HORIZONTAL AND VERTICAL CONNECTOR COUNTRIES IN A GEOECONOMICALLY FRAGMENTING WORLD

SHEKHAR AIYAR
FRANZISKA OHNSORGE
HAKAN YILMAZKUDAY

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Abstract

Geoeconomic fragmentation—the phenomenon of international transactions being increasingly restricted to politically aligned partners—creates risks for individual countries but also opportunities that some hope to seize by becoming "connector" countries. We modify a standard trade model by introducing iceberg costs that increase with geopolitical distance between country pairs. The response of per capita consumption to a geopolitical shock is shown to depend on two related but distinct indices: *vulnerability,* which is a country's transaction-weighted geopolitical distance from its trade partners, and *connectedness,* which is a country's transaction-weighted standard deviation of geopolitical distance from trade partners. The latter captures a country's geopolitical diversification. We distinguish between this type of "horizontal" connectedness and the supply chain-related "vertical" connectedness discussed by previous authors, arguing that the horizontal measure is more relevant in a geoeconomically fragmenting world. We construct a comprehensive database to examine geoeconomic vulnerability and connectedness across multiple types of international transactions, documenting several stylized facts.

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Author's email: *SAiyar@icrier.res.in; fohnsorge@gmail.com; hyilmazk@fiu.edu*

Horizontal and Vertical Connector Countries in a Geoeconomically Fragmenting World

Shekhar Aiyar[a], Franziska Ohnsorge[b], and Hakan Yilmazkuday[c]

1. Introduction

Concerns about "geoeconomic fragmentation" are commanding attention against the backdrop of trade frictions between major economic powers, greater scrutiny of cross-border investment and technology transfers, and an increasing focus on the national security implications of economic relationships with foreign countries (Aiyar and others (2023a); IMF (2023a); Campos and others (2023). In principle, a country that relies more heavily on economic transactions with a country with diverging geopolitical views is at greater risk of geopolitical disruptions. But risk may also turn to opportunity: a country that interacts with a wide range of partner countries with diverse geopolitical leanings might be more resilient to disruptions from individual partner countries and might even benefit due to trade or foreign direct investment (FDI) diversion from rival blocs. Gopinath and others (2024) call such countries "connectors."

In this paper we formalize the concept of connector countries, based on a measure of the breadth of a country's bilateral economic engagements with partner countries across the geopolitical spectrum. Such "horizontal" connectedness is distinct from the "vertical" connectedness emphasized by other authors, where a country connects different links in the international supply chain (for example by receiving FDI from one country and exporting final products to another). We show that horizontal connectedness emerges naturally as a desirable feature from a standard trade model tweaked to incorporate heterogenous geopolitical stances; such diversification provides insulation against geopolitical shocks arising in one or more trade partners. Based on this theoretical perspective, we assemble a comprehensive database to examine and compare geoeconomic vulnerabilities and connectedness for individual countries, country groupings and types of transactions. We seek to contribute to the literature in several ways.

First, we modify a standard trade model to incorporate bilateral geopolitical distance. Bilateral transactions between two partners are more costly the greater their geopolitical distance from each other. We show that in this simple framework there are two important variables that govern the impact of a geopolitical shock on a given country's per capita consumption: its geoeconomic *vulnerability,* and its geoeconomic *connectedness.* The first term, geoeconomic vulnerability, has been explored earlier (IMF 2023a). It is simply the trade- or liabilities-weighted average of a country's geopolitical distance from its different trade partners or creditors, and it captures the idea that a country reliant on transacting with partner countries with very different geopolitical ideologies is more at risk from geopolitical shocks. The second term, geoeconomic connectedness, is the trade or creditor-weighted standard deviation of a country's geopolitical distance from partner countries, capturing the diversification of a countries' external ties with partners across the geopolitical spectrum. Vulnerability and connectedness are distinct concepts. Reducing transactions with geopolitically distant partners will unambiguously reduce vulnerability, but it could increase or decrease connectedness depending on the initial and final distribution of partner country shares.

Second, we compare our formalization of horizontal connectedness with the more informal or anecdotal discussions of vertical connectedness found in the literature. Mexico has often been held up as an example of a vertical connector (Gopinath and others, 2024; Alfaro and Chor, 2023). The country takes in FDI from various sources including the EU and China but exports almost exclusively to the United States. Horizontal connector countries, in contrast, are countries with well-diversified partner countries within any given category of transactions.

a Indian Council for Research on International Economic Relations (ICRIER), India
b CEPR, UK and CAMA, Australia
c Florida International University, Miami, USA

Vietnam is an excellent example of a horizontal trade connector, with export markets that are balanced across the geopolitical spectrum.

Third, we assemble a comprehensive database to examine geoeconomic fragmentation, vulnerability and connectedness across several different types of transactions, which to date have been investigated piecemeal using different frameworks and datasets. Bilateral geopolitical distance between country pairs is measured using data on voting patterns at the United Nations from Voten, Strezhnev, and Bailey (2009). This is merged with a number of bilateral cross-country data sources covering imports and exports (including their components), FDI, cross-border claims of the Bank for International Settlements (BIS)-reporting banks, and cross-border portfolio investments. The broad coverage and reliance on publicly available data sources disciplines and expands the scope of a literature that has relied heavily on either proprietary databases or datasets with various coverage limitations. For example, IMF (2023a) examines the fragmentation of FDI flows using proprietary data from fDi Markets (a news-based compilation of FDI projects), Gopinath and others (2024) look at trade fragmentation using proprietary data from Trade Data Monitor, and d'Orazio, Ferriani and Gazzani (2024) analyze firm-level geopolitical risk using data on corporate revenues from Orbis. The data compiled here permits comparing the magnitude of geoeconomic vulnerabilities arising from different types of cross-border transactions—an issue that has not yet been studied elsewhere—as well as comparisons across countries and country groupings. The database will be periodically updated as a service to researchers in the field.

Fourth, we confirm what previous studies have found: that a greater geopolitical distance between country pairs is strongly associated with diminished transactions. We corroborate earlier contributions that have used a similar gravity framework to examine the economic impact of geopolitical fragmentation of different kinds: Aiyar, Malacrino and Presbitero (2024) for FDI, Gopinath and others (2024) for trade, and IMF (2023b) for cross-border bank claims. Because we use a common methodology for different transaction types, we can compare the strength of these effects. Specifically, we contribute to the literature by showing that the adverse effect of geopolitical distance on economic transactions is largest for FDI, followed by exports and portfolio investment liabilities.

Fifth, we document some stylized facts about geopolitical vulnerability and connectedness. We find that, in general, emerging markets and developing economies (EMDEs) are significantly more vulnerable than advanced economies and are more vulnerable in their financial liabilities than in their exports. EMDEs are also significantly more geoeconomically connected than advanced economies in almost all their international economic ties. Connectedness is higher in trade-related transactions than in financial liabilities.

Sixth, we examine the recent evolution of vulnerability and connectedness. Many advanced economies, particularly in Europe, have been actively derisking their international transactions. For almost all types of transactions, those countries with the largest geoeconomic vulnerability in 2016 were also those with the steepest cuts in vulnerabilities since then. There have been significant declines in export (but not financial) connectedness since 2016, with the most geoeconomically vulnerable countries in 2016 reducing their export and FDI connectedness the most.

The rest of the paper is organized as follows. The next Section summarizes the literature to date. Section III introduces bilateral geopolitical distance into a standard trade model and shows how the response of per capita consumption to a geopolitical shock depends on vulnerability and connectedness. Section IV describes the database. Section V details our methodology for measuring geopolitical distance, and Section VI confirms previous findings that rising geopolitical distance is associated with declining bilateral transactions. Section VII illustrates the distinction between horizontal and vertical connector countries. Section VIII provides some stylized facts about geoeconomic vulnerability and connectedness, and it discusses how these indices have evolved recently. Section IX concludes.

