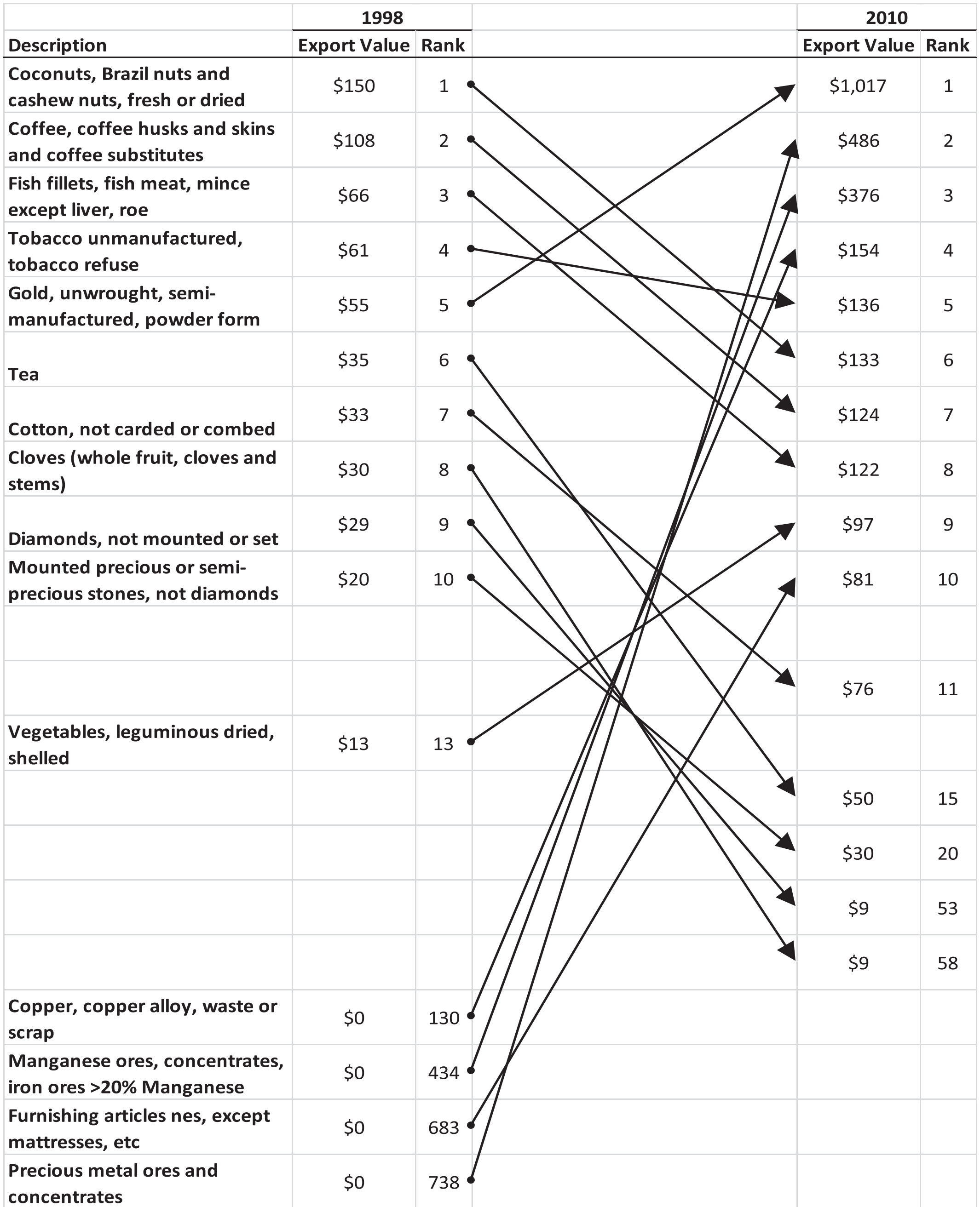

Fig. 4. A: Top exports churning. Panel A: Tanzania. Panel B: Ghana. Panel C: Germany. Panel D: United States. The figure reports for each country in each panel the ranks and values of top ten exports in 1998 and in 2010, and their ranking and value in the opposite end of the sample, all in 2012 prices (thousands of U.S. dollars). Source: COMTRADE.

Table 2 illustrates the pervasiveness of instability of exported goods (Panel A) and flows (Panel B). We prefer the cutoff at 20 as a sweet spot that captures concentration both for goods and for flows and where the power law seems to apply. However, we consider robustness to other cutoffs. For top 20 goods, which account for 73.56% of all exports, on average (Table 1), the rank correlation is 0.28. And rank correlations are even lower when we exclude commodities and extractables. The correlations remain low regardless of whether we focus on top 20, top 10, and top 5 goods. Panel B reports similar patterns for flows (product-by-destination), although, not surprisingly, the magnitude of correlations is much smaller. The upshot of Fig. 4 and Table 2 is simple: Churning is pervasive, even within the top exported goods and flows.

We now ask: Is the degree of instability and churning related to country characteristics? Using data on exports in 1998 and 2010 we define which goods belonged to either the top 5, top 10 or top 20 exports for each country-year. We report here the results on top 20; here and in all other tables and figures involving the top 20, the results on top 5 and 10 are available in the Appendix in the tables indicated in the note to each table or figure. We estimate the probability that 1998 top goods remain at the top in 2010, looking at the relation with good and country characteristics. We estimate linear probability model regressions of the type

$$y_{g,c,2010} = \alpha + \beta \cdot 1\{Top_{g,c,1998}\} + \gamma \cdot X_{g,c} \cdot 1\{Top_{g,c,1998}\} + \delta \cdot X_{g,c} + \mu_{g,c}, \quad (1)$$

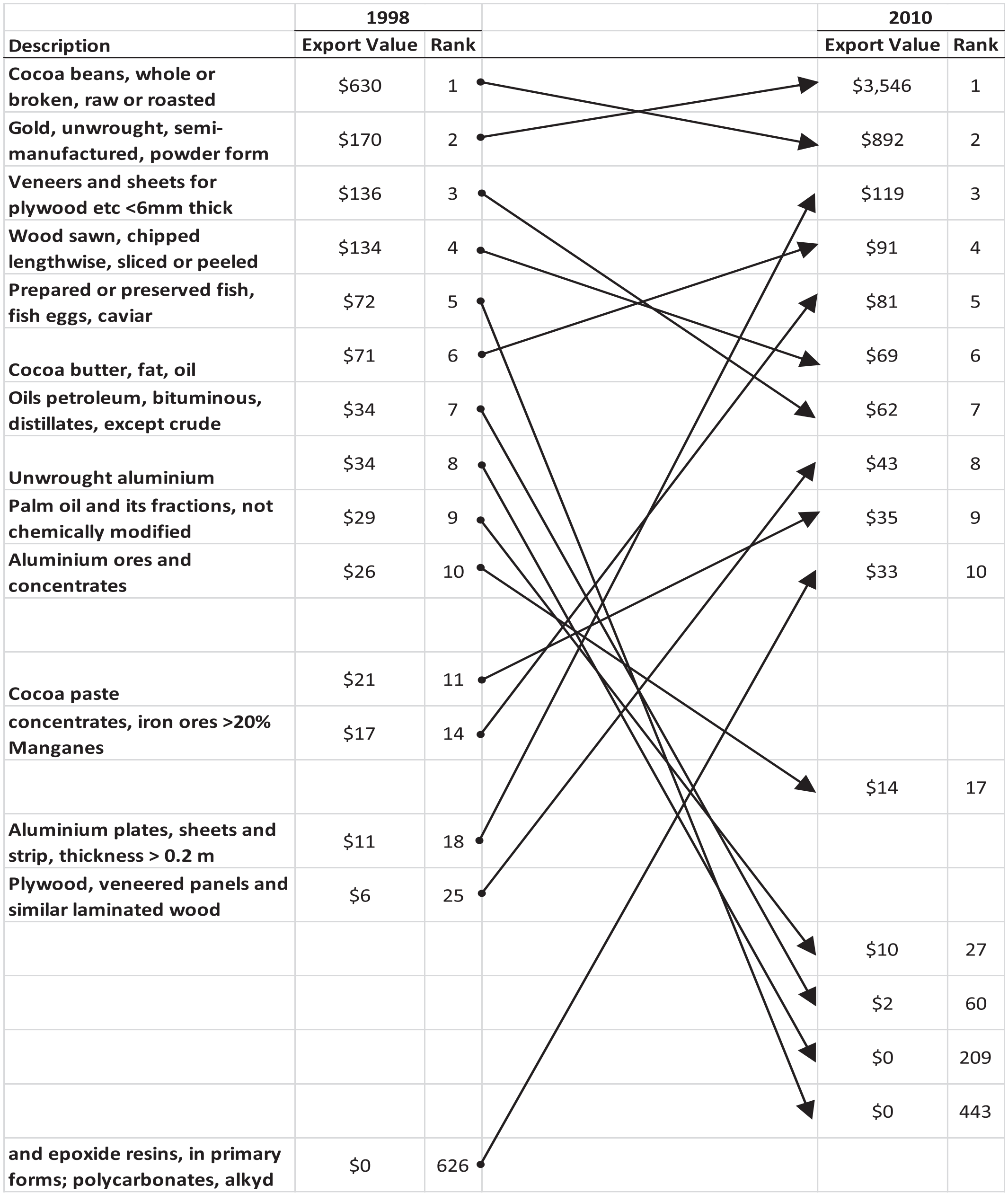

Fig. 4. (*continued*).

where $y_{g,c,t} = 1\{Top_{g,c,t}\}$ is an indicator for good g in country c is a top good in year $t = 1998$ or 2010, and $X_{g,c}$ stands for the characteristics of the good g and country c in 1998, which can be interacted with $1\{Top_{g,c,1998}\}$.[22] Since some of the right hand side regressors vary only by country (not by country and good), we cluster standard errors by country (Moulton, 1990). We report descriptive statistics and correlations in the Appendix.

Table 3 shows that without conditioning on any other information, the probability of remaining a top 20 good is around 0.54, a small probability in itself, which indicates the high degree of churning into and out of the top 20 group. Column 2 shows that overall, goods exported from richer countries have a lower probability to be in the top 20, by virtue of these countries exporting more products. But the probability of remaining a top 20 good – conditional on being a top 20 good in 1998 – is increasing in the level of GDP per capita of the country: Richer countries exhibit less instability.[23] The results in Table 3 are robust to alternative cutoffs of Top 5 or Top 10 products, as shown in the tables indicated in the in the Appendix. Fig. 5 illustrates that this result also holds when we look at flows (goods-by-destinations) rather than goods. Again, the results are robust to alternative top 5 or top 10 cutoffs.

In column 3 of Table 3 we add a control for concentration: the Herfindahl Index over Destinations for each product exported from each source exporting country. Higher concentration across destinations reduces the probability of a good to be in the top: Goods that are exported more evenly and to more destinations are more likely to be a top good. Higher concentration across destinations also reduces chances of remaining a top 20 good: Top goods that are exported more evenly and to

[22] We also estimated corresponding probit models, with similar results, which are available upon request.

[23] This is consistent with results in Fernandes et al. (2016), who find greater instability (entry and exit) at the firm level in developing countries.

	1998		2010	
Description	Export Value	Rank	Export Value	Rank
Motor vehicles for transport of persons (except buses)	$85,012	1	$135,467	1
Parts and accessories for motor vehicles	$21,565	2	$46,211	2
Medicaments, therapeutic, prophylactic use, in dosage	$13,786	3	$45,452	3
Aircraft, spacecraft, satellites	$13,390	4	$24,386	4
Automatic data processing machines (computers)	$12,312	5	$16,251	5
Electronic integrated circuits and microassemblies	$8,924	6	$14,703	6
Motor vehicles for the transport of goods	$8,476	7	$13,023	7
Electrical switches, connectors, etc, for < 1kV	$7,679	8	$12,719	8
Machines nes having individual functions	$6,911	9	$12,695	9
Pumps for liquids	$6,777	10	$11,746	10
			$11,692	11
Printing and ancillary machinery	$6,228	12	$11,361	12
Parts for internal combustion spark ignition engines	$5,904	13		
			$10,568	16
			$10,065	18
Instruments etc for medical, surgical, dental, etc use	$5,016	20		
			$9,317	21
Oils petroleum, bituminous, distillates, except crude	$3,438	37		
Blood, antisera, vaccines, toxins and cultures	$1,761	91		

Fig. 4. (*continued*).

more destinations are more likely to *remain* a top good. This result is significant, because it indicates the importance of destination-specific factors in determining instability, and we investigate this relationship further below. As we saw above, richer (OECD) countries are less concentrated by destination, and this can help explain part of the relationship of instability with income, as the coefficient to ln(Initial GDP per capita) × Top in Start Year drops by 40%. This is also evident in the correlations table in the Appendix.

Next, we check that our selection of years is not driving our results. We perform a similar analysis while allowing either initial or end years to change. First, we fix the initial year 1998 and look at the probability of remaining top goods in each year from 1999 to 2010. Then we estimate the reverse probability that goods that are top in 2010 were also among the top in the previous years.

These regressions also serve as a test on the risk of measurement error in the data. While Fig. 4 (A-D) was reassuring that misclassification errors were not driving our results, we are also concerned about reporting errors (as illustrated by the well-known fact that source and destination reports of the same trade flow show discrepancies). If measurement error explains our results, we would expect that the probability estimates to fluctuate erratically with no trend over time. They actually show a smooth trend, which is more consistent with gradual entry of new products and exit of old ones.

