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Export Concentration and Instability

Revisiting the Evidence with Enhanced Trade Data

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INTRODUCTION

The dynamics of international trade have become increasingly significant in the global economy. Belgium for instance is dependent from its exports, as the country ranks in the 7th place on per capita product exports value in 2024 (**OEC, 2024**). Understanding the factors that contribute to export growth and the stability of export specializations is therefore essential for policymakers and economists. Several papers analyzed concentration of goods exported at countries level as well as instability of those goods across time, but "The Surprising Instability of Export Specializations" by **Daruich et al. (2019)** combines the fact of using a very large set of countries and trying to evaluate the impact of several causes. This thesis revisits this foundational work using enhanced trade data that provides both improved quality and increased temporal coverage. This paper is the core of this thesis and will be referred to as reference paper or reference article in the following text.

The primary research question explored in this thesis is: "How has the instability of export concentration changed since 2010?" The objective of this research is dual: First it is to replicate the findings of the reference article while contributing new insights through a robust dataset spanning a broader temporal range. By extending the original analysis, this dissertation aims to provide a clearer understanding of the patterns of export instability, offering valuable contributions to the field of international economics. Second, the replication of reproducing scientific research cannot be overstated. It's one of the cornerstones of the scientific method. It allows searchers to validate findings, identify biases or errors, and overall, enhance the robustness of a study. Therefore, by attempting to replicate the results of the reference paper, this thesis does not only aim to reinforce the original findings of the authors, but also to contribute to the scientific and academic methodology.

Preliminary results indicate that the overall concentration of exports remains high in the second period. The top 20 goods represented on average 75,77% of the total exportation in 2022 while the reference paper found 73,56% in 2010. The average destination concentration index remained stable for all the groups of countries.

Regarding the stability of top exports for 2010-2022, we notice that the results are close to the ones found for 1998-2010 by the authors. The probability of a good remaining in the top 20 exports is slightly higher for the second period than for the first one, which could indicate a decrease in volatility for export rankings. While the findings regarding the relationship between export concentration and GDP per capita remain consistent during this period, the level of export growth and the U-shaped relationship with instability observed by the authors is not present in the 2010-2022 period.

This paper first presents the reference article and places it in the context of the literature on export concentration and volatility. Secondly, the data used is presented. Thirdly, the results obtained are analyzed and compared with those of the reference article. Finally, the study's limitations and avenues for improvement are presented.

I. REVIEW OF THE LITERATURE

1. Reference Paper

"The Surprising Instability of Export Specializations" by **Daruich et al. (2019)** addresses the phenomenon of export instability at a highly granular level, specifically analyzing export flows across 4-digit HS codes over the period 1998–2010. It investigates how export specializations vary over time by looking at different groups of countries and checking for their top-exports variation.

Firstly, the authors show that exports are concentrated in a small number of goods and destinations, building on earlier works that documented this phenomenon (**Firebaugh & Bullock, 1987** ; **Karahan, 2017**). The authors find that, on average, the top 20 goods (at the 4-digit HS level) account for over 73% of a country's total exports, with this concentration being even higher for less developed economies. For export flows (product-by-destination), the top 20 flows represent just over 52% of total flows.

The paper then looks at the instability of countries' top exports. It reveals a surprisingly huge instability of export rankings, even among the most prominent products and destinations. The correlation between a product's export rank in 1998 and 2010 is only 0.3, underscoring significant churning at the top of export distributions. For the top 20 goods, the probability of remaining a top export in 2010 is just 54%, with this persistence being even lower in less developed economies.

In the final part, the authors investigate the sources of this instability. They find that source-country factors, such as comparative advantage, explain only a small portion (about 20%) of the variation in export growth. The remaining variation is attributed to product-specific, destination-specific, and product-by-destination factors. A significant portion of the variation (about 30%) is due to individual factors at the source-product-destination level, making it difficult to predict top-exports based on source-country characteristics alone.

In this dissertation, we will focus exclusively on the authors' first two sections, namely the concentration and instability of top-exports.

2. Comparison with Economic Trade Theory

2.1. Comparative Advantages

David Ricardo (1817) expanded on Smith's theory with the concept of comparative advantage. He stated that even if a country does not have an absolute advantage in any product, it can still benefit from trade by specializing in the production of goods for which it has the lowest opportunity cost. This means that a country should produce and export goods that it can produce relatively more efficiently compared to other goods, even if it is not the most efficient producer overall (**Rivera-Batiz et al., 2020**).

Daruich et al. (2019) highlight that export ranks are not persistent, and new top products and destinations replace old ones. This finding could align with the idea of comparative advantages, as countries might shift their export specializations over time based on changing comparative advantages. For example, a country might develop a comparative advantage in a new product due to technological advancements or changes in global market conditions. The instability of export specializations suggests that even if a country has developed a comparative advantage in a specific product, this advantage may not be maintained consistently over time. This

instability could be due to changes in technology, resource availability, shifts in global demand (**MacBean, 2012**).

2.2. Heckscher-Ohlin Model

The HO model (**Heckscher, 1991**) is built on the Ricardian theory of comparative advantage, but it introduced factor endowments (e.g., labor, capital) between countries as the basis for trade. The model predicts that a country will export goods that use its abundant factors intensively and import goods that use its scarce factors intensively. If a country's endowment of one factor increases, it will produce more of the good that uses that factor intensively and less of the other good (**Leamer, 1995**)

The reference paper suggests that source-country factors (such as factor endowments) are not the main explanation for the instability of export specializations. Instead, they emphasize the importance of destination and product-specific factors. Therefore, it challenges the traditional HO model by showing that factors other than factor endowments play a significant role in determining export patterns.

2.3. Krugman Model

More recently, **Krugman (1980)** proposed a model that considers economies of scale, transport costs and consumer preferences to explain patterns of trade. A country with a large domestic market might attract more firms in industries characterized by increasing returns to scale. These firms produce a wide variety of goods and export some, while importing products from similar industries in other countries, thus fostering trade and economic growth. It implies that comparative advantages of countries are created over time thanks to cumulative past output (**Asheghian & Saidi, 1999**), rather than being the result of country's characteristics. The pattern of specialization is therefore quite well preserved in the future.

But the reference paper's findings are that there is a huge volatility of top exports goods for every country. This goes against the idea of the pattern of specialization which would imply a very low volatility of exports.

3. Comparison with Previous Trade Literature

3.1. Type of Study

When it comes to analyzing concentration and instabilities, there are broadly two common approaches: cross-country analyses and panel data analyses. Cross-country analyses were very popular in the 50s and 60s, focusing on comparing export concentration and instabilities among countries at a specific point in time. These studies have often struggled to highlight the links between concentration and instability (**Asheghian & Saidi, 1999**).

Panel data analyses, on the other hand, incorporate elements of both cross-country and time-series approaches. They study several countries over a period of time, allowing for the examination of variations in exports while also considering averages across countries. For instance, **Love (1986)** used data from 1960 to 1970 to investigate the relationship between concentration and instability at the country level, supporting the conventional argument that higher commodity concentration leads to greater export earning instability.

The reference article primarily falls into the panel data category, as it analyzes concentration and instability in countries' top exports over a period of almost 12 years. While the subject has

been well studied, this article remains interesting for several reasons, which we will explore in this section.

3.2. Links with Previous Studies

This paper is not the first to study export concentration. **Michaely (1958)** uses the Standard International Trade Classification (SITC) to measure concentration among commodities and emphasizes the fact that a country's fortune depends on one or a few goods. This is not just the case at product level, but also at industry level. There are huge concentrations of export firms (i.e. few firms accounting for most of the exports) and this observation is not just the case for developed countries, but also for developing ones (**Eaton et al., 2007**; **Freund & Pierola, 2015**). The link between concentration and the level of economic development is also a much-studied topic. **Cadot et al. (2011)** have shown a U-shaped relationship between these two parameters: highly and less developed countries are more concentrated than medium-developed countries, which are more diversified. The results found by the authors of the reference paper align with the ones of the mentioned studies.

Regarding the instability of exports, this phenomenon has been observed a lot in scientific literature. **Besedeš and Prusa (2006)** show that US imports are not sustainable over the long term: what they export, and their suppliers change regularly, which can be a source of instability. The reference paper also shows a high degree of instability in traded goods for the US, but also for other countries.

These combined results of high concentration and high volatility of exports have been at the center of a lot of articles in recent years. For instance, **Di Giovanni & Levchenko (2009)** explored the relationship between export concentration and economic volatility and highlight how more concentration leads to greater economic instability. They argue that while trade openness increases specialization and therefore concentration, it also increases instability due to higher risks associated with a highly concentrated economy. Other authors like **Koren & Tenreyro (2007)** explored the impact of export concentration on economic performance and found that poorer countries are less specialized on average but in more volatile sectors. When countries develop, they then shift their exports towards lower risk sectors, reducing the overall volatility. Finally, **Vannoorenberghe (2012)** also contributed to this literature at a more microeconomic level, focusing on a firm level. He found that firms with higher export shares have a higher volatility of their domestic sales but less volatile exports, suggesting that exporting can lead to greater instability in domestic markets while providing a buffer against external shocks.

This literature highlights the importance of understanding the links between export concentration and export stability, providing broader context for the findings of the reference paper and this thesis.

3.3. Novelty of this Paper

While the benchmark paper is aligned with some of the literature and similar to certain studies, it differs in several respects.

Firstly, while the authors focus on the volatility of goods and export destinations, they do so at a much higher level than previous studies. **Besedeš and Prusa (2006)** focus solely on the US, whereas **Daruich et al. (2019)** use a much broader dataset. The results are similar for both

studies, but the use of a dataset comprising more than a hundred countries enables these observations to be extended to a large number of countries.

Secondly, the authors use export shares directly. This runs counter to other studies by **Cadot et al (2011)** using the Theil index, a statistical measure that quantifies inequality (and therefore the degree of concentration). The disadvantage of this index is that it is highly sensitive to discrepancies between high and low values (**Daruich et al., 2019**).

Lastly, what is truly innovative about the authors' paper is that they not only analyze the evolution over time of export concentration and instability, but also look at the source of this instability. Several papers (**Hanson et al., 2015**; **Levchenko & Zhang, 2011**) focus on shocks affecting certain companies in certain countries. These shocks can arise from factors such as technological changes, cost fluctuations, policy shifts, or global demand patterns, which alter the comparative advantage of industries in that source country. But these papers focus on just one source of instability. The authors of the reference paper, on the other hand, are interested in several sources of instability. One of their key observations is that these source-by-product shocks in fact explain only a small part of total export volatility. The main cause of instability is destination factors (demand shocks from importing countries).

4. Motivation for the Choice of Reference Paper

The choice to reproduce the results of this reference paper with enhanced data stems from several reasons.

First, this study challenges traditional views of economic theories (mainly the one of stable comparative advantages). Reproducing it allows to contribute to the ongoing academic debate by providing updated empirical evidence.

Second, global trade has evolved significantly since the original study (1998–2010), with new trade agreements, shifts in global demand (Covid 19, Ukraine conflict…), and changes in technology. Using extended data to see if the results of the authors are still aligned with the current economic climate is therefore relevant.

The third reason is robustness. The study is already very robust for the period studied. The authors use on many occasion variations of top goods, take separate examples at some moments and the whole sample at others. Trying to replicate it is therefore very interesting to see if the robustness only holds for this period or also for others.

Finally, the authors use a very well-described and new methodology. The fact that the methodology is new allows for replication, and the use of percentage of top goods as a novelty means that there is a need to reproduce the results and see if they hold when the data is different. This thesis is therefore there to reproduce the methodology with similar data, and then extend it to see how it holds.

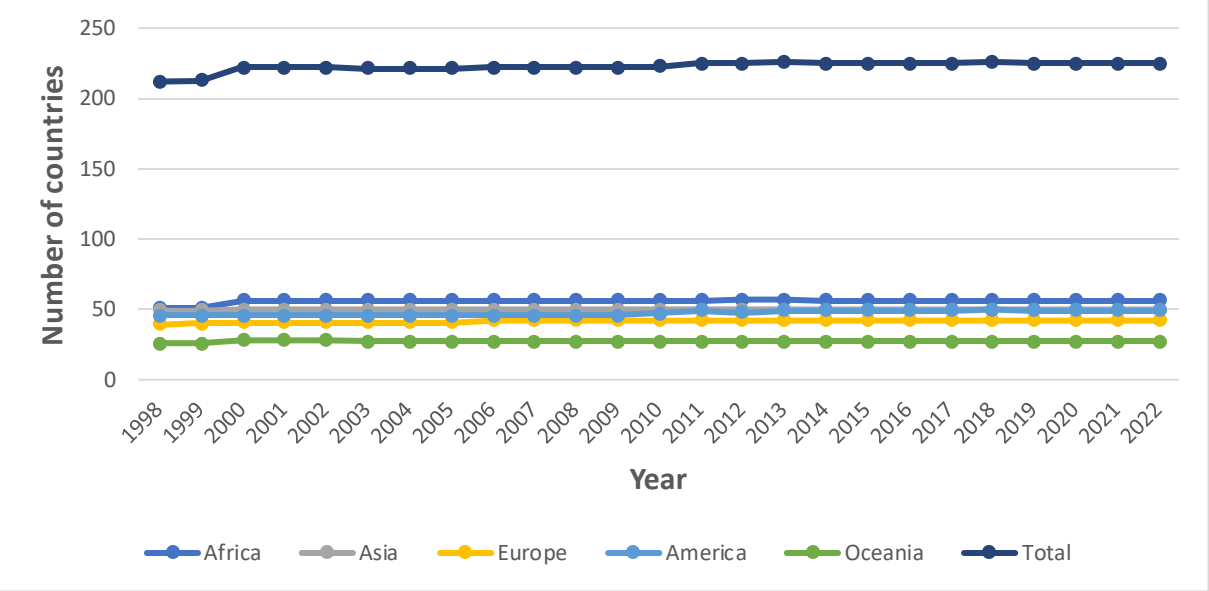
II. DATA PRESENTATION

1. Data Collection

Trade data are taken from the BACI database. The database shows the value of annual bilateral trade for many countries between 1992 and 2022 at the 6-digit HS code level. Data prior to 1998 have been removed, leaving only the period from 1998 to 2022. This reference period was chosen because it covers the 1998-2010 period of the reference article, and extends the period over a further 12 years. The data were then aggregated at the 4-digit level. This data aggregation reduces the risk of misclassification, or changes in classification that may occur over time (influencing the trade data without the trade itself having changed), while maintaining a sufficiently fine level of granularity.

Figure 1

Number of countries sampled in the BACI database per year, total and by continent.



Data: **BACI**.
Note: The continents were determined using the UN classification.

Figure 1 shows that the countries present in the database are not constant over time, and their number varies between 213 and 227 depending on the year. This is either because they do not exist for the entire 24-year period selected, or because trade data are not available for these countries for certain years. By retaining only those countries for which data is available for the entire 1998-2022 period, we obtain a sample of 207 countries.

These trade data were then combined with information on real PPP GDP per capita from the World Bank Indicators[1]. As data is not available for all countries in the sample over the defined period, the final remaining sample consists of 174 countries. Trade values were then transformed into constant 2012 US dollars using FRED's CPI index, to focus only on variations due to trade and not on those linked to currency changes (mainly inflation).

Part of the analysis also differentiates between categories of goods, namely extractables and commodities, as these types of goods often weigh more heavily in the balance of trade of poorer

[1] Data available at **https://data.worldbank.org/indicator/NY.GDP.MKTP.PP.CD**

countries. This categorization of goods is based on the list provided by the reference article and is available in the Appendix (**Item A3.1**).

Finally, descriptive data on population and land mass are taken from the World Bank Indicators[2].

2. Data Description

The final trade data sample comprises 174 countries. **Table 1** shows that all continents are evenly represented in the sample, except for Oceania, which naturally has fewer countries.

Table 1

Number of countries by continent from the final Sample

Continent	Number of countries in the Sample
Africa	45
Asia	44
Europe	36
America	35
Oceania	14
TOTAL	174

Data: **BACI**.

Country characteristics also vary widely. The land area of countries varies from 20 to 16,381,300 km², and GDP varies from 37 million to 14,244 billion dollars for 1998 data (**Table 2**). These differences in country characteristics must be considered when analyzing the results and are compared with the characteristics of the countries in the reference study in the next paragraph.

Table 2

Descriptive Statistics of the Final Sample

Descriptive Statistics	Mean	25th Percentile	Median	75th Percentile	Min	Max
GDP per capita (thousand USD)	5,389	2,197	5,578	14,975	430	92,315
GDP (thousand USD)	41.470.090	9.981.805	46.027.772	265.395.117	37.811	14.244.876.327
Population	4.594.805	1.293.438	6.003.084	19.139.493	9.634	1.241.935.000
Land Size	70.115	21.406	112.324	479.255	20	16.381.300

Data: **World Bank (2024)**.

3. Differences with the Reference Article

As one of the challenges of this work is to partly reproduce the results of the reference article, it is important to compare the new data with the previous ones.

The first difference is in temporality. The data in the reference article covers a period of 12 years, whereas the data used to reproduce the article covers twice that period. Secondly, the

[2] Data available at **https://data.worldbank.org/indicator/NY.GDP.MKTP.PP.CD**

number of countries in the final sample was 112 in the reference article, versus 174 in the current sample. The 47 countries included in this analysis but not in the authors' are listed in the Appendices (**Table A3.1**). The additional countries are mainly African and Asian. There are also 9 additional Oceanic countries, tripling the sample size from the 5 present in the reference article. These countries are all islands. The same trend can be observed in the Americas, with 8 more countries, all island countries except Suriname. Finally, there are only two new European countries. We therefore expect the results for these countries to be fairly similar to those of the authors for the 1998-2010 period.

These differences are reflected in discrepancies in the descriptive statistics between this work and the authors' paper. The addition of these new countries has reduced the sample's average and median GDP/capita. Island countries also pull down the average land size.

III. RESULTS

1. Exports concentration

1.1. Overview

This section aims to show that exports are highly concentrated for all countries, even those with a perceived stable economy. **Table 3** shows that, worldwide, a country's exports are highly concentrated. This concentration applies not only to goods, but also to goods by destination (flows).

Table 3

Export Concentration among top 20 goods and flows and power law coefficients in 2022.

Rank	Export Shares: **Goods** (%)		Export Shares: **Flows** (%)	
	All Goods	Excl, Extractables and Commodities	All goods	Excl, Extractables and Commodities
1	30,57%	24,85%	17,95%	15,12%
2	12,52%	10,49%	7,87%	6,69%
3	6,62%	6,41%	5,23%	4,62%
4	4,56%	4,63%	3,84%	3,54%
5	3,27%	3,57%	3,03%	2,70%
6	2,66%	2,88%	2,46%	2,28%
7	2,20%	2,38%	2,07%	1,88%
8	1,86%	2,00%	1,81%	1,68%
9	1,60%	1,74%	1,59%	1,48%
10	1,40%	1,54%	1,40%	1,34%
11	1,24%	1,39%	1,26%	1,21%
12	1,11%	1,28%	1,15%	1,10%
13	1,00%	1,17%	1,05%	1,02%
14	0,92%	1,09%	0,97%	0,94%
15	0,85%	1,02%	0,90%	0,88%
16	0,77%	0,95%	0,84%	0,83%
17	0,72%	0,89%	0,78%	0,77%
18	0,67%	0,83%	0,73%	0,73%
19	0,63%	0,79%	0,68%	0,69%
20	0,59%	0,74%	0,64%	0,66%
Total	75,77%	70,65%	56,28%	50,16%
Power Law	-0,76	-0,86	-0,91	-0,97

Data: **BACI**.

Note: This table shows, for each top 20 good or flow (good-by-destination), the average share it represents in the total of exportation in value of the countries at HS4 level in 2022, extractables and commodities included or not. It also shows the Power Law coefficients, given by the regression of the log rank on the log export share.