2 Literature review

The literature on geoeconomic fragmentation is young but growing rapidly. Aiyar and others (2023a) and IMF (2023) observe that flat or falling global trade and investment flows since about the Global Financial Crisis have coincided with increasing geopolitical tensions, calls to de-risk supply chains by minimizing exposure to geopolitical rivals, and incentives to "reshore", "friendshore" or "nearshore" investments. At the same time there has been a sharp increase in trade restrictions, greater scrutiny of foreign direct investment and cross-border technology transfers, and a rising incidence of non-tariff barriers. The focus of the literature is not so much on deglobalization—where the data are open to interpretation, as pointed out by Antras (2021) and Baldwin (2022)—as on fragmentation: the phenomenon of economic interactions increasingly being restricted to geopolitically aligned partner countries.[1]

A number of recent papers examine the empirical evidence on different aspects of fragmentation.[2] Aiyar, Malacrino, and Presbitero (2024) combine data on United Nations voting patterns (Bailey, Strezhnev, and Voten 2017) with bilateral data on foreign direct investment from fDI Markets to document that the share of global foreign direct investment that occurs between ideologically distant countries has been declining steeply. Catalan, Fendoglu and Tsuruga (2024) replicate this result for portfolio asset positions and Gopinath and others (2024) for trade flows, using data from Trade Data Monitor. Both papers use gravity models to control for country-level shocks and time-invariant factors. Gopinath and others (2024) also find that while the degree of current fragmentation is well below fragmentation at the height of the Cold War, the trajectory is similar to the early years of that historical episode. One major difference from the Cold War era is the emergence of a number of non-aligned "connector" countries that are expanding their trade and investment links with opposing blocs, and might be substituting for direct inter-bloc linkages.[3]

Other papers focus more specifically on the trading relationship between the United States and China. Alfaro and Chor (2023) use product-level data from UN Comtrade to show that China's share of U.S. imports fell considerably from 2017 to 2022, while the shares of countries such as Mexico and Vietnam increased, with a high degree of correlation across product lines. At the same time, China's trade and FDI with Mexico and Vietnam picked up, suggesting that U.S.-China linkages may simply have become more indirect. Similar evidence of reallocation across supply chains is found by Freund and others (2023), Dahlman and Lovely (2023), Benguria and Saffie (2023), Blanga-Gubbay and Rubinova (2023), Handley, Kamal and Monarch (2024), Fajgelbaum and others (2024), Alfaro and others (2024), Goldberg and Reed (2023) and Utar, Cebreros Zurita, and Torres Ruiz (2023).

A related strand of the literature seeks to model output losses arising from potential future geoeconomic fragmentation. IMF (2022) and Cerdiero and others (2021) find significant losses to global GDP from trade fragmentation into rival blocs. Bolhuis, Chen and Kett (2023) construct a database of production and trade in commodities, finding that low-income countries in particular stand at risk of large output losses from fragmentation of trade in commodities. Alvarez and others (2023) find that mineral markets critical for the green transition would be extremely vulnerable to fragmentation. Goes and Bekkers (2022) show that adding technological decoupling to trade fragmentation greatly increases the magnitude of losses. IMF (2023a) examines the consequences of FDI fragmentation, finding that there are large global losses, disproportionately falling upon the China-centric bloc. Emerging markets are more severely affected than advanced economies, since they stand to gain more from FDI productivity spillovers (Ahn and others, 2024). Attinasi and others (2023) model the impact of decoupling supply chains, finding spikes in consumer and producer prices, especially for trade-intensive manufacturing sectors.

1 The fragmentation literature is also conceptually distinct from a set of papers that examine the impact of changes in global indices of geopolitical risk on variables such as investment, capital flows and oil prices (Caldara and Iacoviello 2022; Ivanovski and Hailemariam 2022; Feng and others 2023).

2 The theoretical literature on the causes and mechanisms of fragmentation is thinner. Clayton, Maggiori and Schreger (2023, 2024) model the ability of a "hegemon" to exert pressure on foreign firms and governments in its economic network to take costly actions favoring the hegemon. They show that the benefits arising from trading with the global hegemon, such as external economies of scale, also confer coercive power upon the hegemon, because economic relationships with the hegemon cannot be easily substituted. A similar mechanism arises from financial power (Pflueger and Yared 2024). Garcia-Macia and Goyal (2020) show that under certain conditions it can be optimal for a technological leader to restrict exports in order to prevent technological diffusion to potential rivals.

3 In Appendix 1, we confirm recent results on fragmentation across various different types of transactions.

Financial flows may also be disrupted or reconfigured by geoeconomic fragmentation. IMF (2023b) finds that cross-border portfolio allocations and bank claims are influenced by geopolitical distance, as measured by the S-score (Signorino and Ritter, 1999). An increase in geopolitical distance between a country and its financial partners can lead to reduced bank funding, squeezing domestic credit supply. Kempf and others (2021) find that ideological alignments with foreign countries influence syndicated corporate loans and the allocation of equity mutual funds. Correa and others (2023) show that the uncertainty generated by the U.S.-China trade tensions during 2018-2019 led to significant reductions of bank credit supply, even to firms not directly exposed to trade uncertainty. An overview of these results is provided in Aiyar, Presbitero and Ruta (2023).

3 Trade and geopolitical distance

We begin by introducing geopolitical distance into a standard trade model featuring a constant elasticity of substitution across goods from different source countries. Modeling geopolitical distance as akin to iceberg costs makes trade between political rivals more costly. This simple framework demonstrates how a country's choice of trade partners—which defines its geopolitical vulnerability and connectedness—impacts its per capita consumption in the face of a geopolitical shock.

3.1 Optimization problem

The consumption C_n of a representative household in country n is given by:

$$C_n = \left(\sum_i (\alpha_{in})^{\frac{1}{\eta}} (C_{in})^{\frac{\eta-1}{\eta}}\right)^{\frac{\eta}{\eta-1}} \quad (1)$$

where C_{in} represents the goods imported from country i (and it represents home consumption when $i=n$), η is the elasticity of substitution across goods of different source countries, and α_{in} represents preferences for such goods. The household's budget constraint is $\sum_i P_{in} C_{in}=E_{n,}$ where P_{in} is the price of $C_{in,}$ and E_n represents nominal per capita income obtained from the sale of endowments. Maximizing consumption subject to the budget constraint yields the following value of imports from country i:

$$P_{in}C_{in} = \alpha_{in}\left(\frac{P_{in}}{P_n}\right)^{1-\eta} P_n C_n \quad (2)$$

where P_n is the price of C_n given by:

$$P_n = (\sum_i \alpha_{in}(P_{in})^{1-\eta})^{\frac{1}{1-\eta}} \quad (3)$$

Per capita income in country n is further given by:

$$E_n = Y_n P_{nn} \quad (4)$$

where Y_n represents the fixed per capita endowment of country n, and P_{nn} is the source price of that good.

So far this is a textbook model with fixed endowments a la Armington (1969) and a love-of-variety in consumption, with the presentation following Yilmazkuday (2021). Our point of departure is that trade is subject to iceberg costs that depend on bilateral geopolitical distance. Formally, destination prices are given by:

$$P_{in} = \tau_{in} P_{ii} \quad (5)$$

where P_{ii} is the source price, and $\tau_{in}>1$ represents gross trade costs between source country i and destination country n. These trade costs are given by:

$$\tau_{in} = (\exp D_{in})^{\delta} \phi_{in} \quad (6)$$

where D_{in} represents the difference in the geopolitical stances of the home country n and the foreign country i. We discuss in greater detail below how we measure this geopolitical distance. In this expression, ϕ_{in} represents all other costs capturing the effects of standard gravity variables including distance, language, colonial relationship, and contiguity.

Real income per capita in country n is measured by $C_n=E_n/P_n$ according to the budget constraint. Using Equations 3, 4 and 5, it follows that:

$$C_n = \left(\sum_i \alpha_{in}\left(\frac{\tau_{in}\theta_{in}}{Y_i}\right)^{1-\eta}\right)^{\frac{1}{\eta-1}} \quad (7)$$

where the real income per capita is a function of gross trade costs τ_{in}'s, relative per capita nominal incomes $\vartheta_{in}=E_i/E_n$'s, and endowments Y_i's.

3.2 Per capita consumption losses from geoeconomic fragmentation

Widening differences in geopolitical stances vis-à-vis trade partners drive up D_{in}, and hence raise trade costs. Given fixed endowments Y_i, relative per capita nominal incomes ϑ_{in}, and preferences α_{in}, the

effect of a change in trade costs on the real income per capita of country *n* is proportional to the effect on per capita consumption. It can be measured by taking the total derivative of Equation 7 up to the second order in its log form, as follows:

$$d(\log C_n) = -\delta \sum_i \lambda_{in} d(D_{in}) + \frac{(\eta-1)\delta^2}{2}\left(\left(\sum_i \lambda_{in}\left(d(D_{in})\right)^2\right) - \left(\sum_i \lambda_{in} d(D_{in})\right)^2\right) \quad (8)$$

where $\lambda_{in}=P_{in} C_{in}/P_i C_i$ is the share of expenditure on goods from country *i* in country *n*. $d(\log\tau_{in})=\delta d(D_{in})$ according to Equation 6, since $d(\log\phi_{in})=0$ as the effects of the gravity variables are assumed to be fixed.