We first fit following linear probability models of the following form

$$y_{g,c,t} = \alpha + \beta_t \cdot 1\{Top_{g,c,1998}\} + \mu_{g,c,t}, \tag{2}$$

where β_t is the coefficient of interest, $t = 1999, 2000, \ldots 2010$. Fig. 6 reports the sequence of β_t's, (which are all precisely estimated) which are the probabilities of being a top 20 good in year t, conditional on being a top good in 1998. The decline in the probability of being in the top 20

Description	1998 Export Value	1998 Rank	2010 Export Value	2010 Rank
Aircraft, spacecraft, satellites	$51,786	1	$56,545	1
Electronic integrated circuits and microassemblies	$48,086	2	$41,373	2
Parts and accessories for motor vehicles	$38,974	3	$39,553	3
Automatic data processing machines (computers)	$36,388	4	$34,340	4
Parts, accessories, except covers, for office machines	$27,779	5	$25,209	5
Motor vehicles for transport of persons (except buses)	$23,526	6	$24,589	6
Parts of aircraft, spacecraft, etc	$21,519	7	$24,355	7
propellers/other gas turbine engines	$19,226	8	$23,166	8
Parts for use with lifting, moving machinery	$12,510	9	$19,568	9
Electric apparatus for line telephony, telegraphy	$11,701	10	$16,065	10
Instruments etc for medical, surgical, dental, etc use	$11,546	11		
			$14,851	12
Gold, unwrought, semi-manufactured, powder form	$7,077	15	$13,010	15
Soya beans	$6,880	17		
			$9,679	21
Oils petroleum, bituminous, distillates, except crude	$5,622	25		
Medicaments, therapeutic, prophylactic use, in dosage	$5,501	26		
			$5,561	40
			$1,876	142

Fig. 4. (*continued*).

goods is smooth, which suggests that measurement error is not solely driving our results. This result is robust to alternative cutoffs of Top 5 and Top 10, as shown in the Appendix figures indicated.

Fig. 6 also illustrates that persistence in Africa (as a simple way to capture low income countries) is lower than in the OECD countries, and that this is true over all horizons. A similar figure for the probability of being in the top 20 goods in 2010 conditional on being top in year $t = 2009, 2008 \ldots 1998$ delivers a similar message (and is available upon request).

Fig. 7 reports the coefficient to the interaction of income with being a top export good in 1998, γ_t, which captures the differential effect of income on persistence:

$$y_{g,c,t} = \alpha + \beta_t \cdot 1\{Top_{g,c,1998}\} + \gamma_t \cdot 1\{Top_{g,c,1998}\} \cdot \log(GDP\ per\ capita) + + \delta_t \cdot \log(GDP\ per\ capita) + \mu_{g,c,t} \quad (3)$$

The effect is always positive (and always precisely estimated), and remains similar for all time difference lengths, despite a weak overall downward trend. This implies that richer countries exhibit greater persistence of goods in the top, and that this effect is always positive and relatively stable, regardless of the time horizon.

We now ask: Is having more instability of top exports associated with worse export growth performance? We estimate specifications like equation (3), where we differentiate by high, medium and low export growth. Here "high" is defined as being at or above the 75th percentile of export growth, "medium" as being between 25th and 75th percentiles, and "low" as being at or below the 25th percentile. In Fig. 8 we find that a higher exit rate out of the top 20 goods for countries goes with more rapid

Table 2
Rank correlations indicate instability of top exported goods and flows. The table reports the average across all countries of the correlation between ranks of top goods (Panel A) and top flows (Panel B, where a flow is a product by destination) that were exported in 1998 and their ranks in 2010. N is the average number of goods or flows that a country exports in 1998. See text above for more details. Data: COMTRADE.

	Top 5	Top 10	Top 20	Top 50	Top 100	N
A. Goods, Top in 1998						
All Goods	0.44	0.33	0.28	0.25	0.29	882
Exclude Extractables	0.34	0.32	0.27	0.27	0.30	738
Exclude Extractables and Commodities	0.36	0.27	0.22	0.26	0.30	700
B. Flows, Top in 1998						
All Goods	0.08	0.13	0.10	0.06	0.09	16796
Exclude Extractables	0.12	0.19	0.10	0.08	0.08	14893
Exclude Extractables and Commodities	0.10	0.17	0.09	0.06	0.08	14496

Table 3
Probability of being in the top 20 goods in 2010, marginal effects. "Top Start Year" takes value one if the good was top 20 in 1998. See text above for more details. See Appendix I for alternative versions I.1 and I.2 with top 5 and top 10 exports. Standard errors clustered by country in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Data: COMTRADE.

	(1)	(2)	(3)
Top in Start Year	0.539***	0.00998	0.00918
	(0.0144)	(0.0146)	(0.0175)
ln(Initial GDPpc)		−0.00294***	−0.00419***
		(0.000364)	(0.000549)
ln(Initial GDPpc) × Top in Start Year		0.00665***	0.00614***
		(0.000912)	(0.000998)
Initial Herf. Index over Destinations			−0.0144***
			(0.00178)
Initial Herf. Index over Destinations × Top in Start Year			−0.00381
			(0.00371)
Observations	103,754	88,296	88,296
# of countries	102	100	100

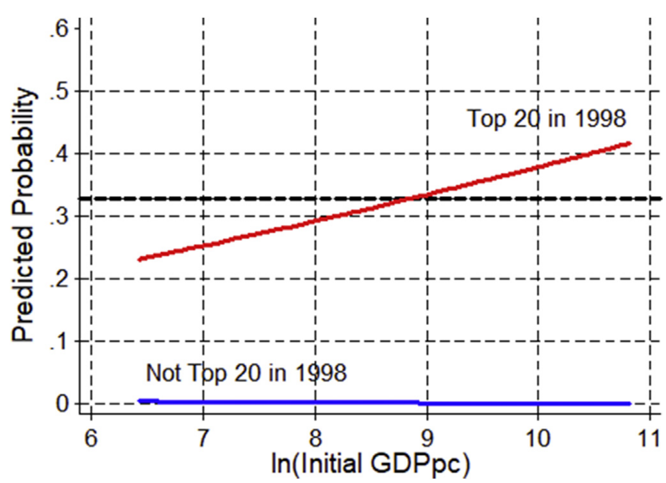

Fig. 5. Marginal Effects of GDP per Capita on Persistence of Top 20 Export Flows. The figure reports the predicted probability of being a top 20 flow in 2010 for flows that were (Top0 = 1) and were not (Top0 = 0) top 20 in 1998. The dashed line is the unconditional probability of a top 20 flow in 1998 of being a top 20 flow in 2010. See text above for more details. See Appendix I for alternative versions Fig. I.1 and I.2 with top 5 and top 10 exports. Data: COMTRADE.

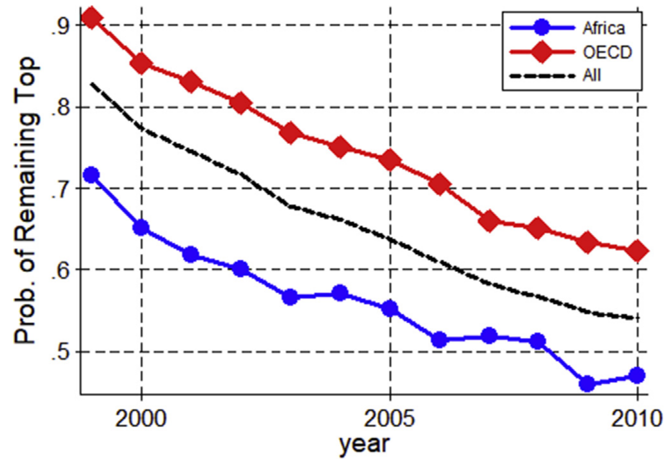

Fig. 6. The figure reports the predicted probability of being a top 20 good in each year conditional on being a top 20 good in 1998, as estimated by equation (2). See Appendix I for alternative Fig. I.3 and I.4 with top 5 and top 10 exports. Data: COMTRADE.

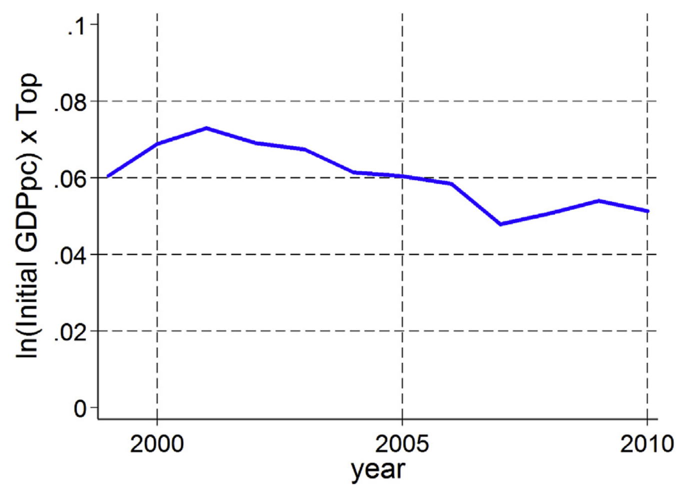

Fig. 7. Linear probability model, marginal effect of GDP on probability of remaining top good over time (Top 20, Goods). The figure reports the marginal effect of GDP on the predicted probability of being a top 20 good in 2010 for goods that were top 20 in 1998, as estimated in equation (3). See Appendix for alternative Fig. I.5 and I.6 with top 5 and top 10 exports. Data: COMTRADE.

overall export growth, and this difference becomes larger with longer horizons.[24]

In conclusion, this section presented the key finding of the paper – that instability of top exports is surprisingly high for all countries. The probability of remaining in the top exports falls smoothly with time, which suggests that simple i.i.d. measurement error is not solely driving the results. Across countries, instability is higher along the same splits featured in the previous section: low income vs. high income, Africa vs. OECD, and high export growth vs. low export growth.

[24] We focus on top 20 goods, but results are similar if using top 5 or top 10 goods; these results are shown in Appendix I. When we go in the opposite direction, the message is on instability is the same: goods that were in the top 20 category in 2010 have a differentially smaller chance of being in that category in earlier years for high export growth countries. This figure is available upon request.

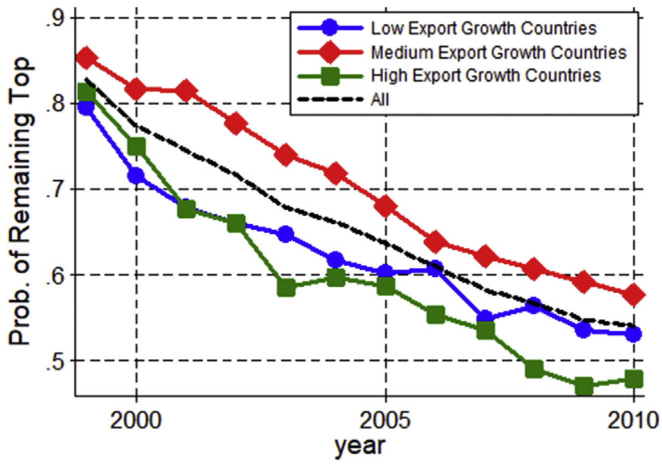

Fig. 8. Linear probability model, probability of remaining top good over time by Total Export Growth (Top 20, Goods). The figure reports the probability of being a top 20 good in each year for goods that were top 20 in 1998 for different groups of countries according to their total export growth between 1998 and the year in the horizontal axis. Here "high" is defined as being at or above the 75th percentile of export growth, "medium" as being between 25th and 75th percentiles, and "low" as being at or below the 25th percentile. See Appendix I for alternative Fig. I.7 and I.8 with top 5 and top 10 exports. Data: COMTRADE.

5. Sources of instability

So far we have illustrated the great degree of concentration in exports, and the instability within top exports. We now turn to characterizing the sources of this instability. A better accounting of the underlying sources of instability can inform theory and policy alike.

At the most basic level we can characterize an export flow along these dimensions:

(i) Exporter (source country) characteristics (absolute advantage due to infrastructure, export barriers, aggregate productivity, etc.);
(ii) Importer (destination country) characteristics (wealth or income level, import barriers, etc.);
(iii) Products (quality, world tastes or technological change, etc.).

We extend this to include the following interactions:

(iv) Source-product characteristics (including cost or technologically-driven competitiveness, policies and trade barriers across goods within exporter country, etc.);
(v) Destination-product characteristics (including tastes for particular goods in destination, productivity of good as an input at the destination, particular import barriers for specific product in importer country, as well as the general equilibrium effect of source-product characteristics on destination-product demand);
(vi) Source-destination bilateral characteristics (distance, trade relations, etc.).

We describe the importance of each of these dimensions in accounting for variation in trade flow growth. We do this in a non-parametric way, by studying the importance of each dimension using the variance (and covariance) share of fixed effects in the total variance of export growth.

