Geographic concentration of imports and economic vulnerability of countries*

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Abstract

This paper documents that the geographic concentration of imports is associated with a higher volatility of country-level imports. We find that this is because a higher geographic concentration of imports is correlated with greater exposure to supply shocks in source countries, so that the growth of country-product level imports is more sensitive to these supply shocks. We also find that the imports of small and poor countries are unambiguously much less diversified from a geographic point of view than those of big and rich economies. This remains true when accounting for supplier access and the participation of countries in trade agreements and economic unions, which are found to favor the geographic diversification of import flows. These findings point to a double penalty for small and poor countries. On the one hand, their imports are more volatile conditional on their geographic concentration. And on the other, their imports are geographically more concentrated, which further increases their volatility.

Keywords: Geographic concentration of imports; Volatility; Economic vulnerability; Supply shocks.

JEL Codes: F14, F41, F63, F13.

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1 Introduction

Globalization has allowed economies to achieve substantial productivity gains through both the exploitation of sectoral comparative advantages[1] and the division of labor along global value chains.[2] Still, the globalization backlash we observe in many countries[3], the increased probability of extreme weather events and pandemics due to climate change,[4] and the acute geopolitical uncertainties, make some people fear that by interconnecting countries, globalization has made economies more vulnerable to external shocks.[5] This fuels various calls for reshoring or near-shoring in the public debate.[6] However, one can think about international trade as an insurance mechanism against idiosyncratic supply shocks, so reshoring may simply substitute exposure to external shocks for exposure to internal shocks without improving the stability and the resilience of economies. In other words, beyond the simplistic dichotomy between sourcing abroad or close-by, the geographic concentration of imports may be an important dimension determining the vulnerability of countries in case of disruptions in the international supply of the goods they use and consume.

In this paper, we build two simple indexes measuring the geographic concentration of product-level imports for 183 countries from 2000 to 2019. We first show that the geographic concentration of imports is associated with a higher volatility of country-level imports. We find that this is explained by the fact that a higher geographic concentration of imports is correlated with greater exposure to supply shocks in source countries, so that the growth of country-product level imports is more sensitive to these supply shocks. Therefore, a higher geographic concentration of imports makes countries more vulnerable to supply disruptions. We also find that the level of geographic concentration of imports varies a lot across countries. The imports of smaller and poorer countries are unambiguously much less diversified from a geographic point of view than those of bigger and richer economies. This remains true when we account for supplier access and the participation of countries in trade agreements and economic unions (in particular the World Trade Organization and the European Union) which are found to favor the geographic diversification of import flows. Hence, our results highlight a double penalty for small and poor countries. On the one hand, their imports are more volatile conditional on their geographic concentration. And on the other hand, their imports are geographically more concentrated, which further increases their volatility. Our conclusions point to a new and intuitive reason why the effects of globalization has been uneven across economies, and why its benefits may not be evident to the poorer economies in

[1] See, e.g., Costinot et al. (2012).

[2] For a recent review, see Antràs and Chor (2021).

[3] See, for a recent review, Colantone et al. (2022). The Brexit, the US-China trade war, the lack of progress in the Mercosur-EU trade agreement and the difficulties faced by WTO to maintain multilateralism are a few recent examples of the consequences of the globalization backlash.

[4] See, for example https://www.mckinsey.com/business-functions/sustainability/our-insights/could-climate-become-the-weak-link-in-your-supply-chain

[5] See, for example, Javorcik (2020).

[6] See for example the 2022 State of the Union address of President Biden here: https://www.whitehouse.gov/state-of-the-union-2022/

the world. The analysis proposed also suggests that import diversification strategies may be particularly beneficial to smaller and poorer economies, as diversification can provide valuable insurance against imported volatility.

More in the details, the two measures of geographic concentration of imports we use are the Herfindahl index and the number of source countries computed at the importing country-product level. We show that over the period, these two indexes mostly vary across products and across countries, not over time. In terms of variations across products, we document that imports tend to be more concentrated in products where the international supply is concentrated, and when products are less differentiated, more upstream and less tradable. We also show that the positive correlation between the geographic concentration of imports and their volatility is robust and pervasive across all industries, although significant differences exist in the intensity of this relationship. Regarding the country-level determinants of the geographic concentration of imports, all the patterns we highlight are robust when we account for the gravity of trade flows. This means that the fact that the imports of small and poor countries are more geographically concentrated is not the mere reflection of their geographic position.

Our study contributes to several strands of the literature. First, while it has been largely ignored so far, the nexus between international trade, geographic concentration/diversification of trade flows and economic volatility has been the object of rising attention over the past few years. Caselli et al. (2020) revisit, in a quantitative model of trade, the link between trade openness and income volatility by incorporating trade-induced geographic diversification of the sources of supply and demand.[7] In the same vein, Bonadio et al. (2021) study, in a multi-country/multi-sector model of trade, the role of global supply chains in explaining the impact of the Covid-19 pandemic on GDP growth. D'Aguanno et al. (2021) use a stylized two-country model of trade to discuss the relationship between economic volatility and participation to global value chains where international trade may increase volatility by favoring sectoral specialization, but may also reduce it by allowing countries to diversify supply and demand internationally. Borin et al. (2021) propose a new country-level index of participation in global value chains and show that GVC participation increases exposure to external shocks but also mitigates local shocks. The main takeaway from these studies is that the geographic diversification channel is powerful enough to make the relationship between trade openness and output volatility insignificant or negative in spite of increased sectoral specialization. By relying on quantitative models of trade, this line of work allows for counterfactual analyses. However, for calibration purposes, it has to focus on aggregated sectors and on a reduced number of countries. Moreover, the extent and the determinants of the geographic diversification of imports are not studied *per se*. Our goal here

[7] Before that, Koren and Tenreyro (2007) show that the lower GDP volatility in high-income countries is explained by their specialization in less volatile sectors and the lower volatility of their macroeconomic shocks, while Koren and Tenreyro (2013) emphasize technological diversification as a driver of both productivity growth and lower income volatility. However, international trade is (mostly) absent from their analysis. di Giovanni and Levchenko (2009) study how trade openness affects volatility through its impact on sectoral specialization, but there is no role for the geographic patterns of trade flows in their analysis.

is different. We aim at building indexes that measure the geographic concentration of country-level imports across very detailed product categories. Indeed, at the level of aggregated sectors, geographically diversified imports may hide product-level imports that are geographically highly concentrated, each product coming from different (narrow sets of) countries. In case products within sectors are not easily substitutable in the production function of firms or in the utility function of consumers, the sector-level analysis will provide a distorted assessment of the vulnerability of countries. Moreover, we want to build these indexes for the widest possible range of countries so as to investigate the characteristics of the countries with a high geographic concentration of imports, and thus with an increased vulnerability to idiosyncratic shocks affecting source countries.

Only a few papers provide a detailed analysis of the geographic concentration of imports. Cadot et al. (2014) document an increasing diversification of country-product level imports for OECD countries from the 1960's to the early 2000's, and they relate it to the search of high-quality suppliers. Freund et al. (2021) show that following the Tohoku earthquake in 2011, countries that used to heavily rely on Japan for their imports in the automobile and electronic sector changed suppliers and became more likely to source their inputs from developing countries. However, this movement was not accompanied by a higher diversification of imports nor by re- or near-shoring. Compared to these two studies, our goal is more general so we include in our sample a wider range of countries and/or products. Moreover, we deal with the determinants of country-level geographic import diversification in the cross-section, instead of its evolution over time, as we find that the geographic concentration of country-product imports varies very little between 2000 and 2019. Jaimovich (2012) shows that the geographic diversification of country-product level imports grows as per capita GDP increases over time, which echoes our findings in the cross-section. Nevertheless, that paper does not touch upon the relationship between the geographic diversification of import flows and the economic vulnerability of countries.