Without loss of generality consider moving from a situation of perfect political alignment between every country to a situation where there are at least some non-zero bilateral political distances between trade partners, i.e. the geoeconomic distance beween countries changes from zero to D_{in} and therefore $d(D_{in})=D_{in}$. Then the per capita consumption loss caused by the geopolitical shock can be written as follows:

$$d(\log C_n) = -\delta GeoV_n + \frac{(\eta-1)\delta^2}{2} GeoC_n^2 \quad (9)$$

where $d(\log C_n)$ represents the percentage change in per capita consumption in country *n*.

In this expression, $GeoV_n$ is a measure of the geoeconomic vulnerability of country *n*, defined as the weighted average of the country's geopolitical distance vis-à-vis its trade partners, with trade shares comprising the weights:

$$GeoV_n = \sum_i \lambda_{in} D_{in} \quad (10)$$

$GeoC_n$ is a measure of the geoeconomic connectedness of country *n*, defined as the weighted standard deviation of country *n*'s geopolitical distance vis-à-vis its trade partners, with trade shares again comprising the weights:

$$GeoC_n = \sqrt{\sum_i \lambda_{in}(D_{in} - \sum_i \lambda_{in} D_{in})^2} \quad (11)$$

Note that consumption losses from a geopolitical shock are increasing in *GeoV* but decreasing in *GeoC,* provided that η is greater than 1.[4] We now take these definitions of geoeconomic vulnerability *GeoV* and geoeconomic connectedness *GeoC,* derived in equation (9), to our data. In the database, we apply this index to all cross-border transactions but, in this paper, we discuss only the *GeoV*'s and *GeoC*'s of exports (in total and for different subcomponents), FDI liabilities, portfolio investment liabilities, and liabilities to BIS-reporting banks.

4 Data

The empirical exercises in this paper draw on a wide range of data sources to capture geopolitical stances and bilateral economic transactions and liabilities.

Data for geopolitical distance is drawn from the database provided by Voten, Strezhnev, and Bailey (2009). The *ideal point index* captures a country's geopolitical stance, while the *ideal point distance* (D), defined as the absolute distance between two countries' ideal point indices, captures bilateral geopolitical distance (Bailey, Strezhnev, and Voten 2017). The ideal point distance reflects the frequency with which two countries vote in the same direction in the United Nations General Assembly, controlling for the characteristics of the issues that are tabled for votes. It ranges from 0 to 5, with a higher ideal point distance indicating greater differences in voting patterns. The index is available for up to 193 economies for 2002-2023. Since the core trade data is only available from 2002, our consolidated database also starts in 2002.

Bilateral exports and imports are from the IMF's Direction of Trade Statistics (DOTS, for aggregate exports and imports) and the Centre d'Etudes Prospectives et d'Informations Internationales' (CEPII) BACI Database (for disaggregated exports and imports, Gaulier and Zignago 2010). The IMF's DOTS database includes data for up to 199 economies for 2002-2023. CEPII's BACI Database includes data for up to 226 economies for 1948-2022. Missing observations are filled through mirror data from partner countries' reporting. Territories included in the database are consolidated into their sovereign states. This yields a sample of up to 186 economies (including 150 EMDEs) with non-missing and non-zero total exports and imports for 2002-2023; and a sample of up to 189 economies (including 152 EMDEs) with disaggregated exports and import data for 2002-2022.

4 It is widely assumed in the literature that η is greater than 1, with empirical estimates usually indicating a considerably larger value. See, for example, Simonovska and Waugh (2014), who find an estimate of between 2.79-4.46 and provide a review of the literature.

Data on exports and imports is disaggregated into broad categories by end-use: exports and imports of capital goods, intermediate inputs, and consumer goods. Only non-overlapping categories are used for this classification, in order to sharpen the distinctions between categories. Also included in the database are exports and imports by broad SITC category: agriculture (agriculture, forestry, fishing, food, beverages, tobacco, mining), construction materials (construction, wood, glass, stone, basic metals, housing, electrical appliances), textiles (textiles, apparel, shoes), ICT (ICT, media, computers, business and financial services), health equipment (Mining, quarrying, refinery, fuels, chemicals, electricity, water, waste treatment), transport equipment (transport equipment and services, travel, postal services), and government-related goods (government, military and other).

Inward and outward FDI positions are compiled from four data sources. The OECD's Bilateral FDI Statistics report inward and outward FDI positions and flows from 38 reporting countries for 2000-22. The IMF's Coordinated Foreign Direct Investment Survey (CDIS) reports outward and inward direct investment positions from 2009-22 from 129 reporting economies vis-à-vis 247 partner economies. UNCTAD's Bilateral FDI database reports inward and outward FDI flows and stocks for 206 reporting countries for 2001-2012. Since data for China before 2009 is unavailable from these cross-country sources, they are complemented with data from China's Statistical Bulletin of China's Outward FDI and China's Statistic Yearbook for inward FDI. The core of the dataset is the OECD bilateral FDI dataset. The data is extended over time and across countries using the other sources by order of presumed data quality as detailed in Steenbergen and others (2022). This yields non-missing and non-zero inward FDI stocks (FDI liabilities and FDI assets, respectively) for up to 195 economies (including 156 EMDEs) for 2002-22, but with limited coverage for 2002-08.

Inward and outward portfolio investment positions are derived from the IMF's Coordinated Portfolio Investment Survey (CPIS). The CPIS database includes annual data on total holdings of inward and outward portfolio investment positions from 93 reporting economies vis-à-vis 244 partner economies for 2001-22. Missing observations are filled with mirror data from partner countries. This results in a sample of non-missing and non-zero observations of up to 190 economies (including 154 EMDEs) for 2002-22, but with limited coverage in the early years from 2002-2008.

The Bank for International Settlements' (BIS) Consolidated Banking Statistics reports total claims of BIS-reporting banks on all counterparties in partner countries.[5] Several banking systems with sizable cross-border positions only started reporting in 2007 (Austria, Canada), 2009 (South Africa), or 2014 (Hong Kong SAR China; Italy; Spain) and neither mainland China nor Russia report to the BIS banking statistics. We therefore only include data starting from 2007 in our database. Here, we take the perspective of borrower countries since borrower countries' liabilities to BIS-reporting banks are a source of foreign exchange. Data is available for up to 173 economies (including 136 EMDEs) for 2002-23 but with limited coverage during 2002-06.

The various databases for bilateral economic transactions include data for 28 territories, protectorates, or other subnational units. These are consolidated with their sovereigns.[6] After this consolidation, the largest available samples include 186 economies (36 advanced economies, 150 EMDEs) for 2002-23 for aggregate exports and imports, 195 economies (39 advanced economies, 156 EMDEs) for 2009-2022 for FDI assets and liabilities, 190 economies (36 advanced economies, 154 EMDEs) for 2009-22 for portfolio assets and liabilities, and 186 economies (38 advanced economies, 148 EMDEs) for 2007-2023 for liabilities to BIS-reporting banks. Appendix Table 1 lists the economies in these samples.

The database also includes the gravity variables of CEPII's Gravity Database, including Greenwich

5 The data used are total claims outstanding to reporting banks in the reporting country, on an immediate counterparty basis for all sectors, in all instruments, at all maturities, and in all currencies.

6 The territories thus consolidated are: American Samoa; Andorra; Anguilla; Aruba; Bermuda; British Virgin Islands; Cayman Islands; Curacao; Faroe Islands; French Polynesia; Gibraltar; Greenland; Guadeloupe; Guam; French Guiana; Hong Kong SAR, China; Isle of Man; Macao SAR, China; Martinique; Montserrat, United Kingdom; New Caledonia; Northern Mariana Islands; Puerto Rico; Reunion; Sint Maarten; Turks and Caicos Islands; and U.S. Virgin Islands. In addition, Niue and Cook Island are consolidated with New Zealand.

Mean Time offset, geographic distance between the largest population centers, common language, common legal system, common colonial history, and membership in a common free trade agreement or a regional free trade agreement. Offshore financial centers are defined as the 17 independent "sink" countries in Garcia-Bernardo and others (2017).[7]

In the discussion in this paper, we restrict ourselves to economic transactions that generate foreign exchange: exports and its major subcomponents by end use, FDI liabilities, portfolio liabilities, and liabilities to BIS-reporting bank. That said, the database also includes data for imports and its subcomponents, aggregate trade, and additional subcomponents of exports and imports.