The estimation framework starts from a gravity-inspired equation for log exports x from source s to destination d of product p in time t,

$$x_{sdpt} = \alpha_t + \theta_{st} + \vartheta_{spt} + \beta_{sdt} + \gamma_{pt} + \delta_{dt} + \rho_{dpt} + \varepsilon_{sdpt}, \tag{4}$$

where α_t captures a global aggregate trend in total trade; θ_{st} captures the aggregate productivity (absolute advantage) in source country s in time t; ϑ_{spt} captures the competitiveness of source country s in product p in time t; β_{sdt} captures the bilateral factors that affect exporting from s to destination country d in time t; γ_{pt} captures global demand for product p in time t; δ_{dt} captures the aggregate demand in destination country d in time t; ρ_{dpt} captures the relative demand in destination d for product p in time t; and ε_{sdpt} is the residual which may reflect source-destination-product specific demand or supply shocks over time.[25] Taking first differences of (4) from 1998 to 2010 we have

$$x_{sdp} = \alpha + \theta_s + \vartheta_{sp} + \beta_{sd} + \gamma_p + \delta_d + \rho_{dp} + \varepsilon_{sdp}, \tag{5}$$

where a variable without time subscript is in changes, e.g., $\alpha = \alpha_{2010} - \alpha_{1998}$. We estimate (5) by exploiting the variation in exports flows of different products across sources and destinations.[26]

In order to avoid losing observations that either end or start with zero exports, we replace log differences on the left hand side of (5) with bounded growth

$$x_{sdp} = \frac{x_{sdp,2010} - x_{sdp,1998}}{\frac{1}{2}\left(x_{sdp,2010} + x_{sdp,1998}\right)}, \tag{6}$$

which has the virtue of explicitly taking into account new goods that emerge, as well as old goods that disappear. That is, we take into account $x_{sdp,t}$ export values that are zero. We illustrate in the Appendix the relationship between growth and bounded growth. We test the sensitivity of our results to using bounded growth by comparing them to results obtained from a subsample that includes only strictly positive flows in 1998 and 2010, i.e. eliminating new and disappearing export flows. Overall, those results are similar, both qualitatively and quantitatively.

After estimating the fixed effects (FE), we describe the results for the average country in the sample. To do this, we first compute the share in total variance of each type of FE, covariance and residuals, separately for each country; then we compute the average share for the average country. We estimate fixed effects and evaluate the sources of export growth twice: Once for top 20 exports (defined as being in the top 20 category either in 1998 or in 2010, or in both), and for all exports. We also report results for the subsample that includes only strictly positive flows in 1998 and 2010.

We estimate fixed effects by least squares, and therefore the interpretation of the fixed effects estimates is that of partial derivatives. In other words, we contemplate variation along some dimension, while keeping all other dimensions fixed.

Since we do not employ a structural approach, we cannot precisely disentangle how much variation in destination market effects can be explained by variation in industry competitiveness, variation in trade costs (i.e. policy changes), changing national incomes, and how much is left to come from 'pure' demand factors that can reasonably be considered as exogenous. According to standard gravity models (e.g., Eaton and Kortum, 2002; Anderson and van Wincoop, 2003; Chaney, 2008), Product × Destination effects are driven by changing incomes in destinations, changes in expenditure shares across products within destinations, and "pure" demand factors – but also by variation in Source × Product factors (e.g., variation in industry competitiveness and policies across industries within source countries). For example, applying the Eaton and Kortum (2002) gravity framework at the level of the product, the log of exports x_{sdpt} is determined by the following equation

$$x_{sdpt} = -\theta_{st}\ln\left(\tau_{sdpt}c_{spt}\right) - \ln\left[\sum_{s'\in S_{dpt}}\left(\tau_{s'dpt}c_{s'pt}\right)^{-\theta_{st}}\right] + x_{dpt}, \tag{7}$$

where τ captures trade barriers (geographical, policies, or other), c captures technological, cost or policy driven productivity, x_{dpt} is the log of total expenditure on product p in destination d at time t, and S_{dpt} is the set

[25] Each of these components can be characterized in a gravity model. However, this representation ignores the concept of "structural gravity", e.g., the inter-linkages between source and destination fixed effects.

[26] We use the statistical package *Stata*'s routine *reghdfe* to estimate (5).

of sources that serve destination d in product p in time t. Here the elasticity θ_{st} may vary across sources and time. The first term captures the direct effect of factors that may affect exports. In our estimation, changes in this term are absorbed in the Source × Product fixed effects. The second term captures the effect of the sum of these factors in all source countries, multilaterally – including the destination itself. In our estimation, changes in this term are absorbed in the Destination × Product fixed effects.

Equation (7) illustrates that the Destination × Product fixed effects in (5) may be affected by changes in the patterns of policies and technology that originate in potentially all source countries. The dependence of variation in Destination × Product on source country variation in productivity in the same product is regulated by the sparseness of the trade network, or, more precisely, on the number of sources that serve each product in a destination and their relative importance. To see this, use (7) to derive the elasticity of exports (in levels) with respect to c_{spt}:

$$\frac{\partial x_{sdpt} c_{spt}}{\partial c_{spt}} = -\theta_{st}\left[1 - \frac{\left(\tau_{sdpt} c_{spt}\right)^{-\theta_{st}}}{\sum_{s' \in S_{dpt}} \left(\tau_{s'dpt} c_{s'pt}\right)^{-\theta_{st}}}\right]. \tag{8}$$

The 1 in the brackets in (8) captures the direct effect of a change in c_{spt} (an increase in the cost to product p in s at time t), while the second term captures the indirect effect through competition in the destination market. The indirect effect is always smaller than one, unless s is the sole supplier (i.e., $S_{dpt} = \{s\}$, which is rarely the case as d is almost always included in S_{dpt}), and is smaller still when the size of S_{dpt} increases. It is also smaller when s is a relatively less important supplier of d. The latter is governed by relative productivity of product p in s compared to all other suppliers.

In order to gauge the importance of the indirect effect we calculate the following statistics. The median number of sources (excluding the domestic economy of the destination itself) for the average product in the average destination is 7 and the mean is 12.3 (the maximum number of sources in our data is 124). If we weight these by relative size of imports, the median increases to 46 and the mean to 49 sources. We obtain virtually the same numbers when we drop extractables and commodities.[27] In addition, while the unweighted distribution of sources is skewed (the mean is greater than the median), the weighted distribution is not (a uniform distribution is a good approximation). From these facts we conclude that while the trade network is not evenly distributed, it is not as sparse as to create a serious misrepresentation of the role of Source × Product relative to Destination × Product variation – especially when one contemplates the larger trade flows that count, e.g. the top 20 products for any country.[28] In other words, we estimate the indirect effect in (8) to be small, particularly for the large trade flows that matter. As another way to gauge the importance of these interdependencies, we examined the covariances between Source × Product and Destination × Product fixed effects in our estimation (these are reported in the more elaborate versions of Tables 4 and 5). We generally find negligible covariances as a share of overall variance, in particular between Source × Product and Destination × Product fixed effects, which is consistent with our analysis of the sparseness of the trade network above. This result indicates that overall, the general equilibrium linkages do not completely invalidate our interpretation of partial effects. However, we still acknowledge that Destination × Product fixed effects contain some degree of (indirect) general equilibrium linkages to Source × Product factors that we are unable to separately identify.

Table 4 reports the main results. The first row reports the average standard deviation of bounded growth for each sample. This number can

Table 4
Variance decompositions of export growth of export flows in 1998–2010 for the average country. There are four subsamples: top 20 exports (either in 1998 or in 2010 or in both), all export flows, and the same while restricting to strictly positive export flows in both 1998 and 2010. Columns do not sum exactly to 100 because other covariance terms are not reported here; these covariance terms account for small shares of overall variance. See Appendix I for alternative Table I.3 with top 5 and top 10 exports. Data: COMTRADE.

Sample:	Top 20 Flows	All Flows	Strictly positive flows in 1998 and 2010	
			Top 20 Flows	All Flows
Standard deviation	1.54	1.62	1.24	1.26
Perecent of overall variance				
Source	6	8	7	5
Source × Product	10	12	13	15
Source × Destination	13	5	14	4
Product	6	5	6	5
Destination	10	8	4	3
Destination × Product	17	7	21	12
Residual	41	55	42	60

be compared to 4, which is the range of bounded growth (from −2 to 2). Unsurprisingly, it is lower when we exclude new and disappearing flows. There is some variation across subsamples, but the broad message is similar: variation in export growth is driven by all dimensions. The single largest dimension is the residual, accounting for 41–60 percent of overall variance. The residual becomes much more important outside of the top 20 exports. We omit from Table 4 the covariance terms, which account for a negligible amount of overall variation (see Appendix for how small their contribution is).

The key result in Table 4 is that variation in Source × Product factors account for only 10–12% of overall variation in export growth, or 13–15% when we do not consider new and disappearing flows. Pure source country effects add to this 5–8%. Together, the Source plus Source × Product factors account for 16–20% of overall variation in export growth. This suggests that theories of export success that focus only on industry competitiveness and/or overall country productivity (and the policies motivated by these) may be missing other important determinants of export success. This result is robust to alternative cutoffs of Top 5 or Top 10 products, as shown in the Appendix tables indicated in the note to Table 4.

It is particularly telling that these results are broadly similar for countries with high, medium and low total export growth, and across different regions and levels of development, as illustrated in Table 5 for top 20 export flows, although there are some important differences too. Africa has higher overall variation in export growth than Europe. Africa also has a somewhat higher share of Source × Product and Source × Destination effects. High growth countries overall have a larger share of export growth associated with source-country effects, largely at the expense of residual forces. In the Appendix we report results like those in Table 5 for the other samples in Table 4. We also report in the Appendix similar tables that restrict the analysis to top 5 and top 10 export flows. These conclusions are not materially changed.[29]

The global Product, Destination and Destination × Product interaction effects together account for a similar share of overall variation as the sum of effects involving the source country, Source, Source × Product

[27] Panagariya and Bagaria (2013) also examine the number of sources for U.S. imports of HS 6-digit imports.

[28] Within the top 20 products the unweighted median number of sources per destination for the average product is 16 and the mean is 22. These numbers increase to 51 and 52, respectively, when we weight observations by relative size of imports.

[29] The decomposition of sources of variation that account for the variation in export growth within the top 5 and top 10 export flows are reported in Tables I.3–I.5 in Appendix I. The conclusions are not materially different from what we find for top 20 export flows in Table 4 in the main text and the corresponding appendix Tables A7–A10. In particular, comparing Table I.3 to Table 4, we see that Source and Source × Product effects account for the same percent of variation for top 5, top 10 and top 20 export flows. Bilateral Source × Destination effects seem to matter more for top 5 and top 10 export flows, while the residual absorbs less of the variation.

Table 5
Variance decompositions of export growth of top 20 export flows in 1998–2010 for the average country within each subset of countries. Countries are classified as "low" export growth if their export growth is at or below the 25th percentile, "medium" if between 25th and 75th percentiles, and "high" if export growth is at or above the 75th percentile of export distribution. Columns do not sum exactly to 100 because other covariance terms are not reported here; these covariance terms account for small shares of overall variance. See Appendix for alternative Tables I.4 and I.5 with top 5 and top 10 exports. Data: COMTRADE.

	World	Africa	America	Asia	Europe	Export Growth		
						Low	Medium	High
Standard deviation	1.54	1.73	1.56	1.56	1.49	1.51	1.52	1.57
Perecent of overall variance								
Source	6	6	6	10	4	2	3	12
Source × Product	10	15	13	10	8	9	10	14
Source × Destination	13	22	14	13	12	13	14	14
Product	6	5	5	7	6	5	7	5
Destination	10	12	9	10	11	11	11	10
Destination × Product	17	18	19	16	16	16	18	18
Residual	41	32	41	38	45	45	42	34

Table 6
Variance shares, income and export diversification. The Table reports OLS estimates of how variance shares vary across countries with log GDP per capita and with the Destination Concentration Index. GDP data are from the World Bank's World Development Indicators. Destination Concentration Index is the weighted average of the Initial Herfindahl Index over destinations within a source exporting country, where the weights are export values. Both regressors pertain to 1998. See Appendix I for alternative Table I.6 with top 5 and top 10 exports. Source for exports is COMTRADE.

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent Variables: Percent of Variance of Export Flow Growth due to					
	Var(Source × Product)	Var(Source × Destination)	Var(Product)	Var(Destination)	Var(Destination × Product)	Var(Residual)
A. Top 20 flows						
Log GDP per capita	−2.706***	−3.713***	0.114	−0.794**	−1.034**	4.584***
	(0.666)	(0.550)	(0.279)	(0.305)	(0.422)	(0.579)
Destination Concentration Index	17.93***	13.34***	−2.215	−9.976***	−5.345*	−5.684
	(4.936)	(4.079)	(2.071)	(2.263)	(3.129)	(4.294)
B. All flows						
Log GDP per capita	−3.004***	−2.810***	0.321***	−1.356***	−0.326	4.990***
	(0.607)	(0.468)	(0.111)	(0.397)	(0.239)	(0.556)
Destination Concentration Index	21.94***	8.658**	−2.910***	−12.54***	−2.489	−8.322**
	(4.499)	(3.469)	(0.823)	(2.940)	(1.773)	(4.119)

and Source × Destination, even though the latter does not capture strictly only source country effects. While we cannot rigorously use this decomposition to locate the micro origins of the shocks driving export flows, these results suggest that a lot of action in exports is *not* driven by source country factors alone. The upshot is that perhaps too much export success or failure is attributed to the source countries as opposed to demand effects coming from outside the source country. This helps understanding why specializations are so unstable: they may be driven by demand effects coming from many different sources.

We now ask more systematically whether the importance of each dimension of export growth variation changes with development and with concentration of products across destinations. To do this, we regress the shares from Table 4 for top 20 exports (defined as being in the top 20 category either in 1998 or in 2010, or in both) and all export flows (including new and disappearing flows) on log GDP per capita and on the Destinations Concentration Index (both in 1998).