While we provide a country-level analysis, in practice, it is firms that produce and trade, not countries. The measures of country-level geographic concentration of imports we propose thus reflect two things. They partly capture the geographic concentration of individual firms' imports, in particular the big ones which account for a larger share of countries' imports. Through this lens, the lower volatility of product-level imports observed in countries with more geographically diversified imports may be due to the fact that firms with geographically diversified imports are in a better position to cope with a negative shock in one or a few suppliers.[8] Second, not all firms importing a given product source their imports from firms in the same countries. In case of a negative shock in one supplying country, the firms that source their inputs from it may shrink, while those that source their inputs from other countries may expand so that the shock is dampened at the aggregate level (di Giovanni et al., 2020; Lafrogne-Joussier et al., 2021). This would translate into a lower volatility of country-product level imports too. Analyzing

[8]Inspired by the seminal contribution of Gabaix (2011) on the micro-origins of aggregate fluctuations, the fact that large firms both generate and transmit aggregate shocks is now well documented (see, e.g., di Giovanni et al., 2014, 2020).

cross-country differences in the geographic concentration of imports with firm-level data is hard since such data is not accessible for a large number of countries. The country-level analysis is important though since as argued by Baldwin and Freeman (2021), in a risk-versus-reward framework, firms may adopt diversification strategies in terms of input supply that are more risky than those desired by governments. From a policy perspective, we thus think addressing the issue of the geographic concentration imports and the vulnerability to supply disruptions with country-level data is fruitful.

The rest of the paper is organized as follows. We present the data, the concentration indexes and descriptive statistics in Section 2. We analyze the relationship between the geographic concentration of country-product level imports and their volatility and exposure to supply shocks in Section 3. Section 4 is dedicated to the investigation of the country-level determinants of the geographic concentration of imports. Finally, Section 5 concludes.

2 Data and descriptive statistics

2.1 Data

This work uses publicly available country-level datasets. Our main data source is the BACI database that reports bilateral trade flows at the 6-digit level of the international HS product nomenclature (more than 5,000 products). This dataset is maintained by CEPII[9] and matches reports from exporting countries with those from importing countries using the raw UN COMTRADE data as input. This yields consistent trade flows that minimize potential issues with the reliability of reporters (for more details, see Gaulier and Zignago, 2010). We focus on the period 2000-2019 as it provides a relatively stable set of countries and stops before the Covid crisis, and we keep all country-products with positive import values in all years.[10] Our final sample comprises 183 countries and 4552 unique products, and covers over 97% of all reported international trade.

Population and nominal GDP data are taken from the World Development Indicators of the World Bank, while the GeoDist database of CEPII[11] is used to obtain information on trade costs (bilateral distance, common border and common language dummies etc.). Such information is used to run different gravity equations and to construct suppliers' shocks as specified below. We also use these data to construct a measure of supplier access that we define, for a given country j, as the distance-weighted sum of the producing capabilities (GDP) of all other countries.

[9] Centre d'études prospectives et d'informations internationales: http://www.cepii.fr/CEPII/en/bdd_modele/bdd_modele_item.asp?id=37.

[10] This restriction allows to get rid of very small trade flows or of products that become obsolete over the period.

[11] http://www.cepii.fr/CEPII/en/bdd_modele/bdd_modele_item.asp?id=6.

2.2 Definition of the indexes

Let v_{ijpt} represent the value of the trade flow in product p going from country i to country j on year t, so $X_{ipt} = \sum_j v_{ijpt}$ represents total exports of p by country i and $M_{jpt} = \sum_i v_{ijpt}$ is total imports of p by country j. Then we can define a Herfindahl index of geographic concentration of imports of product p by country j at time t as:

$$H^M_{jpt} = \sum_i \left[\frac{v_{ijpt}}{M_{jpt}}\right]^2 \tag{1}$$

We can also define a Herfindahl index of geographic concentration of worldwide exports of product p at time t as:

$$H^X_{pt} = \sum_i \left[\frac{X_{ipt}}{\sum_i X_{ipt}}\right]^2 \tag{2}$$

Here it is important to underscore that while the first Herfindahl index (H^M_{jpt}) offers a measure of the geographic concentration of imports for a given importing country-product across the various source countries, the second Herfindahl index (H^X_{pt}) measures the geographic concentration of worldwide exports of a product across the countries exporting it. The former index will be the benchmark measure of geographic concentration of imports used throughout the paper.

As an alternative to the previous index, we compute the number of countries supplying good p to country j, $N^M_{jpt} = \sum_i \mathbb{I}(v_{ijpt})$, where $\mathbb{I}(v_{ijpt})$ is an indicator function that takes value one if $v_{ijpt} > 0$, and zero otherwise. This index is used to complement the analysis below when focus is to be placed on the extensive margin of trade.

2.3 Descriptive statistics

As expected, the correlation between the Herfindahl index (H^M_{jpt}) and the alternative index (N^M_{jpt}) measuring the number of countries from which j imports the HS6-product p in a given year t is highly negative, equal to -0.49 (and to -0.66 when using logs).

Variations in the geographic concentration of imports across countries, products and time. We first assess how much of the variability observed in the data for the two measures of geographic concentration of imports can be attributed to importing country characteristics, product characteristics and/or time. To do this, we simply regress the measure of geographic concentration of imports on various sets of fixed effects. We report in Table 1 the R-squared of these regressions. When using the Herfindahl index, it appears that 17% of the variations observed in the geographic concentration of imports is related to country characteristics that are fixed over time. Adding HS2 fixed effects (i.e. fixed effects defined at the 2-digit level of the Harmonized System nomenclature of products, which corresponds to "Chapters") or HS4 fixed effects ("Headings" fixed effects) increases the R-squared only modestly from 17% to 24% and 29% respectively. HS6 fixed effects ("Sub-headings" fixed effects, which are often close to products) have a more substantial explanatory power, increasing the R-squared to 34%. Adding a time dimension to the importing country and the HS6-product fixed effects adds little explanatory power to the regression, with an R-squared rising to 0.37. Hence, when we measure the geographic concentration of imports with the Herfindahl index, importer characteristics and HS6-product characteristics contribute equally to the variations observed in the data. Variations over time are not null, but they are modest. This is why in most parts of the paper, we will ignore the time dimension by averaging variables at the country and/or HS6-product level.

When we measure the geographic concentration of imports by the number of countries supplying product p to country j (N^M_{jpt}), the picture is qualitatively the same, but the product-dimension has a relatively stronger explanatory power, and the set of fixed effects we consider explain a higher share of the overall variability observed in the data.

Table 1: Variability in the geographic concentration of imports

	R-squared				
	(1)	(2)	(3)	(4)	(5)
Dep. var.					
H^M_{jpt}	0.17	0.24	0.29	0.34	0.37
N^M_{jpt}	0.24	0.40	0.57	0.71	0.76
Fixed effects:					
Importing country	✓	✓	✓	✓	
HS2		✓			
HS4			✓		
HS6				✓	
Importing country-Year					✓
HS6-Year					✓

Note: H^M_{jpt} is the Herfindahl index of geographic concentration of imports of product p by country j, while N^M_{jpt} is the number of countries from which j imports p. The table presents the R-square of regressions of the specified dependent variable on the set of fixed effects mentioned in the bottom part of the table.