In 2022, the most exported good represented on average 30.57% of a country's total exports. The 20 most-exported goods for each country represented an average of 74.49% of their total exports. In other words, the 20 most-exported goods of each country weighed on average 3x more than all the 1221 other goods. This trend remains high (70.65%) even if we exclude extractables and commodities, which generally account for a very large share of exports in certain countries, notably in Africa. Those observations are in line with what was found by the reference paper in 2010, and when we compute for 2010, we can find very close results (**Table A1.1-B**)

Table 4

Export Concentration among top 20 goods and power law coefficients in 2022 for groups of countries.

Rank	Export Shares							
	African Countries		EU Countries		OECD Countries		Non-OECD Countries	
	All Goods	Excl, Extractables and Commodities	All Goods	Excl, Extractables and Commodities	All Goods	Excl, Extractables and Commodities	All Goods	Excl, Extractables and Commodities
1	44,40%	31,73%	11,41%	11,78%	14,85%	12,67%	34,66%	28,02%
2	17,15%	13,32%	5,54%	5,78%	7,70%	6,38%	13,78%	11,56%
3	6,96%	7,37%	4,49%	4,18%	5,29%	4,71%	6,97%	6,85%
4	4,46%	4,60%	3,32%	3,16%	3,61%	3,80%	4,80%	4,85%
5	3,04%	3,68%	2,51%	2,47%	2,82%	3,01%	3,39%	3,71%
6	2,32%	2,90%	2,28%	2,13%	2,41%	2,46%	2,73%	2,99%
7	1,82%	2,41%	1,94%	1,87%	2,11%	2,09%	2,22%	2,46%
8	1,49%	1,95%	1,72%	1,67%	1,83%	1,86%	1,87%	2,04%
9	1,27%	1,69%	1,56%	1,53%	1,66%	1,65%	1,59%	1,77%
10	1,08%	1,45%	1,38%	1,42%	1,44%	1,50%	1,39%	1,55%
11	0,92%	1,28%	1,32%	1,31%	1,33%	1,35%	1,21%	1,40%
12	0,83%	1,19%	1,22%	1,25%	1,21%	1,27%	1,09%	1,28%
13	0,72%	1,08%	1,15%	1,17%	1,11%	1,19%	0,98%	1,17%
14	0,65%	0,98%	1,07%	1,12%	1,04%	1,13%	0,89%	1,08%
15	0,58%	0,93%	1,00%	1,07%	0,97%	1,09%	0,81%	1,01%
16	0,52%	0,86%	0,95%	1,01%	0,91%	1,02%	0,74%	0,93%
17	0,47%	0,80%	0,91%	0,97%	0,87%	0,97%	0,68%	0,87%
18	0,43%	0,74%	0,88%	0,94%	0,82%	0,93%	0,63%	0,81%
19	0,39%	0,70%	0,84%	0,90%	0,79%	0,89%	0,59%	0,76%
20	0,35%	0,65%	0,80%	0,87%	0,75%	0,86%	0,55%	0,72%
Total	89,84%	80,33%	46,28%	46,62%	53,53%	50,85%	81,58%	75,81%
Power Law	-0,62	-0,77	-1,13	-1,17	-0,99	-1,10	-0,73	-0,82

Data: **BACI**.

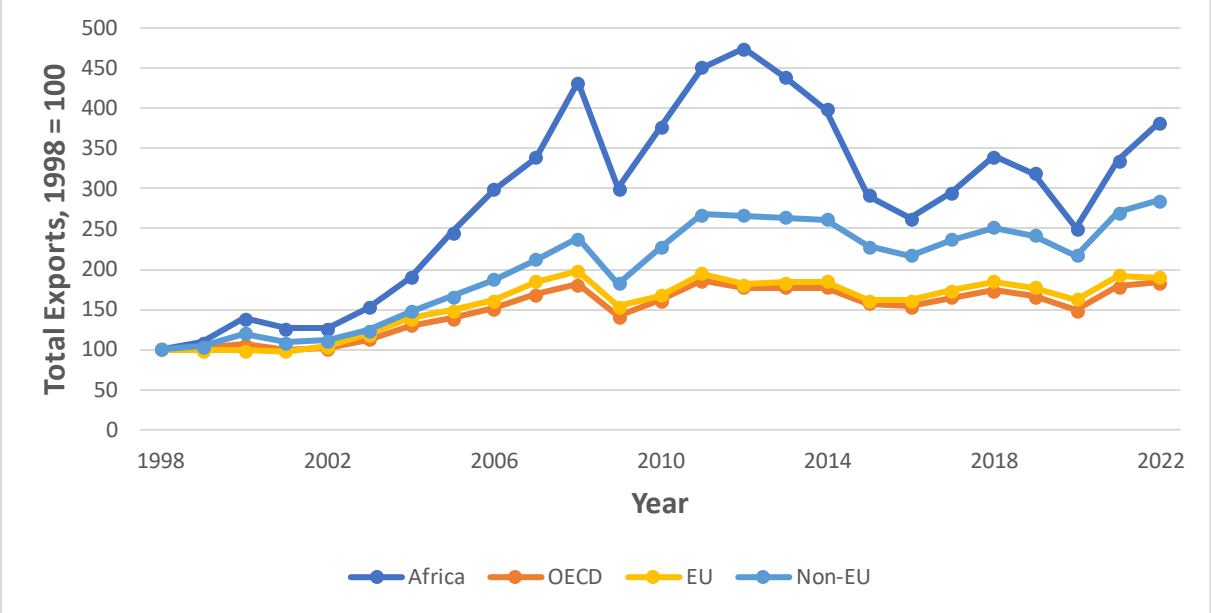
If we take the top 20 goods by country group (**Table 4**), total average concentration rises to 89.84% in 2022 for African countries but falls to 80.33% once this type of good is excluded. For OECD countries, on the other hand, the exclusion of this type of good from the calculations

leads to virtually no change in concentration, rising from 46.28% to 46.62% once the goods have been excluded. Again, those results are close to what was found by the authors of the reference paper for 2010, and we can find similar results if we replicate them for 2010 (**Table A1.2-B**).

This nuance in the types of goods is even more important as African countries play an increasingly important role in the world trade balance. **Figure 2** shows that exports from these countries increased by a factor of 3.8 between 1998 and 2022, compared with a factor of 1.9 for European countries. The tendency of the results is in line with the one of the reference paper for the 1998-2010 period but with an even higher growth (the index for 2010 was around 300 in the reference paper, and at 377 with our updated dataset).

Figure 2

Export growth for group of countries.



Data: **BACI**.

We can also observe this trend when we compare the average growth of exports by group of countries for the year 2010 (**Table 5-A**) and 2022 (**Table 5-B**). Those results are not weighted averages but simple averages. What is interesting is that we observe higher results than what was found by the authors for 2010, but we can see huge spikes in results for the year 2022. While we expect to see a higher growth than in 2010 (because the base year is 1998), we see that the average growth increased a lot in Asia with an average growth of 2021%, while the median didn't increase on the same basis. This means that a few countries (either new to the dataset or not) in this continent showed huge growth during the 2010 to 2022 period. This is confirmed by the growth of the 90th percentile for Asia. This motivates this replication of the study, to see if the differences in growth have an impact on the results showed by the authors for the same period, and if the new period will have an impact or not.

Table 5

Export growth across regions and types of goods from 1998 to 2010 and 2022.

A. 2010

	Africa	North America	South America	Asia	Europe	Oceania
Avg. Country	355	484	281	657	240	388
Avg Country, Top 5 in 1998	371	141	310	270	146	185
Avg Country, with share >10% in 1998	513	153	273	315	136	228
Median Country	219	151	280	335	191	162
Perc. 90th Country	598	361	387	820	400	666
Perc 10th Country	105	58	171	146	136	65
Avg. Country, w/o Ext or Como.	302	507	199	348	218	438
Avg. w/o Ext. or Como., Top 5 in 1998	205	126	185	258	135	151

B. 2022

	Africa	North America	South America	Asia	Europe	Oceania
Avg. Country	520	168	460	2021	326	951
Avg Country, Top 5 in 1998	298	180	355	350	151	255
Avg Country, with share >10% in 1998	327	196	301	418	134	304
Median Country	345	158	370	523	279	209
Perc. 90th Country	1086	307	570	2318	634	731
Perc 10th Country	108	27	218	157	121	56
Avg. Country, w/o Ext or Como.	376	164	288	716	302	1045
Avg. w/o Ext. or Como., Top 5 in 1998	276	155	223	330	137	171

Data: **BACI**.

Note: Average country is the index of growth with 1998 = 100; top 5 means that we only take the 5 biggest countries of the region; with share > 10% in 1998 means that we only take country accounting for 10% of the total exportation of the region.

This concentration also applies to flows (good-by-destination), since the top 20 flows account for 56.28% of the total value of exports. This number is logically lower than for goods (there was an average of 24,530 flows per country in 2022) and is relatively unaffected by the exclusion of extractables and commodities, even though they account for a significant share of African countries' flows compared to OECD countries (**Table 3**). If we split it into a group of countries like we did for the goods, we find again that the concentration is lower than for the goods, but this was expected (**Table 6**). We also see that the total part that the top 20 flows represent in the total of exportations of the African countries is 74,15%, while it goes down to 28,24% for OECD countries. This difference is way more important than for the goods, which would suggest that African countries are not only more concentrated in terms of what they export, but also to where they export those goods.

Those results are, once again, very similar to the ones we found for 2010 but with slightly higher concentration percentages (**Table A1.3-B**). When we compare the results with the ones computed in the reference paper, we find that they align, meaning that the change of dataset didn't impact much what the authors found.

Table 6

Export Concentration among top 20 goods and power law coefficients in 2022 for groups of countries.

Rank	Export Shares							
	African Countries		EU Countries		OECD Countries		Non-OECD Countries	
	All Goods	Excl, Extractables and Commodities	All Goods	Excl, Extractables and Commodities	All Goods	Excl, Extractables and Commodities	All Goods	Excl, Extractables and Commodities
1	26,48%	20,49%	3,84%	3,98%	6,53%	4,93%	20,92%	17,78%
2	10,53%	8,47%	2,29%	2,10%	3,28%	2,68%	9,07%	7,74%
3	6,90%	5,88%	1,84%	1,73%	2,46%	2,12%	5,96%	5,28%
4	4,82%	4,44%	1,55%	1,42%	2,04%	1,68%	4,31%	4,02%
5	3,84%	3,40%	1,34%	1,19%	1,74%	1,35%	3,37%	3,05%
6	3,07%	2,94%	1,20%	1,06%	1,46%	1,20%	2,72%	2,56%
7	2,48%	2,42%	1,10%	0,89%	1,33%	1,05%	2,26%	2,10%
8	2,18%	2,17%	0,94%	0,80%	1,12%	0,95%	1,99%	1,87%
9	1,86%	1,89%	0,83%	0,74%	1,00%	0,86%	1,74%	1,65%
10	1,67%	1,68%	0,77%	0,68%	0,92%	0,80%	1,53%	1,48%
11	1,49%	1,51%	0,72%	0,63%	0,84%	0,75%	1,37%	1,33%
12	1,35%	1,36%	0,67%	0,59%	0,78%	0,69%	1,24%	1,20%
13	1,24%	1,23%	0,62%	0,56%	0,72%	0,66%	1,14%	1,11%
14	1,12%	1,12%	0,59%	0,53%	0,68%	0,62%	1,05%	1,02%
15	1,02%	1,05%	0,56%	0,51%	0,63%	0,59%	0,97%	0,96%
16	0,96%	0,96%	0,53%	0,50%	0,59%	0,57%	0,91%	0,89%
17	0,88%	0,90%	0,51%	0,47%	0,56%	0,54%	0,84%	0,84%
18	0,82%	0,86%	0,49%	0,45%	0,54%	0,51%	0,78%	0,79%
19	0,76%	0,79%	0,47%	0,43%	0,52%	0,49%	0,73%	0,74%
20	0,69%	0,74%	0,45%	0,42%	0,50%	0,48%	0,67%	0,71%
Total	74,15%	64,31%	21,30%	19,69%	28,24%	23,52%	63,59%	57,11%
Power Law	-0,84	-0,92	-1,37	-1,34	-1,17	-1,29	-0,88	-0,94

Data: **BACI**.

1.2. Power Law Coefficients

As in the reference article, we also computed the Power Law Coefficient. **Table 3** shows this coefficient for goods and flows, with or without extractables and commodities. This coefficient is calculated by regressing the log rank on the log share between countries and goods. This type of coefficient is generally quite effective in describing many economic phenomena, including concentration.

A Small Coefficient (below 1 in absolute value) indicates extremely high concentration, as export shares decline very slowly with rank. This reflects situations where a few top-ranked goods dominate the export basket, leaving negligible contributions from lower-ranked goods. Larger coefficients on the other hand indicate lower concentration, as export shares decline

steeply, with many goods contributing more evenly to the export basket. This is characteristic of more diversified economies.

The results for the year 2022 show a very low coefficient in absolute value of -0,76 for goods. If we exclude extractables and commodities and take into account the country of destination, this coefficient increases in absolute value to -0,97. This shows that there is a big concentration of goods and flows exported when we look at the top 20. These initial results concerning concentration can also be observed in 1998 and 2010 (**Table A1.1-A** & **Table A1.1-B**). Compared to the reference paper, the results are very similar when we compute the coefficients for the same period with the bigger dataset and are also similar through time when we extend the results for the period 1998-2022.

1.3. Destination Concentration Index

Another measure of market concentration that can be used is the Herfindahl Index (HI). It's mostly used to assess the level of competition within a market by summing up the squares of the marker shares of all firms in the market. In the context of export destinations, the Herfindahl index helps to quantify the concentration of a country's exports across different destinations. A higher Herfindahl index indicates a higher concentration of exports in fewer destinations, while a lower index suggests a more diversified trade strategy.

We compute the Herfindahl index **(1)** for each product exported from each country, which indicates concentration levels (a higher index signifies greater concentration).

$$\boldsymbol{HI} = \sum_{\boldsymbol{i=1}}^{\boldsymbol{N}} (\boldsymbol{s_i^2}) \tag{1}$$

with:
$\boldsymbol{s_i}$ = share of the total export value for a good for a specific destination i
N = the number of destinations

We then calculate the Destination Concentration Index by weighing the Herfindahl indexes for the same country by the value each good represents in its total exports **(2)**. This index will allow us to summarize the concentration for the entire distribution.

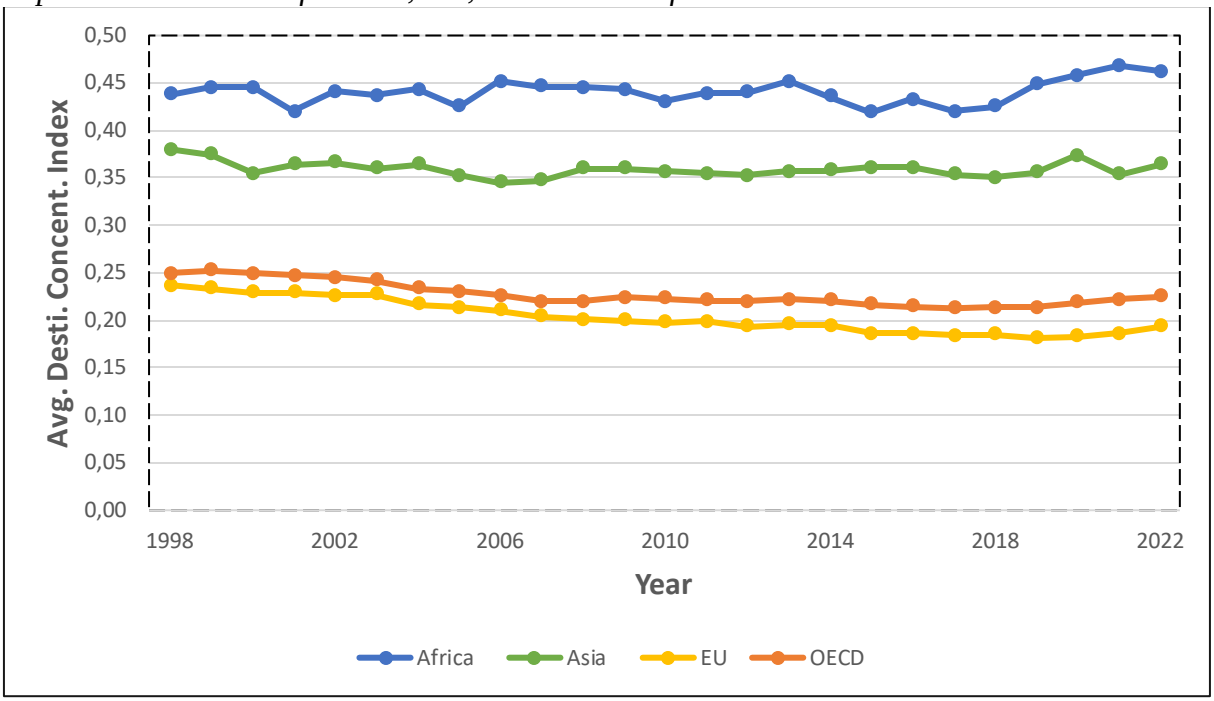
$$\boldsymbol{Destination\ Concentration\ Index} = \frac{\sum_{\boldsymbol{j=1}}^{\boldsymbol{M}} (\boldsymbol{HI_j} \times \boldsymbol{V_j})}{\sum_{\boldsymbol{j=1}}^{\boldsymbol{M}} \boldsymbol{V_j}} \tag{2}$$

with:
$\boldsymbol{HI_j}$ = Herfindahl index for product *j*.
$\boldsymbol{V_j}$ = total export value of product *j*.
$\boldsymbol{M}$ = total number of products exported.

Finally, we can compute the average of those Destination Concentration Index for different groups of countries. **Figure 3** shows this average for African, Asian (often developing), EU and OECD countries. Concentration trends between countries persist over time. African countries have a significantly higher average Destination Concentration index than developed and developing countries.

Figure 3

Export concentration of OECD, EU, non-EU and African countries.



Data: **BACI**.

1.4. Concentration and Export Variables

The link between concentration and a country's wealth can be further explored by regressing the Power Law coefficient on the log GDP/capita for 2022. **Table 7-(1)** shows a negative and highly significant coefficient. In other words, as GDP/capita rises, the Power Law coefficient falls: wealthier countries are, on average, more diversified. The same is observed when regressing on total log exports (**Table 7-(2)**): a country that exports more is more diversified, but these results could be related to income. A final variable that could be important is the number of goods or flows (**Table 7-(3)**). Here we find a very strong negative coefficient, which is normal since the number of goods is itself a form of variable calculating concentration: the more a country exports a varied number of goods, the more likely it is that its export concentration is low. If we control for GDP/capita and total exports, these results remain significant (**Table 7-(4)**). The results obtained for flows are like those obtained for goods, but with different coefficients. Moreover, these results are like those found for 2010 (**Table A1-(4)**).

To summarize, the findings in this first section are very similar to the ones found in the Reference Article. All the countries in the sample have very concentrated exports in goods and in flows, even when we do not account for extractables and commodities. This can be seen though their Top 20 exports, but also through Power Law Coefficients and Destination Concentration Indexes. Therefore, countries do not only rely on a few goods for their exports, but also on a few destinations. However, we observe important differences among countries. Richer countries (GDP/capita) and bigger exporters (number of goods and total of exports) are, on average, less concentrated.

Table 7

Concentration across goods and flows with GDP per capita, total exports and number of exported goods in 2022.