Table 6 reports the results. Source × Product and bilateral Source × Destination factors account for less of overall variance for richer countries. The share of export growth variation that is driven by residual forces is smaller for less developed countries, while the share of export growth variation that is driven by Source × Product and by Source × Destination forces are greater there.[30] In countries with more concentrated export networks across destinations we find that Source × Product and bilateral Source × Destination factors account for more of overall variance. In contrast, Destination and Destination × Product effects are less important for these countries with more concentrated export networks. This may seem counterintuitive, since more concentration across destinations may increase the sensitivity of export growth to destination-related factors. One possible explanation for this finding is that exports are concentrated on relatively stable sources of demand. These results are robust to alternative cutoffs for Top 5 or Top 10 flows, as shown in the Appendix tables indicated in the notes to the corresponding tables.

We draw a few conclusions from this part of our analysis. First, the interaction between source and destination factors at the product level is important for understanding export growth.[31] This implies that modeling variation in demand at the product level across countries is warranted. Consistent with this, Eaton et al. (2011) illustrate that adding demand variation at the firm level is very important for understanding the pattern of exports in France. Trade models that rely on symmetric dispersion in productivity across countries – e.g., Eaton and Kortum (2002) – miss this important dimension. Here we show the importance of demand shocks at the industry (4-digit) level. This is consistent with Gaubert and Itskhoki (2016), who find that granular firm-level shocks are important for understanding industry-level exports. Here we investigate the potential sources of these shocks, and we find that much of the variation originates outside of the exporting-country. While not accounting for the bulk of variation, Source × Product variation seems to matter more for less

[30] These findings are consistent with Hanson et al. (2015), who find greater churning of industry productivities for less developed countries. This is accounted for in our Source × Product variation, which, according to our Table 6 accounts for more variation in less developed countries. As noted on Table 5, Africa shows higher variation of export growth than Europe. This implies greater churning there, which is in line with the Hanson et al. (2015) finding on less developed countries.

[31] We also illustrate this in the analysis of the cut flower export market in the Appendix (Table A5).

developed countries. This is consistent with Hanson et al. (2015), who obtain a similar result for industry productivities, which is included in our Source × Product variation.

Second, and related to the first point, our results inform policy. Less than 15% of the variation in export growth can be explained by variation in Source × Product factors (be they technology or product-country specific policies), leaving the lion's share to other forces that are outside the realm of national export promotion and common industrial policies. Less than 14% of the variation in export growth is explained by variation in bilateral Source × Destination forces. The high shares of product, destination, and product × destination effects further diminishes the emphasis on the nations where the exports originate.

Third, the high share of idiosyncratic variance (Residual at the source-product-destination level of variation), even for top 20 products, points to even less ability to predict export successes through industrial policies. These results are suggestive that it would be better to emphasize policies that can affect the ease of doing business more generally, and letting entrepreneurs in the source countries find markets for their products on their own (while also encouraging entrepreneurs in the destination countries to source products in the nations of origin).

6. Conclusions

Our analysis contributes to the literature that documents the phenomenon of extreme export specialization and "granularity", where a few narrow product categories or export flows (here, at the 4-digit level) account for a surprisingly high share of total exports. Our most novel finding is that these specializations are not persistent over time. Using data from 1998 to 2010, we observe major reshufflings of the top ranks across products between 1998 and 2010 for all countries, including the entry of some products in 2010 that were nonexistent in 1998, and the disappearance of some goods that were in the top 20 in 1998. The instability holds also for export flows (defined by a product by destination). Instability is somewhat lower for richer economies, and economies where exports are more diversified. Measurement error is unlikely to be an important determinant of this pattern.

In order to understand the instability of top exports we decompose the variance of growth from 1998 to 2010 of exports of product *p* from source *s* into variations due to (1) source effects (including overall productivity growth), (2) source-by-product effects (such as industry competitiveness), (3) bilateral source-by-destination effects, (4) global product growth, (5) overall destination demand growth, (6) destination-by-product specific demand growth, and (7) a residual. Our key finding is that changes in source-by-product factors play a smaller role than we expected – only about 10–12% percent of the variance. We find that variation that does not involve the source country directly (5 and 6) are as important as those that do (1 and 2). The residual accounts for 41–55% of the variance, stressing even more the instability and unpredictability, even of the top export specializations. Richer economies' export growth is driven less by variation in source-by-product factors and bilateral ties, as well as economies with more diversified export networks. This may reflect greater importance of intra-industry trade in more developed economies, which rely on trade networks for differentiated goods.

We acknowledge the difficulty of identifying the precise sources of shocks, due to general equilibrium linkages. However, together these findings are suggestive that the common attribution of export successes and failures to the policies or other characteristics of the source country is exaggerated. The forces operating outside the source country overall play a larger role than usually appreciated, and even bilateral relationships (source-by-destination effects), which account for no more than 13 percent of overall variance (22 percent for African countries), reflect policies and other characteristics in the destination importing country as much as in the source country. The shocks coming from outside the country help us understand the instability of top export specializations.

The combination of important forces in export specialization coming from outside the country and the remarkably high instability and unpredictability of top specializations suggest that industrial policies that try to guide specialization could face grave challenges coping with fast-moving shocks. The findings could support policies that allow local entrepreneurs to rapidly enter and exit specializations by product and destination in response to large changes in opportunities in the global trade market.

Appendix

A. *Definition of commodities and extractables*

We do our best to define the goods that belong to the broad categories of extractables and commodities, based on the analysis of the list of goods from http://www.foreign-trade.com/reference/hscode.htm and arrived to the following categories. We present here the list included in each category. Each entry is defined by the code and a small description available. Codes with four digits are already at the AG4 aggregation level, while those with just two digits are at the AG2 level and imply that all sub-goods are included.

Commodities:
- 09 coffee, tea, mate & spices
- 10 cereals
- 12 oil seeds/misc. grains/med. plants/straw
- 13 lac, gums, resins, etc.
- 1701 cane or beet sugar & chem pure sucrose, solid form
- 18 cocoa & cocoa preparations except 1806 chocolate & other food products containing cocoa
- 2401 tobacco, unmanufactured, tobacco refuse
- 4001 natural rubber, balata, gutta-percha, guayule, chicle and similar natural gums, in primary forms or in plates, sheets or strip
- 4501 natural cork, raw or simply prep, waste cork etc.
- 5001 silkworm cocoons suitable for reeling
- 5002 raw silk (not thrown)
- 5003 silk waste, including silk yarn waste etc.
- 5101 wool, not carded or combed
- 5102 fine or coarse animal hair, not carded or combed
- 5103 waste of wool or of fine or coarse animal hair
- 5104 garnetted stock of wool/fine or coarse animal hair
- 5105 wool & fine or coarse animal hair, carded & combed

5201 cotton, not carded or combed
5202 cotton waste (including yarn waste etc.)
5203 cotton, carded or combed
5204 cotton sewing thread, retail packed or not
5301 flax, raw etc but not spun, flax tow and waste
5302 true hemp, raw etc not spun, true hemp tow and waste
5303 jute & other text bast fibers nesoi, raw etc & tow etc
5304 sisal & other agave text fibers, raw etc & tow etc
5305 coconut, abaca, ramie etc nesoi, raw etc, tow etc

Extractables:

25 salt, sulphur, earth & stone, lime & cement
26 ores slag & ash
27 mineral fuels, oils, waxes & bituminous sub
28 inorganic chem, org/inorg compounds of precious metals, isotopes
29 organic chemicals
7101 pearls, natural or cultured, not strung or set etc
7102 diamonds, worked or not, not mounted or set
7103 precious nesoi & semiprec stones, not strung etc
7104 synth prec or semiprec stones etc, not strung etc
7105 dust & powder of nat or synth prec or semipr stone
7106 silver (incl prec plated), unwr, semimfr or powder
7107 base metals clad w silver not frth wkd than smmnfctrd
7108 gold (incl put plated), unwr, semimfr or powder
7109 base metal or silver clad w gld not frtr wkd th smmnfctrd
7110 platinum, unwrought, semimfr forms or in powder fm
7111 base metal a slv a gld cld w put nt fr wkd th smnfctd
7112 waste & scrap of prec metal or metal clad w prec metal
72 iron & steel
7401 copper mattes, cement copper (precipitated copper)
7402 unrefined copper, copper anodes for electrolytic refining
7403 refined copper & alloys (no mast alloy), unwrought
7404 copper waste and scrap
7405 master alloys of copper
7406 copper powders and flakes
7407 copper bars, rods and profiles
7408 copper wire
7409 copper plates, sheets & strip, over 0.15 mm thick
7501 nickel mattes, nickel oxide sinters, other int prod
7502 nickel, unwrought
7503 nickel waste and scrap
7504 nickel powders and flakes
7505 nickel bars, rods, profiles and wire
7506 nickel plates, sheets, strip and foil
7601 aluminum, unwrought
7602 aluminum waste and scrap
7603 aluminum powders and flakes
7604 aluminum bars, rods and profiles
7605 aluminum wire
7606 aluminum plates, sheets & strip over 2 mm thick
7607 aluminum foil (back or not) n/ov 2 mm th (ex back)
7801 lead, unwrought
7802 lead waste and scrap
7803 lead bars, rods, profiles and wire
7804 lead plates, sheets, strip, foil, powder & flakes
7901 zinc, unwrought
7902 zinc waste and scrap
7903 zinc dust, powders and flakes
7904 zinc bars, rods, profiles and wire
7905 zinc plates, sheet, strip and foil
8001 tin, unwrought
8002 tin waste and scrap
8003 tin bars, rods, profiles and wire
8004 tin plates, sheet and strip over 0.2 mm thick
8005 tin foil (backed or not), n/ov .2 mm, tin pow & flak
81 base metals nesoi, cermets, articles etc.

B. *Export concentration across regions*

Table A1
Export concentration among top 20 goods, distribution within top 20 goods, and power law coefficients. The table reports the average share of top 20 goods for all countries in groups (Africa, Non-African Countries, and OECD members) at the 4-digit HS code level. Source: COMTRADE. Data from 2010.

Rank	Export Shares								
	African Countries			Non-African Countries			OECD		
	All Goods	Excl. Extractables	Excl. Extractables and Commodities	All Goods	Excl. Extractables	Excl. Extractables and Commodities	All Goods	Excl. Extractables	Excl. Extractables and Commodities
1	37.29	30.93	21.68	25.25	20.89	21.38	12.74	11.53	11.71
2	13.32	12.51	11.78	10.79	9.37	9.02	7.60	6.82	6.91
3	8.33	8.04	7.52	6.46	6.01	6.08	4.49	5.00	5.07
4	5.26	4.95	5.26	4.65	4.51	4.45	3.76	3.72	3.76
5	3.62	3.65	4.28	3.46	3.51	3.48	3.00	3.09	3.13
6	2.78	2.93	3.50	2.76	2.88	2.85	2.53	2.59	2.62
7	2.21	2.34	2.85	2.27	2.47	2.46	2.13	2.23	2.25
8	1.87	2.05	2.44	1.98	2.19	2.11	1.81	1.95	1.97
9	1.50	1.83	2.18	1.68	1.90	1.83	1.63	1.73	1.74
10	1.32	1.59	1.93	1.49	1.67	1.64	1.49	1.54	1.55
11	1.18	1.42	1.74	1.32	1.51	1.47	1.32	1.39	1.39
12	1.06	1.27	1.57	1.21	1.36	1.36	1.21	1.31	1.32
13	0.92	1.16	1.44	1.10	1.26	1.26	1.12	1.23	1.23
14	0.83	1.03	1.30	1.01	1.17	1.17	1.07	1.16	1.14
15	0.74	0.95	1.22	0.94	1.07	1.08	0.99	1.07	1.07
16	0.68	0.89	1.14	0.87	1.00	1.02	0.95	1.01	1.02
17	0.63	0.83	1.07	0.81	0.95	0.96	0.90	0.96	0.95
18	0.59	0.77	0.99	0.77	0.89	0.90	0.84	0.91	0.91
19	0.55	0.72	0.92	0.72	0.85	0.85	0.80	0.87	0.87
20	0.52	0.69	0.90	0.68	0.80	0.80	0.77	0.84	0.84
Total	85.18	80.56	75.71	70.20	66.26	66.18	51.15	50.93	51.45
Power Law	−0.66	−0.75	−0.86	−0.82	−0.94	−0.94	−1.08	−1.14	−1.13

Table A2
Export concentration among top 20 export flows (product-by-destination), distribution within top 20 flows, and power law coefficients. The table reports the average share of top 20 goods for all countries in groups (Africa, Non-African Countries, and OECD members) at the 4-digit HS code level. Source: COMTRADE. Data from 2010.