Evolution of the geographic concentration of imports over time. Variations over time explain a very little share of the overall variability of the geographic concentration of imports observed at the importing country-HS6 product-year level. Hence, it does not come as a surprise that the growth of the Herfindahl index between 2000 and 2019 (measured in delta log) is very low: across importing country-HS6 product cells, it is equal to -6.4% on average (median equal to -6.1%). The fact that on average this growth is negative shows that geographic concentration of country-product level imports tends to fall over time. This may be surprising if we consider that the product-level geographic concentration of worldwide exports tends to rise between 2000 and 2019. The product-level Herfindahl index of geographic concentration of exports across exporting countries increases by 9.4% on average (median equal to 3.2%). However, the geographic concentration of worldwide exports and country-level imports of products are very imperfectly correlated. As shown in Table 2, many importing country-product cells exhibit increasing geographic concentration of imports despite decreasing geographic concentration of worldwide exports for that product and *vice versa*.

Table 2: Geographic concentration of imports *vs* geographic concentration of exports 2000-2019

		Δ LnH^X_{pt}		
		-	+	Total
Δ LnH^M_{jpt}	-	149 959	126 491	267 450
	+	89 619	125 312	214 931
	Total	230 578	251 803	482 381

Note: The geographic concentration of worldwide exports H^X_{pt} is measured by a Herfindahl index computed using exporting country-HS6 product export flows. The geographic concentration of importing country-HS6 product imports H^M_{jpt} is measured by a Herfindahl index computed using importing country-exporting country-HS6 product import flows. The table presents the count of importing country-HS6 product cells falling in each of the four possible categories when tabulating dummies that identify importing country-HS6 product cells with growing/decreasing geographic concentration of imports on the one hand, and HS6-products with growing/decreasing geographic concentration of worldwide exports on the other.

Geographic concentration of imports and product-level characteristics. While the focus of this paper is on the characteristics of countries that influence the geographic concentration of their imports, we here want to give some insights on the product-level determinants of the geographic concentration of import flows. To do so, we retrieve the product-year fixed effects estimated in column (5) of Table 1; they can be interpreted as a measure of the average product-level geographic concentration of imports net of the country characteristics that may also influence it. We use this measure as the dependent variable to investigate the correlation between the geographic concentration of imports and some product-level characteristics.

On top of the geographic concentration of worldwide exports, which is an obvious determinant of the geographic concentration of imports at the product level, we consider three types of product characteristics. First, we use several measures of product differentiation. If for a given good, different countries provide different varieties of that good, the imports of differentiated products should be more geographically diversified than those of homogeneous products, as consumers value more variety when differentiation is high. To measure product differentiation, we use the elasticities of substitution estimated by Broda et al. (2017) at the HS3-level[12], a dummy identifying homogeneous products in the classification proposed by Rauch (1999)[13], and the measure of product stickiness proposed by Martin et al. (2020). The latter indicator captures, based on the duration of firm-to-firm trade relationships, how specific varieties of a given product are to their users. Second, we use the Antras et al. (2012) measure of product upstreamness, with the idea that products that are more upstream in the value chains are more often little transformed materials and inputs for which diversification matters less. Finally, we use the distance coefficients from gravity equations estimated separately for each product based on country-level bilateral trade flows (see section 4.2 for more details) as a measure of HS6-product level tradability. The more tradable the products, the more geographically diversified their imports should be.

Table 3: Geographic concentration of imports and product-level characteristics

	$\bar{H}^M_{jpt}$ (net of importer-year FE)		$\bar{N}^M_{jpt}$ (net of importer-year FE)
	(1)	(2)	(3)
HS6-product level characteristics:			
Geographic concentration of exports	0.470^a	0.489^a	0.264^a
	(0.004)	(0.004)	(0.001)
Substitution elasticity		0.001^a	-0.035^a
		(0.000)	(0.002)
Homogeneous product		0.069^a	-0.899^a
		(0.001)	(0.042)
Relationship stickiness		-0.029^a	0.720^a
		(0.001)	(0.035)
Upstreamness		0.025^a	0.946^a
		(0.001)	(0.035)
Tradeability		-0.055^a	3.727^a
		(0.002)	(0.061)
Observations	48,453	48,453	48,453
R-squared	0.189	0.438	0.885
Fixed effects:			
Year	✓	✓	✓

Note: H^M_{jpt} is the Herfindahl index of geographic concentration of imports of product p by country j, while N^M_{jpt} is the number of countries from which j imports p. The dependent variable in columns (1) to (3) is the residual of regression (5) in Table 1 for the relevant variable. In columns (1) and (2), the geographic concentration of exports is measured thanks to the average Herfindahl index $\bar{H}^X_{pt}$, while in column (3), it is the average number of exporters $\bar{N}^X_{pt}$.

The results displayed in column (1) of Table 3 show that as expected, for a given product, country-level imports tend to be geographically more concentrated when the international supply

[12] For each HS3 line, we take the average value of the estimates they provide for 73 countries from 1994 to 2003.

[13] We take the broader definition of homogeneous products.

of that product is also concentrated. The R-squared of the regression using this sole regressor is quite high, equal to 19%. As shown in column (2), other product-level characteristics are also significantly correlated with the average geographic concentration of imports. The three measures of product differentiation all point to a greater geographic concentration of imports for less differentiated/specific products. The imports of products that are more upstream in the value chains are also more geographically concentrated. And finally, in line with the intuition, the imports of less tradable products are more geographically concentrated. Accounting for these characteristics increases the R-squared of the regression from 19% to 43%. The results in column (3) are qualitatively similar when using the number of source countries as an inverse measure of geographic concentration of imports.

3 Geographic concentration of imports and economic vulnerability of countries

3.1 Geographic concentration of imports and the volatility of imports

When the imports of a country are highly geographically concentrated, this country may be highly dependent on the relatively few import connections it has, especially in a context where establishing new trade connections is costly (see, e.g., Arkolakis, 2010; Albornoz et al., 2012; Monarch and Schmidt-Eisenlohr, 2023). Therefore we expect the geographic concentration of imports to be positively correlated with import volatility. To confirm this conjecture, we first compute indicators that measure, for each country-product cell, the growth and the volatility of imports. We compute the average growth rate of imports of product p by country j as: $\bar{g}^M_{jpt} = (1/T)\sum_t g^M_{jpt}$, where $g^M_{jpt} = (M_{jpt}/M_{jpt-1} - 1)$ measures the yearly growth rate of imports, and $T = 19$ represents the length of our time period. To measure volatility, we compute an estimator of the standard deviation of the yearly growth rate of country-product imports over the time period:

$$\sigma^M_{jp} = \frac{1}{T-1}\sqrt{\sum_t (g^M_{jpt} - \bar{g}^M_{jpt})^2} \tag{3}$$

Since volatility is measured over a given time period (here 2000-2019), we compute the average value of the Herfindahl index of geographic concentration of country-product imports and of other country-level characteristics over the same time-period. Column (1) of Table 4 shows that within products (all regressions contain HS6-product fixed effects), there is a significantly strong and positive correlation between the volatility of country-product level imports and their geographic concentration across suppliers as measured by the Herfindahl index. Column (2) shows that this relationship is robust to the inclusion of other potential variables that correlate with both the geographic concentration and the volatility of imports. Larger, richer and more open economies exhibit lower volatility of their imports. But the geographic concentration of imports remains positively correlated with import volatility after controlling for these characteristics. We also expect higher import volatility in country-product cells for which imports have strongly increased over time, which is what is observed in column (3). But again, although it is reduced, the correlation between the geographic concentration of imports and their volatility remains positive and highly significant. In column (4), we further control for country fixed effects that account for all countries' characteristics that are invariant over time; this does not affect the results. In column (5), we see that the results qualitatively hold when including in the sample extreme values of the volatility of country-product level imports (but the correlation between geographic concentration and volatility of imports is greatly boosted). In column (6), we control for the initial concentration of country-product imports (i.e. in 2000) instead of the average one over the years 2000-2019, and the correlation remains positive and highly significant. Finally, column (7) shows that the average number of countries from which country j imports product p correlates negatively with volatility, confirming that the geographic concentration of imports increases import volatility even when we account for the extensive margin of concentration only.