Dependent Variable: Power Law Coefficient for Top 20 Goods and Flows								
	Goods				Flows			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
ln(GDPpc)	-0,0483***			0,00863	-0,0988***			0,0101
	(0,0216)			(0,0336)	(0,0124)			(0,0317)
ln(Total Exports)		-0,0430***		0,0254		-0,0874***		0,0993*
		(0,0151)		(0,0218)		(0,0210)		(0,0247)
ln(nb Goods Exp)			-0,357***	-0,367***			-0,241***	-0,347***
			(0,0412)	(0,0549)			(0,0191)	(0,444)
# of countries	174	213	213	174	174	213	213	174

Data: **BACI**.

Note: The table reports coefficients from an OLS regression of power law coefficients on diverse variables. Standard error in parentheses. ***p < 0,01, ** p <0,05, * p <0,10.

2. Exports Instability

2.1. Top Exports Churning

Another important finding from the authors of the Reference Article is that exportations are instable: the concentration remains high for the countries, but not always for the same goods or flows. We can illustrate this phenomenon by taking the same 4 countries as the authors: Tanzania, Ghana, Germany and the US. For each country we rank the top 10 exports goods in 1998, 2010 and 2022 to see how the ranking of each top export good evolves through time. Taking those specific countries allows us to see the importance of the churning of ranks, as well as confirming that this instability does not come from a misclassification (when a good change classification, making the top good change but not the real exports).

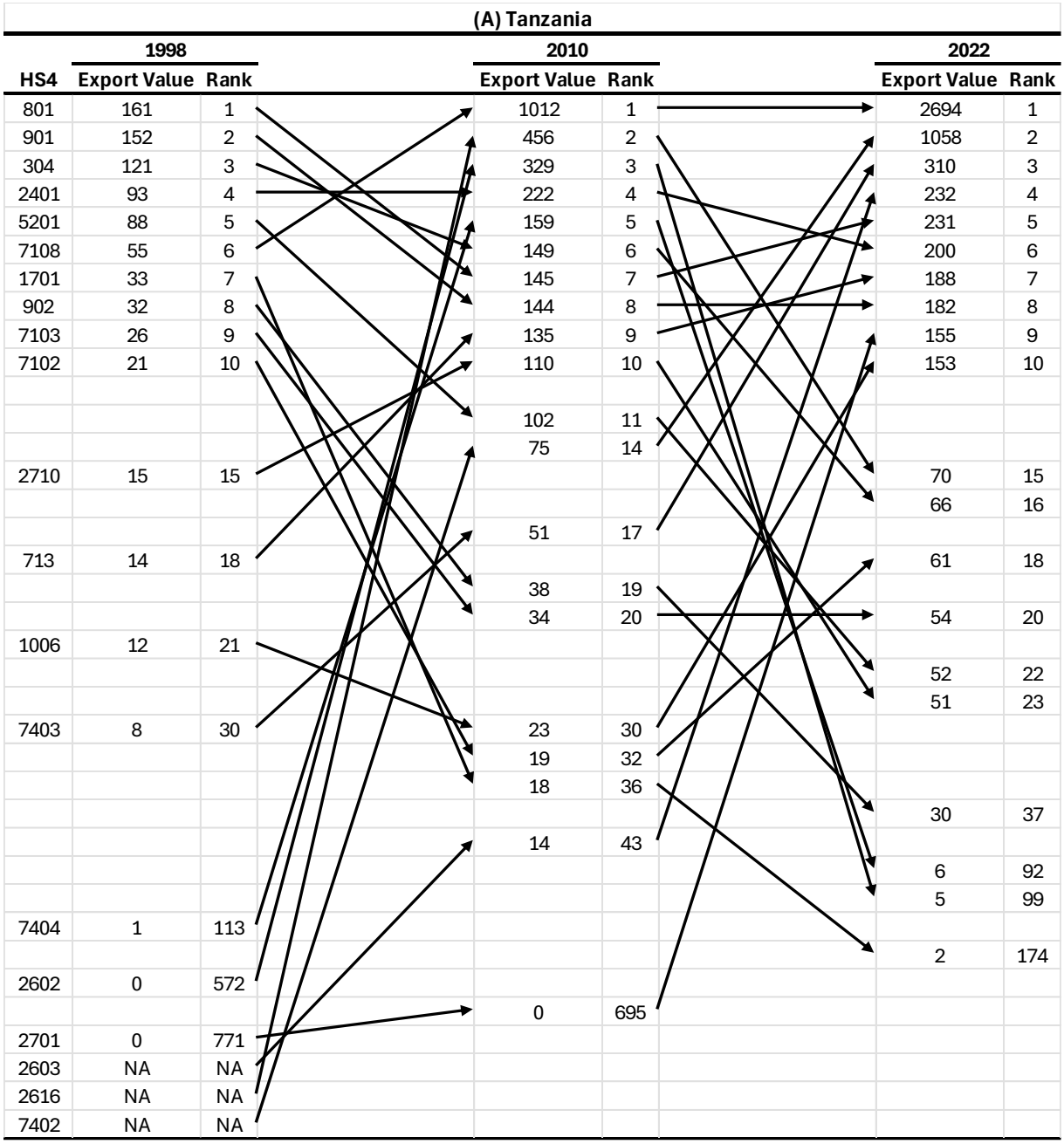
Figure 4 shows that instability seems to be linked to something else than misclassification in most cases, because the new products are very different than the previous ones. But contrary to the reference article, we observe this situation more frequently, especially between 2010 and 2022. In the case of non-misclassification, the changes could be the results of different factors, such as a change in global demand (technologies appearing and disappearing, leading in changes directly from those goods, through the goods used to make those new products), geopolitical agreements (trade agreements, embargos…) or a change in comparative advantage (productivity, human capital…).

Tanzania (**Figure 4-A**) top 3 exports in 1998 were Nuts (edible), Coffee and Fish, so very much focused on agriculture. In 2010, these exports remained virtually unchanged in terms of value, but there was an explosion in exports of products that were not imported at all, such as gold, copper and precious metals, which became the country's top 3 exports, accounting for over 50% of the total value of exports. This marks the transition from an agricultural export economy to a mining export economy. Similar to what the authors of the reference article found, this is explained by a general increase in demand for these metals. In the space of 12 years, the country's trade has totally changed, and so have its destinations, since where very little trade

was with Asian countries in 1998, a very large proportion of these metals is now exported to the continent in 2010. The paper also shows that this churning is not confined to this period, but is also taking place between 2010 and 2022.

Figure 4

Top exports churning for Tanzania (A), Ghana (B), Germany (C) and the US (D) in 1998, 2010 and 2022.



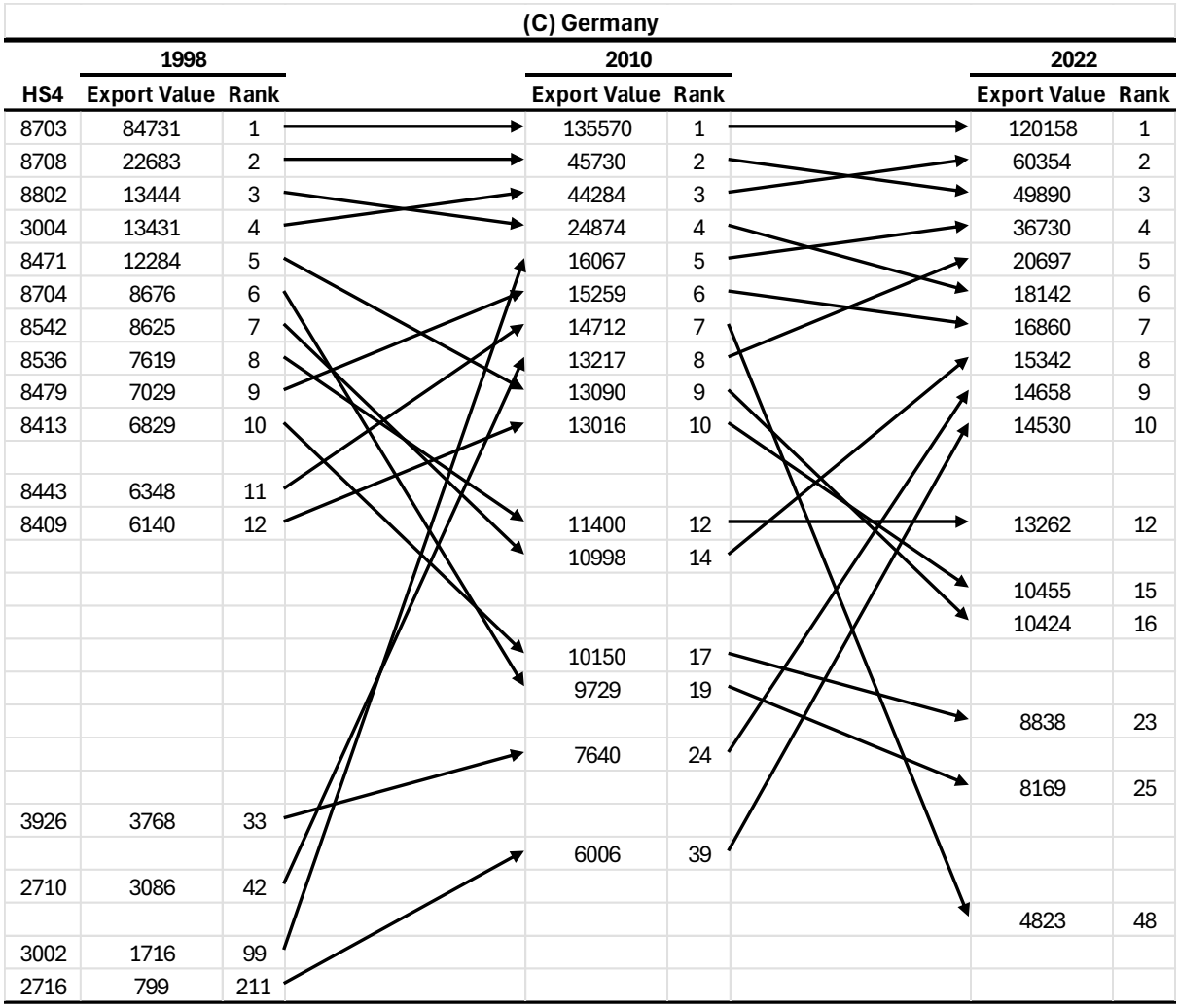
This is an interesting example, since gold exports continued to rise and remain in first place. Exports of copper 7404 (Copper; waste and scrap) have fallen sharply, but at the same time, exports of copper 7402 (Copper; unrefined, copper anodes for electrolytic refining) and 7403 (Copper; refined and copper alloys, unwrought) have risen to second and third place respectively. This may reflect a change in classification or a change in the type of copper

exported. Finally, precious metals, which occupied third place in 2010, are relegated to 99th place. We are therefore faced with a country whose exports were agricultural and underdeveloped in 1998, and a country turned towards mining exports, particularly gold and copper, from 2010 onwards, a trend which continues in 2022.

(B) Ghana

	1998		2010		2022	
HS4	Export Value	Rank	Export Value	Rank	Export Value	Rank
1801	740	1	3602	1	7688	1
7108	187	2	921	2	4200	2
4412	144	3	129	3	875	3
7102	141	4	99	4	404	4
7601	76	5	88	5	363	5
4407	75	6	76	6	352	6
1804	37	7	71	7	216	7
1604	37	8	49	8	146	8
4408	35	9	41	9	128	9
2710	29	10	37	10	126	10
			35	11	92	11
1803	22	12	34	12		
			29	13	86	13
2602	15	16				
					58	18
7606	11	20				
4001	9	28				
					19	31
			7	49		
801	2	56				
1805	1	77			4	77
					1	135
			0	215		
			0	377		
					0	532
2709	NA	NA	NA	NA		

In the case of Ghana (**Figure 4-B**), the same trend as in the reference article can be observed between 1998 and 2010, with cocoa and gold exports moving up to second and first place respectively. At the same time, manganese exports, which were almost non-existent in 1998, move up to third place in 2010. We are thus once again witnessing a decline in the importance of agricultural exports and a sharp increase in gold and manganese exports. Ghana, like Tanzania, has seen its trade patterns change as a result of an increase in global demand following the development, among other things, of demand for electronic devices. These exports remain relatively stable in the years up to 2022, but with the very significant development of oil exports, which until then had not existed at all in the country's trade balance and which move up to second place. Once again, exports are highly unstable, mainly due to a change in global demand for hydrocarbons and metals.



If we take a developed European country, Germany (**Figure 4-C**), here again the results of the reference article are confirmed: instabilities are less present than for developing countries, especially in the top 5 exported products, but they are still quite high. Germany exported mainly cars, motor vehicles and aircrafts in 1998. By 2010, aircrafts had been overtaken by pharmaceuticals, while cars and motor vehicles remained in 1st and 2nd place. In 2022, the trend remains the same at the top of the rankings, with cars still in the lead (despite a fall in the value of exports), medicines in 2nd and motor vehicles in 3rd.

Finally, if we look at the USA, we see even more instability than for Germany, as in the reference article, both between 1998 and 2010, and between 2010 and 2022, so that we find only one product from the 1998 top 5 in the 2022 top 5. However, where the authors had observed a drastic fall in aircrafts exports between 1998 and 2010 (from 1st to 142nd place), our analysis shows that these have not fallen so drastically and remain in 5th place. It is likely that a change in classification is at the root of such a difference between results and a change due to the quality of the sample (with more countries and more recent data). In any case, we once again observe strong variations in exports, not as spectacular as for Ghana and Tanzania, but surprisingly high nonetheless.

(D) USA

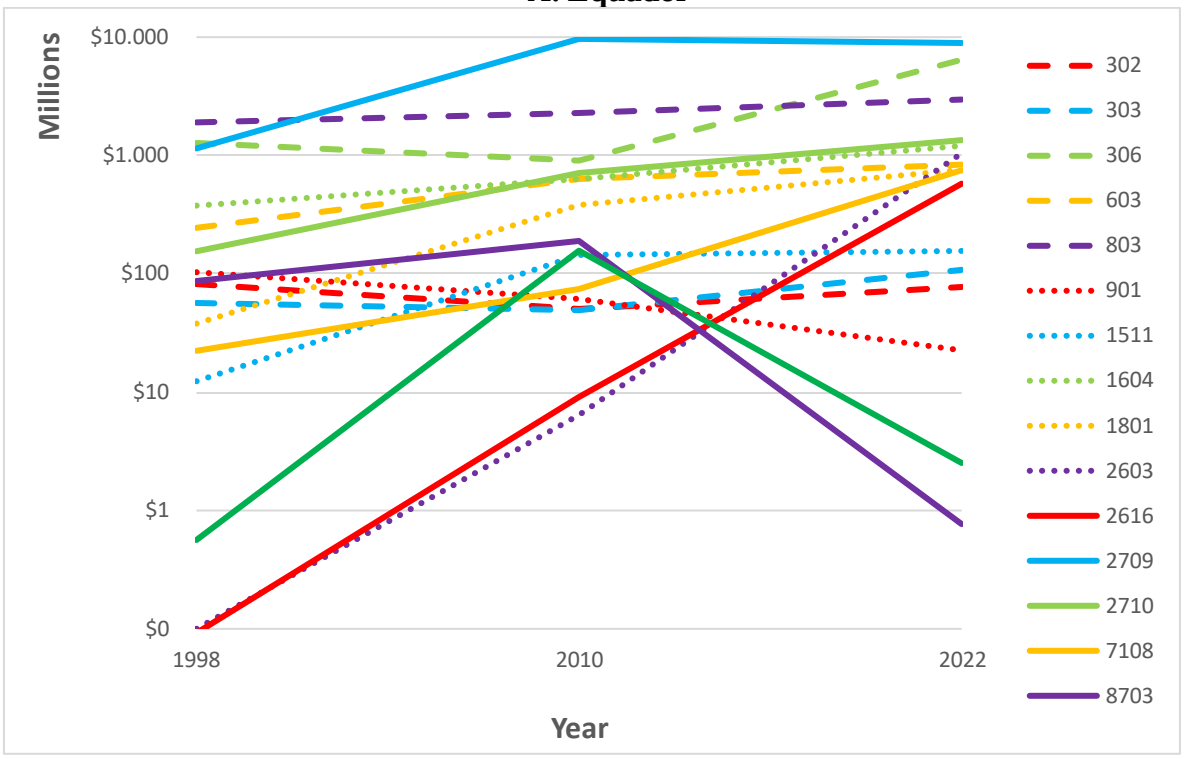
	1998		2010		2022	
HS4	Export Value	Rank	Export Value	Rank	Export Value	Rank
8802	52882	1	56393	1	111593	1
8542	50724	2	41974	2	95570	2
8708	37690	3	37305	3	93589	3
8471	36109	4	32734	4	46429	4
8473	26942	5	32093	5	40200	5
8703	24443	6	27008	6	37774	6
8411	21677	7	26849	7	31402	7
8803	21321	8	24796	8	30855	8
8517	13452	9	22835	9	30231	9
9018	11370	10	19750	10	27906	10
					26854	11
			17482	12		
			16119	13	26196	13
7108	7781	15	14755	15	22296	15
1201	7408	16	12937	16		
					18166	17
					14048	21
			10028	22		
3004	6246	23				
			8951	24		
2710	5770	25				
					9840	27
3002	3713	45				
			2033	129		
					1609	157
2709	1180	164				
2711	977	193				

This strong variation in the rank of countries' exports is also reflected in strong variations in the value of exports. The change in rank of an exported good is not only due to small variations in exports, but sometimes to very large changes in the value of exports of that product. The reference article had illustrated this variation in values by taking the example of Ecuador (**Figure 5-A**) and Kenya (**Figure 5-B**) and using a logarithmic scale to show the variations in export values of the 10 most exported products in 1998 and 2010. If we reproduce this graph with the most up-to-date data and show the evaluation of this value also in 2022, we can see that what the authors have observed is true for the period 1998, but also between 2010 and 2022. If we take Ecuador, for example, we see that car exports (8703) have risen from 87 million in 1998, to 190 million in 2010, before dropping to 1 million dollars of exports in 2022. At the same time, exports of precious metals (2616) rose from nothing to 9 million between 1998 and 2010, finally reaching 577 million export dollars in 2022. The significant change in the rank of the most exported products is therefore the result of significant changes in the export values of these products, and not just small changes.

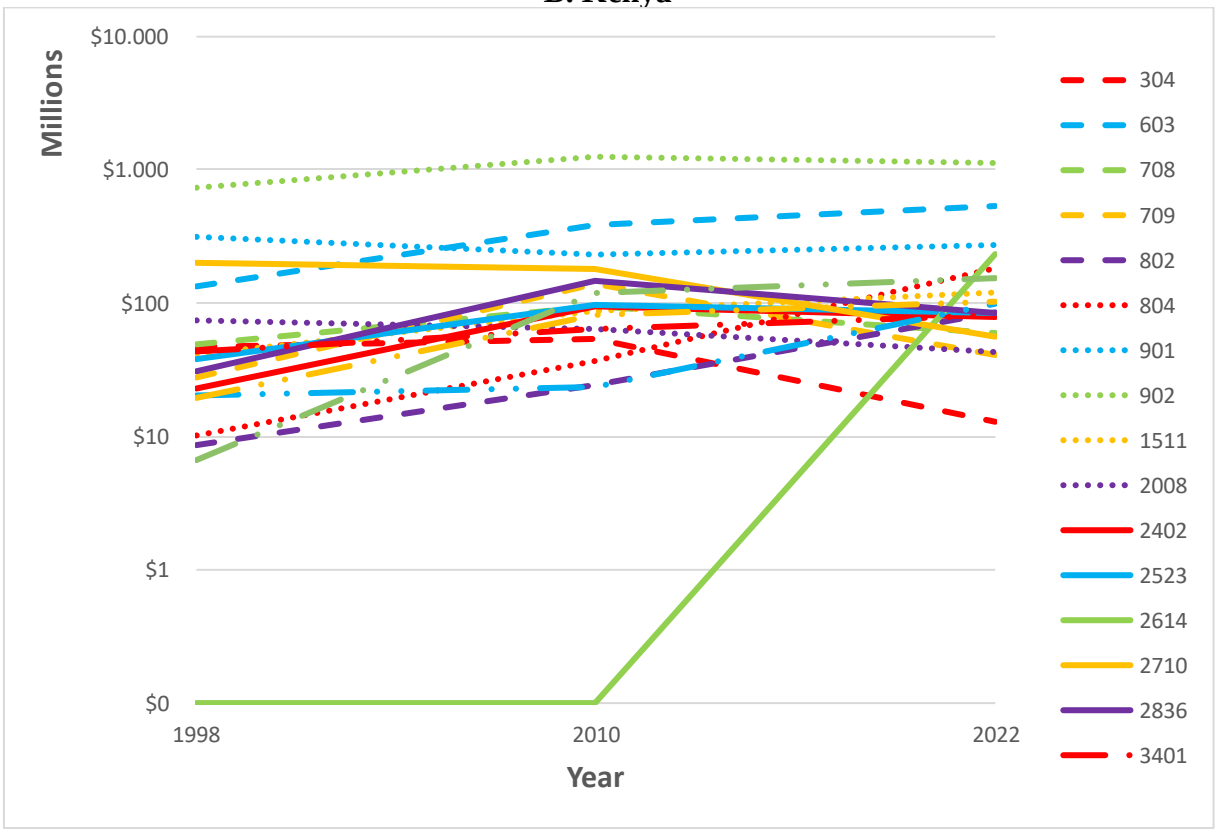
Figure 5

Countries top export revenues by good, log base 10 scale, 1998, 2010 and 2022.