Rank	Export Shares								
	African Countries			Non-African Countries			OECD		
	All Goods	Excl. Extractables	Excl. Extractables and Commodities	All Goods	Excl. Extractables	Excl. Extractables and Commodities	All Goods	Excl. Extractables	Excl. Extractables and Commodities
1	20.85	14.46	14.74	14.50	12.40	13.13	12.74	11.53	11.71
2	9.88	8.99	7.82	6.74	5.48	5.52	7.60	6.82	6.91
3	7.07	6.46	5.13	4.60	3.79	3.83	4.49	5.00	5.07
4	4.93	4.44	3.94	3.38	2.89	2.96	3.76	3.72	3.76
5	3.91	3.57	3.15	2.73	2.42	2.39	3.00	3.09	3.13
6	3.15	2.87	2.69	2.18	1.98	1.94	2.53	2.59	2.62
7	2.42	2.52	2.23	1.89	1.77	1.73	2.13	2.23	2.25
8	2.06	2.09	1.94	1.69	1.57	1.52	1.81	1.95	1.97
9	1.75	1.78	1.70	1.53	1.38	1.34	1.63	1.73	1.74
10	1.53	1.56	1.53	1.35	1.24	1.21	1.49	1.54	1.55
11	1.39	1.38	1.41	1.21	1.13	1.10	1.32	1.39	1.39
12	1.23	1.29	1.33	1.07	1.03	1.01	1.21	1.31	1.32
13	1.12	1.20	1.24	0.98	0.97	0.96	1.12	1.23	1.23
14	1.05	1.12	1.17	0.89	0.89	0.90	1.07	1.16	1.14
15	0.96	1.05	1.12	0.82	0.84	0.84	0.99	1.07	1.07
16	0.87	0.99	1.04	0.78	0.80	0.79	0.95	1.01	1.02
17	0.82	0.93	0.98	0.73	0.75	0.75	0.90	0.96	0.95
18	0.78	0.87	0.92	0.68	0.71	0.70	0.84	0.91	0.91
19	0.74	0.82	0.89	0.65	0.68	0.66	0.80	0.87	0.87
20	0.69	0.78	0.84	0.62	0.65	0.63	0.77	0.84	0.84
Total	67.19	59.18	55.80	49.01	43.37	43.90	51.15	50.93	51.45
Power Law	−0.85	−0.96	−1.04	−0.95	−1.04	−1.02	−1.28	−1.45	−1.45

C. Correlates of power law coefficients

Table A3 correlates power law coefficients from Table 1, which capture concentration at the top, with a few covariates of interest. Higher GDP per capita makes the power law coefficient more negative (i.e. increases it in absolute value), which implies lower concentration. The higher prevalence of multiproduct firms in richer countries can explain the fact that exports from richer countries are more concentrated in firms, (discussed in Fernandes et al. (2016)), but less concentrated in products.

When we include a GDP per capita squared term (not reported), it is marginally significant at the 10 percent level. The implied turning point for log (GDPPC) is about 10, which is at the upper end of our sample range. Hence the negative relationship between GDP per capita and the power law coefficient holds for most of our sample range. The squared term is not precisely estimated for the regressions using flows, which corroborates our conclusion that overall concentration is higher for less developed countries.

Power law coefficients also have a strong inverse relationship with the scale of total exports. The largest exporters are less concentrated at the top. This could reflect that both these coefficients and total exports are correlated with income, and indeed the coefficient is not significant controlling for income in column (4).

Another important dimension is the total number of nonzero goods export categories (at the HS4 level) by exporter. The number of nonzero goods exported is itself a measure of (non)concentration, so we are really assessing how one type of concentration measure predicts a different type of concentration measure. The two measures are indeed strongly correlated: The steepest power laws are in countries that have many nonzero entries for different goods, implying that these exporters are less concentrated. This result survives controlling for income and total exports (column 4). When we examine concentration within top export flows (good-by-destination), the results are broadly similar to those for goods, but somewhat stronger.

Table A3

Concentration across goods (4-digit HS codes), or flows (4-digit HS codes by destination) and development, total exports and the number of exported goods. The table reports OLS regressions of power law coefficients on log GDP per capita (in PPP units), log total exports, log number of goods exported. Data: COMTRADE, in 2010. Standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$.

	Dependent Variable: Power Law Coefficient for Top 20 Goods							
	Goods				Flows			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
ln(GDPpc)	−0.0573***			−0.00749	−0.106***			0.00407
	(0.0196)			(0.0240)	(0.0259)			(0.0290)
ln(Total Exports)		−0.0395***		0.0113		−0.0833***		0.0764**
		(0.0123)		(0.0187)		(0.0161)		(0.0294)
ln(# Goods Exp)			−0.295***	−0.316***			−0.195***	−0.296***
			(0.0467)	(0.0679)			(0.0216)	(0.0456)
R-squared	0.074	0.076	0.241	0.254	0.133	0.177	0.394	0.427
# of countries	110	127	127	110	110	127	127	110

D. Export growth across regions and types of goods

Table A4

Export growth across regions and types of goods. Details: "Avg. Country" is the average country level export growth (1998 = 100) in each region; "Top 5 in 1998" refers to the 5 biggest countries in each region in 1998; "with share >10% in 1998" refers to the countries which exported more than 10% of total exported in each region in 1998; Median, Perc. 90th and Perc. 10th refer to the corresponding country quantile in each region regarding export growth; "w/o extractable" and "w/o ext. or commodity" removes the corresponding set of goods from the exports calculations.

	Africa	America	Asia	Europe	Oceania
Avg. Country	285	261	423	249	142
Avg. Country, Top 5 in 1998	390	190	293	157	142
Avg. Country, with share >10% in 1998	444	155	320	142	235
Median Country	214	195	279	193	122
Perc. 90th Country	521	464	642	419	279
Perc. 10th Country	98	91	106	138	45
Avg. Country, w/o Extractable	331	195	285	230	111
Avg. Country w/o Ext. or Commodity	409	218	293	229	134
Avg. w/o Extractable, Top 5 in 1998	235	164	287	150	111
Avg. w/o Ext. or Commodity, Top 5 in 1998	244	159	290	150	134

E. Top exports churning: additional figures

In Uganda, electrical energy went from being #5 in 1998 to #28 in 2010, while cement went from #14 to #4. Cement in 1998 had almost all gone to Democratic Republic of Congo, but Uganda had added an even larger market in Rwanda in 2010 (possibly reflecting Rwanda's rapid growth from 1998 to 2010). Cell phones also show a big increase in rank as an export; these are likely to be re-exports, since imports of cell phones are even larger and it is unlikely that Uganda is manufacturing cell phones as a final good.

In Japan, computers went from the #3 export in 1998 to #67 in 2010, while printing machinery went from #50 in 1998 to #7 in 2010. Japan's #5 export in 2010 was "Machines used to produce semiconductors, integrated circuits, and flat panels", while this category was virtually nonexistent in 1998. In the richer countries at the technological frontier, technology changes are an added source of export instability.

	1998		2010	
Description	Export Value	Rank	Export Value	Rank
Coffee, coffee husks and skins and coffee substitutes	$404	1	$299	1
Fish fillets, fish meat, mince except liver, roe	$89	2	$105	2
Tea	$40	3	$85	3
Tobacco unmanufactured, tobacco refuse	$31	4	$78	4
Electrical energy	$17	5	$76	5
Precious metal ores and concentrates	$12	6	$72	6
Maize (corn)	$11	7	$65	7
Gold, unwrought, semi-manufactured, powder form	$9	8	$61	8
Raw hides and skins of bovine, equine animals	$8	9	$49	9
Precious metal colloids, compounds and amalgams	$7	10	$37	10
			$32	12
			$29	13
Cement (portland, aluminous, slag or hydraulic)	$4	14		
Live plants nes, roots, cuttings, mushroom spawn	$4	16		
			$13	28
Solid cane or beet sugar and chemically pure sucrose	$1	39		
Animal and vegetable fats or oils, hydrogenated only	$0	60		
Oils petroleum, bituminous, distillates, except crude	$0	89		
			$1	143
telephones for cellular networks or for other	$0	462		
			$0	852
			$0	871

Fig. A1-A. Top exports churning in Uganda. The figure reports the ranks and values of top ten exports in 1998 and in 2010, and their ranking and value in the opposite end of the sample, all in 2012 prices (thousands of U.S. dollars).
Source: COMTRADE.

	1998		2010	
Description	Export Value	Rank	Export Value	Rank
Motor vehicles for transport of persons (except buses)	$71,598	1	$95,146	1
Electronic integrated circuits and microassemblies	$27,284	2	$36,944	2
Automatic data processing machines (computers)	$22,079	3	$36,356	3
Parts and accessories for motor vehicles	$17,517	4	$26,944	4
Parts, accessories, except covers, for office machines	$16,664	5	$20,091	5
Passenger and goods transport ships, boats	$13,847	6	$16,007	6
Motor vehicles for the transport of goods	$10,407	7	$13,102	7
Radio and TV transmitters, television cameras	$8,407	8	$12,271	8
Machines nes having individual functions	$8,278	9	$10,822	9
Photo-copying apparatus	$7,804	10	$9,810	10
Diodes, transistors, semi-conductors, etc	$7,122	11		
			$9,523	12
Printing and ancillary machinery	$2,063	49		
			$2,817	64
			$2,786	66
Oils petroleum, bituminous, distillates, except crude	$1,123	96		
			$0	1174
kind used solely or principally for the manufacture of	$0	1188		

Fig. A1-B. Top exports churning in Japan. The figure reports the ranks and values of top ten exports in 1998 and in 2010, and their ranking and value in the opposite end of the sample, all in 2012 prices (thousands of U.S. dollars).
Source: COMTRADE.

Another way to show the instability of exports is to show the drastic changes in value over time. When ranks change, this is accompanied with huge swings in value. A log base 10 scale is necessary to capture these changes. Here a one-unit increase signifies an increase of 10 times; two units imply a change of 100 times. We do this for Ecuador in Fig. A2-A and for Kenya in Fig. A2-B.

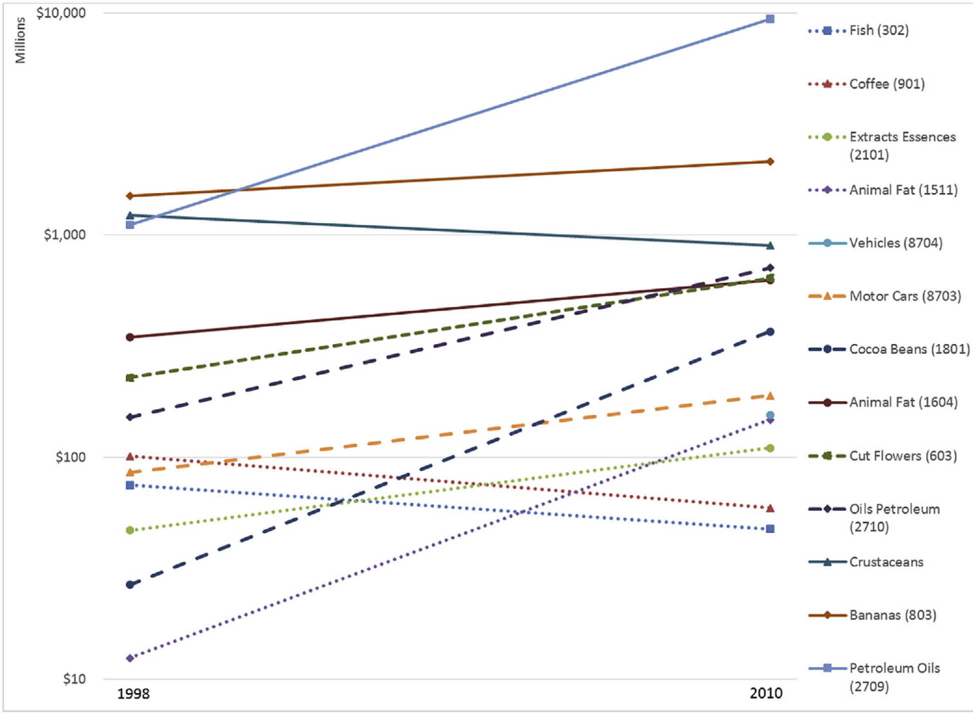

Fig. A2-A. Ecuador top export revenues by good, log base 10 scale, 1998 and 2010.
Source: COMTRADE.

Ecuador (Fig. A2-A) shows an increase of a factor of 2.8 in cut flowers, while coffee export revenues fell by 40%, which scrambled the ranks of top exports. In contrast, cocoa beans exhibited a 14 times increase in exports. Vehicles and parts thereof were not exported at all in 1998, but in 2010 they accounted for 155.4 million U.S. dollars (in 2012 prices). Even if this is partly related to the increase in exports of motor cars designed for the transport of persons – which increased by a factor of 2.2 – adding the two together indicates a large fourfold increase in the value of exports. Kenya in Fig. A2-B shows the fall of a traditional export and the rise of some non-traditional ones. Coffee revenue declined 27 percent, while export revenue from cut flowers and fresh vegetables increased by a factor of 3.4. Exports of cement, another non-traditional export, increased almost threefold.

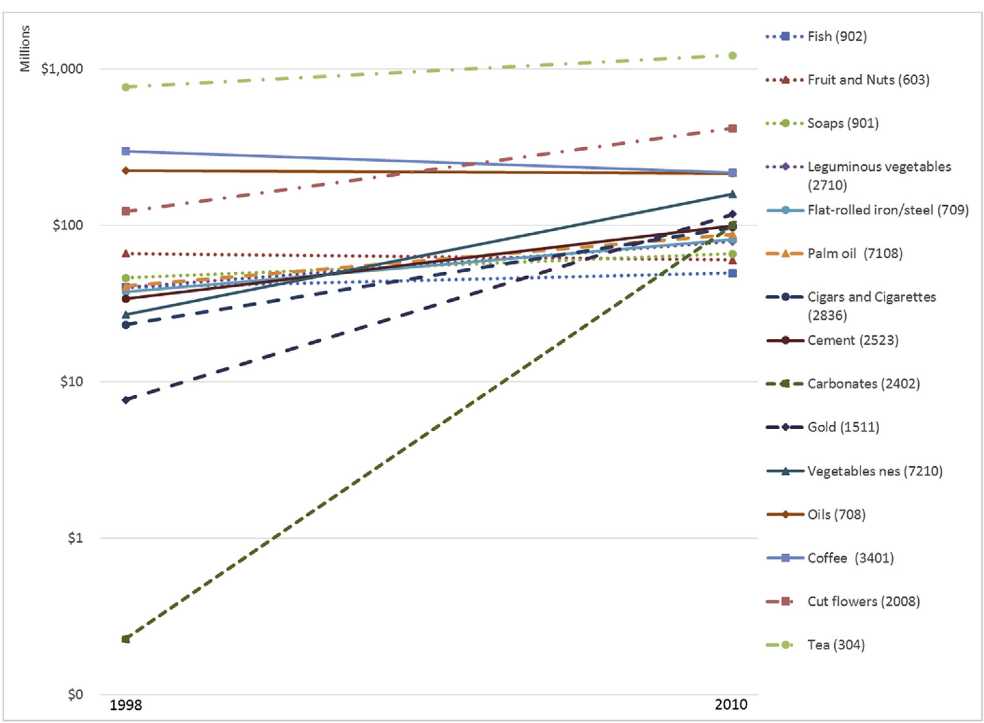

Fig. A2-B. Kenya top export revenues by good, log base 10 scale, 1998 and 2010.
Source: COMTRADE.