5 Geopolitical distance

The ideal point index of Bailey, Strezhnev, and Voten (2017) describes countries' geopolitical stance as captured by their voting patterns in the United Nations General Assembly. Figure 1A shows the distribution of ideal point indices in 2016 (blue line) and 2023 (red line), with vertical lines benchmarking the United States and China.

Broadly speaking, over the past decade these geopolitical stances have been clustered into two camps: EMDEs and advanced economies (Figure 1B). Most EMDEs have voting patterns similar to China, while most advanced economies have voting patterns somewhere between the United States and China, but slightly closer to the United States.

Since 2016, geopolitical stances have shifted closer to the United States. Overall, as well as for advanced economies and EMDEs separately, the distribution of ideal point indices has shifted to the right, towards the U.S. index. China is an important exception: its stance has shifted away from the United States (that is, leftward in Figure 1A). In 2016, China's voting patterns approximately coincided with those of the median country; by 2023, China's voting patterns had shifted to the decile that was furthest away from the United States.

6 Impact of geopolitical distance on bilateral transactions

Bilateral trade has long been known to depend on "economic gravity": factors such as economic size, transport costs and cultural proximity (Tinbergen 1962). These are powerful economic forces that may be offset or reinforced by geopolitical considerations. Aiyar, Malacrino, and Presbitero (2024), Gopinath and others (2024), and IMF (2023b) have shown that greater geopolitical distance, or membership in an opposing geopolitical bloc, significantly reduces bilateral FDI transactions, trade and cross-border bank claims, respectively.

In this section, we confirm these results using a common methodology for trade flows, FDI liabilities and financial liabilities, consistent with the implications of equations (2), (5) and (6). For each type of transaction, we estimate a gravity model as in Aiyar, Malacrino, and Presbitero (2024), controlling for geographic and cultural closeness:

$$v_{i,j,t} = \exp\left(\alpha D_{i,j,t} + \beta \mathbf{Controls}_{i,j} + \gamma_{i,t} + \theta_{j,t}\right)\varepsilon_{i,j,t} \quad (12)$$

where $v_{i,j,t}$ is the value of the bilateral transaction v (exports, FDI liabilities, portfolio liabilities, or liabilities to BIS-reporting banks) of country i with partner country j at time t. $D_{i,j,t}$ is the geopolitical distance between countries i and j at time t. It is lagged to mitigate concerns about reverse causality. $g_{,t}$ and $q_{i,t}$ are fixed effects for country i or j, respectively, at time t to capture all country characteristics of countries i and j that change over time (including economic size). $\mathbf{Controls}_{i,j}$ are the time-invariant characteristics of the country pair i and j that capture geographic or cultural distance, consistent with the $\phi_{in'}$s in Equation (6): harmonized geodesic distance between the two partner countries' largest cities, common languages, common legal systems, and common colonial history. Table 1 reports the results. As is evident, greater geopolitical distance is associated with significantly diminished transactions across all categories, although with considerable variations in magnitude. The effect is strongest for FDI, with more muted effects for capital goods exports and portfolio investment liabilities.[8] For a one-standard deviation increase in geopolitical

7 Offshore financial centers include Andorra, Bahamas, Belize, Guyana, Cyprus, Liberia, Liechtenstein, Luxembourg, Marshall Islands, Malta, Mauritius, Monaco, Nauru, Samoa, Seychelles, St. Vincent and the Grenadines. "Conduit" countries (Ireland, Netherlands, Singapore, Switzerland, United Kingdom) are not included among the offshore financial centers.

8 The effect on liabilities to BIS-reporting banks has the opposite sign, indicating greater liabilities to geopolitically more distant partners after controlling for other factors. This likely reflects the fact that BIS-reporting banks are predominantly located in advanced economies that are all geopolitically close to each other but quite geopolitically distant from the EMDE with which they have lending relationships (see Figure 1B). Only six EMDEs are represented among BIS-reporting banking systems (Brazil, Chile, India, Mexico, Panama and Turkey).

distance—equivalent to the difference between the geopolitical distance of the United States from the UK versus its geopolitical distance from Germany, or a 0.75-point increase in the index—FDI liabilities are 31 percent lower, and exports of capital goods and portfolio liabilities are 12-13 percent lower. The associations with intermediate goods exports and aggregate exports are statistically significant, but economically much smaller.

7 Geoeconomic vulnerability and geoeconomic connectedness

Based on the trade model above, this section calculates indices of geoeconomic vulnerability and connectedness. It then offers intuition for their economic relevance, discusses the differences between the two concepts, and examines some country examples.

7.1 Geoeconomic vulnerability Index: *GeoV*

For each type of cross-border economic relationship, we calculate the geoeconomic vulnerability index *GeoV* as defined in equation (10). In the database, we apply this index to all cross-border transactions but, here, we discuss only the *GeoV*'s of exports (in total and for different subcomponents), FDI liabilities, portfolio investment liabilities, and liabilities to BIS-reporting banks.

In line with equation (10), the vulnerability of country *i*'s international transactions to geopolitical shocks is the transaction-weighted average of the ideal point distance:

$$GeoV_{i,t} = \sum_j \lambda_{i,j,t} D_{i,j,t} \quad (13)$$

where $D_{i,j,t}$ is the ideal point distance (ranging from 0 to 5) between country *i* and partner country *j* at time *t,* and $\lambda_{i,j,t}$ is the share of economic transactions between country *i* and its partner country *j* at time *t*.[9]

The higher the geoeconomic vulnerability index, the more country *i*'s geopolitical alignment differs from that of its trading partners and creditors. Policy actions in partner countries that harm geopolitically more distant countries are more likely to disrupt these economic transactions: country *i* is therefore more vulnerable to geopolitical tensions.

We calculate indices for up to 188 economies for 2002-2023 for trade-related transactions (Appendix Table 2). For financial liabilities, data coverage starts either in 2007 (liabilities to BIS-reporting banks) or 2009 (FDI and portfolio investment liabilities) and country coverage is lowest for liabilities to BIS-reporting banks (up to 167 economies).

Although our *GeoV* index is derived from the model presented in Section III, it is empirically identical to the vulnerability index first proposed in IMF (2023a). While it measures the vulnerability of exports, FDI, portfolio investment, and bank claims to geopolitical tensions, it does not capture the country's overall economic vulnerability. A country with near-zero transactions could have the same *GeoV* as a country with large transactions. Researchers interested in calculating the overall vulnerability of a country could consider scaling the index in a way appropriate to their purpose, for example by scaling by the ratio of exports to GDP. Similarly, by construction, *GeoV* is agnostic about the "bloc" that a country is geopolitically close to. In practice, different policies that prevail in different blocs may result in asymmetric impacts of geopolitical shocks.

7.2 Geoeconomic Connectedness Index: *GeoC*

In line with equation (11), we calculate the geoeconomic connectedness index *GeoC* as the transaction-weighted standard deviation of geopolitical distances:

$$GeoC_{i,t} = \sqrt{\sum_j \lambda_{i,j,t}\left(D_{i,j,t} - \sum_j \lambda_{i,j,t} D_{i,j,t}\right)^2} \quad (14)$$

where $D_{i,j,t}$ is again the ideal point distance between country *i* and partner country *j* at time *t* and $\lambda_{i,j,t}$ is again the share of economic transactions between country *i* and its partner country *j* at time *t*.

A higher index of geoeconomic connectedness index indicates greater diversity of geopolitical views among country *i*'s trading partners, creditors, and debtors. A higher index, therefore, indicates that country *i* plays a larger role as a "connector" among countries distributed across the geopolitical spectrum. The sample is the same as for *GeoV* and data coverage is summarized in Appendix Table 2.

9 To ensure positive weights, negative stocks (about 5 percent of the sample for FDI and 0.5 percent of the sample for portfolio investment), which likely reflect valuation losses, are dropped.

7.3 Distinction between *GeoV* and *GeoC*

As shown in the conceptual framework of Section III, geoeconomic vulnerability and connectedness indices describe distinct phenomena. The first is a weighted average of geopolitical distance from international partners. The second captures the degree to which a country transacts with geopolitically diverse players. The correlation between *GeoV* and *GeoC* is low, ranging from 0.07 to 0.4 depending on the transaction type (Appendix Table 3).