Table 4: Geographic concentration and volatility of imports

	Log standard-deviation of the yearly growth rate of imports ($\text{Ln}\sigma^M_{jp}$)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ln Avg conc. ($\text{Ln}\bar{H}^M_{jpt}$)	1.244^a	0.727^a	0.318^a	0.285^a	1.034^a		
	(0.044)	(0.045)	(0.024)	(0.015)	(0.040)		
Ln Init. conc. ($\text{Ln}H^M_{jp2000}$)						0.101^a	
						(0.007)	
Ln Avg # suppliers ($\text{Ln}\bar{N}^M_{jpt}$)							-0.429^a
							(0.012)
Ln Avg gdp per cap.		-0.295^a	-0.178^a				
		(0.017)	(0.011)				
Ln Avg pop.		-0.160^a	-0.106^a				
		(0.013)	(0.008)				
Ln Avg trade/GDP		-0.120^a	-0.084^a				
		(0.032)	(0.020)				
Avg growth rate of imports ($\bar{g}^M_{jpt}$)			0.772^a	0.736^a	0.000^b	0.753^a	0.697^a
			(0.009)	(0.008)	(0.000)	(0.009)	(0.007)
Observations	481,869	481,869	481,869	481,869	540,262	481,869	481,869
R-squared	0.395	0.500	0.791	0.811	0.506	0.807	0.820
Fixed effects:							
Importing country				✓	✓	✓	✓
HS6-product	✓	✓	✓	✓	✓	✓	✓

Notes: ^{a}, ^{b}, ^{c} denote significance at the 1%, 5% and 10% level respectively. Standard errors clustered at the country-level in parentheses. All regressions but column (5) exclude from the sample observations that belong to the first and last percentile of the distribution of σ^M_{jpt} once those with a volatility measure greater than 20 have been removed.

All in all, these results show there is a robust positive correlation between the geographic concentration and the volatility of imports at the country-product level.

3.2 Geographic concentration of imports and exposure to suppliers' shocks

An economy that has a high geographic concentration of its imports is likely to be more sensitive to shocks affecting its suppliers. To evaluate whether this is the case, we proceed as follows. First, we construct suppliers' shocks at the exporting country-product-year level by estimating the following equation (separately for each year t):

$$\Delta \text{Ln} v_{ijpt} = \alpha_t + \text{FE}_{ipt} + \text{FE}_{jpt} + \epsilon_{ijpt} \tag{4}$$

where $\Delta \text{Ln} v_{ijpt} = \text{Ln} v_{ijpt+1} - \text{Ln} v_{ijpt}$ is the change in the value of trade at the exporter-importer-product level, α_t is a year-specific constant that absorbs aggregate effects specific to that year, FE_{ipt} is an exporter-product (and year) fixed effect capturing variations in the intensity of bilateral trade relationships related to supplier shocks, and FE_{jpt} is an importer-product (and year) fixed effect recovering demand shocks. Note that we restrict ourselves to triplets ipt and jpt for which we have at least three observations.

Then, we define the average supply shock faced by an importer j for product p at time t as the following weighted average:

$$\bar{S}S_{jpt} = \frac{1}{M_{jpt}} \sum_i v_{ijpt} \hat{F}E_{ipt} \tag{5}$$

where the weight v_{ijpt}/M_{jpt} measures the share of origin i in the imports of product p by country j in year t.

As an alternative measure of supply shock faced by importing country j for product p at time t, we also compute the minimum value of the supply shocks estimated for countries exporting p to j at time t:

$$SS^{min}_{jpt} = min[\hat{F}E_{ipt}]_{i \in S_{jpt}} \tag{6}$$

where S_{jpt} is the set of countries from which j sources p at time t. The higher SS^{min}_{jpt}, the more likely the distribution of supply shocks faced by importer j for product p across its suppliers to be right-shifted in t.

Armed with these two measures of supply shocks faced by importing countries, we run two exercises. First, we evaluate whether the diversification of suppliers can function as an insurance mechanism. We hypothesize this could be the case since the more diversified the imports, the more diversified the risks in terms of supply shocks faced by an importing country. If this is true, we should observe that in absolute value, the importer-product-year average supply shock $\bar{S}S_{jpt}$ is smaller when the imports of product p by country j at time t are geographically less concentrated. Results reported in Table 5 show that this is exactly what we find in the data. All specifications include product-year fixed effects. Column (1) shows that for a given product-year, countries with a higher geographic concentration of their imports face a higher average supply shock in absolute value, i.e. more intense negative or positive average supply shock. Column (2) shows that the results are both qualitatively and quantitatively similar when controlling for importing country-year fixed effects which absorb all importer-wide shocks. In column (3), where we use an unweighted measure of average supply shock, the correlation between average supply shock and geographic concentration of imports is still positive and significant, albeit lower. This suggests that the positive relationship between the geographic concentration of imports and the exposure to shocks is partly driven by large shocks affecting large suppliers of product p to country j at time t. Finally, column (4) shows that results are robust to the use of the number of suppliers as an alternative (inverse) measure of geographic concentration of imports.

Table 5: Geographic concentration of imports and exposure to supply shocks

	Avg suppliers' shock (abs. val.) ($|\bar{SS}|_{jpt}$)			
	(1)	(2)	(3)	(4)
Ln Herfindahl index ($\text{Ln}H^M_{jpt}$)	0.244^a	0.280^a	0.076^a	
	(0.009)	(0.005)	(0.005)	
Ln # suppliers ($\text{Ln}N^M_{jpt}$)				-0.145^a
				(0.006)
Observations	9,155,180	9,155,180	9,155,180	9,155,180
R-squared	0.275	0.291	0.364	0.259
Fixed effects:				
HS6 Product-year	✓	✓	✓	✓
Importing country-year		✓	✓	✓

Notes: ^{a}, ^{b}, ^{c} denote significance at the 1%, 5% and 10% level respectively. Standard errors clustered at the country-level in parentheses. All regressions exclude from the sample importing country-product pairs that belong to the first and last percentile of the distribution of σ^M_{jp} once those with a volatility measure greater than 20 have been removed. Column (3) shows results where we impose equal weights in the construction of SS_{jpt}. The sample is restricted to triplets *ipt* and *jpt* for which we have at least three observations.