Cut flowers exports are a good example of the international dimensions of export performance. Table A5 shows the change in export revenue from cut flowers from 1998 to 2010 by source and destination (many smaller sources and destinations are omitted from the table to ease the exposition, but row and column totals include omitted countries).

Table A5

Change in value of Cut Flowers Exports in 1998–2010, millions of $US adjusted for inflation. Rows and columns do not add up to the Grand Totals because not all trading partners are shown, only those with the largest values. Source: COMTRADE.

Change from 1998 to 2010 in Exports of Cut Flowers (million US$ adjusted for inflation)									
	Destination								
	USA	Canada	Japan	Netherlands	UK	Russia	Germany	France	Grand Total
Exporter									
Netherlands	0	3	4	0	278	173	−99	94	976
Colombia	382	10	45	17	6	52	−2	0	519
Ecuador	116	18	7	43	2	119	6	5	408
Kenya	2	0	7	154	81	11	13	5	294
Malaysia	0	0	76	0	0	0	0	0	92
Korea	0	0	73	0	0	0	0	0	73
China	0	0	33	0	0	0	0	0	50
Thailand	9	0	10	2	0	3	−1	0	46
Turkey	0	0	−1	0	−2	4	0	0	8
Tanzania	0	0	0	4	1	0	0	0	5
Uganda	0	0	0	−4	0	0	0	0	−4
Guatemala	−9	0	0	0	0	0	0	0	−7
NZealand	1	0	−7	0	0	0	0	0	−8
Mexico	−7	−2	0	0	0	0	0	0	−8
Morocco	−1	0	0	−1	3	0	−6	−3	−9
Australia	−4	0	−5	−2	0	0	−1	0	−14
Italy	−2	0	0	11	−5	0	−30	−4	−64
Israel	−3	1	2	−106	−2	8	−8	−5	−97
Spain	−1	0	0	−56	−36	0	−10	−11	−119
Grand Total	502	52	237	68	331	369	−143	78	2183

Cut flowers trade as a whole grew by more than $2 billion from 1998 to 2010. The big winners are Colombia, Ecuador, and Kenya. Colombia and Ecuador presumably benefited from their closeness to the biggest growth market, the USA. They also managed to crowd out other nearby exporters like Mexico and Guatemala. Kenya did well by capturing more of the European market, which obviously reflects geographic distance again (although neighboring sources like Tanzania and Uganda failed to benefit). Malaysia, Korea, China, and Thailand in turn benefited from closeness to the Japanese growth market. The biggest losers were Australia and New Zealand for the Japanese market, and Italy, Israel, Morocco, and Spain for the European market. Italy and Morocco may have suffered in particular from the contraction of their previously large German market. There are some cross-overs between geographic markets, such as the surprising flow from Ecuador to Russia, a rapidly growing market.

Another particular factor in flower exports is the role of the Netherlands as both a flower producer and a trade hub that re-exports imported flowers to other European countries. Table A5 shows how these Dutch exports and re-exports have also shifted, going down in Germany (reflecting the overall contraction of the German market) and increasing a lot to the UK and Russia (reflecting expanding markets). The famous Dutch auction of flowers creates an atypical example of importing and re-exporting the same good on a large scale. However, global value chains (GVCs) that import inputs from many sources to produce a product to be exported to yet other places are a well-known phenomenon. Analyzing such GVCs is beyond the scope of this paper and left for subsequent research. We just note here that GVCs could be another factor contributing to instability of exports, and to diminish further the importance of source country characteristics or policies.

F. Descriptive statistics

Table A6

Descriptive statistics and pairwise correlations for regressions in Table 3. All statistics based on the sample in Table 3, a maximum of 103 cross country observations, depending on data availability, except for Initial Herfindahl Index over Destinations, which is a sample of 90,317 country-by-product observations. Initial Herfindahl Index over Destinations is calculated for each product and each source exporting country. Destination Concentration Index is the weighted average of the Initial Herfindahl Index over Destinations within a source exporting country, where the weights are export values. Source for export is COMTRADE. Source for GDP, population, land mass and credit (M3) are from the World Bank's World Development Indicators. All variables pertain to 1998 (hence, “initial”).

A. Descriptive Statistics							
	Mean	Std. Dev.	25th Percentile	Median	75th Percentile	Min	Max
ln(Initial GDP per capita)	8.91	1.24	7.96	9.04	9.97	6.43	10.82
Initial Destination Concentration Index	0.35	0.17	0.23	0.31	0.41	0.1	0.88
ln(Initial GDP Total)	24.65	2.06	22.96	24.53	26.05	20.89	30.18
ln(Initial Population)	16.31	1.57	15.32	16.12	17.24	12.49	20.94
ln(Land Size)	12.12	2.05	11.14	12.22	13.27	5.77	16.05
Initial Credit/GDP	46.96	47.83	11.31	30.76	64.38	2.79	222.51
Initial Herfindahl Index over Destinations	0.51	0.32	0.23	0.44	0.83	0.03	1

B. Pairwise Correlations						
	ln(Initial GDP per capita)	Destination Concentration	ln(Initial GDP)	ln(Initial Population)	ln(Land Size)	Initial Credit/GDP
ln(Initial GDP per capita)	1					
Initial Destination Concentration Index	−0.34	1				
ln(Initial GDP Total)	0.64	−0.47	1			
ln(Initial Population)	−0.17	−0.27	0.64	1		
ln(Land Size)	−0.23	−0.01	0.43	0.74	1	
Initial Credit/GDP	0.60	−0.34	0.55	0.10	−0.12	1

G. True growth and bounded growth

Bounded growth is a monotonic transformation of true growth, that has a range of [-2,2]; −2 represents disappearing goods that were exported in 1998 but not in 2010, and 2 represents new goods that were not exported in 1998 but are in 2010:

$$x_{sdp} = \frac{x_{sdp,2010} - x_{sdp,1998}}{\frac{1}{2}\left(x_{sdp,2010} + x_{sdp,1998}\right)},$$

where $x_{sdp,t}$ is the value in year t of (in our case) exports from source s to destination d of product p, and x_{sdp} is the value of bounded growth. Thus, bounded growth has the virtue of explicitly taking into account new goods that emerge, as well as old goods that disappear. That is, we take into account $x_{sdp,t}$ export values that are zero. While bounded growth is always strictly below true growth except at zero, it is a good approximation for true growth that is not extreme. For example, when true growth is between −40% and 50%, bounded growth is less than 10 percent points below it. Bounded growth deviates from true growth the most for new (∞ is represented by 2) and disappearing goods (−1 is represented by −2). The following figures illustrate these features.

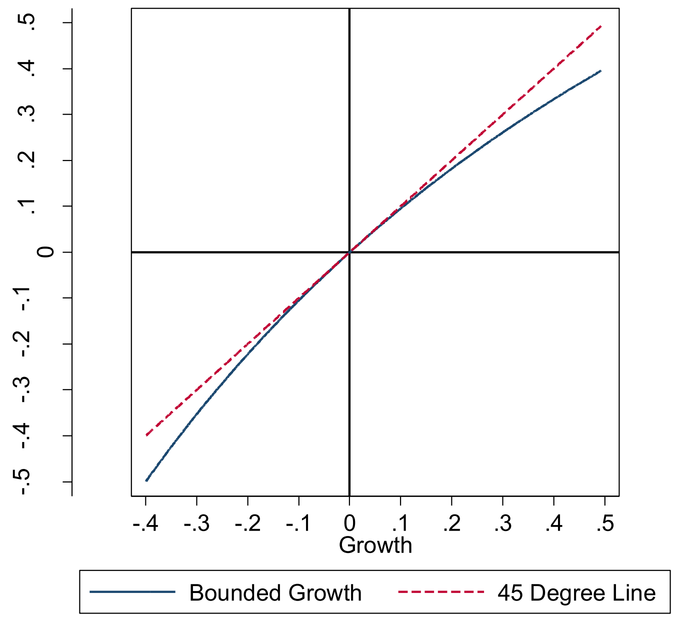

Fig. A3-A. Restricting the difference between true growth and bounded growth to 0.1 in absolute value gives a range of [-0.4,0.5] for true growth.

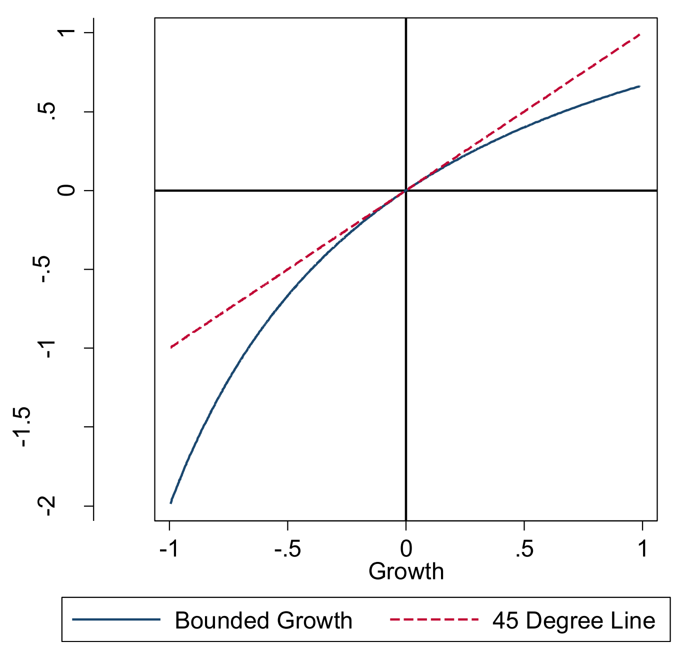

Fig. A3-B. True growth and bounded growth, when true growth is in [−1,1].

H. Appendix tables for fixed effect estimation

Table A7
Variance decompositions of export growth of top 20 export flows in 1998–2010 for the average country within each subset of countries. Countries are classified as "low" export growth if their export growth is at or below the 25th percentile, "medium" if between 25th and 75th percentiles, and "high" if export growth is at or above the 75th percentile of export distribution. Data: COMTRADE.

	World	Africa	America	Asia	Europe	Export Growth		
						Low	Medium	High
Standard deviation	1.54	1.73	1.56	1.56	1.49	1.51	1.52	1.57
A. Perecent of overall variance: Variances								
Source	6	6	6	10	4	2	3	12
Source × Product	10	15	13	10	8	9	10	14
Source × Destination	13	22	14	13	12	13	14	14
Product	6	5	5	7	6	5	7	5
Destination	10	12	9	10	11	11	11	10
Destination × Product	17	18	19	16	16	16	18	18
Residual	41	32	41	38	45	45	42	34
B. Perecent of overall variance: Covariances								
2 × Cov(Source × Product,Source)	0	0	0	0	0	0	0	0
2 × Cov(Source × Destination,Source)	0	−1	2	0	0	0	−1	1
2 × Cov(Source × Destination, Source × Product)	0	−1	0	0	0	0	0	0
2 × Cov(Product,Source)	−1	0	−2	0	0	0	0	−1
2 × Cov(Product, Source × Product)	0	−1	0	0	0	0	0	1
2 × Cov(Product, Source × Destination)	0	0	−1	0	0	0	−1	0
2 × Cov(Destination,Source)	0	1	0	0	0	0	0	0
2 × Cov(Destination, Source × Product)	0	1	0	0	0	0	0	1
2 × Cov(Destination, Source × Destination)	0	−2	0	−1	1	3	0	−4
2 × Cov(Destination,Product)	0	1	0	0	0	0	0	1
2 × Cov(Destination × Product,Source)	0	0	0	0	0	0	0	0
2 × Cov(Destination × Product, Source × Product)	−1	−1	−2	0	0	0	−1	−1
2 × Cov(Destination × Product, Source × Destination)	−3	−6	−4	−3	−3	−2	−4	−4
2 × Cov(Destination × Product,Product)	0	0	0	0	0	0	0	0
2 × Cov(Destination × Product,Destination)	0	1	0	0	−1	−1	0	0
Total	100	100	100	100	100	100	100	100

Table A8
Variance decompositions of export growth of all export flows in 1998–2010 for the average country within each subset of countries. Countries are classified as "low" export growth if their export growth is below the 25th percentile, "medium" if between 25th and 75th percentiles, and "high" if export growth is above the 75th percentile of export distribution. Data: COMTRADE.