The difference is illustrated by the simple example in Table 2. Suppose that a country trades with four partner countries, at varying geopolitical distances. For simplicity, the initial trade weights are equal for each country. Now suppose that the country reduces its trade weight with its geopolitically closest partner, while increasing its trade weight with its geopolitically most distant partner. Clearly, this increases geoeconomic vulnerability. On the other hand, if it increases its trade weight with its geopolitically closest partner, while reducing its trade weight with its geopolitically most distant partner, this reduces geoeconomic vulnerability. But connectedness is reduced in either case, because the country now transacts with a more geopolitically concentrated set of countries. In general, the change in connectedness depends on the initial and final transaction weights vis-à-vis all partner countries.

Countries can make choices about their international partners, at least to the extent that policy measures can be used to encourage some transactions and discourage others. For a given set of geopolitical alignments, the choice of partner countries will affect both *GeoV* (through the first moment of the distribution of ideal point distances) and *GeoC* (through the second moment).

7.4 Types of connectors

In principle one could think of connector countries as connectors across *markets* ("horizontal connectors") or connectors across *types of transaction* ("vertical connectors"). To understand the difference between these types of connectors, consider Mexico and Vietnam. Both countries have been mentioned as connector countries (see Section II), but they differ fundamentally in their external economic ties.

In particular, Mexico receives about one-half of its FDI from the EU (49 percent in 2022) and exports the vast majority of its exports (83 percent in 2023) to the United States (Figure 2A). FDI from China into Mexico may be growing rapidly in some sectors but is, for now and in aggregate, still negligible. Accordingly, Mexico can be interpreted as an example of a "vertical connector country" in the cross-transaction sense: a sizable share of FDI may be in sectors and firms that export to the United States. Whether this type of connector will remain sustainable is a matter of some doubt, especially when geopolitically more distant markets are involved.

In contrast, Vietnam's external links are highly diversified. Vietnam hosts FDI from a wide range of sources (for example, only 9-10 percent each from the EU and China). Just over one-half of Vietnam's FDI is from Japan and Korea, two countries that are geopolitically about as similar to Vietnam as the three largest EU countries are to Mexico. Its exports, too, are shipped to a widely diversified set of export markets (28 percent to the United States in 2023, 18 percent each to the EU and China).

Vietnam is therefore an example of a "horizontal connector country", in a cross-market sense. It cultivates substantial trade links across the range of the geopolitical spectrum. By diversifying across a wide range of trading partners with large ideological differences, it may be able to better insulate itself from shocks in individual export markets.

The different characteristics of Mexico and Vietnam are reflected in their *GeoVs* and *GeoCs* (Figure 2B). Mexico's highly concentrated exports to the United States, which happens to be geopolitically quite distant from Mexico, are reflected in a much higher *GeoV* and lower *GeoC* for Mexico's exports than for Vietnam's.

Mexico and Vietnam resemble each other much more closely in their *GeoV* and *GeoC* for FDI liabilities, since both countries host the majority of their FDI from countries at similar geopolitical distances (the EU for Mexico, Japan and Korea for Vietnam). That said, Vietnam is slightly more diversified in its FDI sources because three geopolitically similar EMDEs account for about one-quarter of its FDI (China, Singapore, and Thailand). In contrast, Mexico's three largest EMDE trading partners account for only 2 percent of FDI and are geopolitically much closer to the EU than Vietnam's three largest EMDE trading partners are to Japan and Korea.

8 Patterns in *GeoV* and *GeoC*

In this section, we document patterns and recent trends in vulnerability and connectedness. *GeoV* and *GeoC* are significantly larger in EMDEs than in advanced economies. For EMDEs, although not for advanced economies, geoeconomic vulnerabilities are also significantly larger in finance than in trade. Since 2016, several advanced economies in Europe appear to have been actively derisking their international transactions by shifting their trade towards geopolitically proximate partners.

8.1 Patterns in *GeoV*

EMDEs are significantly more vulnerable to geopolitical shocks than advanced economies, both in trade and in finance. Tables 3A and B shows the unweighted average *GeoV* index for advanced economies and EMDEs over the sample period and the 90 percent confidence intervals around these averages. None of the confidence intervals of advanced economies and EMDEs overlap: EMDEs' geoeconomic vulnerability is significantly higher than that of advanced economies for exports (and their components) and financial liabilities (of all types).[10]

In addition, EMDEs' liabilities to banks and portfolio liabilities are significantly more vulnerable to geopolitical shocks than their FDI liabilities or exports.[11] There is no such difference for advanced economies.

The growing concentration of trade among geopolitically proximate countries documented in Appendix 1 has been accompanied by declining geoeconomic vulnerabilities, especially in EMDEs. Which countries featured the largest declines in geoeconomic vulnerability? We answer this question in a cross-country linear regression of changes in *GeoVs,* for each type of transaction, between 2016 and 2023 on the initial *GeoV* in 2016. The results are shown in Table 4. For all types of transactions, the countries with the largest initial geoeconomic vulnerabilities in 2016 were also those with the largest reductions in geoeconomic vulnerabilities.

This cutback in geoeconomic vulnerability seems to have resulted from more than a shift in geopolitical stances: the transactions-related *GeoV* index that fixes ideal point distances at 2016 levels and accounts only for changes in transactions declined significantly more in the initially more vulnerable countries.[12] Apparently, trade and financial transactions have been reconfigured since 2016 to lower geoeconomic vulnerability. For advanced economies, consider the example of capital goods exports and FDI liabilities shown in Figures 3A and B. Red dots indicate advanced economies inside the European Free Trade Area (EFTA), and blue dots outside EFTA. All but eight of the thirty EFTA countries in Figure 3A lie below the horizontal 0 line: the *geoeconomic vulnerability* of their exports of capital goods has declined. At the same time, all but five of them lie to the left of the vertical 0 line: the transactions-related geoeconomic vulnerability of their capital goods exports has also declined. In other words, in most EFTA countries, the geoeconomic vulnerability of capital goods exports has declined because of changes in trading partners towards destinations that were geopolitically closer in 2016.

Now consider EFTA countries' FDI liabilities in Figure 3B. In more than one-third of them (11 countries), the geoeconomic vulnerability of FDI liabilities declined (i.e., they lie below the horizontal 0 line). But only in about five of these 11 countries did it decline because of actual changes in creditors (i.e. they lie to the left of the vertical 0 line). In the other five countries, vulnerabilities of FDI liabilities declined because of changes arising from evolving geopolitical alignments since 2016.

8.2 Patterns in *GeoC*

EMDEs are significantly more geoeconomically connected than advanced economies. Tables 5A and B show the average geoeconomic connectedness index *GeoC* for advanced economies and EMDEs. For all transactions other than capital goods exports or liabilities to global banks, confidence intervals do not overlap: EMDEs are significantly more connected.[13] In a panel regression of *GeoC* on country characteristics, Appendix 3 shows that larger and more open economies tend to be significantly more connected.

10 Appendix Table 4 shows that this is also the case for imports (and all their components) and overall trade.
11 Again, there is no significant difference between export and import vulnerabilities. In fact, GeoVs and GeoCs for exports and imports are highly correlated (0.8 and 0.6, respectively, Appendix Table 5), as could be expected if a large share of global trade is conducted within global value chains (World Bank 2020).
12 Appendix 2 decomposes changes in geopolitical vulnerability into changes due to shifting transactions or changes due to shifting geopolitical alignments, by comparing changes in the baseline GeoV index with the changes in a counterfactual GeoV index that holds geopolitical distances constant at 2016 levels.
13 This is also the case for imports (of all types) and trade.

Among both advanced economies and EMDEs, geoeconomic connectedness is significantly higher in trade-related transactions than in financial liabilities. This likely reflects the much larger number of trading partners than financial partners in the reported data (see robustness tests in Appendix 4). Liabilities to BIS-reporting banks are the least geoeconomically connected for both country groups, consistent with the global banking system being centered around major hubs in New York and London (Korniyenko and others 2018).

For all trade transactions and FDI, the most geoeconomically vulnerable economies in 2016 were the ones that have cut back their geoeconomic connectedness most since 2016. The linear regression of changes in *GeoC* since 2016 on the initial geoeconomic vulnerability in 2016 in Table 6 captures this correlation.