A. Equador



B. Kenya



These changes in exports and imports are sometimes the result of interactions between the importer, the exporter and the product. If we take the example of the reference paper, we see that the observations they made for cut flowers still seem to hold true, and that an increase in demand for these products from certain countries (such as the USA) has benefited exports from nearby countries such as Colombia in 2010 and 2022 (**Table A1.5-B** & **Table A1.5-C**).

2.2. Rank Correlations

It is possible to systematize the instabilities of the most exported products to see if they are generalized or not. Like the reference article, we have ranked the most exported goods for each country in 1998 and 2010, while also doing so for 2022. We then keep only the products in the most distant date range (i.e. 1998 in the study), with alternative cutoffs (top 5, 10, 20, 50 and 100) to test the robustness of the coefficients. As in the reference article, if a product is present for one of the dates but not for another, we then give the rank value to this product equal to N+1, where N is the total number of products exported by this country on the given date. This solution is imperfect but only concerns a limited number of products. **Table 8** shows the average rank correlation coefficients between two dates for each country. This exercise is carried out for goods and for flows.

Table 8

Rank correlations of top exported goods and flows between several periods.

A. 1998v2022	TOP 5	TOP 10	TOP 20	TOP 50	TOP 100
1. Goods, Top in 1998					
All Goods	0,32	0,24	0,25	0,23	0,25
Exclude Extract. & Commo.	0,23	0,21	0,22	0,21	0,25
2. Flows, Top in 1998					
All Goods	0,12	0,11	0,12	0,12	0,12
Exclude Extract. & Commo.	0,09	0,10	0,11	0,11	0,11

B. 1998v2010	TOP 5	TOP 10	TOP 20	TOP 50	TOP 100
1. Goods, Top in 1998					
All Goods	0,42	0,34	0,32	0,29	0,32
Exclude Extract. & Commo.	0,40	0,30	0,29	0,27	0,32
2. Flows, Top in 1998					
All Goods	0,14	0,16	0,12	0,12	0,14
Exclude Extract. & Commo.	0,15	0,13	0,12	0,13	0,13

C. 2010v2022	TOP 5	TOP 10	TOP 20	TOP 50	TOP 100
1. Goods, Top in 2010					
All Goods	0,39	0,32	0,29	0,24	0,28
Exclude Extract. & Commo.	0,29	0,29	0,26	0,25	0,31
2. Flows, Top in 2010					
All Goods	0,20	0,19	0,12	0,11	0,12
Exclude Extract. & Commo.	0,20	0,14	0,09	0,10	0,12

We note that the correlation coefficient results are relatively close to those found by the reference article between 1998 and 2010 (**Table 8-B**), despite the larger sample. For example, the authors calculated a coefficient of 0.44 for the top 5 goods between 1998 and 2010, while the coefficient in this extended sample is 0.42. As in the reference article, the coefficients for flows are lower than those for goods, but this is to be expected, since in addition to product change there is also change of destination. We also note that the coefficients decrease as the sample size increases. Finally, excluding extractables and the commodities has virtually no impact on the results.

The average correlation coefficients obtained for the period 1998-2022 (**Table 8-A**) show even weaker results, with coefficients dropping to 0.09 for the top 5 flows excluding extractables and commodities. It therefore seems that correlations between countries' most exported products and flows from one period to the next are relatively weak, and that these coefficients tend to decrease over time. It is therefore difficult to predict what a country's exports will be based on current exports alone.

It also seemed interesting to calculate this coefficient average over the period 2010-2022 to understand which period had the greatest impact on the coefficient decrease between 1998 and 2022. We note that, in general, coefficient averages are lower between 2010 and 2022 (**Table 8-C**) than between 1998 and 2010 (**Table 8-B**), which could indicate that churning is more important in recent years than before.

Overall, **Figure 4** and **Table 8** confirm what the authors found with a smaller sample, and show that this trend appears to be continuing over time. Churning is present even for the most exported goods and flows, whether we look at the example of developed or poor countries, or whether we systematize the trend with correlation coefficients.

2.3. Regressions of Top Goods Probability

Now that we've shown that there's a high degree of instability in countries' exports, we're going to look, as the authors did in the reference article, to see if any country-specific characteristics can explain these instabilities.

To do this, we take the top 5, top 10 and top 20 goods exported by a country over two dates (1998-2010, 2010-2022 and 1998-2022). We then create a binary variable for each year, which takes a value of 1 if the good is among the top for that year, or a value of 0 if it is not. Then, using linear regression, we estimate the probability that a good that was in the top at a certain date (1998 or 2010) will still be in the top at a later date (2010 or 2022), controlling for the characteristics of that country **(3)**.

$$y_{g,c,t} = \alpha + \beta.\mathbf{1}\{Top_{g,c,t}\} + \gamma.X_{g,c}.\mathbf{1}\{Top_{g,c,t}\} + \delta.X_{g,c} + \mu_{g,c} \quad (3)$$

with:
$\{Top_{g,c,t}\}$ = binary indicator taking the value 1 if the good g in country c is a top good in year t or taking 0 otherwise.
$X_{g,c}$ = characteristics of the good g and country c

Table 9 shows the results of this regression, controlling for different country characteristics and with different parameters. The regression results shown here are for the periods 1998-2022, 1998-2010 and 2010-2022 and the Top 20. In the Appendix, the observations for these same

periods are shown, with alternatives for the Top 10 (**Table A2.1**) and Top 5 (**Table A2.2**) to test the robustness of the results.

Table 9

Probability to be a top 20 goods in different periods, marginal effects.

A. Top 20 - 1998 -2022

	(1)	(2)	(3)
Top in Start Year	0,454***	0,0725	0,00656
	(0,00241)	(0,132)	(0,0483)
ln(Inital GDPpc)		-0,00245***	-0,00379***
		(0,000400)	(0,000532)
ln(Inital GDPpc) x Top in Start Year		0,00578**	0,00536***
		(0,00930)	(0,00122)
Initial H. Index over Destinations			-0,00509***
			(0,00167)
Initial H. Index over Destinations x Top in Start Year			-0,00418
			(0,00280)
Observations	150338	122262	122262
# of countries	174	174	174

B. Top 20 - 1998 - 2010

	(1)	(2)	(3)
Top in Start Year	0,533***	0,0122	0,00732
	(0,00231)	(0,0882)	(0,0356)
ln(Inital GDPpc)		-0,00257***	-0,00317***
		(0,000402)	(0,000527)
ln(Inital GDPpc) x Top in Start Year		0,00509***	0,00483***
		(0,00969)	(0,000905)
Initial H. Index over Destinations			-0,00562***
			(0,00154)
Initial H. Index over Destinations x Top in Start Year			-0,00501
			(0,00776)
Observations	147237	122262	122262
# of countries	174	174	174

C. Top 20 - 2010 -2022

	(1)	(2)	(3)
Top in Start Year	0,597***	0,0507	0,00536
	(0,00218)	(0,102)	(0,0236)
ln(Inital GDPpc)		-0,00238***	-0,00284***
		(0,000388)	(0,000439)
ln(Inital GDPpc) x Top in Start Year		0,00536***	0,00648***
		(0,0109)	(0,00278)
Initial H. Index over Destinations			-0,00465***
			(0,00136)
Initial H. Index over Destinations x Top in Start Year			-0,00335
			(0,00213)
Observations	150338	147237	147237
# of countries	174	174	174

Data: **BACI**.
Note: The table reports coefficients from an OLS regression of power law coefficients on diverse variables. Standard error in parentheses. ***p < 0,01, ** p <0,05, * p <0,10.

First, we look at the first column of results for the period 1998-2022 (**Table 9-A-(1)**). It is obtained by taking no external characteristics or data into account when calculating the probability coefficient in equation **(3)**. The simplified equation is therefore:

$$y_{g,c,t} = \alpha + \beta . 1\{Top_{g,c,t}\} + \mu_{g,c} \quad (4)$$

The coefficient calculated from **(4)** is 0.45, which is relatively small and significant. In other words, if a good is in the top 20 most-exported goods of a country in 1998, there is on average a 45% chance that this good will be in the top 20 most-exported goods of this country in 2022. This coefficient is low and confirms the observations on churning found earlier in this paper. If we look at the results found by the authors, we see that they are close when the same period (**Table 9-B-(1)**) is selected (0.53 vs. 0.54 in the reference article). The difference in dataset therefore has very little impact on the results for this period. What's more, we can see that the probability decreases over time, from 0.53 to 0.45, when we extend the period from 2010 to 2022. In the more recent period 2010-2022, however, the regression coefficient is higher (**Table 9-C-(1)**), at 0.6. But in general, being a top 20 property at a certain period is not a very good predictor of still being a top 20 property at a later period. These results are robust with the top 10 and top 5 (**Table A2.1** & **Table A2.2**).

Secondly, as in the reference paper, we add the logarithm of the countries' GDP to the equation. If we add this characteristic to equation (3), we obtain:

$$y_{g,c,t} = \alpha + \beta . 1\{Top_{g,c,t}\} + \gamma . log(GDP\ per\ capita) . 1\{Top_{g,c,1998}\} + \delta . log(GDP\ per\ capita) + \mu_{g,c} \quad (5)$$

Looking again at the period 1998-2022 (**Table 9-A-(2)**), we see that the Top in Start Year coefficient becomes insignificant, while the GDP coefficient and the interaction coefficient between GDP and Top in Start Year are significant. The coefficient of ln(Inital GDPpc) is negative, indicating that the higher a country's GDP, the lower its probability of being in the

top 20. As the authors note, this is explained by the fact that the richer a country is, the more different goods it exports, and therefore the lower the probability of a good being in the top 20. The GDP/capita coefficient, however, is positive for the conditional probability. In other words, the probability of being in the top 20 for a good, if that good was already in the top 20 in 1998, increases with GDP. This positive coefficient of 0.0054 is larger than the unconditional coefficient of -0.0024, meaning that, on average, richer countries have a higher probability of having a good in their top 20 in 2022 if that good was in their top 20 in 1998 than poorer countries. Richer countries show less instability than poorer ones. If we now compare the results found with those of the authors for the same period 2010-2022 (**Table 9-B-(2)**), we find that once again the results are similar, despite a different dataset, with a calculated GDP coefficient of -0.0026 versus -0.0038 for the authors, and an interaction coefficient of 0.0051 versus 0.0066. The magnitude changes slightly, but not the direction of the coefficients. And if we compare between the periods calculated in this paper, we again notice little change, indicating that even over a longer period, the observation that GDP has an impact on the probability of a good remaining in the top 20 is verified. These results are again robust with the top 10 and top 5 (**Table A2.1** and **Table A2.2**).
Finally, in a third step, we can also add a control for concentration, namely the Herfindahl Index over Destinations calculated earlier for each exported product from each exporter. Equation **(3)** thus becomes:

$$y_{g,c,t} = \alpha + \beta.\mathbf{1}\{Top_{g,c,t}\} + \gamma.\log(GDP\ per\ capita).\mathbf{1}\{Top_{g,c,1998}\} + \delta.log(GDP\ per\ capita) + \rho.(Herf.Index).\mathbf{1}\{Top_{g,c,1998}\} + \sigma.log(Herf.Index) + \mu_{g,c} \quad (6)$$

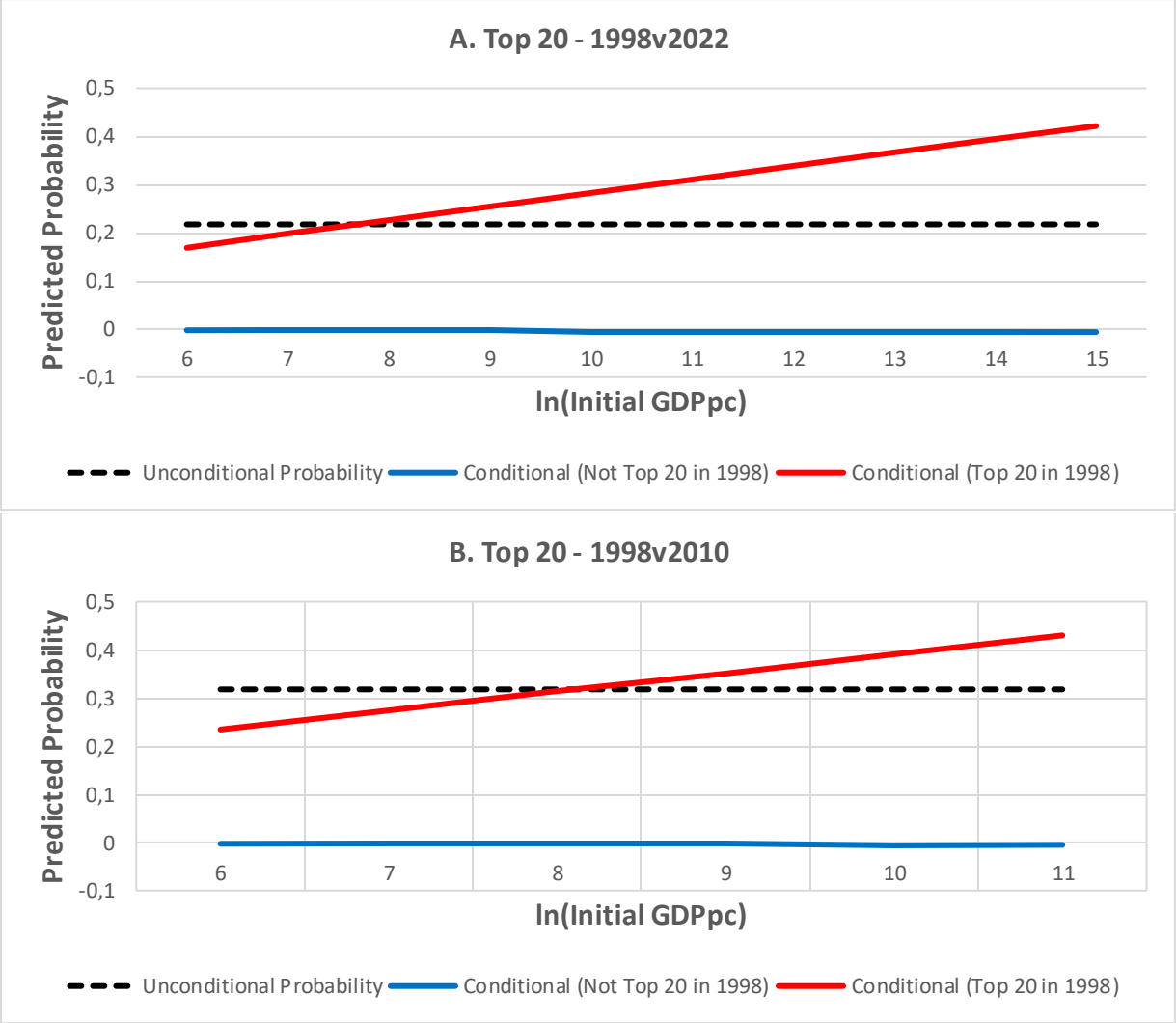
Adding this measure of concentration and looking again at the period 1998-2022 (**Table 9-A-(3)**), we note that, as in the reference paper, the coefficients found previously for GDP are still significant and with the same sign, but we also have the coefficient of the Herfindahl Index which becomes significant with a negative coefficient of -0.0051. To put it another way, a higher Herfindahl Index leads to a lower probability of a good being in the top 20. This means that a higher concentration of importers reduces the probability of a good being in the top 20. The more equitably a country exports the same good to different destinations, the more likely it is to be in the top 20. However, the interaction coefficient is not significant. The concentration of importers for a good in the top 20 in 1998 has no impact on its probability of remaining in the top 20 in 2022. At the same time, the interaction coefficient for GDP fell from -0.25 to -0.38 between **Table 9-A-(2)** and **Table 9-A-(3)**. This suggests a relationship between a country's wealth and its concentration. As with the two previous regressions, the results calculated for the same period as the reference paper (**Table 9-B-(3)**) are similar for all coefficients, and the direction of interpretation is similar for a longer period. The results found by the authors seem to hold up with more data and a longer period. As before, these results are robust to the top 10 and top 5 (**Table A2.1** & **Table A2.2**).

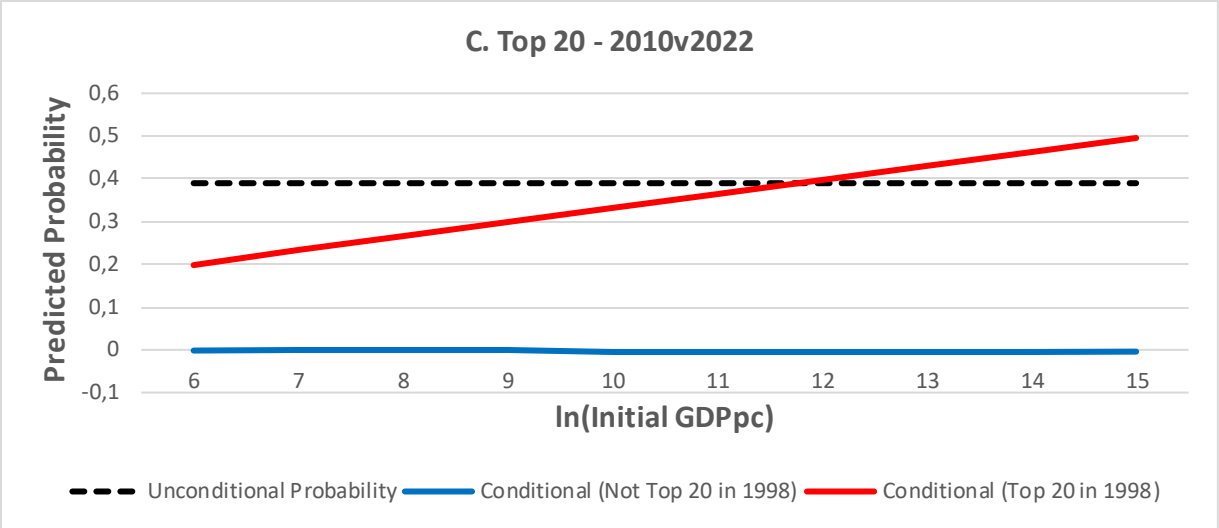
As the authors of the reference paper point out, these results are interesting because they show the importance of destinations (and therefore flows) in instabilities. The fact of exporting the same good to one or more countries, whether equally or not, has a significant impact on the instability of its exports. As we have seen, this concentration in destinations is also correlated with country wealth. We can confirm this correlation using the correlation coefficients (**Table A1.6**), where we see a negative coefficient of -0.28 between GDP and the Concentration Index. This could explain why GDP has an impact on instabilities (a richer country is less concentrated, and concentration itself impacts export stability).