	World	Africa	America	Asia	Europe	Export Growth		
						Low	Medium	High
Standard deviation	1.62	1.69	1.59	1.63	1.60	1.61	1.61	1.50
A. Perecent of overall variance: Variances								
Source	8	5	7	13	5	4	4	11
Source × Product	12	21	14	11	10	10	12	14
Source × Destination	5	10	5	6	5	5	5	8
Product	5	4	5	5	5	6	5	5
Destination	8	9	6	8	9	9	8	8
Destination × Product	7	7	8	7	7	8	7	8
Residual	55	48	56	51	59	59	58	49
B. Perecent of overall variance: Covariances								
2 × Cov(Source × Product,Source)	0	0	0	0	0	0	0	0
2 × Cov(Source × Destination,Source)	0	−1	0	−1	−1	0	0	0
2 × Cov(Source × Destination, Source × Product)	0	1	0	0	0	0	0	1
2 × Cov(Product,Source)	0	0	0	0	0	0	0	0
2 × Cov(Product, Source × Product)	−1	−2	−1	−1	0	−1	0	−2
2 × Cov(Product, Source × Destination)	0	0	1	0	0	0	0	0
2 × Cov(Destination,Source)	0	1	0	1	0	0	0	0
2 × Cov(Destination, Source × Product)	0	2	0	1	0	0	1	1
2 × Cov(Destination, Source × Destination)	0	−3	1	−1	0	1	0	−3
2 × Cov(Destination,Product)	0	0	0	0	1	1	0	0
2 × Cov(Destination × Product,Source)	0	0	0	0	0	0	0	0
2 × Cov(Destination × Product, Source × Product)	−1	−2	−1	−1	0	0	−1	−1
2 × Cov(Destination × Product, Source × Destination)	0	0	0	0	0	0	0	0
2 × Cov(Destination × Product,Product)	0	0	0	0	0	0	0	0
2 × Cov(Destination × Product,Destination)	0	0	0	0	−1	−1	0	0
Total	100	100	100	100	100	100	100	100

Table A9
Variance decompositions of export growth of top 20 NON-ZERO export flows in 1998–2010 for the average country within each subset of countries. The sample is restricted to export flows that are strictly positive in both 1998 and 2010. Countries are classified as "low" export growth if their export growth is at or below the 25th percentile, "medium" if between 25th and 75th percentiles, and "high" if export growth is at or above the 75th percentile of export distribution. Data: COMTRADE.

	World	Africa	America	Asia	Europe	Export Growth		
						Low	Medium	High
Standard deviation	1.24	1.34	1.24	1.28	1.20	1.20	1.22	1.25
A. Perecent of overall variance: Variances								
Source	7	8	3	11	4	1	3	9
Source × Product	13	24	17	12	11	11	13	20
Source × Destination	14	33	16	13	13	12	16	18
Product	6	7	6	8	5	6	7	6
Destination	4	3	4	4	4	5	4	4
Destination × Product	21	25	25	19	20	21	22	23
Residual	42	31	44	39	46	46	44	36
B. Perecent of overall variance: Covariances								
2 × Cov(Source × Product,Source)	0	0	0	0	0	0	0	0
2 × Cov(Source × Destination,Source)	0	0	1	1	0	0	−1	1
2 × Cov(Source × Destination, Source × Product)	−1	−12	−1	0	0	−1	−1	−3
2 × Cov(Product,Source)	−1	0	−1	−1	0	0	1	−1
2 × Cov(Product, Source × Product)	1	1	0	0	2	2	0	1
2 × Cov(Product, Source × Destination)	−1	0	0	−1	−1	0	−1	−1
2 × Cov(Destination,Source)	0	1	0	0	0	0	0	−1
2 × Cov(Destination, Source × Product)	0	0	0	0	0	0	0	0
2 × Cov(Destination, Source × Destination)	0	−2	−2	0	1	1	0	−4
2 × Cov(Destination,Product)	0	0	0	0	0	0	0	0
2 × Cov(Destination × Product,Source)	0	−2	0	0	0	0	0	0
2 × Cov(Destination × Product, Source × Product)	−2	−3	−4	−1	−1	−1	−2	−3
2 × Cov(Destination × Product, Source × Destination)	−5	−14	−7	−4	−4	−4	−5	−7
2 × Cov(Destination × Product,Product)	0	0	0	0	0	0	0	0
2 × Cov(Destination × Product,Destination)	0	1	0	0	0	0	0	1
Total	100	100	100	100	100	100	100	100

Table A10
Variance decompositions of export growth of all NON-ZERO export flows in 1998–2010 for the average country within each subset of countries. The sample is restricted to export flows that are strictly positive in both 1998 and 2010. Countries are classified as "low" export growth if their export growth is at or below the 25th percentile, "medium" if between 25th and 75th percentiles, and "high" if export growth is at or above the 75th percentile of export distribution. Data: COMTRADE.

	World	Africa	America	Asia	Europe	Export Growth		
						Low	Medium	High
Standard deviation	1.26	1.37	1.24	1.31	1.24	1.21	1.27	1.28
A. Perecent of overall variance: Variances								
Source	5	5	1	11	2	1	2	8
Source × Product	15	31	17	16	13	11	16	21
Source × Destination	4	10	5	4	4	3	4	7
Product	5	4	5	5	5	6	5	5
Destination	3	1	2	3	3	3	3	2
Destination × Product	12	12	14	11	12	13	12	12
Residual	60	49	61	54	63	64	62	52
B. Perecent of overall variance: Covariances								
2 × Cov(Source × Product,Source)	0	0	0	0	0	0	0	0
2 × Cov(Source × Destination,Source)	0	−1	0	2	0	0	0	2
2 × Cov(Source × Destination, Source × Product)	−1	−3	−1	−1	−1	0	−1	−2
2 × Cov(Product,Source)	−1	0	0	−1	0	0	0	−2
2 × Cov(Product, Source × Product)	1	−1	1	1	1	0	1	0
2 × Cov(Product, Source × Destination)	−1	0	0	0	−1	0	−1	−1
2 × Cov(Destination,Source)	0	1	0	−1	0	0	0	0
2 × Cov(Destination, Source × Product)	0	0	0	0	0	0	0	0
2 × Cov(Destination, Source × Destination)	0	−1	0	0	0	1	0	−1
2 × Cov(Destination,Product)	0	0	0	0	0	0	0	0
2 × Cov(Destination × Product,Source)	0	−1	0	0	0	0	0	0
2 × Cov(Destination × Product, Source × Product)	−2	−6	−4	−2	−1	−1	−2	−2
2 × Cov(Destination × Product, Source × Destination)	0	−1	−1	0	0	0	0	0
2 × Cov(Destination × Product,Product)	0	0	0	0	0	0	0	0
2 × Cov(Destination × Product,Destination)	0	0	0	0	0	0	0	0
Total	100	100	100	100	100	100	100	100

I. Additional figures and tables for Top-5 and Top-10 cutoffs

This section replicates all the tables and figures in the main text for Top-5 and Top-10 exports. Results are presented in the same order as the main text.

Table I.1
Probability of being in the top 5 goods in 2010, marginal effects. This table is an alternative version of Table 3 in the main text. "Top Start Year" takes value one if the good was top 5 in 1998. See main text for more details. Standard errors clustered by country in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1. Data: COMTRADE.

	(1)	(2)	(3)
Top in Start Year	0.517***	0.0898	0.0804
	(0.0216)	(0.0760)	(0.0793)
ln(Initial GDPpc)		−0.000537***	−0.000839***
		(0.000110)	(0.000140)
ln(Initial GDPpc) × Top in Start Year		0.00119***	0.00113***
		(0.000387)	(0.000369)
Initial Herf. Index over Destinations			−0.00353***
			(0.000650)
Initial Herf. Index over Destinations × Top in Start Year			−0.00150
			(0.00167)
Observations	103,754	88,296	88,296
# of countries	102	100	100

Table I.2
Probability of being in the top 10 goods in 2010, marginal effects. This table is an alternative version of Table 3 in the main text. "Top Start Year" takes value one if the good was top 10 in 1998. See main text for more details. Standard errors clustered by country in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1. Data: COMTRADE.

	(1)	(2)	(3)
Top in Start Year	0.534***	0.0126	0.00270
	(0.0181)	(0.0165)	(0.00876)
ln(Initial GDPpc)		−0.00141***	−0.00205***
		(0.000194)	(0.000265)
ln(Initial GDPpc) × Top in Start Year		0.00345***	0.00338***
		(0.000586)	(0.000584)
Initial Herf. Index over Destinations			−0.00785***
			(0.000945)
Initial Herf. Index over Destinations × Top in Start Year			0.000986
			(0.00222)
Observations	103,754	88,296	88,296
# of countries	102	100	100

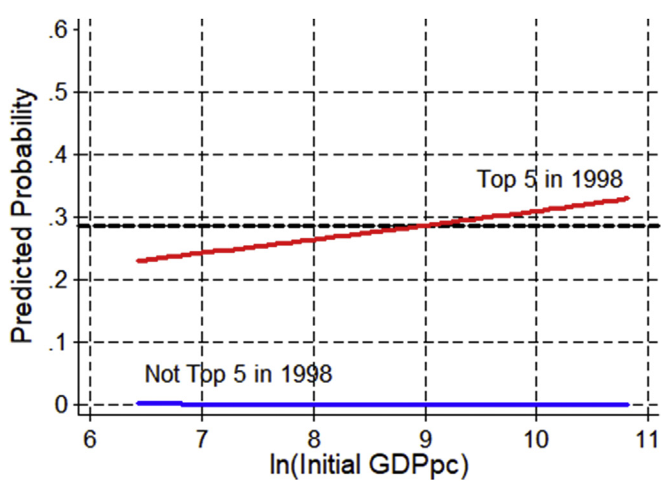

Fig. I.1. Marginal Effects of GDP per Capita on Persistence of Top 5 Export Flows. This figure is an alternative version of Fig. 5 in the main text. The figure reports the predicted probability of being a top 5 flow in 2010 for flows that were (Top0 = 1) and were not (Top0 = 0) top 5 in 1998. The dashed line is the unconditional probability of a top 5 flow in 1998 of being a top 5 flow in 2010. See main text for more details. Data: COMTRADE.

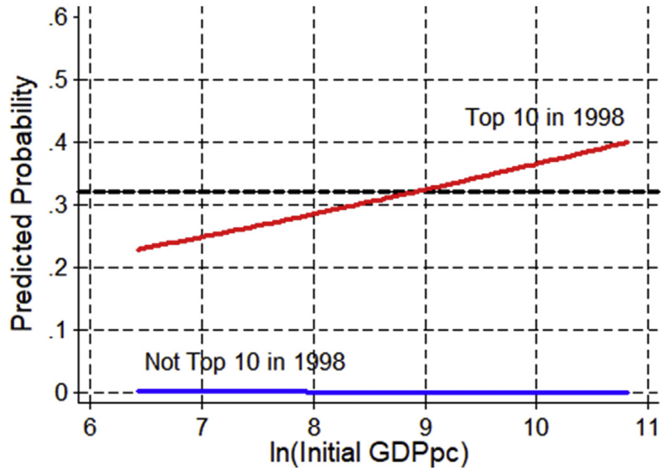

Fig. I.2. Marginal Effects of GDP per Capita on Persistence of Top 10 Export Flows. This figure is an alternative version of Fig. 5 in the main text. The figure reports the predicted probability of being a top 10 flow in 2010 for flows that were (Top0 = 1) and were not (Top0 = 0) top 10 in 1998. The dashed line is the unconditional probability of a top 10 flow in 1998 of being a top 10 flow in 2010. See main text for more details. Data: COMTRADE.

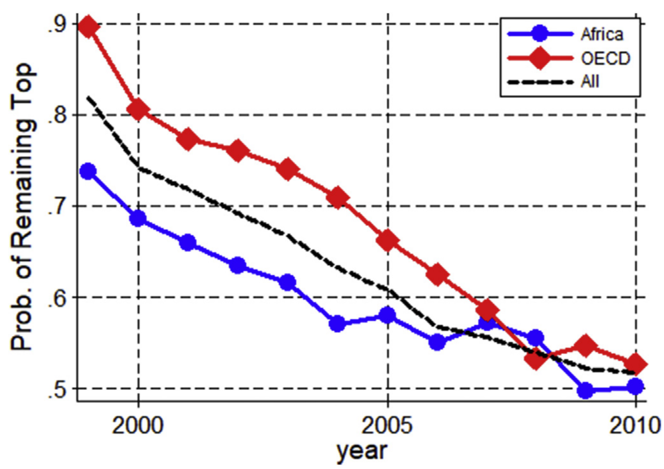

Fig. I.3. The figure reports the predicted probability of being a top 5 good in each year conditional on being a top 5 good in 1998, as estimated by equation (2). This figure is an alternative version of Fig. 6 in the main text. Data: COMTRADE.

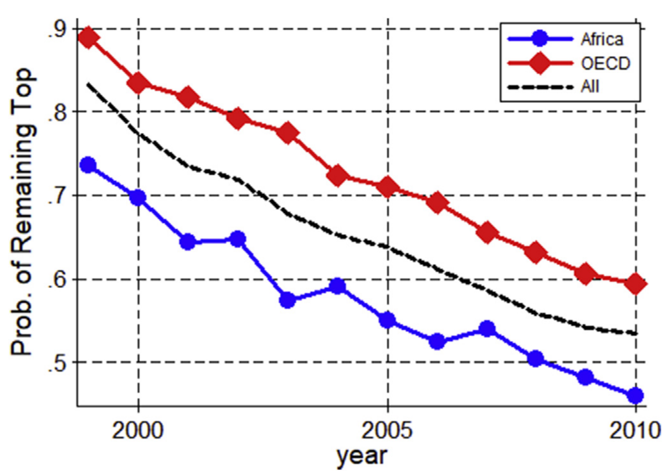

Fig. I.4. The figure reports the predicted probability of being a top 10 good in each year conditional on being a top 10 good in 1998, as estimated by equation (2). This figure is an alternative version of Fig. 6 in the main text. Data: COMTRADE.