The larger declines in connectedness of exports and FDI liabilities among the initially most vulnerable countries parallels the retrenchment shown in Section VIII.1 for *GeoV*. However, in contrast to geoeconomic vulnerabilities, this retrenchment in connectedness was not apparent in portfolio liabilities and liabilities to BIS-reporting banks.

As had been the case for *GeoV*, much of the effect appears to have worked through a reallocation of transactions (rather than geopolitical alignments). The coefficient estimates for the *GeoC* indices based on fixed 2016 ideal point distances range from one-half to three-quarters of those in the baseline estimates.

9 Conclusion

In this paper, we modify a standard trade model, in which geopolitical distance adds to iceberg cost, to formalize the concept of connector countries. The model illustrates two channels through which geoeconomic fragmentation can impact per capita consumption: geoeconomic vulnerability and geoeconomic connectedness. The first captures the average geopolitical distances to partner countries; the second the standard deviation of these geopolitical distances. We use the two indices derived in this framework, geoeconomic vulnerability *GeoV* and geoeconomic connectedness *GeoC*, to explore the distinction between vertical (cross-transaction) and horizontal (cross-market) connector countries, illustrating the difference with the examples of Mexico and Vietnam.

We find that EMDEs are generally more geoeconomically connected than advanced economies, due to their more balanced transactions with partners across the ideological spectrum. And trade-related transactions generally show greater connectedness than financial transactions. Since 2016, EMDEs' trade- and FDI-related geoeconomic connectedness has declined, most steeply in the initially most vulnerable countries.

The database constructed in this paper allows comparisons between geoeconomic fragmentation of different types, for different groups of countries. Researchers interested in a particular country can compare both vulnerability and connectedness against relevant comparator groups and investigate trends over time. By fixing geopolitical distance at a particular point in time, it is possible to distinguish between transaction-related changes and changes in geopolitical alignments.

Our data invites several directions for future research, of which we note the following two.

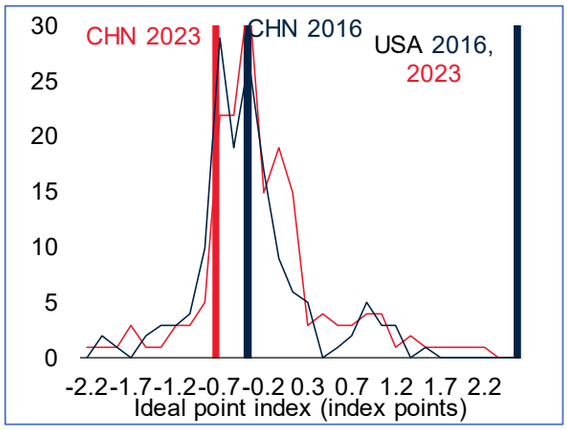
First, the indices developed in this paper—*GeoV* and *GeoC*—could be further explored through an examination of both their determinants and consequences. What factors might help explain a given country's vulnerability or connectedness across different types of transactions? Could some factors—such as, say, openness, governance, ease of doing business and well-functioning credit markets—be amenable to policy? Equally important, future work could delve deeper into the consequences of vulnerability / connectedness. For example, event studies could seek to establish whether horizontal connectedness indeed confers some insulation from specific geopolitical shocks, as the model developed here would suggest.

Second, we have applied the *GeoV* and *GeoC* indices to publicly available data on bilateral economic transactions. Future research could apply the same methodology to value added, instead of gross trade, to obtain a more finely grained picture of vulnerability and connectedness across global value chains. Bilateral data on remittances or tourism could offer a window into another major source of foreign exchange inflows or services exports for EMDEs.

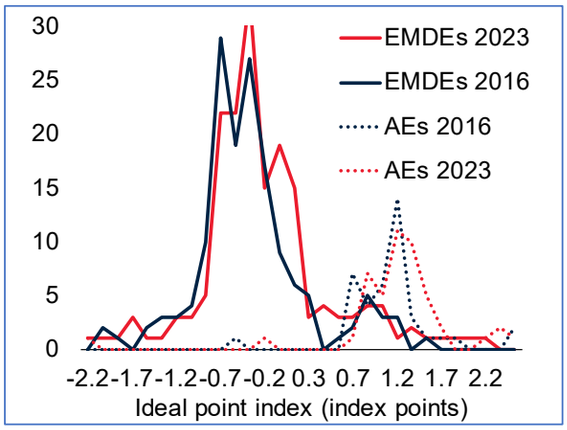
TABLES AND FIGURES

Figure 1: Geopolitical stances: Ideal point index

A. Distribution of ideal point indices in 2016 and 2023
(Number of economies)



B. Distribution of ideal point indices in 2016 and 2023
(Number of economies)



Source: Bailey, Strezhnev, and Voten (2017); authors' estimates.

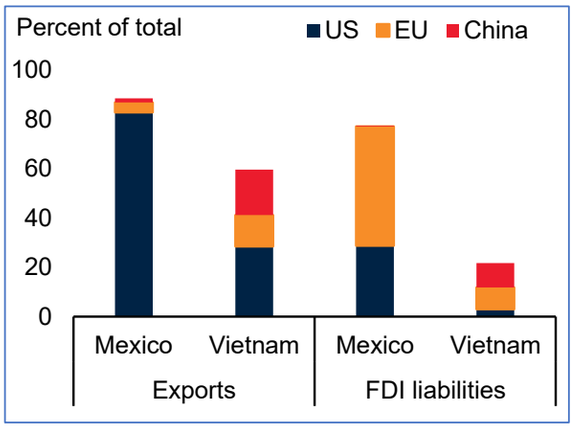
Note: Figures show the distribution of ideal point indices in 2016 (blue line) and 2023 (red line).

A. Vertical lines indicate indices for China and United States in 2016 and 2023.

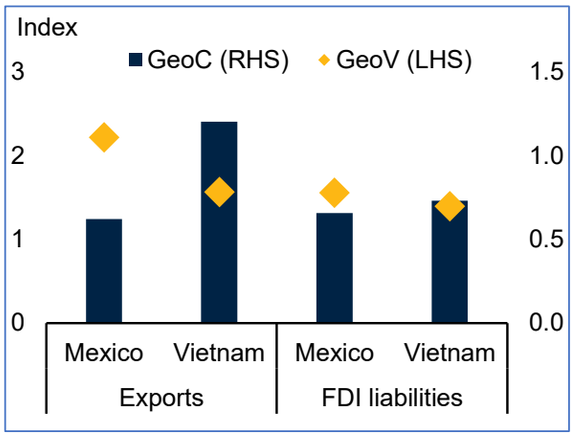
B. "AEs" stands for advanced economies. "EMDEs" stands for emerging market and developing economies.

Figure 2: Mexico and Vietnam

A. Composition of exports and FDI liabilities



B. *GeoV* and *GeoC*



Source: Authors' estimates.

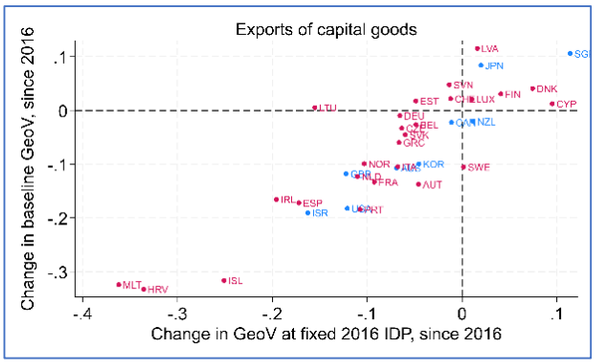
Note: Latest available data for exports and imports for 2023, for FDI liabilities for 2022.

A. Mexico's and Vietnam's exports to the United States, EU, and China in percent of total exports, and FDI liabilities to United States, EU, and China in percent of total FDI liabilities.

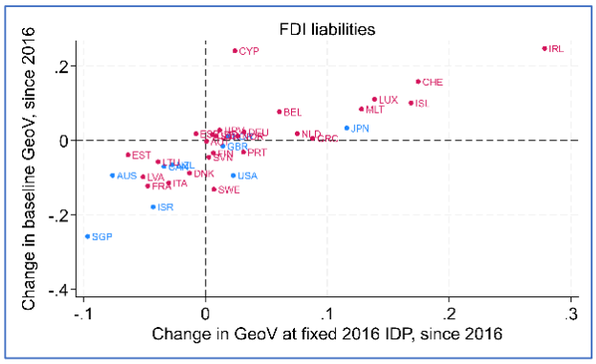
B. Geoeconomic Vulnerability Index (GeoV) is the trade- or FDI-weighted average of geopolitical distance. Geoeconomic Connectedness Index (GeoC) is trade- or FDI-weighted standard deviation of geopolitical distance, as captured in Bailey, Strezhnev and Voten (2017).