After having shown that for a given product, the geographic diversification of imports acts as an insurance mechanism that drives to zero the average supply shocks faced by importing countries, we examine whether the growth of imports of product p by country j between t and $t+1$ is more sensitive to supply shocks when the imports of p by j are geographically more concentrated in t. We cannot use the weighted average measure of supply shocks $\bar{SS}_{jpt}$ here as we have shown that it is itself related to the geographic diversification of imports. We rather use SS^{min}_{jpt}: the higher the minimum value of the supply shocks among the countries supplying product p to country j at time t, the more favorable (i.e. right-shifted) the supply shocks to which importer j is exposed for product p. The column (1) of Table 6 shows that as expected, there is a positive correlation between the growth of imports of product p by country j between t and $t+1$ and the minimum value of supply shocks among countries supplying p to j in t. However, column (2) shows that this positive correlation is highly heterogeneous, and stronger when the geographic concentration of imports is high (positive coefficient on the interaction between the minimum value of supply shocks faced by an importing country and the geographic concentration of its imports). Put differently, country-product level import growth is more sensitive to supply shocks when imports are more geographically concentrated. This remains true when we control for importing country-year fixed effects (column 3), and when the number of countries supplying p to j in t is used as a measure of geographic diversification of imports (column 4).

Table 6: Import growth and suppliers' shocks

	Growth in imports ($\Delta \text{Ln} M_{jpt}$)			
	(1)	(2)	(3)	(4)
Min. Supp. Shock (SS^{min}_{jpt})	0.045^{a}	0.084^{a}	0.077^{a}	0.057^{a}
	(0.003)	(0.006)	(0.005)	(0.005)
Ln Herfindahl index ($\text{Ln}H^{M}_{jpt}$)		-0.038^{a}	-0.078^{a}	
		(0.007)	(0.005)	
$SS^{min}_{jpt} \times \text{Ln}H^{M}_{jpt}$		0.036^{a}	0.035^{a}	
		(0.004)	(0.004)	
Ln # suppliers ($\text{Ln}N^{M}_{jpt}$)				-0.200^{a}
				(0.007)
$SS^{min}_{jpt} \times \text{Ln}N^{M}_{jpt}$				-0.028^{a}
				(0.002)
Observations	9,145,640	9,145,640	9,145,640	9,145,640
R-squared	0.044	0.048	0.078	0.079
Fixed effects:				
HS6 Product-year	✓	✓	✓	✓
Importing country-year FE			✓	✓

Notes: ^{a}, ^{b}, ^{c} denote significance at the 1%, 5% and 10% level respectively. Standard errors clustered at the country-level in parentheses. All regressions include product-year fixed effects. All regressions exclude from the sample observations that belong to the first and last percentile of the distribution of σ^{M}_{jpt} once those with a volatility measure greater than 20 have been removed.

To sum up, the results of this section show that the geographic diversification of imports allows importing countries to reduce the average supply shocks they face and then to make their product-level imports less sensitive to shocks affecting their suppliers.

3.3 Analysis at the level of broad sectors

In this section we analyze how heterogeneous the patterns highlighted so far are across broad industries. We split the results in broad industries that are easily recognizable to the reader following the classification used by the HS system at two digits.[14] Then we run all our previous specifications separately for each broad industry.

Figure 1 displays the results on the relationship between the geographic concentration of imports and the volatility of imports. It shows the point-estimate and the 95% confidence interval corresponding to the coefficient obtained on the Herfindahl index ($\text{Ln}\bar{H}^{M}_{jpt}$) in a specification replicating column (4) of Table 4 by broad industry. As can be seen the coefficient is positive and significant for all the broad industries, highlighting that our previous results can be considered pervasive at least qualitatively: in all industries a higher geographic concentration of imports is associated with higher import volatility. Quantitatively however, differences are significant with Textiles, Animal Products and Chemicals exhibiting a higher positive correlation than other industries such as Wood Products, Foodstuffs and Footwear.

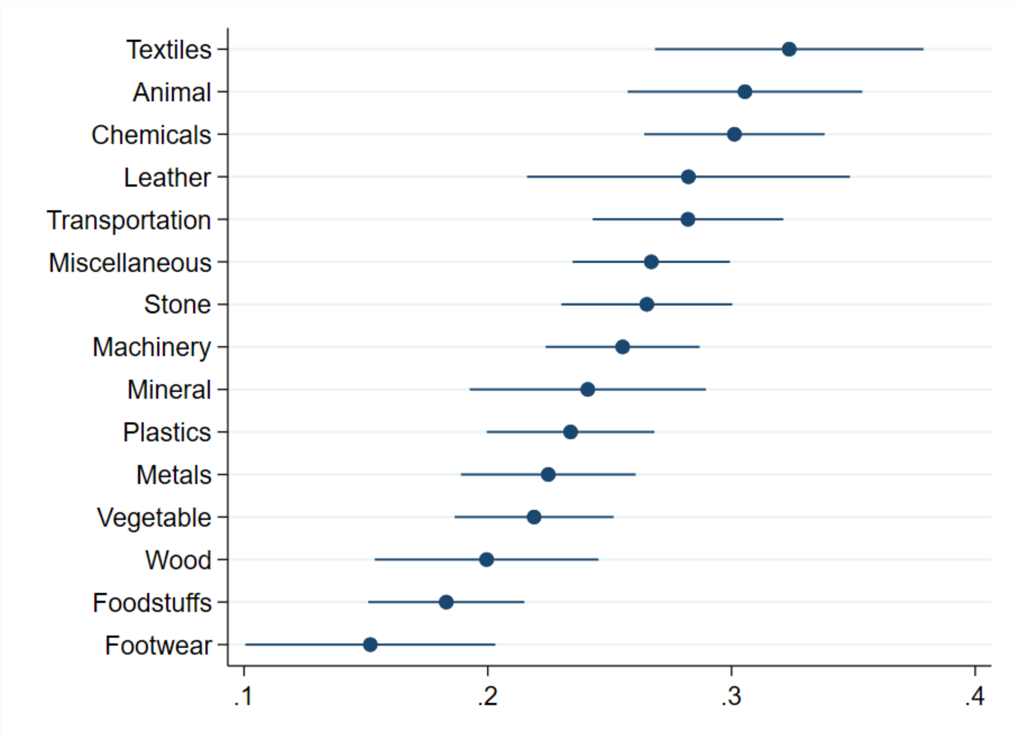
Our previous conclusion that country-product level import growth is all the more sensitive to supply shocks that imports are geographically concentrated also holds true for all broad industries. Figure 2 shows the point-estimate and confidence interval for the coefficient corresponding to the interaction term in industry-level regressions similar to the one in column (3) of Table 6. The figure shows that positive and significant coefficients are obtained for all industries. Differences across industries can be significant though, with a lower response being found for Vegetable and Mineral products and Transportation services.

4 Geographic concentration of imports and country characteristics

When the imports of countries are geographically more concentrated, they are more volatile and more sensitive to idiosyncratic international supply shocks. However, the geographic concentration of imports varies greatly across countries. We uncover here some country-level characteristics that are systematically associated with a higher geographic concentration of imports.

[14]This yields the following categories (with their respective intervals in the HS2 classification at two digits): Animal & Animal Products (01-05), Vegetable Products (06-15), Foodstuffs (16-24), Mineral Products (25-27), Chemicals & Allied Industries (28-38), Plastics/Rubbers (39-40), Raw Hides, Skins, Leather, & Furs (41-43), Wood & Wood Products (44-49), Textiles (50-66), Footwear/Headgear (64-67), Stone/Glass (68-71), Metals (72-83), Machinery/Electrical (84-85), Transportation (86-89), and Miscellaneous (90-97). This is a widely used categorization, see for example: https://www.foreign-trade.com/reference/hscode.htm.