Finally, we can check whether these results are also true once destinations are considered. **Figure 6** shows the linear regression coefficients obtained from equation **(4)** and **(5)** for different levels of ln(Initial GDP per capita). If we take the conditional probability of being a top 20 flow in 2022 according to country and flow characteristics in 1998 (Figure 6-A), we see an unconditional regression coefficient of 0.2174 (this is the coefficient obtained from **(4)**). This coefficient is, as expected, lower than the one obtained in **Table 7-A-(1)**, but still significant and positive. But once we introduce GDP/capita (from equation (5)), we see that this coefficient falls to -0.000424, while the interaction coefficient is 0.0286. Therefore, the conditional probability if the product was in the top 20 in 1998 is very low, whereas the combined coefficient (GDP coef. + GDP coef. x Top in Start Year) is 0.0281, indicating that the probability for a flow in the top 20 in 1998 to still be in the top 20 in 2022 increases strongly with GDP/capita. For all coefficients found, we find significant conditional coefficients, negative and very low for GDP/capita, and positive and very high for the interaction variable GDP x Top in Start Year.

Figure 6

Regression coefficients of GDP/capita on the Persistence of Top 20 Export Flows.





Data: **BACI**.
Note: The table shows the predicted probability of being a top 20 flow in different periods (2010 or 2022) that were or were not top 20 in previous periods (1998 or 2010). It also reports the unconditional probability of being a top 20 flow for the same periods.

If we go back to the reference paper period (**Figure 6-B**), we find similar results to those found by the authors, but with lower coefficients. The unconditional probability coefficient is 0.318, higher than that calculated for 2022. These results seem consistent, since the probability of a flow always being in the top 20 decreases over time, as we saw earlier. As for the marginal effects of conditional probabilities, we again observe amplitudes similar to those observed for flows for all coefficients. Finally, if we look at the unconditional probability and conditional probability of being a top 20 flow in 2010 if one is or is not a top 20 flow in 2022 (**Figure 6-C**), we note coefficients with the same signs and the same differences, but above all a different unconditional probability and conditional probability coefficients over the same 12-year period compared to 1998v2010. The unconditional probability coefficient is 0.390 versus 0.318 for the 1998v2010 period, while the combined conditional probability coefficient for flows in 2022 that were in the top 20 in 2010 is 0.0330, versus 0.0391 for the previous period. This means that in recent years, GDP has had less impact on the conditional probability of being a top 20 flow for flows that were in the top 20 12 years earlier. These results are again robust with the top 10 and top 5 flows for the same periods (**Figure A2.1** & **Figure A2.2**).

2.4. Year Selection Verification

The authors of the reference paper then check that the selected years are not the cause of the results. As this paper replicates what is done by the authors for different time periods, this work is already partly done. But it is always interesting to look at other time periods and see whether or not the results found by the authors are far from those produced by the more complete dataset. **Figure 7** shows the predicted probability of being a top 20 good computed using equation **(4)** with t = 1998 for all the results:

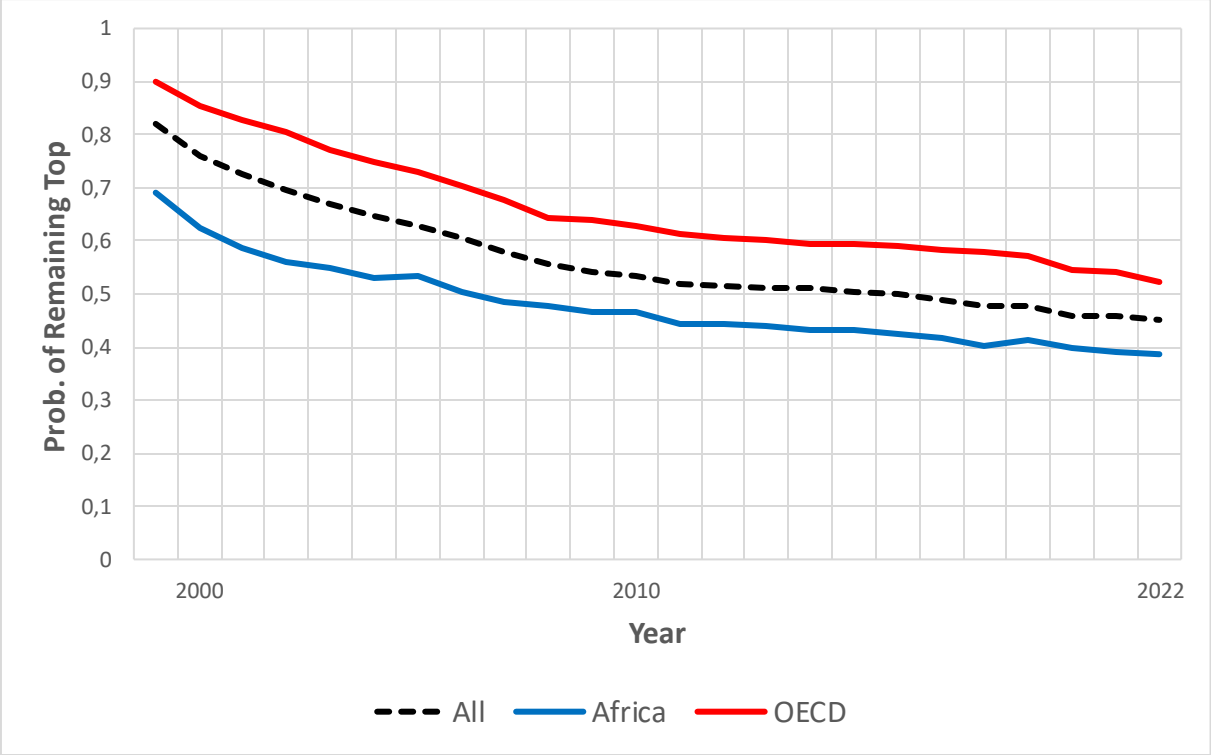
$$y_{g,c,t} = \alpha + \beta . 1\{Top_{g,c,1998}\} + \mu_{g,c} \quad (7)$$

with:
t = 1999, 2000,… 2022.
β = coefficient of interest used in **Figure 7**

Initially, we can see that the results obtained are very similar to those found by the authors for the 1998-2010 period. Once again, the addition of new countries to the dataset does not change the trend of the results found, and only slightly alters the coefficients. Secondly, if we look at the period following that studied by the authors, we see that the downward trend continues over time. The results found above are therefore probably not the result of measurement error or of a particular period, since they are verified every year over a longer period and there is no apparent break in the series. **Figure 7** also shows that this conditional probability is higher for developed countries like the OECD than for poorer ones like Africa. This confirms the idea that more developed countries experience less instability in their top exports over time, but this instability still increases as the years go by, so that the probability for a good in the top 20 in 1998 of an OECD country to still be in the top 20 of exports from this same country in 2022 is 0.522. This same probability is only 0.386 for African countries. These observations also hold true for the top 10 and top 5 exported goods (**Figure A2.3** & **Figure A2.4**).

Figure 7

Predicted probability to be a top 20 good in each year from 1999 to 2022 conditional on being a top 20 good in 1998.



Data: **BACI**.

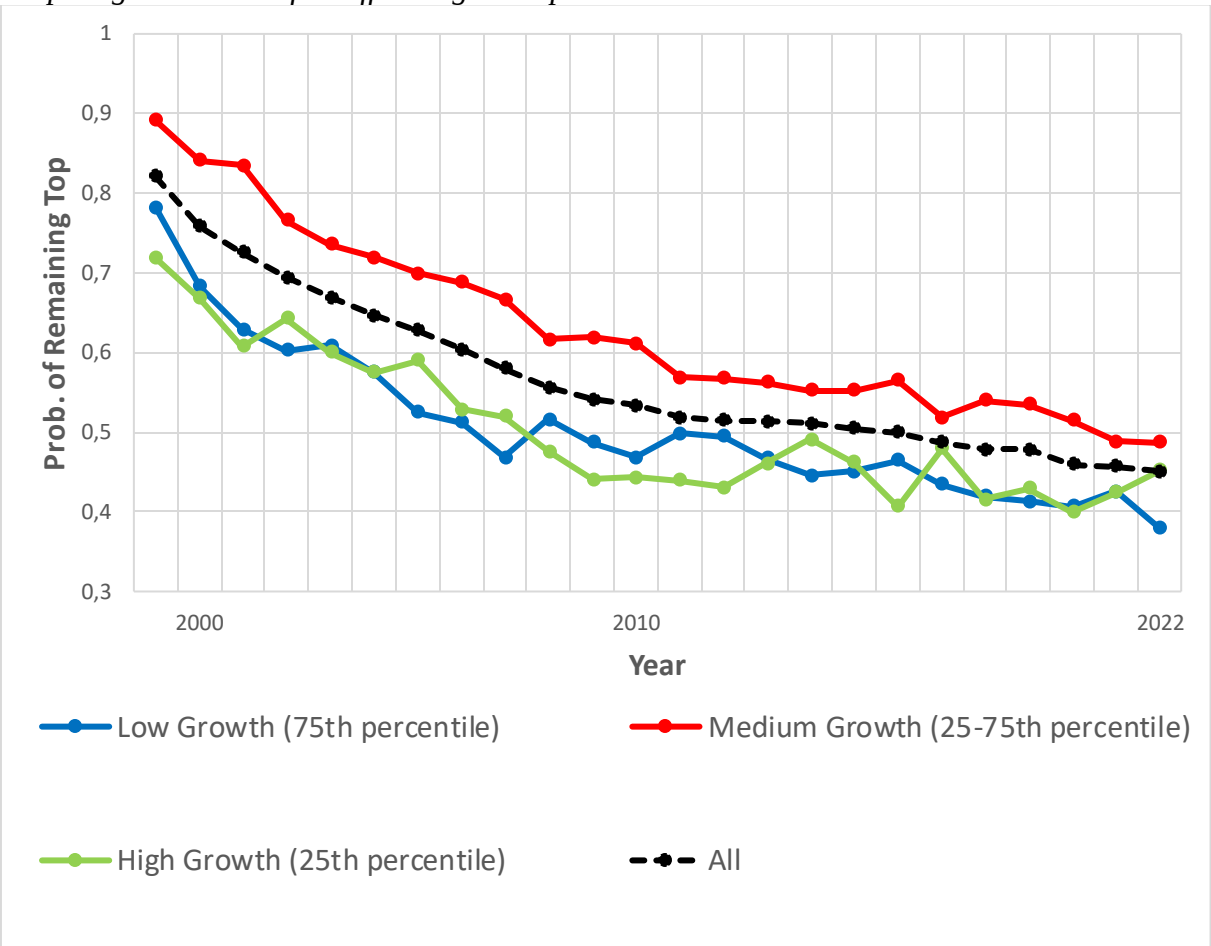
2.5. Growth and Instability

To conclude the section on export instabilities, Daruich, Easterly and Reshef look at the link between instability and export growth. So far, we've seen that all countries experience instability in their exports, especially the poorest ones. But is this instability linked to low export growth? This part is especially interesting as we have seen that the new countries in this sample have on average higher export growth compared to the ones in the authors' sample (**Table 5**). We can again use the coefficient from equation **(7)**, but this time by separating countries according to their export growth rate. **Figure 8** shows the evolution of this coefficient over time for low-, medium- and high-growth countries from 1998 to 2022.

Initially, we note that the results are like those found by the authors for the period 1998-2010. During this period, countries with high export growth generally experience more instability in their top 20 exports than other countries. We note that countries with low export growth also have more instability than the rest of the countries, and this difference in instability increases over time.

Figure 8

Predicted probability to be a top 20 good in each year from 1999 to 2022 conditional on being a top 20 good in 1998 for different growth percentile



Data: **BACI**.
Note: Low Growth Countries are countries at or under 25th percentile of growth in the defined year, Medium Growth is between the 25th and the 75th percentile, and High Growth is at or above the 75th percentile. Each category has different countries in it every year because their growth rate varies over time and a country with low growth rate in a said year could have a huge increase in the following years and end up in the high growth rate group.

But in the second part of our analysis, for the period 2010-2022, we observe different results. On the one hand, the differences in instability between high-growth and low-growth countries are much less obvious. More importantly, the difference between high-growth and medium-growth countries seems to diminish over this period, contrary to the authors' observations. In other words, the difference in instability between high-growth countries and the rest of the world seems to narrow over time. This narrowing of the instability gap is even more noticeable

when we look at the top 5 and the top 10 (**Figure A2.5** & **Figure A2.6**). In both cases, we observe that countries with high export growth rates have a lower instability rate than other country categories in 2022, which seems to invalidate the authors' findings if we extend the observations over a longer period.

There are several possible explanations for this difference compared with the reference paper. The first is that the new, high-growth countries in the sample are less unstable than the others. It is also possible that the difference stems from countries that were already in the authors' sample, but whose instabilities and/or export growth varied significantly during this period. Both these possible explanations seem plausible to us, but the second suffers from the fact that observations of export growth for the period 1998-2010 were relatively similar to those made by the authors on their sample for the same period. It therefore seems more likely to us that this difference is more likely due to changes in the instabilities and/or growth of countries already present in the authors' sample for the 2010-2022 period.

To summarize, the findings in this second section are once again very similar to the ones found in the Reference Article for the most. Instability is important for all countries, not only at the good level but also at the good-destination level. This is the case when we look at individual countries of different wealth levels, but also in general when we regress on top goods and flows. This instability is not the fact of the choice of a period but can be observed through time and increase with it. Across countries, we observe that the level of instability is higher for the same splits as in the concentration section: richer countries and bigger exporters (OECD vs Africa) witness a lower instability of their top exported goods and flows than their counterparts. However, contrary to the author’s findings, a low growth rate doesn’t seem to come with more instabilities, at least for the period between 2010 and 2022.

IV. DISCUSSION

This section presents the limitations of this dissertation and of the approach taken by the authors of the reference paper. It also presents the main differences between the key findings and what had been found by the authors and discusses the implications of this paper for future studies and for the field of trade economics.

1. Limitations of the Study

The implications of the results of this paper come with several limitations, linked on the one hand to the methodology used in the reference paper, and on the other to the dataset used in this paper.

1.1. Limitations from the Reference Paper

Use of Top Goods and Flows

One of the main limitations of the reference paper and this dissertation is the authors' strong focus on the top goods and flows for each country. This scope allows a manageable and detailed examination of concentration and instability, but also implies that certain critical dynamics or trends outside this scope may not be captured or analyzed. For example, it is possible that certain small, fast-growing industries are not present in the top 20 and yet are an important focus for countries due to their potential or strategic aspects. This limitation could therefore underestimate the diversification trends of certain countries or the variability of exports. If we take a large country like the USA, we can imagine that certain sectors are not present in the top 20, but that there is nevertheless a strong variability in exports for this good over time.

It is important to note that the authors of the reference article test the robustness of their results using alternatives such as the top 10 or the top 5. What's more, the authors' aim is to show that even the most developed countries experience a high degree of instability in their exports. The fact of taking only the most exported goods, which account for a very large proportion of countries' exports, makes it possible to draw this conclusion. But it's important to bear in mind that this analysis focuses on only a fraction of goods and flows, and therefore effectively excludes a whole range of goods and flows from the analysis. Future research could expand the scope to take into account a 'higher top' or even all goods, using computational techniques to handle a broader part of the data.

Use of Binary Variables

Another limitation of this paper is that the authors use binary variables for their regressions. If the good is in the top X it takes the value of 1, otherwise it takes the value of 0. This solution allows for clear, easy-to-understand results, but omits a whole host of details and subtleties. For example, a good that moves from 20th to 21st position for a country will have an impact on the results, whereas this is not the case for a good that moves from 1st to 20th position. And even within the goods remaining in the top, the magnitude of the drop in rank is not reflected.
This is especially the case for some African countries that demonstrate a remarkable rise in export volume from 2010 to 2022 and a huge change in what they export. Here again, the use of binary variables doesn’t allow us to capture the masse drops of values and ranks from certain goods, and therefore the instability.

This limitation needs to be qualified, especially because the authors sometimes use ranks as such at certain points, notably in **Part 2.2. Rank Correlations**. There, the correlation between

top goods and flows is calculated without using these binary variables but directly using the rank numbers.

Use of Ranks

A third limitation of this paper is the use of ranks instead of export values. The aim of the reference paper is to show that all countries experience instability in their exports. Using rank variations, it is indeed possible to see that countries' main exports vary over time, and that the goods or flows that account for most of a country's exports are not fixed over time. What this study does not show, however, is the instability of export values. It is possible that a country's main exports in 1998 will continue to grow until 2022, but at the same time many other products will begin to be exported. The country's most exported goods have therefore changed (there is instability in the balance of exports), but the value of goods that were exported in 1998 may not have undergone much instability (there is not necessarily instability in the value of exports).

This is too broad an analysis, but the use of ranks does not reflect the variability in the value of exports. Take, for example, a country whose exports are highly concentrated, with rank 1 good accounting for 70% of total exports. If, in the following period, exports of this product fall to 40% but remain in rank 1, the rank has not changed, but the reality of exports is very different.

Weight of Countries Not Always Taken into Account

The reference paper, in its instability analysis section, doesn't consistently account for weighting by country-specific factors, especially regarding the trade volume. While the paper uses GDP/capita in some cases to capture the impact of this factor on instabilities, it very rarely takes total export volume into account in its analyses. The only time this volume is considered is when calculating weighted HI, where the export volume of the countries used. For example, the average growth rate of exports might be higher for smaller economies, but these trends might be less impactful globally compared to changes in trade patterns in larger economies. It would have been particularly interesting to use these weights to capture more subtly the differences between what was found from the authors' sample and what was found in this paper, as the latter uses a much larger sample, and the countries added are often much smaller and with much lower exports.

The results found in the regressions do not, for example, consider the size of the country or its exports. The implications of the reference paper do not change: the coefficients found do indeed show instability, and the link between this instability and certain country’s characteristics. But it would have been interesting to use the weight of countries' total exports more often, for more refined results.

Change of Classification Over Time

Trade classification systems, such as the Harmonized System (HS codes), evolve regularly to deal with new products or technologies. This implies that what might be perceived as instability may in fact simply be a change in classification. While data aggregation at the 4-digit level mitigates some of these effects, it cannot entirely eliminate some potential distortions. This is particularly the case in this paper, which uses a longer period and where reclassification could have a greater impact on instabilities.

The authors of the reference paper are aware of those problems, and they regularly check in the paper for those kinds of changes, meaning that their results remain valid. But there may be an exaggeration of the results found about instability due to this change in classification.

Use of HS4 code
This paper, like the authors of the reference paper, mainly uses the HS4 code. This use is justified by the authors of the reference paper, as it limits changes in country classification and the sometimes very subtle variations in exports, while maintaining a good level of granularity. Even though this justification is pertinent, it is important to bear it in mind when analyzing the results. On the one hand, its use in place of HS6 means that certain genuine variations in exports are not captured, resulting in greater instability. On the other hand, it would also have been interesting to use the HS2 level to get a broader idea of how countries' exports evolve over time. Some countries could have a high degree of volatility in the general direction of exports over time: for example, a country with exports mainly oriented towards HS02 (Meat and edible meat offal) then turns completely to HS74 (Copper and articles thereof). These instabilities have an even greater impact on trade.