Figure 3: Changes in advanced economies' GeoV since 2016

A. Exports of capital goods



B. Inward FDI stocks



Source: Authors' estimates.

Note: Charts show the change in GeoV since 2016, allowing ideal point distances to change every year ("baseline") or holding ideal point distances fixed at their 2016 values. Blue indicates non-EFTA countries, red indicates EFTA countries.

Table 1: Gravity regressions: Impact of geopolitical distance on economic transactions

	Exports					
VARIABLES	Overall	Capital goods	Intermediate inputs	FDI liabilities	Portfolio investment liabilities	Liabilities to BIS-reporting banks
Lagged Ideal Point Distance	-0.0188**	-0.170***	-0.0579***	-0.410***	-0.157***	0.298***
	(0.00789)	(0.0294)	(0.0114)	(0.0166)	(0.0204)	(0.0332)
Log of geodesic distance	-0.912***	-0.707***	-0.911***	-0.494***	-0.465***	-0.567***
	(0.00649)	(0.0156)	(0.00768)	(0.0129)	(0.0103)	(0.0170)
Common colonial history	-0.0747**	-0.365***	-0.00714	-0.163***	-0.261***	0.231***
	(0.0294)	(0.0489)	(0.0309)	(0.0434)	(0.0332)	(0.0360)
Common language	0.106***	0.342***	0.0276	0.196***	0.0925***	0.236***
	(0.0160)	(0.0720)	(0.0231)	(0.0383)	(0.0332)	(0.0488)
Common legal tradition	0.118***	0.220***	0.101***	0.110***	0.303***	0.393***
	(0.0112)	(0.0385)	(0.0154)	(0.0234)	(0.0254)	(0.0299)
Observations	489,188	420,740	491,736	338,793	169,091	36,787
R-squared	0.866	0.826	0.778	0.779	0.884	0.856

Source: Authors' estimates.

*Note: Gravity regression of exports (total and subcomponents) or stocks of FDI liabilities, portfolio investment liabilities, and liabilities to BIS-reporting banks on the lagged ideal point distance (IPD) of Voten, Strezhnev, and Bailey (2009), geodesic distance, and dummies for common language, colonial history, common legal framework and country-year dummies. Data for liabilities to BIS-reporting banks before 2008 dropped because of poor reporting coverage. Robust standard errors in parentheses. ***, **, * stand for statistical significance at the 1, 5, and 10 percent level, respectively. Appendix Table 1 shows similar results for imports and its subcomponents.*

Table 2: Geoeconomic vulnerability and connector indices: An illustration

Partner country	IPD to partner country	Share of exports		
		Scenario 1	Scenario 2	Scenario 3
A	1	0.25	0	0.5
B	2	0.25	0.25	0.25
C	3	0.25	0.25	0.25
D	4	0.25	0.5	0
GeoV		2.5	3.25	1.75
GeoC		1.0	0.8	0.8

Note: A country trades equally with four partners, with differing degrees of geopolitical distance. Reducing the weight of the closed geopolitical link increases vulnerability index GeoV while reducing the weights of the furthest link decreases vulnerability GeoV, but either change decreases connectedness GeoC. The calculations in this table ignore the term N/(N-1) in equation (2) because, in large samples, this term approaches 1

Table 3A: Average geoeconomic vulnerability index *GeoV*: Exports

	Total exports		Exports of capital goods		Exports of intermediate inputs		Exports of consumer goods	
	Average	Confidence interval	Average	Confidence interval	Average	Confidence interval	Average	Confidence interval
World	1.05	[0.99 to 1.11]	0.94	[0.9 to 0.98]	1.03	[0.97 to 1.09]	1.06	[0.99 to 1.13]
Advanced economies	0.72	[0.61 to 0.83]	0.8	[0.71 to 0.89]	0.72	[0.61 to 0.83]	0.67	[0.56 to 0.78]
EMDEs	**1.17**	**[1.09 to 1.25]**	**0.99**	**[0.93 to 1.05]**	**1.12**	**[1.05 to 1.19]**	**1.19**	**[1.1 to 1.28]**

Table 3B: Average geoeconomic vulnerability index *GeoV*: Financial liabilities

	Inward FDI stock		Portfolio liabilities		Liabilities to BIS-reporting banks	
	Average	Confidence interval	Average	Confidence interval	Average	Confidence interval
World	1.09	[1.02 to 1.16]	1.4	[1.31 to 1.47]	1.62	[1.52 to 1.72]
Advanced economies	0.55	[0.45 to 0.65]	0.67	[0.57 to 0.77]	0.57	[0.46 to 0.68]
EMDEs	**1.25**	**[1.17 to 1.33]**	**1.58**	**[1.5 to 1.66]**	**1.94**	**[1.84 to 2.04]**

Source: Authors' estimates.

Note: Means are unweighted averages over the sample period, by country group (excluding seven micro states). Confidence intervals are 90 percent confidence intervals. "AEs" = advanced economies, "EMDEs" = emerging market and developing economies. Bolded entries indicate statistically significant differences between advanced economies and EMDEs.

Table 4: Cross-country regression: Changes in GeoV since 2016 on initial GeoV in 2016

	Dependent variable: Change in GeoV (Baseline)				Dependent variable: Change in GeoV (Fixed 2016 IDP)			
	2016 GeoV	Constant	Observations	R-squared	2016 GeoV	Constant	Observations	R-squared
Exports	-0.189***	0.0851**	182	0.135	-0.0899**	0.0153	182	0.040
	(0.0489)	(0.0423)			(0.0401)	(0.0335)		
Exports of capital goods	-0.216***	0.210***	184	0.046	-0.169**	0.202***	184	0.029
	(0.0708)	(0.0641)			(0.0722)	(0.0650)		
Exports of intermediate inputs	-0.296***	0.227***	184	0.178	-0.193***	0.121***	184	0.116
	(0.0767)	(0.0653)			(0.0516)	(0.0448)		
Exports of consumer goods	-0.182***	0.182***	184	0.088	-0.0868**	0.118***	184	0.033
	(0.0457)	(0.0526)			(0.0340)	(0.0415)		
FDI liabilities	-0.227***	0.261***	184	0.162	-0.122***	0.151***	184	0.073
	(0.0465)	(0.0546)			(0.0409)	(0.0463)		
Portfolio liabilities	-0.332***	0.418***	170	0.195	-0.259***	0.376***	170	0.146
	(0.0569)	(0.0936)			(0.0555)	(0.0964)		
Liabilities to BIS-reporting banks	-0.0744**	0.0992	164	0.024	-0.0421	0.0935	164	0.010
	(0.0351)	(0.0620)			(0.0310)	(0.0569)		

Source: Authors' estimates.

*Note: Cross-country linear regression of changes in GeoV since 2016 on initial GeoV in 2016 (excluding seven microstates). Robust standard errors in parentheses. ***, **, * stand for statistical significance at the 1, 5, and 10 percent level, respectively*

Table 5A: Average geoeconomic connectedness index *GeoC*: Exports

	Total exports		Exports of capital goods		Exports of intermediate inputs		Exports of consumer goods	
	Average	Confidence interval	Average	Confidence interval	Average	Confidence interval	Average	Confidence interval
World	0.75	[0.72 to 0.78]	0.68	[0.66 to 0.7]	0.73	[0.7 to 0.76]	0.74	[0.71 to 0.77]
Advanced economies	0.61	[0.58 to 0.64]	0.66	[0.63 to 0.69]	0.61	[0.58 to 0.64]	0.57	[0.53 to 0.61]
EMDEs	**0.81**	**[0.77 to 0.85]**	0.69	[0.66 to 0.72]	**0.77**	**[0.74 to 0.8]**	**0.79**	**[0.75 to 0.83]**

Table 5B: Average geoeconomic connectedness index *GeoC* : Financial liabilities

	Inward FDI stock		Portfolio liabilities		Liabilities to BIS-reporting banks	
	Average	Confidence interval	Average	Confidence interval	Average	Confidence interval
World	0.68	[0.65 to 0.71]	0.6	[0.6 to 0.66]	0.43	[0.41 to 0.45]
Advanced economies	0.46	[0.41 to 0.51]	0.52	[0.48 to 0.56]	0.39	[0.35 to 0.43]
EMDEs	**0.74**	**[0.71 to 0.77]**	**0.67**	**[0.63 to 0.71]**	0.44	[0.41 to 0.47]

Source: Authors' estimates.