Figure 1: Geographic concentration and volatility of imports, per broad industry



Note: Point-estimate and confidence interval at 95% for the coefficient corresponding to $Ln\bar{H}^{M}_{jpt}$ of the specification in column (4) of Table 4. Such specification has Lnv^{M}_{jpt} as dependent variable, $Ln\bar{H}^{M}_{jpt}$ as main explanatory variable, and controls for $\bar{g}^{M}_{jpt}$ and country and product FE. Standard errors clustered at the country-level in parentheses. All regressions exclude from the sample observations that belong to the first and last percentile of the distribution of σ^{M}_{jpt}. Each regression run only considering trade flows in the corresponding broad industry.

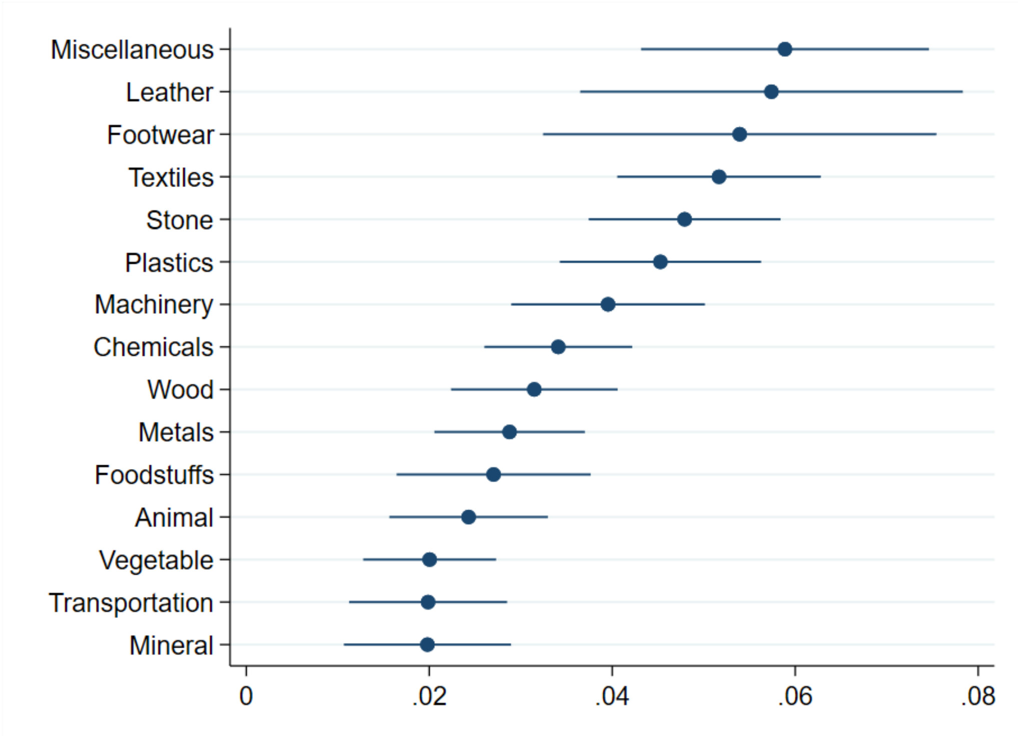
4.1 Baseline results

For each importing country and HS6-product we take the average Herfindahl index of geographic concentration of imports measured from 2000 to 2019.[15] We normalize this measure by its HS6-level average across countries so as to neutralize any differences in geographic concentration of imports stemming, for example, from the geographic concentration of the worldwide exports of that product or from other product-level characteristics highlighted in Section 2.3.

We then regress this measure on three types of country-level characteristics. First, we account for the economic size of each economy by including population and GDP per capita of countries. The intuition here is that bigger/richer/more productive countries host more firms engaged in international transactions. This may be due to a standard productivity argument *a la* Melitz (2003) where only the most productive firms trade, especially when trade costs are high. It could

[15] We take the weighted share by weighting each observation by its share in the overall imports of that product by that country over the period.

Figure 2: Import growth and suppliers' shocks, per broad industry



Note: Point-estimate and confidence interval at 95% for the coefficient corresponding to interaction term of the specification in column (3) of Table 6. Such specification has ΔLnM_{jpt} as dependent variable, and SS^{min}_{jpt}, $Ln\bar{H}^{M}_{jpt}$ and the interaction $SS^{min}_{jpt} \times Ln\bar{H}^{M}_{jpt}$ as explanatory variables, and controls for country-year and product-year FE. Standard errors clustered at the country-level in parentheses. All regressions exclude from the sample observations that belong to the first and last percentile of the distribution of σ_{jpt}. Each regression run only considering trade flows in the corresponding broad industry.

also be related to a market and firm-specific heterogeneity in entry costs and demand as modeled by Eaton et al. (2011). Whatever the reason, we can conjecture that bigger and richer countries will have more geographically diversified import flows simply because they host more (and possibly bigger) importing firms. We also include various characteristics related to the economic geography of countries: on top of the overall trade openness of countries (the sum of aggregate imports and exports over GDP), that we anticipate to be conducive to greater diversification of import flows, we incorporate a measure of supplier access (computed as the weighted sum of other countries' GDP using as weights bilateral distances between countries), the relative size of the importing country (computed as the average ratio between the importing country and the neighbors with which it shares a common border), and finally a dummy identifying island countries. Note that the measure of supplier access we use is purposely very simple. It does not account, in particular, for the gravity determinants of trade flows, a matter we deal with in the next subsection. Finally, we account for the participation of countries in trade agreements and economic unions by identifying countries that are members of the World trade Organization (WTO), the European Union (EU), a Free Trade Agreement in general (FTA) and/or a Currency Union (CU). By facilitating the creation of new trade connections, or on the opposite by diverting trade relationships towards the trade partners of the agreement at the expense of other countries, trade agreements could, conditional on the level of trade openness, both favor or reduce the geographic diversification of trade flows (Carrere, 2006).

The results are reported in Table 7. In columns (1) to (3), we gradually introduce the various regressors and the results are clear-cut. The imports of poor and small countries are, for a given product, geographically more concentrated as measured by the Herfindahl index (column 1). Column (2) shows that imports are more geographically concentrated for countries that have a lower supplier access, and controlling for economic geography characteristics reduces a bit the intensity of the correlation between the geographic concentration of imports and GDP per capita. The results in column (3) reveal that countries from the WTO and/or the EU have imports that are significantly more geographically diversified. The relationships with FTA and CU membership are not significant. Finally, the patterns are very similar in columns (5) to (8) where we use the number of source countries instead of the Herfindahl index as a measure of geographic concentration of imports. Note that when we control for trade policy variables, the correlation between the geographic concentration of imports and supplier access becomes weaker or even insignificant. However, the correlation with country size or income per capita is not affected by the introduction of trade policy variables.

When we combine these insights with those from Section 3.1, it appears that small and poor economies suffer from a double penalty in terms of economic vulnerability as measured by the volatility of imports. Indeed, imports are more volatile in small and poor countries, as well as in countries whose imports are, conditional on these characteristics, more geographically concentrated. But the geographic concentration of imports itself is higher in poor and small economies. There appears to be a nexus here that makes small and poor countries particularly exposed and vulnerable to supply shocks in the countries from which they source their imports.

4.2 Accounting for the gravity of trade flows

It is now well established that empirically, trade flows follow, on average, the law of gravity and that from a theoretical perspective, most models of international trade give strong foundations to this empirical regularity (Head and Mayer, 2014). If poor and small countries are countries that face lower trade opportunities due to their smaller size and/or to higher trade costs, it could well be the case that the patterns highlighted in the previous section simply reflect the impact of gravity on the geographic concentration of countries' import flows.