1.2. Limitations from this Thesis

Impact of Extended Temporal Scope
By extending the study period from 1998-2010 to 1998-2022, this thesis introduces an additional complexity. This is particularly true for the period 2010-2022, during which the global trade landscape has undergone numerous transformations, such as changes in trade policy (trade war between China and the US...) or geopolitical events like Covid 19 or the war between Russia and Ukraine. These factors may mitigate the direct comparison between the results found for this period and the results studied by the authors, as the results found could reflect more structural changes rather than changes directly linked to trade dynamics.

It would therefore have been interesting to also reproduce the part of the reference paper which examines and provides possible explanations for these instabilities, in order to see whether the source of instabilities remains the same as for the period studied, or whether the instabilities are now due to different causes specific to this period.

Impact of Sampling differences
The decision to use a different dataset was motivated by the desire to confirm the results found by the authors with a smaller dataset. But the introduction of new countries into the sample increases heterogeneity in economic and trade profiles. Newly added countries, predominantly smaller or less-developed economies, might exhibit trade behaviors distinct from those in the original sample. This could dilute certain observed trends or introduce noise into concentration and instability metrics.

This also implies that the differences in results between the 1998-2010 period of the study and the 2010-2022 period of this paper are not very relevant, as they could be the result of the difference in sample and not a change due to time. On the other hand, it does seem relevant to compare these two periods within the same sample presented in this paper, since the countries studied are the same regardless of the period.

2. Insights and Broader Implications

The results found in this paper imply several things, whether they are compared with the reference article or placed in a wider context.

2.1. Convergence and Divergence with the Reference Study

Convergence

This study shows a general alignment with the reference study on all key points, such as the high concentration of exports, the significant instability of these exports for all countries, and the links between trade instabilities and wealth, growth and the level of export concentration. What was observed by the authors for the reference period 1998-2010 is also observed in this paper for a more complete dataset and over a longer period.

Divergence

However, there are some notable divergences, particularly in the findings related to export instability and growth. Where the reference paper links high instability and low growth, this thesis observes a narrowing instability gap among high and low growth countries between 2010 and 2022. These changes could be the result of political crises and change, for example, and therefore may not persist over time. This paper does not call into question the results found in the reference paper or the authors' conclusion but highlights the importance of temporality in interpreting trade dynamics. Using a longer study period ensures that the results obtained are not the result of chance or a particular context.

2.2. Implications of this Thesis

Robustness of Methodology

The replication of the results of the reference paper, despite the use of an extended dataset and time horizon, validates the robustness of its methodology. However, the limitations noted above highlight areas where methodological refinements could enhance future analyses. Incorporating weighted metrics and expanding the scope beyond top exports are potential ways for improvement.

Robustness of Results

In addition to the methodology, this paper also highlights the robustness of the results found by the authors, since almost all of them hold true, even for a double time horizon. This verification of the validity of results over a longer period is particularly important in the human sciences, since human behavior changes over time.

Importance for the Scientific Method

More generally, this type of paper replicating the methodology of a paper is a cornerstone of the scientific method. By attempting to replicate the reference paper's results using an improved dataset and extended timeframe, this thesis contributes to improving the quality of the knowledge we have in trade economics and demonstrates the robustness of the original findings. Reproduction also improves critical scrutiny of a study. By trying to replicate the results, it allows to identify potential biases or limitations in the original work while extending its applicability to new contexts. This practice increases the credibility of scientific research but also fosters innovation and ways of improvement in known methodologies.

Opportunities for Further Research

Finally, this thesis also highlights several avenues to nuance and improve the robustness of the results found. First, by developing a new methodology that addresses the limitations mentioned above, and in particular the use of ranks, which does not always capture variations in the value of exported products and leads us to focus on a reduced sample of top goods or flows. Second, it would be interesting to reproduce this study again in a few years' time with an extended time

horizon to see if the authors' results are still robust. Third, this paper shows that the found link between low growth and instability is decreasing over time. It would be great to expend on the subject study this with a more systematic approach to see if this is a statistical anomaly or if the trend continues over time.

CONCLUSION

The main objective of this paper was to reproduce and verify the results of **Daruich et al. (2019)**. Both by reproducing the results obtained by the authors over the same period but with an improved dataset to check whether the results are similar. But also, by extending the period from 1998-2010 to 1998-2022 to see if the results are still valid over this period or if there is a change over the second half. The results found in this brief are in line with those of the authors' paper. Not only are the results for the 1998-2010 period very similar to those of the authors, but the results are also confirmed over an extended period.

To achieve this, we have reproduced the authors' entire methodology for the periods 1998-2010, 1998-2022 and 2010-2022. We began by calculating the shares of their top goods and flows in total exports for different categories of goods and different groups of countries, and then derived the Power Law coefficient. This Power Law coefficient is close to or even below 1 in absolute value for all the periods and country groups studied. We observe a negative relationship between Power Law coefficient and GDP/capita: the richer a country, the less concentrated it is on average. We then derived the Herfindahl Index over destinations over the entire 1998-2022 period, showing that this concentration is stable over time for all country groups. We then analyzed the churning of exports. First, we took the example of Tanzania, Ghana, Germany and the US. We then construct a regression model of the probability of being among the top goods. Once we incorporate GDP, we see that this probability rises sharply for goods already in the top at an earlier date. GDP therefore has a significant impact on the instability of top exports. We then verified that this relationship between GDP and Probability is observable for all periods. Finally, we also looked at countries' export growth to see whether the U-shaped relationship described in the economic literature holds. We have seen that this relationship holds over the whole period, but that the trend for low-growth countries seems to be reversing in recent years.

Doing this has enabled us to assess and improve the robustness of the results found by **Daruich et al. (2019)**. Not only is the methodology followed by the authors sufficiently detailed and clear to be reproducible, but also the choice of methodology seems relevant since the results are reproducible.

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Disclaimer: The content of this paper was not produced by any AI language model tool. All the content is either based on trade literature, on the results of the data analysis or on knowledge accumulated during my studies. However, AI has been used here and there to reformulate sentences when it felt needed.

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APPENDICES

Appendix 1: Additional Figures and Tables for Alternative Time Periods

Table A1.1

Export Concentration among top 20 goods and flows and power law coefficients in different years.

A. Goods and Flows - 1998

Rank	Export Shares: Goods (%)		Export Shares: Flows (%)	
	All Goods	Excl, Extractables and Commodities	All goods	Excl, Extractables and Commodities
1	29,45%	22,31%	16,17%	14,79%
2	12,15%	10,56%	7,76%	6,60%
3	6,70%	6,40%	5,29%	4,37%
4	4,65%	4,51%	3,98%	3,20%
5	3,49%	3,50%	3,25%	2,62%
6	2,74%	2,83%	2,68%	2,19%
7	2,25%	2,40%	2,25%	1,85%
8	1,88%	2,08%	1,93%	1,64%
9	1,58%	1,86%	1,68%	1,43%
10	1,39%	1,65%	1,46%	1,30%
11	1,22%	1,47%	1,29%	1,19%
12	1,10%	1,34%	1,17%	1,08%
13	1,00%	1,23%	1,06%	1,01%
14	0,91%	1,12%	0,99%	0,94%
15	0,84%	1,04%	0,90%	0,87%
16	0,78%	0,98%	0,83%	0,82%
17	0,73%	0,92%	0,77%	0,77%
18	0,68%	0,86%	0,73%	0,73%
19	0,64%	0,81%	0,68%	0,69%
20	0,60%	0,77%	0,64%	0,66%
Total	74,79%	68,62%	55,49%	48,75%
Power Law	-0,77	-0,89	-0,92	-0,98

B. Goods and Flows - 2010				
Rank	Export Shares: Goods (%)		Export Shares: Flows (%)	
	All Goods	Excl, Extractables and Commodities	All goods	Excl, Extractables and Commodities
1	29,54%	22,20%	15,76%	14,48%
2	10,67%	10,67%	7,65%	7,21%
3	6,62%	6,60%	5,40%	4,69%
4	4,55%	4,81%	3,96%	3,69%
5	3,58%	3,75%	3,15%	2,94%
6	2,88%	3,12%	2,62%	2,52%
7	2,38%	2,62%	2,24%	2,21%
8	2,01%	2,27%	1,95%	1,94%
9	1,73%	1,93%	1,72%	1,71%
10	1,51%	1,70%	1,53%	1,53%
11	1,33%	1,54%	1,38%	1,39%
12	1,19%	1,39%	1,25%	1,26%
13	1,06%	1,27%	1,15%	1,17%
14	0,97%	1,18%	1,07%	1,08%
15	0,89%	1,09%	0,98%	1,00%
16	0,83%	1,01%	0,91%	0,92%
17	0,77%	0,93%	0,85%	0,87%
18	0,71%	0,87%	0,80%	0,81%
19	0,67%	0,82%	0,74%	0,76%
20	0,62%	0,76%	0,70%	0,71%
Total	74,49%	70,53%	55,81%	52,89%
Power Law	-0,79	-0,89	0,96	-1,01

Data: **BACI**.

Note: This table shows, for each top 20 good or flow (good-by-destination), the average share it represents in the total of exportation in value of the countries at HS4 level in 2022, extractables and commodities included or not. It also shows the Power Law coefficients, given by the regression of the log rank on the log export share.

Table A1.2

Export Concentration among top 20 goods and power law coefficients in different years for groups of countries.

A. Goods - 1998

Rank	Export Shares							
	African Countries		EU Countries		OECD Countries		Non-OECD Countries	
	All Goods	Excl, Extractables and Commodities	All Goods	Excl, Extractables and Commodities	All Goods	Excl, Extractables and Commodities	All Goods	Excl, Extractables and Commodities
1	46,05%	31,14%	10,84%	11,93%	11,19%	10,44%	34,32%	25,27%
2	13,81%	13,12%	4,95%	5,20%	6,15%	5,89%	11,85%	11,91%
3	7,67%	7,63%	3,64%	3,96%	4,23%	4,33%	7,24%	7,19%
4	4,37%	4,97%	2,89%	3,13%	3,34%	3,54%	4,87%	5,14%
5	3,18%	3,80%	2,58%	2,62%	2,90%	3,01%	3,76%	3,94%
6	2,53%	3,17%	2,20%	2,25%	2,46%	2,47%	2,99%	3,29%
7	1,96%	2,63%	1,93%	2,03%	2,04%	2,19%	2,47%	2,73%
8	1,65%	2,25%	1,78%	1,83%	1,83%	1,91%	2,05%	2,37%
9	1,40%	1,81%	1,59%	1,65%	1,63%	1,64%	1,75%	2,01%
10	1,18%	1,56%	1,43%	1,47%	1,47%	1,51%	1,52%	1,75%
11	1,00%	1,44%	1,31%	1,37%	1,33%	1,42%	1,33%	1,57%
12	0,85%	1,31%	1,24%	1,29%	1,25%	1,30%	1,17%	1,42%
13	0,72%	1,18%	1,17%	1,22%	1,16%	1,21%	1,04%	1,29%
14	0,65%	1,09%	1,10%	1,16%	1,07%	1,15%	0,94%	1,19%
15	0,59%	0,99%	1,04%	1,08%	0,99%	1,08%	0,86%	1,09%
16	0,54%	0,92%	0,99%	1,02%	0,94%	1,03%	0,80%	1,00%
17	0,49%	0,83%	0,95%	0,96%	0,90%	0,98%	0,73%	0,92%
18	0,44%	0,79%	0,89%	0,91%	0,86%	0,93%	0,67%	0,86%
19	0,41%	0,72%	0,84%	0,87%	0,82%	0,90%	0,63%	0,80%
20	0,38%	0,65%	0,80%	0,83%	0,78%	0,84%	0,58%	0,74%
Total	89,87%	82,00%	44,16%	46,78%	47,34%	47,76%	81,57%	76,47%
Power Law	-0,63	-0,78	-1,21	-1,18	-1,11	-1,17	-0,75	-0,85

B. Goods - 2010

Rank	Export Shares							
	African Countries		EU Countries		OECD Countries		Non-OECD Countries	
	All Goods	Excl, Extractables and Commodities	All Goods	Excl, Extractables and Commodities	All Goods	Excl, Extractables and Commodities	All Goods	Excl, Extractables and Commodities
1	39,51%	27,73%	10,73%	10,02%	13,88%	10,92%	33,51%	25,28%
2	15,15%	13,67%	6,54%	5,93%	8,03%	6,34%	13,23%	11,66%
3	8,34%	7,62%	4,05%	4,29%	4,42%	4,80%	7,30%	6,82%
4	5,50%	4,66%	3,05%	3,05%	3,54%	3,51%	4,95%	4,77%
5	3,65%	3,53%	2,35%	2,44%	2,88%	2,95%	3,65%	3,64%
6	2,84%	2,85%	1,98%	2,16%	2,21%	2,50%	2,87%	2,92%
7	2,09%	2,31%	1,77%	1,91%	1,97%	2,15%	2,32%	2,47%
8	1,70%	1,95%	1,63%	1,74%	1,76%	1,90%	1,91%	2,13%
9	1,37%	1,76%	1,49%	1,61%	1,55%	1,72%	1,59%	1,89%
10	1,16%	1,57%	1,37%	1,50%	1,41%	1,56%	1,39%	1,67%
11	0,98%	1,41%	1,26%	1,38%	1,28%	1,39%	1,20%	1,49%
12	0,86%	1,27%	1,18%	1,31%	1,18%	1,32%	1,08%	1,35%
13	0,77%	1,17%	1,13%	1,21%	1,10%	1,21%	0,97%	1,23%
14	0,71%	1,06%	1,07%	1,16%	1,03%	1,14%	0,88%	1,12%
15	0,64%	0,96%	1,02%	1,10%	0,98%	1,08%	0,81%	1,03%
16	0,58%	0,90%	0,95%	1,04%	0,91%	1,02%	0,75%	0,97%
17	0,54%	0,85%	0,91%	0,99%	0,86%	0,96%	0,70%	0,91%
18	0,48%	0,79%	0,86%	0,95%	0,80%	0,92%	0,65%	0,84%
19	0,44%	0,76%	0,83%	0,91%	0,77%	0,89%	0,60%	0,79%
20	0,40%	0,72%	0,80%	0,87%	0,74%	0,85%	0,56%	0,75%
Total	87,70%	77,54%	44,96%	45,58%	51,30%	49,11%	80,92%	73,71%
Power Law	-0,64	-0,80	-1,14	-1,22	-1,01	-1,14	-0,73	-0,85

Data: **BACI**.

Table A1.3

Export Concentration among top 20 flows and power law coefficients in different years for groups of countries.

A. Flows - 1998

Rank	Export Shares							
	African Countries		EU Countries		OECD Countries		Non-OECD Countries	
	All Goods	Excl, Extractables and Commodities	All Goods	Excl, Extractables and Commodities	All Goods	Excl, Extractables and Commodities	All Goods	Excl, Extractables and Commodities
1	22,87%	18,65%	3,97%	4,48%	4,72%	4,47%	18,63%	17,10%
2	10,62%	9,85%	2,58%	2,80%	2,62%	2,55%	8,96%	8,43%
3	7,41%	6,16%	2,07%	2,11%	2,09%	2,00%	6,26%	5,40%
4	4,99%	4,87%	1,54%	1,59%	1,76%	1,63%	4,54%	4,22%
5	4,09%	3,89%	1,33%	1,43%	1,45%	1,44%	3,60%	3,34%
6	3,17%	3,25%	1,15%	1,22%	1,31%	1,23%	2,96%	2,86%
7	2,70%	2,79%	1,02%	1,10%	1,13%	1,10%	2,53%	2,49%
8	2,32%	2,36%	0,93%	1,01%	1,01%	1,01%	2,19%	2,18%
9	2,03%	2,08%	0,87%	0,94%	0,95%	0,95%	1,91%	1,91%
10	1,84%	1,88%	0,81%	0,87%	0,88%	0,85%	1,70%	1,71%
11	1,62%	1,64%	0,72%	0,80%	0,81%	0,80%	1,52%	1,54%
12	1,47%	1,47%	0,68%	0,75%	0,75%	0,77%	1,38%	1,39%
13	1,33%	1,36%	0,65%	0,71%	0,71%	0,73%	1,26%	1,28%
14	1,23%	1,25%	0,62%	0,67%	0,68%	0,69%	1,17%	1,19%
15	1,10%	1,15%	0,59%	0,63%	0,64%	0,65%	1,07%	1,09%
16	1,01%	1,06%	0,57%	0,59%	0,61%	0,61%	1,00%	1,00%
17	0,93%	1,00%	0,53%	0,56%	0,58%	0,58%	0,93%	0,94%
18	0,86%	0,92%	0,52%	0,54%	0,55%	0,55%	0,86%	0,88%
19	0,77%	0,87%	0,49%	0,51%	0,52%	0,52%	0,80%	0,82%
20	0,73%	0,81%	0,47%	0,49%	0,50%	0,50%	0,75%	0,77%
Total	73,12%	67,32%	22,13%	23,79%	24,26%	23,64%	64,04%	60,52%
Power Law	-0,87	-0,94	-1,37	-1,35	-1,35	-1,40	-0,93	-0,98

B. Flows - 2010

Rank	Export Shares							
	African Countries		EU Countries		OECD Countries		Non-OECD Countries	
	All Goods	Excl, Extractables and Commodities	All Goods	Excl, Extractables and Commodities	All Goods	Excl, Extractables and Commodities	All Goods	Excl, Extractables and Commodities
1	20,46%	19,22%	2,99%	3,14%	5,85%	4,02%	18,87%	17,60%
2	10,37%	9,62%	1,97%	2,03%	3,14%	2,14%	8,96%	7,76%
3	6,94%	6,20%	1,66%	1,52%	2,23%	1,66%	6,09%	5,07%
4	5,39%	4,27%	1,36%	1,22%	1,75%	1,42%	4,56%	3,66%
5	4,25%	3,35%	1,17%	1,11%	1,45%	1,27%	3,71%	2,97%
6	3,46%	2,78%	1,07%	1,01%	1,33%	1,13%	3,03%	2,47%
7	2,90%	2,17%	0,95%	0,92%	1,14%	1,02%	2,54%	2,07%
8	2,38%	1,87%	0,87%	0,85%	1,04%	0,93%	2,16%	1,82%
9	2,04%	1,60%	0,81%	0,77%	0,95%	0,86%	1,87%	1,58%
10	1,77%	1,43%	0,77%	0,74%	0,87%	0,80%	1,61%	1,43%
11	1,56%	1,31%	0,72%	0,71%	0,79%	0,77%	1,42%	1,30%
12	1,40%	1,18%	0,68%	0,68%	0,74%	0,73%	1,29%	1,18%
13	1,26%	1,09%	0,65%	0,64%	0,68%	0,69%	1,16%	1,09%
14	1,15%	1,02%	0,63%	0,61%	0,65%	0,65%	1,07%	1,01%
15	1,05%	0,96%	0,60%	0,58%	0,61%	0,61%	0,97%	0,94%
16	0,96%	0,89%	0,57%	0,55%	0,59%	0,59%	0,89%	0,88%
17	0,90%	0,84%	0,54%	0,53%	0,56%	0,56%	0,83%	0,83%
18	0,84%	0,80%	0,52%	0,51%	0,53%	0,54%	0,78%	0,78%
19	0,78%	0,76%	0,50%	0,50%	0,51%	0,52%	0,73%	0,73%
20	0,72%	0,72%	0,48%	0,48%	0,49%	0,50%	0,68%	0,70%
Total	70,58%	62,06%	19,50%	19,10%	25,88%	21,42%	63,22%	55,87%
Power Law	-0,87	-0,89	-1,63	-1,62	-1,22	-1,51	-0,89	-0,94

Data: **BACI**.

Table A1.4

Concentration across goods and flows with GDP per capita, total exports and number of exported goods in 2010.