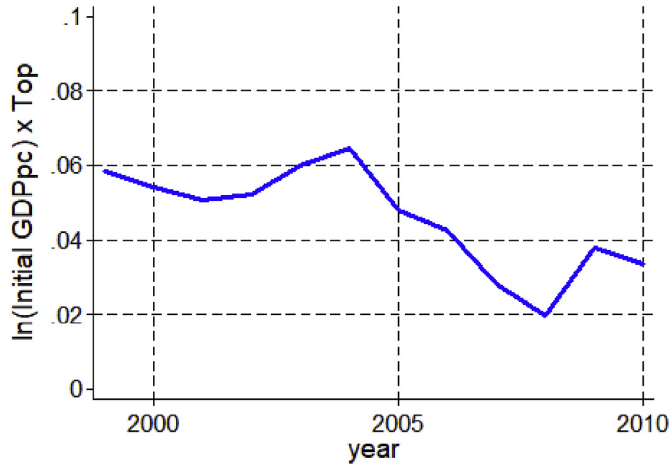

Fig. I.5. Linear probability model, marginal effect of GDP on probability of remaining top good over time (Top 5, Goods). The figure reports the marginal effect of GDP on the predicted probability of being a top 5 good in 2010 for goods that were top 5 in 1998, as estimated in equation (3). This figure is an alternative version of Fig. 7 in the main text. Data: COMTRADE.

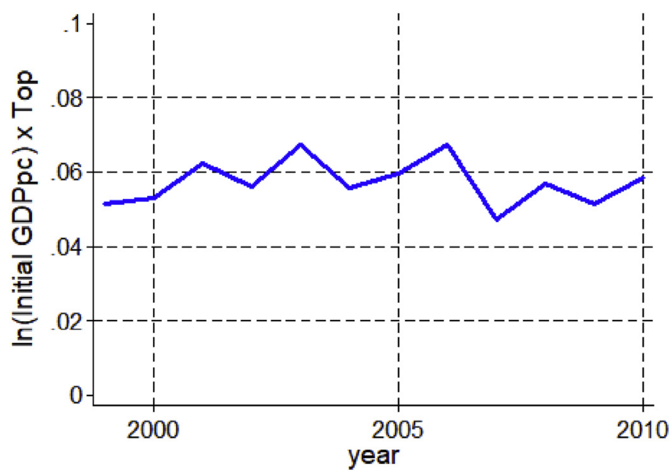

Fig. I.6. Linear probability model, marginal effect of GDP on probability of remaining top good over time (Top 10, Goods). The figure reports the marginal effect of GDP on the predicted probability of being a top 10 good in 2010 for goods that were top 10 in 1998, as estimated in equation (3). This figure is an alternative version of Fig. 7 in the main text. Data: COMTRADE.

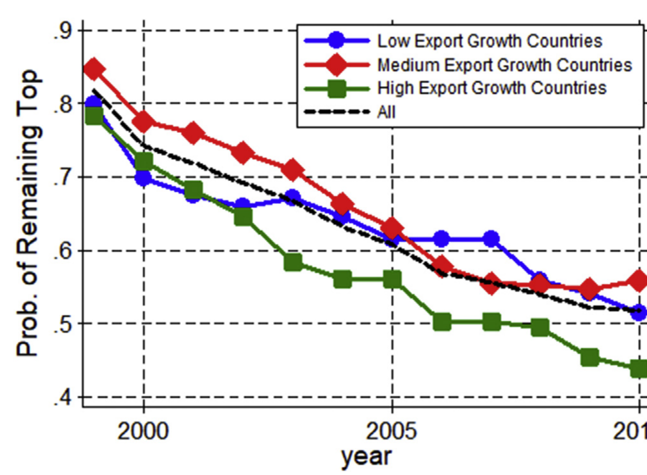

Fig. I.7. Linear probability model, probability of remaining top good over time by Total Export Growth (Top 5, Goods). The figure reports the probability of being a top 5 good in each year for goods that were top 5 in 1998 for different groups of countries according to their total export growth between 1998 and the year in the horizontal axis. Here "high" is defined as being at or above the 75th percentile of export growth, "medium" as being between 25th and 75th percentiles, and "low" as being at or below the 25th percentile. This figure is an alternative version of Fig. 8 in the main text. Data: COMTRADE.

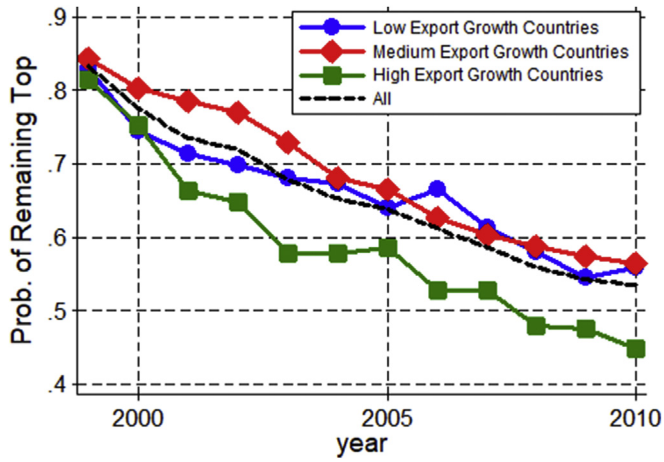

Fig. I.8. Linear probability model, probability of remaining top good over time by Total Export Growth (Top 10, Goods). The figure reports the probability of being a top 10 good in each year for goods that were top 10 in 1998 for different groups of countries according to their total export growth between 1998 and the year in the horizontal axis. Here "high" is defined as being at or above the 75th percentile of export growth, "medium" as being between 25th and 75th percentiles, and "low" as being at or below the 25th percentile. This figure is an alternative version of Fig. 8 in the main text. Data: COMTRADE.

Table I.3

Variance decompositions of export growth of export flows in 1998–2010 for the average country. There are four subsamples: top 5 and top 10 exports (either in 1998 or in 2010 or in both), and the same while restricting to strictly positive export flows in both 1998 and 2010. Columns do not sum exactly to 100 because other covariance terms are not reported here; these covariance terms account for small shares of overall variance. This table is an alternative version of Table 4 in the main text. Data: COMTRADE.

Sample:	Top 5 Flows	Top 10 Flows	Strictly positive flows in 1998 and 2010	
			Top 5 Flows	Top 10 Flows
Standard deviation	1.51	1.62	1.23	1.24
Perecent of overall variance				
Source	9	8	11	9
Source × Product	9	9	9	11
Source × Destination	26	18	28	20
Product	6	6	7	7
Destination	11	11	5	5
Destination × Product	22	20	25	23
Residual	30	35	31	37

Table I.4

Variance decompositions of export growth of top 5 export flows in 1998–2010 for the average country within each subset of countries. Countries are classified as "low" export growth if their export growth is at or below the 25th percentile, "medium" if between 25th and 75th percentiles, and "high" if export growth is at or above the 75th percentile of export distribution. Columns do not sum exactly to 100 because other covariance terms are not reported here; these covariance terms account for small shares of overall variance. This table is an alternative version to Table 5 in the main text. Data: COMTRADE.

	World	Africa	America	Asia	Europe	Export Growth		
						Low	Medium	High
Standard deviation	1.51	1.71	1.51	1.50	1.47	1.49	1.46	1.51
A. Perecent of overall variance: Variances								
Source	9	7	6	11	8	2	5	12
Source × Product	9	15	12	9	6	6	9	14
Source × Destination	26	39	32	26	22	25	29	25
Product	6	4	4	4	8	6	6	5
Destination	11	13	10	11	11	12	12	10
Destination × Product	22	32	27	22	19	20	24	26
Residual	30	19	28	28	33	34	31	25
B. Perecent of overall variance: Covariances								
2 × Cov(Source × Product,Source)	0	0	0	0	0	0	0	0
2 × Cov(Source × Destination,Source)	−1	−3	0	1	−2	−1	−2	1
2 × Cov(Source × Destination, Source × Product)	0	−2	−1	0	0	0	0	−1
2 × Cov(Product,Source)	1	2	1	−1	2	1	1	−1
2 × Cov(Product, Source × Product)	1	2	1	0	1	1	0	3
2 × Cov(Product, Source × Destination)	−1	−1	−1	0	−1	−1	−1	−1
2 × Cov(Destination,Source)	0	1	−1	0	1	0	1	0

(*continued on next column*)

Table I.4 (*continued*)

	World	Africa	America	Asia	Europe	Export Growth		
						Low	Medium	High
2 × Cov(Destination, Source × Product)	0	1	0	0	0	0	0	1
2 × Cov(Destination, Source × Destination)	0	−2	−1	−1	1	2	0	−4
2 × Cov(Destination,Product)	0	1	0	0	0	0	0	1
2 × Cov(Destination × Product,Source)	0	0	0	0	0	0	0	0
2 × Cov(Destination × Product, Source × Product)	−1	−3	−1	0	0	0	−1	−1
2 × Cov(Destination × Product, Source × Destination)	−11	−25	−18	−10	−7	−7	−14	−14
2 × Cov(Destination × Product,Product)	0	0	0	0	0	0	0	0
2 × Cov(Destination × Product,Destination)	0	1	0	0	−1	−1	0	0
Total	100	100	100	100	100	100	100	100

Table I.5
Variance decompositions of export growth of top 10 export flows in 1998–2010 for the average country within each subset of countries. Countries are classified as "low" export growth if their export growth is at or below the 25th percentile, "medium" if between 25th and 75th percentiles, and "high" if export growth is at or above the 75th percentile of export distribution. Columns do not sum exactly to 100 because other covariance terms are not reported here; these covariance terms account for small shares of overall variance. This table is an alternative version to Table 5 in the main text. Data: COMTRADE.

	World	Africa	America	Asia	Europe	Export Growth		
						Low	Medium	High
Standard deviation	1.53	1.71	1.55	1.54	1.48	1.51	1.49	1.56
A. Perecent of overall variance: Variances								
Source	8	7	6	11	6	2	4	12
Source × Product	9	15	13	9	7	8	9	13
Source × Destination	18	27	20	17	17	18	20	18
Product	6	4	4	6	6	5	6	6
Destination	11	12	10	10	11	11	11	10
Destination × Product	20	23	22	18	19	18	21	21
Residual	35	27	34	33	39	39	37	30
B. Percent of overall variance: Covariances								
2 × Cov(Source × Product,Source)	0	0	0	0	0	0	0	0
2 × Cov(Source × Destination,Source)	0	−2	1	1	−1	0	−1	0
2 × Cov(Source × Destination, Source × Product)	0	−1	−1	0	0	0	0	0
2 × Cov(Product,Source)	0	1	−1	−1	1	0	1	0
2 × Cov(Product, Source × Product)	0	−1	0	1	0	1	0	1
2 × Cov(Product, Source × Destination)	−1	−1	−1	0	−1	0	−1	−1
2 × Cov(Destination,Source)	0	1	0	0	0	0	1	0
2 × Cov(Destination, Source × Product)	0	1	1	0	0	0	0	1
2 × Cov(Destination, Source × Destination)	0	−2	−1	−1	1	3	0	−4
2 × Cov(Destination,Product)	0	1	0	0	0	0	0	1
2 × Cov(Destination × Product,Source)	0	0	0	0	0	0	0	1
2 × Cov(Destination × Product, Source × Product)	−1	−2	−1	0	0	0	−1	−1
2 × Cov(Destination × Product, Source × Destination)	−6	−11	−8	−6	−5	−4	−7	−7
2 × Cov(Destination × Product,Product)	0	0	0	0	0	0	0	0
2 × Cov(Destination × Product,Destination)	0	1	0	0	−1	−1	0	0
Total	100	100	100	100	100	100	100	100

Table I.6
Variance shares, income and export diversification. The Table reports OLS estimates of how variance shares vary across countries with log GDP per capita and with the Destination Concentration Index. GDP data are from the World Bank's World Development Indicators. Destination Concentration Index is the weighted average of the Initial Herfindahl Index over destinations within a source exporting country, where the weights are export values. Both regressors pertain to 1998. This table is an alternative version of Table 6 in the main text but for Top 5 and Top 10 exports. Source for exports is COMTRADE.

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent Variables: Percent of Variance of Export Flow Growth due to					
	Var(Source × Product)	Var(Source × Destination)	Var(Product)	Var(Destination)	Var(Destination × Product)	Var(Residual)
A. Top 5 flows						
Log GDP per capita	−2.612**	−6.177***	0.178	−0.750*	−5.491***	4.285***
	(1.066)	(1.294)	(0.388)	(0.446)	(1.101)	(0.666)
Destination Concentration Index	21.38***	0.466	−2.345	−7.689**	−10.94	−6.206
	(7.997)	(9.703)	(2.910)	(3.345)	(8.261)	(4.993)
B. Top 10 flows						
Log GDP per capita	−2.518***	−4.091***	0.0798	−0.859**	−2.117***	4.017***
	(0.812)	(0.844)	(0.305)	(0.340)	(0.602)	(0.598)
Destination Concentration Index	20.59***	4.674	−4.883**	−9.471***	−6.213	−6.836
	(6.088)	(6.329)	(2.291)	(2.551)	(4.515)	(4.489)

Appendix J. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jdeveco.2018.10.009.

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