To account for gravity, we estimate Poisson models at the HS6-product level where bilateral trade flows are regressed on importer-year and exporter-year fixed effects, the log of bilateral distance between trading countries, and dummies identifying country pairs that share a common border, a common language, or a former colonial relationship. We then use the predicted

Table 7: Geographic concentration of imports and country characteristics

	Avg. Herfindahl index ($\bar{H}^M_{jpt}$)				Avg. # suppliers ($\bar{N}^M_{jpt}$)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ln Pop.	-0.091^a	-0.094^a	-0.081^a	-0.089^a	0.215^a	0.221^a	0.211^a	0.209^a
	(0.009)	(0.010)	(0.010)	(0.009)	(0.012)	(0.013)	(0.013)	(0.013)
Ln GDP per cap.	-0.133^a	-0.105^a	-0.089^a	-0.097^a	0.287^a	0.245^a	0.235^a	0.236^a
	(0.010)	(0.011)	(0.013)	(0.011)	(0.016)	(0.016)	(0.017)	(0.017)
Ln Trade openness		-0.038	-0.011	-0.028		0.167^a	0.137^a	0.136^a
		(0.025)	(0.027)	(0.023)		(0.033)	(0.035)	(0.035)
Ln Supplier Access		-0.125^a	-0.065	-0.088^b		0.163^a	0.121^a	0.124^a
		(0.034)	(0.046)	(0.039)		(0.040)	(0.045)	(0.045)
GDP relative to neighbors		-0.003	-0.003	-0.001		0.014^a	0.014^a	0.015^a
		(0.003)	(0.003)	(0.003)		(0.005)	(0.005)	(0.005)
$\mathbb{1}$ Island		-0.062	-0.044	-0.037		0.092^c	0.084	0.091^c
		(0.052)	(0.048)	(0.044)		(0.053)	(0.052)	(0.052)
$\mathbb{1}$WTO member			-0.115^c	-0.149^b			0.181^a	0.182^a
			(0.064)	(0.059)			(0.062)	(0.062)
$\mathbb{1}$European Union member			-0.153^a	-0.124^a			0.114^b	0.116^b
			(0.046)	(0.036)			(0.050)	(0.049)
$\mathbb{1}$FTA member			-0.060	-0.068^c			0.018	0.017
			(0.040)	(0.039)			(0.051)	(0.050)
$\mathbb{1}$Curr. Union member			0.033	0.057^c			-0.008	-0.009
			(0.034)	(0.030)			(0.036)	(0.035)
$\hat{\bar{H}}^M_{jpt}$				0.199^a				
				(0.014)				
$\hat{\bar{N}}^M_{jpt}$								1.943^a
								(0.170)
Observations	481,869	481,869	481,869	481,869	481,869	481,869	481,869	481,869
R-squared	0.219	0.236	0.253	0.302	0.602	0.637	0.649	0.652
Fixed effects:								
HS6 Product	✓	✓	✓	✓	✓	✓	✓	✓

Notes: ^{a}, ^{b}, ^{c} denote significance at the 1%, 5% and 10% level respectively. Standard errors clustered at the country-level in parentheses. All regressions exclude from the sample observations that belong to the first and last percentile of the distribution ofσ^M_{jp} once those with a volatility measure greater than 20 have been removed. Trade openness is measured as the sum of aggregate imports and exports over GDP, and supplier access is the weighted sum of other countries' GDP using as weights bilateral distances between countries. $\hat{H}^M_{jpt}$ and $\hat{N}^M_{jpt}$ are the Herfindahl index and the number of supplying countries computed using predicted trade flows based on the estimated gravity equations described in section 4.2.

value of trade flows based on the estimated Poisson models to compute the predicted importer-product-year Herfindahl index of geographic concentration of trade flows $\hat{H}^M_{jpt}$ (or alternatively the predicted number of countries from which it imports that product $\hat{N}^M_{jpt}$). We then replicate the analysis proposed in the previous section controlling for the geographic concentration of import flows as predicted by gravity.

The results appear in columns (4) and (8) of Table 7. For both measures of concentration used in this paper (Herfindahl or number of suppliers) we find a positive correlation between the observed concentration index and the predicted one based on gravity. Importantly, we still find that all the patterns previously highlighted remain unchanged, even controlling for concentration due to gravity: small and poor economies exhibit geographically more concentrated imports. The lower geographic diversification of the imports of small developing countries is thus not the mere reflection of gravity. Note that in unreported regressions, we checked that the patterns highlighted here are qualitatively similar in most broad industries.

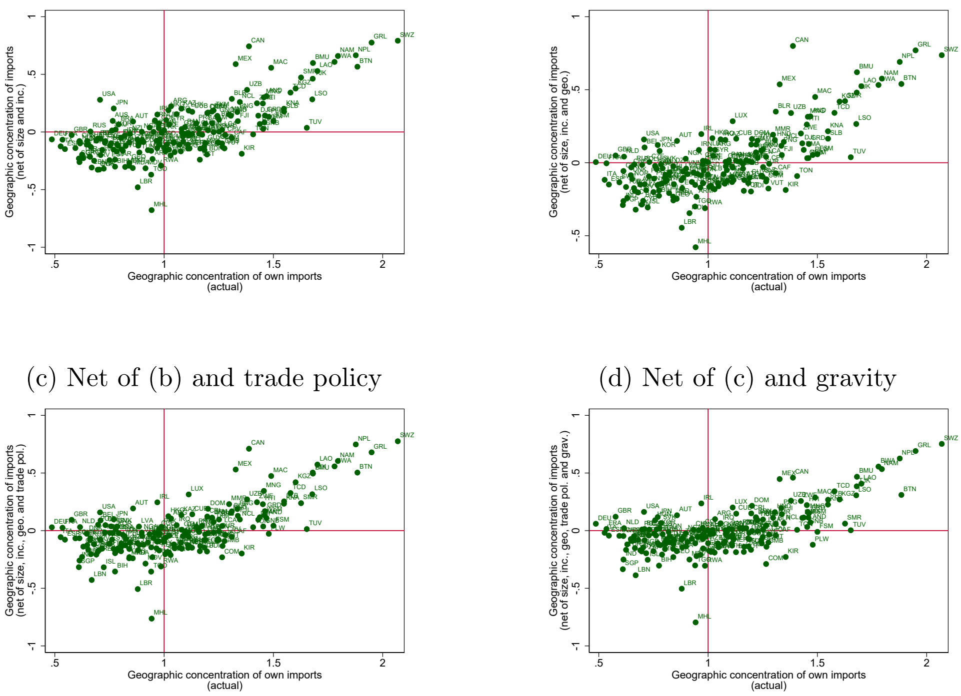
4.3 Geographic concentration of imports beyond country-level characteristics and gravity

As a final exercise, we want to identify countries whose imports are geographically over- or under-concentrated compared to what they should be considering their observable characteristics. To do this, for each regression from column (1) to (4) in Table 7, we recover the residual and then, for a given importing country j, we take the average residual across all products p using as weights the share of each product in the overall imports of j over the period.

In terms of interpretation, a high (resp. low) value of the residual from column (1) means that the imports of a country are geographically over-(resp. under-) concentrated compared to what they are predicted to be considering the size and the GDP per capita of the country. The same applies to the residual of column (2), but this time conditional on size, GDP per capita, and various characteristics related to economic geography, and so on and so forth.