Dependent Variable: Power Law Coefficient for Top 20 Goods and Flows								
	Goods				Flows			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
ln(GDPpc)	-0,0532***			0,00701	-0,0941***			0,0103
	(0,0196)			(0,0278)	(0,0154)			(0,0198)
ln(Total Exports)		-0,0399***		0,0246		-0,0777***		0,0989*
		(0,0120)		(0,0191)		(0,0304)		(0,0254)
ln(nb Goods Exp)			-0,315***	-0,405***			-0,195***	-0,378***
			(0,0355)	(0,0644)			(0,0083)	(0,365)
# of countries	174	213	213	174	174	213	213	174

Data: **BACI**.
Note: The table reports coefficients from an OLS regression of power law coefficients on diverse variables. Standard error in parentheses. ***p < 0,01, ** p <0,05, * p <0,10.

Table A1.5

Change in value of Cut Flowers Exports between different periods, in millions of $US.

A. 1998 - 2022

	Destination							
	Canada	France	Germany	Japan	Netherlands	Russia	United Kingdom	USA
Exporter								
China	0	0	0	35	0	1	0	0
Colombia	9	0	-2	45	17	52	6	375
Ecuador	11	3	5	7	43	120	2	109
Guatemala	0	0	0	0	0	0	0	-9
Australia	0	0	-1	-5	-2	0	0	-4
Israel	0	-4	-14	0	-134	14	-5	-7
Italy	0	-5	-28	0	11	0	-5	-2
Kenya	0	5	13	7	160	11	33	2
Korea	0	0	0	58	0	0	0	0
Malaysia	0	0	0	88	0	0	0	0
Mexico	-1	0	0	0	0	0	0	-9
Morocco	0	-3	-4	0	-1	0	2	-1
Netherlands	1	36	-162	-15	0	180	340	-27
New Zealand	0	0	0	-7	0	0	0	1
Spain	0	-10	-9	0	-54	-2	-36	-1
Thailand	0	0	-1	7	0	3	-1	9
Türkiye	0	0	0	-1	0	8	-4	0
Uganda	0	0	0	0	1	0	1	0
Tanzania	0	0	-3	0	6	0	1	0

B. 1998 - 2010

	Destination							
	Canada	France	Germany	Japan	Netherlands	Russia	United Kingdom	USA
Exporter								
China	0	3	2	38	2	1	0	3
Colombia	34	-1	-8	40	29	1	1	707
Ecuador	18	2	1	9	67	11	7	175
Guatemala	0	0	0	0	0	0	0	2
Australia	-1	0	-1	-8	-3	0	0	-4
Israel	1	-8	-22	-1	-153	-3	-6	-1
Italy	0	0	-33	0	28	0	-9	1
Kenya	0	5	13	6	136	8	73	1
Korea	0	0	0	-8	0	0	0	0
Malaysia	0	0	0	31	0	0	0	0
Mexico	-1	0	0	0	0	0	0	17
Morocco	0	-3	-4	0	0	0	4	-1
Netherlands	7	-150	-299	-23	0	131	-14	8

New Zealand	-1	0	0	-21	-1	0	0	-3
Spain	0	-5	-8	0	-55	0	-42	-1
Thailand	0	0	-2	-15	-3	0	-2	9
Türkiye	0	0	0	-1	23	1	-5	0
Uganda	0	0	0	0	16	0	2	0
Tanzania	0	0	-3	0	-2	0	2	0

C. 2010 - 2022

	Destination							
	Canada	**France**	**Germany**	**Japan**	**Netherlands**	**Russia**	**United Kingdom**	**USA**
Exporter								
China	0	3	2	3	2	0	0	3
Colombia	25	-1	-6	-5	12	-51	-5	332
Ecuador	8	0	-4	1	24	-109	4	65
Guatemala	0	0	0	0	0	0	0	11
Australia	-1	0	-1	-3	-1	0	0	0
Israel	0	-3	-8	-1	-19	-16	-1	6
Italy	0	5	-5	0	17	1	-4	4
Kenya	0	0	-1	-1	-24	-2	40	-1
Korea	0	0	0	-67	0	0	0	0
Malaysia	0	0	0	-57	0	0	0	0
Mexico	0	0	0	0	0	0	0	26
Morocco	0	0	0	0	0	0	2	0
Netherlands	7	-186	-137	-8	0	-49	-354	35
New Zealand	-1	0	0	-14	0	0	0	-4
Spain	0	6	1	0	-1	0	-6	0
Thailand	0	0	-1	-22	-3	-2	-1	1
Türkiye	0	0	0	0	23	-7	-1	0
Uganda	0	0	0	0	16	0	1	0
Tanzania	0	0	-1	0	-7	0	0	0

Data: **BACI**.
Note: The total of exports and imports does not compensate for each other because only the biggest partners are shown.

Table A1.6

Descriptive statistics and pairwise correlations based on the sample of Table 9

A. Descriptive Statistics

	Mean	Std. Dev.	25th Percentile	Median	75th Percentile	Min	Max
ln(Initial GDP per capita)	8,59	1,23	7,69	8,63	9,61	6,06	11,43
Initial Destination Concentration Index	0,43	0,23	0,25	0,35	0,58	0,09	0,99
ln(Initial GDP Total)	24,45	2,39	23,02	24,55	26,30	17,45	30,29
ln(Initial Population)	15,34	2,21	14,07	15,61	16,77	9,17	20,94
ln(Land Size)	11,16	2,83	9,97	11,63	13,08	3,00	16,61
Initial H index over Destinations	0,53	0,33	0,23	0,47	0,91	0,03	1,00

B. Pairwise Correlations

	ln(Initial GDP per capita)	Destination Concentration	ln(Initial GDP Total)	ln(Initial Population)	ln(Land Size)
ln(Initial GDP per capita)	1,00				
Initial Destination Concentration Index	-0,28	1,00			
ln(Initial GDP Total)	0,38	-0,38	1,00		
ln(Initial Population)	-0,13	-0,24	0,86	1,00	
ln(Land Size)	-0,19	-0,02	0,70	0,85	1,00

Data: **BACI** & **World Bank (2024)**.

Appendix 2: Additional Figures and Tables for Top-5 and Top-10 Cutoffs

Table A2.1

Probability to be a top 10 goods in different periods, marginal effects.

A. - Top 10 - 1998 -2022

	(1)	(2)	(3)
Top in Start Year	0,4558936***	0,08548336	0,00475496
	(0,0023920)	(0,09641429)	(0,01015710)
ln(Inital GDPpc)		-0,00148735***	-0,00187620***
		(0,00022851)	(0,00036874)
ln(Inital GDPpc) x Top in Start Year		0,002736122**	0,00264712***
		(0,01062998)	(0,01547763)
Initial H. Index over Destinations			-0,00365471***
			(0,00074103)
Initial H. Index over Destinations x Top in Start Year			-0,00176984
			(0,00341120)
Observations	150338	122262	122262
# of countries	174	174	174

B. Top 10 - 1998 - 2010

	(1)	(2)	(3)
Top in Start Year	0,5428537***	0,07535719	0,0068411
	(0,0022746)	(0,10348638)	(0,0136470)
ln(Inital GDPpc)		-0,00140181***	-0,00185999***
		(0,00020937)	(0,00027306)
ln(Inital GDPpc) x Top in Start Year		0,00349602***	0,00483664***
		(0,0013374)	(0,00090537)
Initial H. Index over Destinations			-0,00434374 ***
			(0,00084866)
Initial H. Index over Destinations x Top in Start Year			-0,00457958
			(0,00410076)
Observations	147237	122262	122262
# of countries	174	174	174

C. Top 10 - 2010 -2022

	(1)	(2)	(3)
Top in Start Year	0,6149808***	0,01780970.	0,03258742
	(0,0021260)	(0,10487605)	(0,04133871)
ln(Inital GDPpc)		-0.00106465***	-0,00131929***
		(0,00019619)	(0,00023187)
ln(Inital GDPpc) x Top in Start Year		0,00428453***	0,00355645***
		(0,01102306)	(0,00012789)
Initial H. Index over Destinations			-0,00260275***
			(0,00066052)
Initial H. Index over Destinations x Top in Start Year			-0,00148771
			(0,00193674)
Observations	150338	147237	147237
# of countries	174	174	174

Data: **BACI**.
Note: Standard error in parentheses. ***p < 0,01, ** p <0,05, * p <0,10.

Table A2.2

Probability to be a top 5 goods in different periods, marginal effects.

A. Top 5 - 1998 -2022

	(1)	(2)	(3)
Top in Start Year	0,4284290***	0,0844048	0,0044265
	(0,0024118)	(0,1320883)	(0,0480785)
ln(Inital GDPpc)		-0,0013778	-0,0016816
		(0,0002202)	(0,0003070)
ln(Inital GDPpc) x Top in Start Year		0,0061419	0,0059912
		(0,0129173)	(0,0475983)
Initial H. Index over Destinations			-0,0030240
			(0,0006585)
Initial H. Index over Destinations x Top in Start Year			-0,0011832
			(0,0009375)
Observations	150338	122262	122262
# of countries	174	174	174

B. Top 5 - 1998 - 2010

	(1)	(2)	(3)
Top in Start Year	0,5180303***	0,11369874	0,00237740
	(0,0022955)	(0,0623176)	(0,04871033)
ln(Inital GDPpc)		-0,0009413***	-0,00132478***
		(0,0009874)	(0,00167924)
ln(Inital GDPpc) x Top in Start Year		0,00179200***	0,00192001***
		(0,0006331)	(0,00087423)
Initial H. Index over Destinations			-0,00225496***
			(0,00063214)
Initial H. Index over Destinations x Top in Start Year			-0,00236512
			(0,00239874)
Observations	147237	122262	122262
# of countries	174	174	174

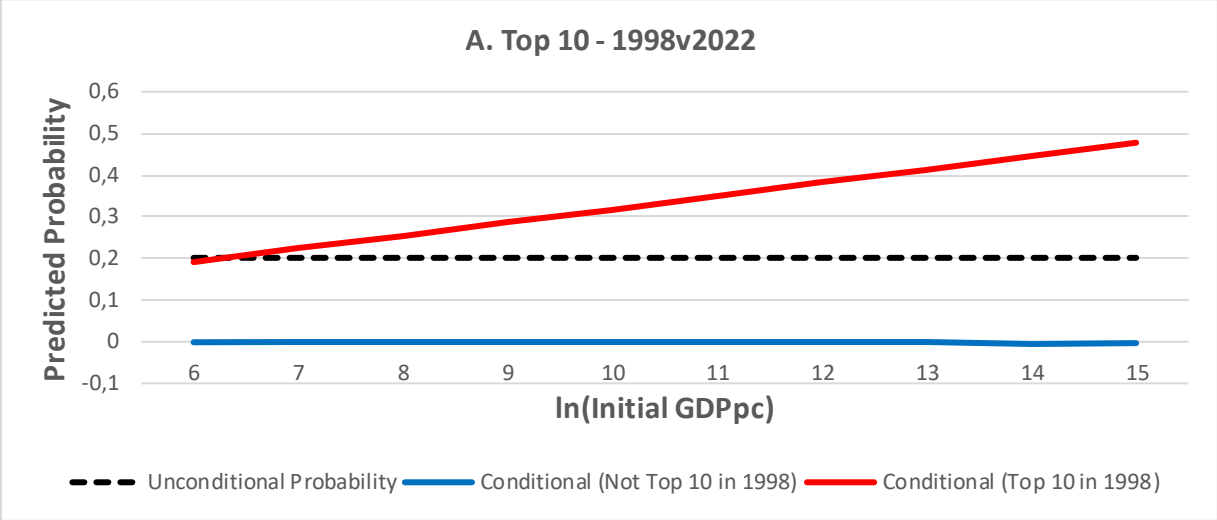
C. Top 5 - 2010 -2022

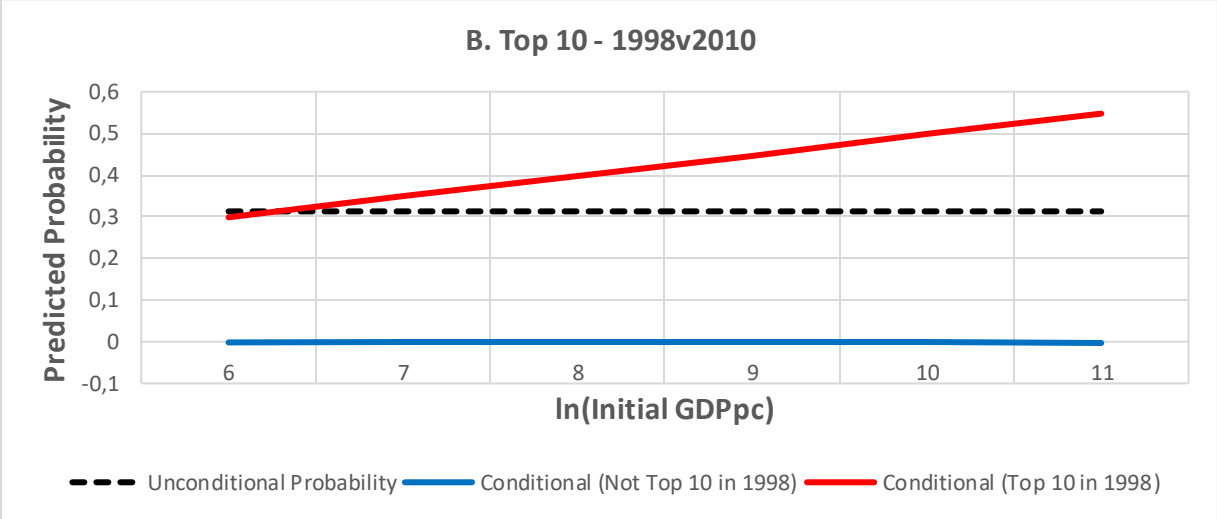
	(1)	(2)	(3)
Top in Start Year	0.6101004***	0,0738371	0,0023874
	(0,0021181)	(0,1222267)	(0,0274062)
ln(Inital GDPpc)		-0,0009863***	-0,0011825***
		(0,0001891)	(0,0001931)
ln(Inital GDPpc) x Top in Start Year		0,0045115***	0,00477131***
		(0,0124726)	(0,0003933)
Initial H. Index over Destinations			-0,0021536***
			(0,0005870)
Initial H. Index over Destinations x Top in Start Year			-0,0009946
			(0,0005323)
Observations	150338	147237	147237
# of countries	174	174	174

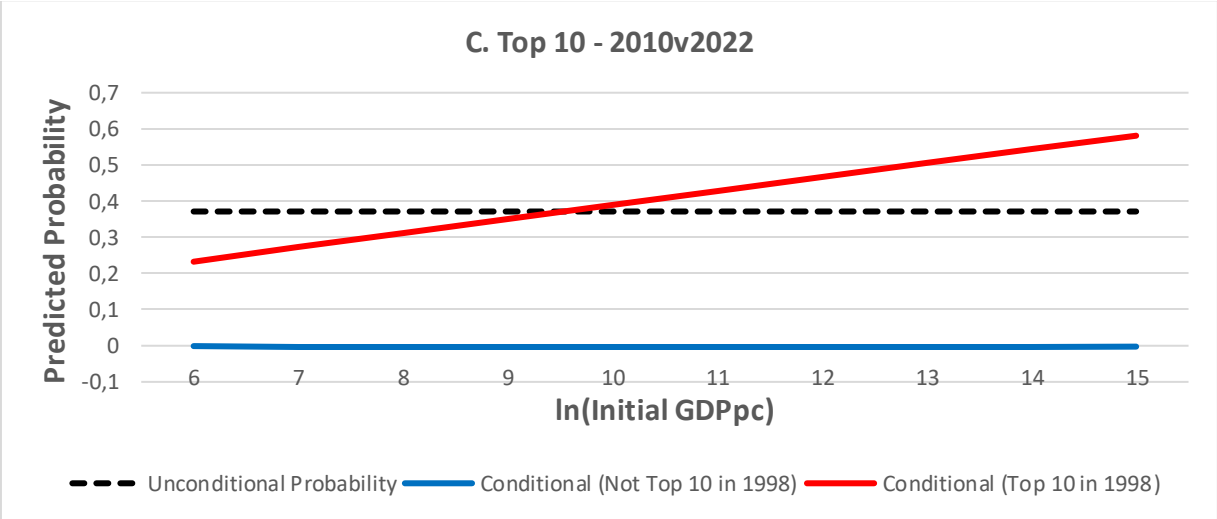
Data: **BACI**.
Note: Standard error in parentheses. ***p < 0,01, ** p <0,05, * p <0,10.

Figure A2.1

Regression coefficients of GDP/capita on the Persistence of Top 10 Export Flows.