In Figure 3, we plot each residual against the actual value of the Herfindahl index. It is beyond the scope of this paper to provide a detailed analysis for each country but some interesting patterns emerge. For example, we can see on Panel (a) of the figure that the geographic concentration of the imports of Canada and Mexico are not only high *per se* (the two countries appear on the right part of the graph), but also relative to what they should be considering their population size and their average GDP per capita (the two countries appear in the upper part of the graph). Panels (b) and (c) reveal that accounting for (economic) geography and trade policy variables does not greatly alter the picture. When gravity is accounted for, the value of the residual decreases more significantly, but it remains high. This means that the standard gravity determinants only partly explain the high geographic concentration of Canadian and Mexican imports. For these economies, the effect of being close to the American economic giant seems to have a more than proportional effect on the concentration of their imports. It is worth noting that this strong commercial dependence is regularly discussed in the public debate in Canada for example (Martin and Mayneris, 2022), where it has been pointed as being very asymmetric. Indeed, the imports of the US are geographically quite diversified (they appear on the left-hand side of the graphs), and compared to Canada and Mexico, they are much less over-concentrated considering their observable characteristics, especially when (economic) geography, trade policy and gravity are accounted for.

Figure 3: Geographic concentration of imports net of country characteristics



(a) Net of size and income

(b) Net of (a) and geography

(c) Net of (b) and trade policy

(d) Net of (c) and gravity

Note: On the vertical axis, the figure displays the average across products of the residual obtained from regression (1) in Table 7 in Panel (a), regression (2) in Panel (b), regression (3) in Panel (c) and regression (4) in Panel (d).

To improve readibility, we present in Table 8 the top-10 and the bottom-10 countries for each panel of Figure 3. Among the countries whose imports are more geographically diversified than what is expected given their characteristics, we find Cyprus who disappears from the bottom-10 of the residuals as soon as trade policy variables are accounted for: this country has imports that are more geographically diversified than predicted by its size, income and economic geography characteristics because it is part of the European Union. For other countries like Lebanon and Liberia, the imports are "abnormally" diversified whatever the controls we account for.

Beyond the particular cases, these examples show how our analysis can be used to identify countries with exceptional geographic concentration or diversification of their imports. In-depth explorations of the different cases that our analysis single out would be welcomed, as there is still a lot to understand regarding the specific causes of these exceptional patterns.

Table 8: Geographic concentration of imports net of country characteristics

Geographic concentration of imports net of:							
(1) size and income		(2) (1) + geography		(3) (2) + trade policy		(4) (3) + gravity	
Top 10							
Swaziland	.79	Canada	.80	Swaziland	.77	Swaziland	.75
Greenland	.77	Greenland	.77	Nepal	.75	Greenland	.69
Canada	.74	Swaziland	.74	Canada	.71	Nepal	.63
Nepal	.67	Nepal	.69	Greenland	.68	Botswana	.56
Namibia	.66	Bermuda	.62	Namibia	.60	Namibia	.53
Botswana	.61	Namibia	.58	Lao	.57	Bermuda	.47
Bermuda	.60	Bhutan	.54	Botswana	.56	Canada	.46
Mexico	.59	Mexico	.54	Mexico	.53	Mexico	.45
Bhutan	.57	Botswana	.53	Tajikistan	.50	Lao	.41
Macao	.56	Lao	.52	Bhutan	.50	Tajikistan	.38
Bottom 10							
Malta	-.30	India	-.26	India	-.26	India	-.25
Lebanon	-.31	Cyprus	-.28	Maldives	-.29	Iceland	-.25
Moldova	-.31	Singapore	-.29	Rwanda	-.31	Comoros	-.29
Maldives	-.31	Togo	-.30	Singapore	-.32	Togo	-.30
Iceland	-.32	Iceland	-.31	Iceland	-.32	Bosnia Herzeg.	-.30
Bulgaria	-.33	Rwanda	-.31	Bosnia Herzeg.	-.35	Rwanda	-.30
Cyprus	-.33	Lebanon	-.32	Togo	-.36	Singapore	-.33
Togo	-.37	Maldives	-.35	Lebanon	-.43	Lebanon	-.39
Liberia	-.48	Liberia	-.45	Liberia	-.51	Liberia	-.50
Marshall Isds	-.68	Marshall Isds	-.58	Marshall Isds	-.76	Marshall Isds	-.80

Notes: Columns (1), (2), (3) and (4) present to Top 10 and the Bottom 10 countries based on the residuals of regressions (1), (2), (3) and (4) in Table 7.

5 Concluding remarks

In this paper, we investigated the relationship between geographic concentration of imports and economic vulnerability. We first propose simple country-product level measures of import concentration that are easy to implement using standard cross-country international trade data. We underscore a significant and positive relationship between the geographic concentration of imports and import volatility. Moreover, economies with a high geographic concentration of their imports are more vulnerable to idiosyncratic shocks in their few suppliers. We find that having a more diversified pool of suppliers provides economies with insurance against shocks in suppliers' exports, and turns product-level imports less sensitive to such shocks when they happen.

We also highlight important country-level characteristics correlated with the geographic concentration of imports. In particular, the geographic concentration of imports is more pervasive in smaller and poorer economies. This remains true when controlling for economic geography, participation in trade agreements or economic unions, and gravity. Our results point to a double penalty for small and poor countries. On the one hand, their imports are more volatile conditional on their geographic concentration. And on the other hand, their imports are geographically more concentrated, which further increases their volatility.

Beyond the regularities we highlight, some countries do particularly well or particularly bad in terms of geographic diversification of their imports conditional on their observed characteristics. We leave the understanding of these exceptional performances for future research.

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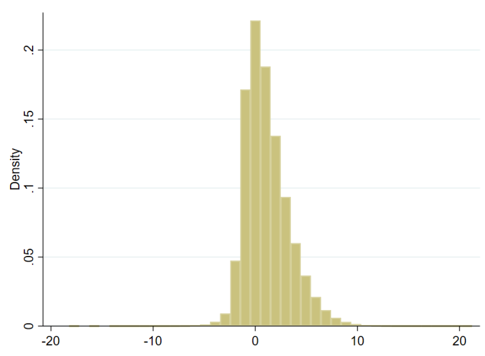
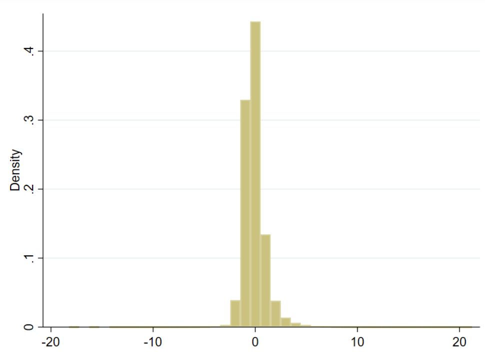
A Appendix

Figure A.1: Distribution of suppliers' shocks

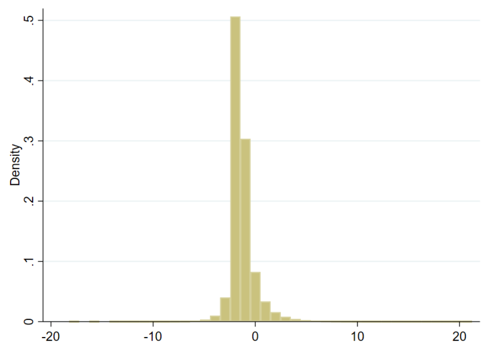
(a) Suppliers' shocks (FE_{ipt})



(b) Average import shock (SS_{jpt})



(c) Minimum import shock (SS^{min}_{jpt})



Note: All panels present the pool for all countries and years.