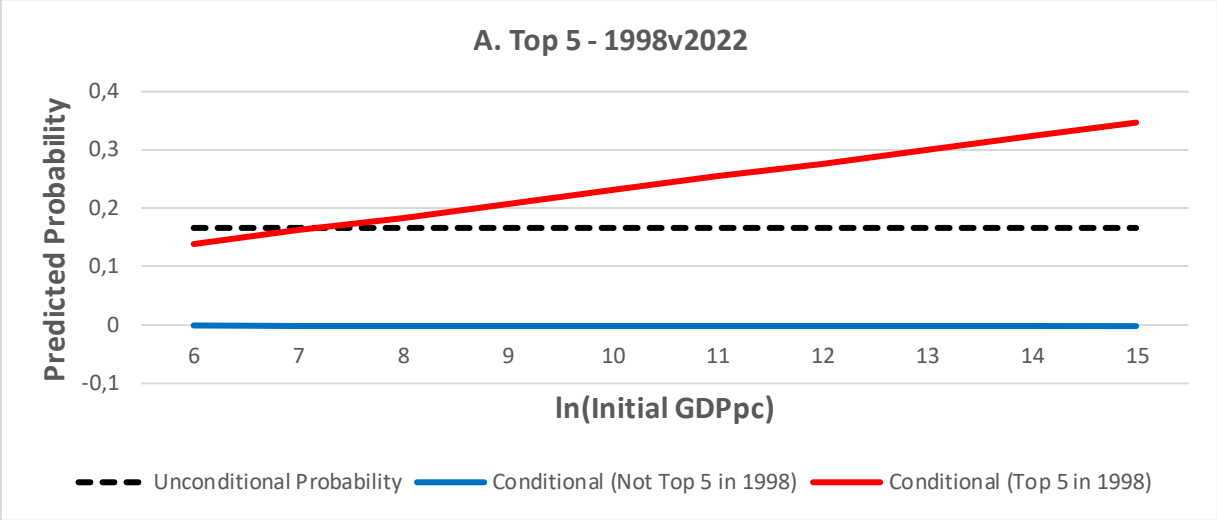


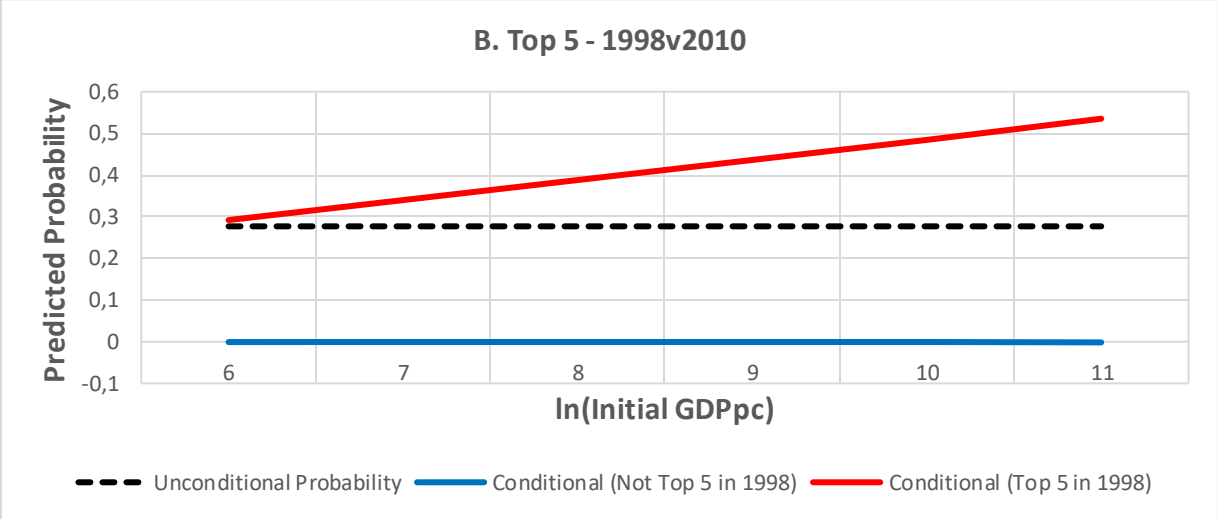


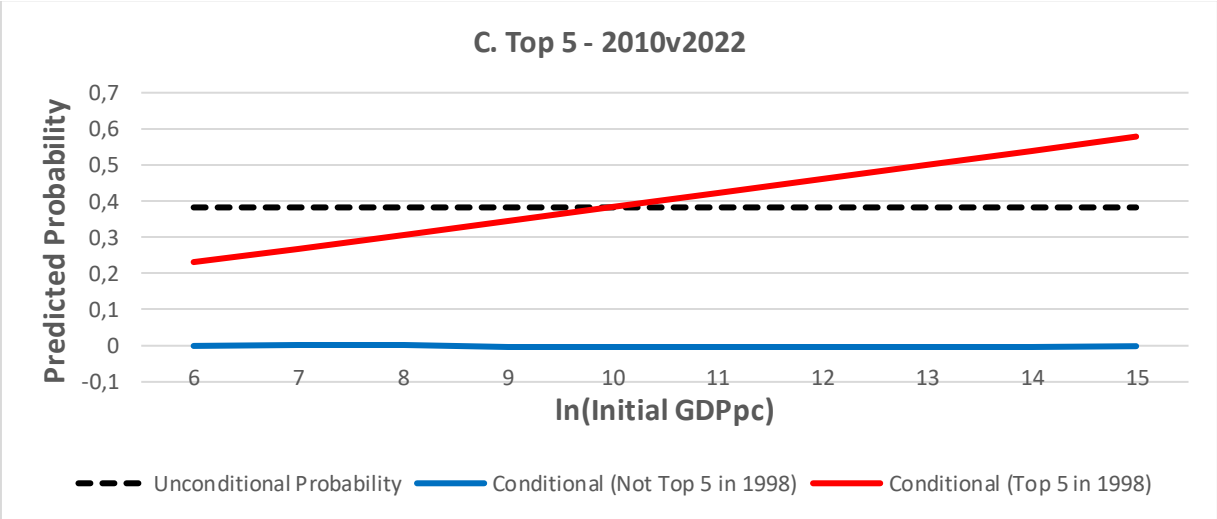
Data: **BACI**.
Note: The table shows the predicted probability of being a top 10 flow in different periods (2010 or 2022) that were or were not top 10 in previous periods (1998 or 2010). It also reports the unconditional probability of being a top 10 flow for the same periods.

Figure A2.2

Regression coefficients of GDP/capita on the Persistence of Top 5 Export Flows.



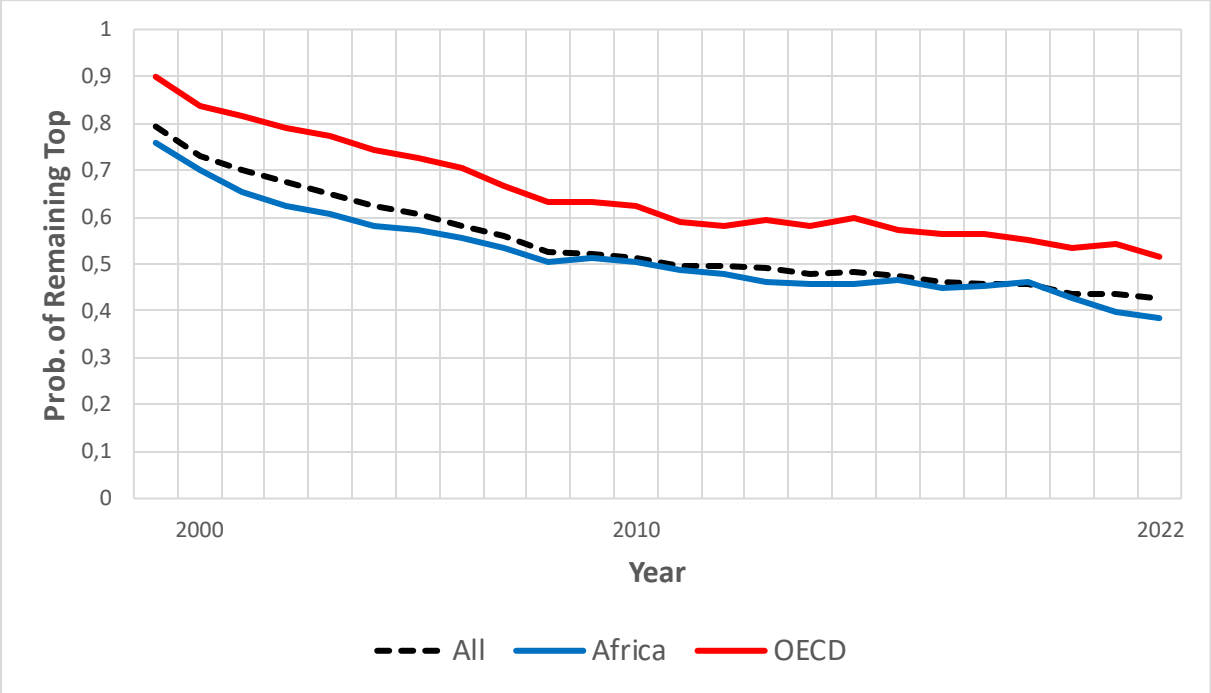




Data: **BACI**.
Note: The table shows the predicted probability of being a top 5 flow in different periods (2010 or 2022) that were or were not top 5 in previous periods (1998 or 2010). It also reports the unconditional probability of being a top 5 flow for the same periods.

Figure A2.3

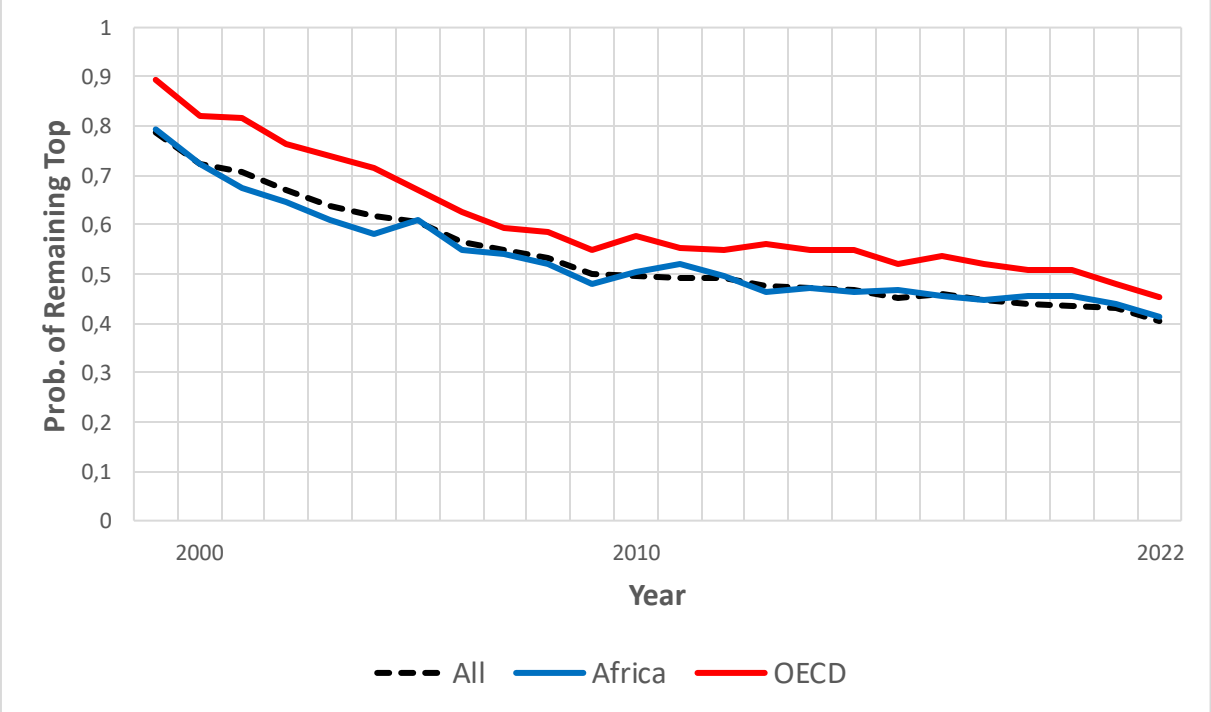
Predicted probability to be a top 10 good in each year from 1999 to 2022 conditional on being a top 10 good in 1998.



Data: **BACI**.

Figure A2.4

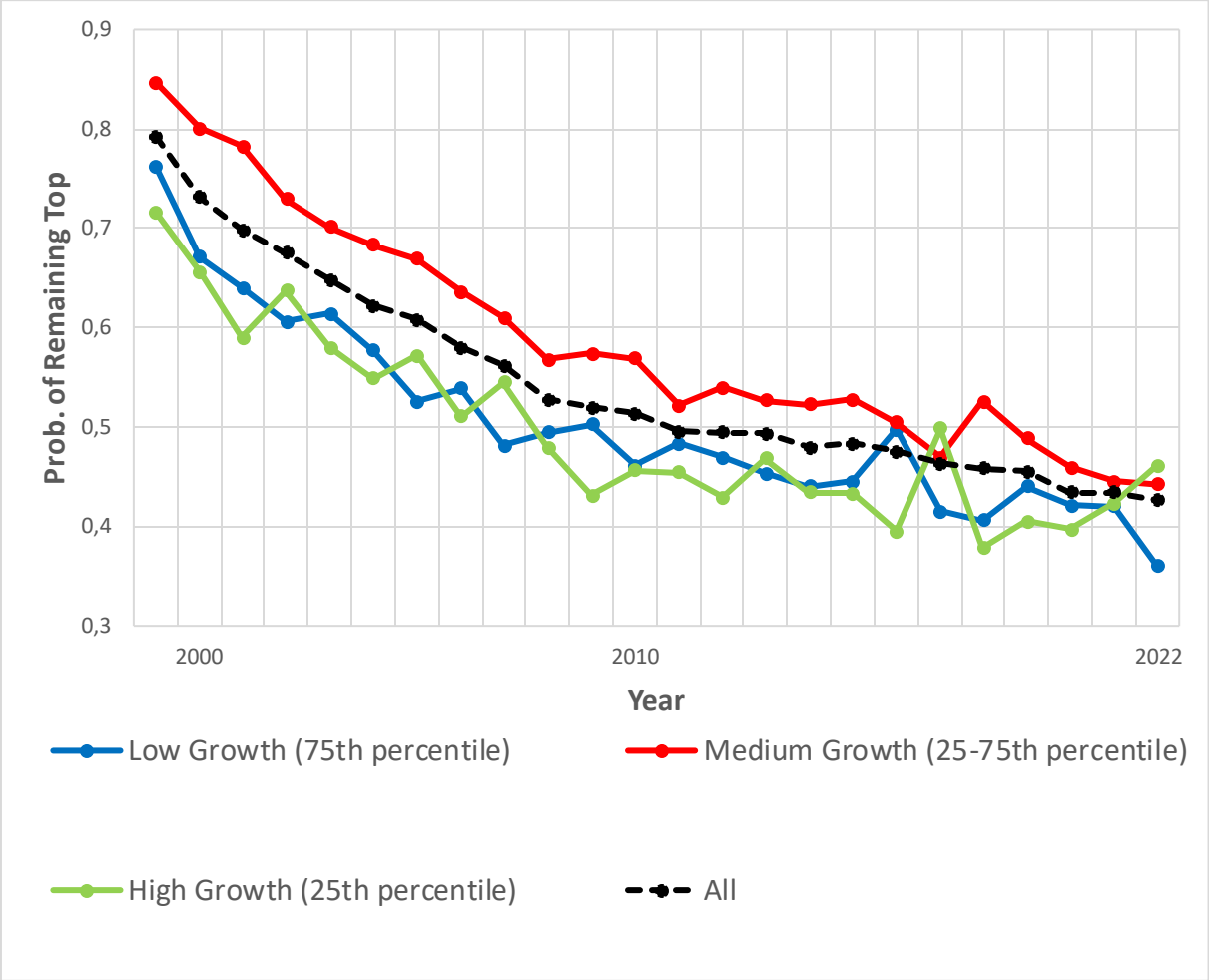
Predicted probability to be a top 5 good in each year from 1999 to 2022 conditional on being a top 5 good in 1998.



Data: **BACI**.

Figure A2.5

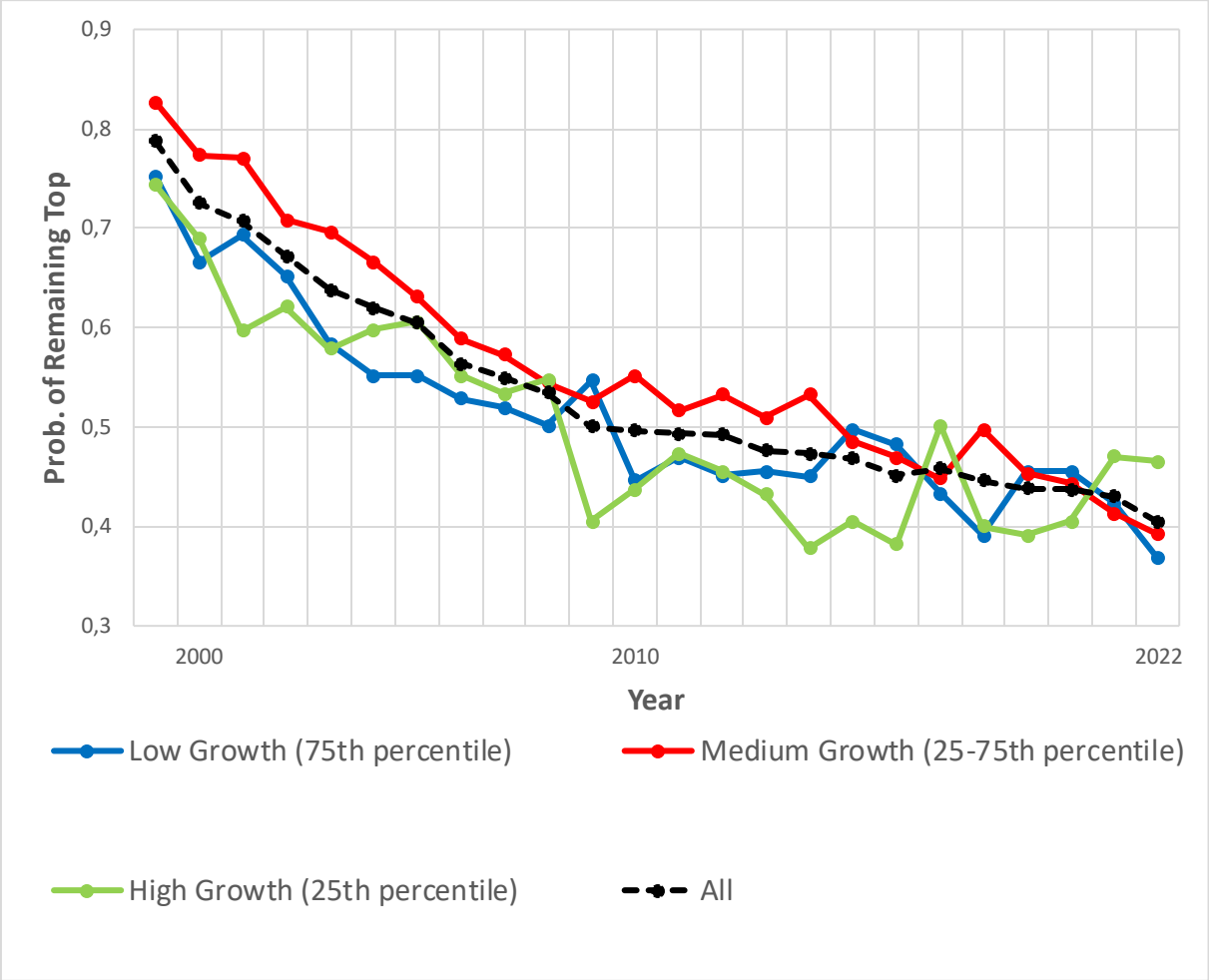
Predicted probability to be a top 10 good in each year from 1999 to 2022 conditional on being a top 10 good in 1998 for different growth percentile



Data: **BACI**.
Note: Low Growth Countries are countries at or under 25th percentile of growth in the defined year, Medium Growth is between the 25th and the 75th percentile, and High Growth is at or above the 75th percentile. Each category has different countries in it every year because their growth rate varies over time and a country with low growth rate in a said year could have a huge increase in the following years and end up in the high growth rate group.

Figure A2.6

Predicted probability to be a top 10 good in each year from 1999 to 2022 conditional on being a top 10 good in 1998 for different growth percentile



Data: **BACI**.
Note: Low Growth Countries are countries at or under 25th percentile of growth in the defined year, Medium Growth is between the 25th and the 75th percentile, and High Growth is at or above the 75th percentile. Each category has different countries in it every year because their growth rate varies over time and a country with low growth rate in a said year could have a huge increase in the following years and end up in the high growth rate group.

Appendix 3: Additional Documents

Item A3.1
List of Commodities and Extractables as listed in the Reference Article.

This list was compiled by the authors of the reference paper based on the analysis of the list of goods from **http://www.foreign-trade.com/reference/hscode.htm**. HS2 codes mean that all the HS4 goods under are part of the category.

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.

Table A3.1
List of countries present in the final sample of this paper that were not present in the paper of the reference article.

Country Name	Continent
Angola	Africa
Antigua and Barbuda	America
Armenia	Asia
Aruba	America
Bahrain	Asia
Bermuda	America
Bosnia and Herzegovina	Europe
Cambodia	Asia
Cameroon	Africa
Chad	Africa
Congo	Africa
Democratic Republic of the Congo	Africa
Dominica	America
Dominican Republic	America
Equatorial Guinea	Africa
Fiji	Oceania
Guinea-Bissau	Africa
Haiti	America
Iraq	Asia
Kuwait	Asia
Kyrgyzstan	Asia
Laos	Asia
Liberia	Africa
Libya	Africa
Marshall Islands	Oceania
Mauritania	Africa
Moldova	Europe
Mozambique	Africa
Myanmar	Asia
Nauru	Oceania
Pakistan	Asia
Papua New Guinea	Oceania
Saint Kitts and Nevis	America
Samoa	Oceania
São Tomé and Príncipe	Africa

Sierra Leone	Africa
Solomon Islands	Oceania
Somalia	Africa
Sri Lanka	Asia
Suriname	America
Timor-Leste	Asia
Tonga	Oceania
Tuvalu	Oceania
Uzbekistan	Asia
Vanuatu	Oceania
Vietnam	Asia
Zimbabwe	Africa

Data: **BACI** & **Comtrade**.
Note: This list of countries is pre-GDP data, meaning that it's not the exhaustive list of countries that are different in both samples. While it was possible to retrieve the database from Comtrade used by the authors in the reference paper at that time, it was not possible to do the same for the GDP data. This list shows, however, the type of countries that were not present in the authors' sample (mainly islands, small and/or African countries).