Note: Means are unweighted averages over the sample period, by country group. Confidence intervals are 90 percent confidence intervals. "AEs" = advanced economies, "EMDEs" = emerging market and developing economies. Bolded entries indicate statistically significant difference between groups.

Table 6: Cross-country regression: Changes in *GeoC* since 2016 on initial *GeoV* in 2016

	Dependent variable: Change in *GeoC* (Baseline)				Dependent variable: Change in *GeoC* (Fixed 2016 IDP)			
	2016 *GeoV*	Constant	Observations	R-squared	2016 *GeoV*	Constant	Observations	R-squared
Exports	-0.0726***	0.0383	182	0.058	-0.0396*	0.0126	182	0.029
	(0.0228)	(0.0249)			(0.0205)	(0.0213)		
Exports of capital goods	-0.139***	0.129***	184	0.050	-0.106**	0.0990**	184	0.030
	(0.0437)	(0.0419)			(0.0451)	(0.0431)		
Exports of intermediate inputs	-0.107***	0.0763**	184	0.060	-0.0756***	0.0554*	184	0.044
	(0.0309)	(0.0314)			(0.0287)	(0.0288)		
Exports of consumer goods	-0.102***	0.106***	184	0.093	-0.0592***	0.0686**	184	0.040
	(0.0218)	(0.0286)			(0.0195)	(0.0271)		
FDI liabilities	-0.0669**	0.0410	182	0.053	-0.0528**	0.0508**	182	0.044
	(0.0272)	(0.0281)			(0.0247)	(0.0257)		
Portfolio liabilities	0.00732	-0.0196	160	0.001	0.0185	-1.43e-05	160	0.004
	(0.0258)	(0.0419)			(0.0263)	(0.0430)		
Liabilities to BIS-reporting banks	0.00307	0.0167	161	0.000	-0.00311	0.0385*	161	0.000
	(0.0140)	(0.0217)			(0.0140)	(0.0215)		

Source: Authors' estimates.

*Note: Cross-country linear regression of changes in GeoC since 2016 on initial GeoV in 2016 (excluding seven micro states). Robust standard errors in parentheses. ***, **, * stand for statistical significance at the 1, 5, and 10 percent level, respectively.*

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APPENDICES

Appendix Table 1: List economies with GeoV and GeoC estimates

Advanced economies: Andorra, Australia, Austria, Belgium, Canada, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, Korea, Rep., Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Monaco, Netherlands, New Zealand, Norway, Portugal, San Marino, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom, United States. EMDEs in East Asia and Pacific: Brunei Darussalam, Cambodia, China, Fiji, Indonesia, Kiribati, Lao PDR, Malaysia, Marshall Islands, Micronesia, Mongolia, Myanmar, Nauru, Palau, Papua New Guinea, Philippines, Samoa, Solomon Islands, Thailand, Timor Leste, Tonga, Tuvalu, Vanuatu, Vietnam.

EMDEs in Europe and Central Asia: Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Georgia, Hungary, Kazakhstan, Kyrgyz Republic, Moldova, Montenegro, North Macedonia, Poland, Romania, Russian Federation, Tajikistan, Turkiye, Turkmenistan, Ukraine, Uzbekistan.

EMDEs in Latin America and Caribbean: Antigua and Barbuda, Argentina, Bahamas, The, Barbados, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, St. Kitts & Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago, Uruguay, Venezuela, RB.

EMDEs in Middle East and North Africa: Algeria, Bahrain, Djibouti, Egypt, Arab Rep., Iran, Islamic Rep., Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Somalia, Syrian Arab Republic, Tunisia, United Arab Emirates, Yemen, Rep. EMDEs in South Asia: Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka.

EMDEs in Sub-Saharan Africa: Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Dem. Rep., Congo, Rep., Cote d'Ivoire, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, The, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, South Africa, South Sudan, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, Zimbabwe.

Source: CEPII, IMF, national statistical offices, OECD, World Bank.

Appendix Table 2: Data availability of *GeoV* and *GeoC*

	Number of economies	Year range
Total exports and imports	179 - 185	2002-2023
Exports and imports of capital goods	182 - 188	2002-2022
Exports and imports of intermediate inputs	182 - 188	2002-2022
Exports and imports of consumer goods	182 - 188	2002-2022
Exports and imports of agricultural goods	182 - 188	2002-2022
Exports and imports of mining goods	182 - 188	2002-2022
Exports and imports of construction materials	182 - 188	2002-2022
Exports and imports of textiles	182 - 188	2002-2022
Exports and imports of health equipment	182 - 188	2002-2022
Exports and imports of transport equipment	182 - 188	2002-2022
Exports and imports of ICT	182 - 188	2002-2022
Exports and imports of government-related goods	182 - 188	2002-2022
FDI liabilities	188 - 190	2009-2022
portfolio investment liabilities	173 - 176	2009-2022
Liabilities to BIS-reporting banks	164 - 167	2007-2023

Source: Authors' estimates.

Note: Number of countries and maximum number of years for which GeoV and GeoC are available.

Appendix Table 3: Correlations between *GeoV* and *GeoC*

	Exports	Imports	FDI liabilities	Portfolio investment liabilities
GeoV				
Imports	0.788***	...	...	...
FDI liabilities	0.240***	0.200***	...	...
Portfolio investment liabilities	0.0743***	0.0848***	0.127***	...
Liabilities to BIS-reporting banks	0.206***	0.188***	0.345***	0.460***
GeoC				
Imports	0.602***	...	...	...
FDI liabilities	0.188***	0.204***	...	...
Portfolio investment liabilities	0.0577**	0.0640***	0.110***	...
Liabilities to BIS-reporting banks	0.0602*	0.0363	0.139***	0.267***

Source: Authors' estimates.

*Note: Results of an ordinary least squares regression of GeoC on GeoV for each type of transaction, with robust standard errors. *** indicates statistical significance at the 99 percent level.*

Appendix Table 4: Average geoeconomic vulnerability index *GeoV*

	Imports		Imports of capital goods		Imports of intermediate inputs		Imports of consumer goods		Trade	
	Avg.	Confidence interval	Avg.	Confidence interval	Avg.	Confidence interval	Avg.	Confidence interval	Avg.	Confidence interval
World	0.99	[0.94 to 1.04]	1.11	[1.06 to 1.16]	0.96	[0.91 to 1.01]	0.91	[0.86 to 0.96]	1.02	[0.97 to 1.07]
Advanced economies	0.73	[0.61 to 0.85]	0.68	[0.57 to 0.79]	0.77	[0.65 to 0.89]	0.77	[0.63 to 0.91]	0.72	[0.61 to 0.83]
EMDEs	**1.09**	**[1.03 to 1.15]**	**1.24**	**[1.18 to 1.3]**	**1.03**	**[0.97 to 1.09]**	**0.98**	**[0.92 to 1.04]**	**1.14**	**[1.08 to 1.2]**

Source: Authors' estimates.

Note: Means are unweighted averages over the sample period, by country group (excluding seven micro states). Confidence intervals are 90 percent confidence intervals. "AEs" = advanced economies, "EMDEs" = emerging market and developing economies. Bolded entries indicate statistically significant difference between groups.

Appendix Table 5: Average geoeconomic vulnerability index *GeoV*

	Exports	Imports	FDI liabilities	Portfolio investment liabilities
GeoV				
Imports	0.788***	...	...	...
FDI liabilities	0.240***	0.200***	...	...
Portfolio investment liabilities	0.0743***	0.0848***	0.127***	...
Liabilities to BIS-reporting banks	0.206***	0.188***	0.345***	0.460***
GeoC				
Imports	0.602***	...	...	...
FDI liabilities	0.188***	0.204***	...	...
Portfolio investment liabilities	0.0577**	0.0640***	0.110***	...
Liabilities to BIS-reporting banks	0.0602*	0.0363	0.139***	0.267***

Source: Authors' estimates.

*Note: Table shows pairwise correlations between GeoV or GeoC of different transaction types. Correlations are estimates in a panel regression of GeoV or GeoC of transaction type indicated in the column headers on the GeoV or GeoC of transaction type indicated in rows. *** indicates statistical significance at the 1 percent level, ** at the 5 percent level.*

Appendix 1: Evidence of geoeconomic fragmentation

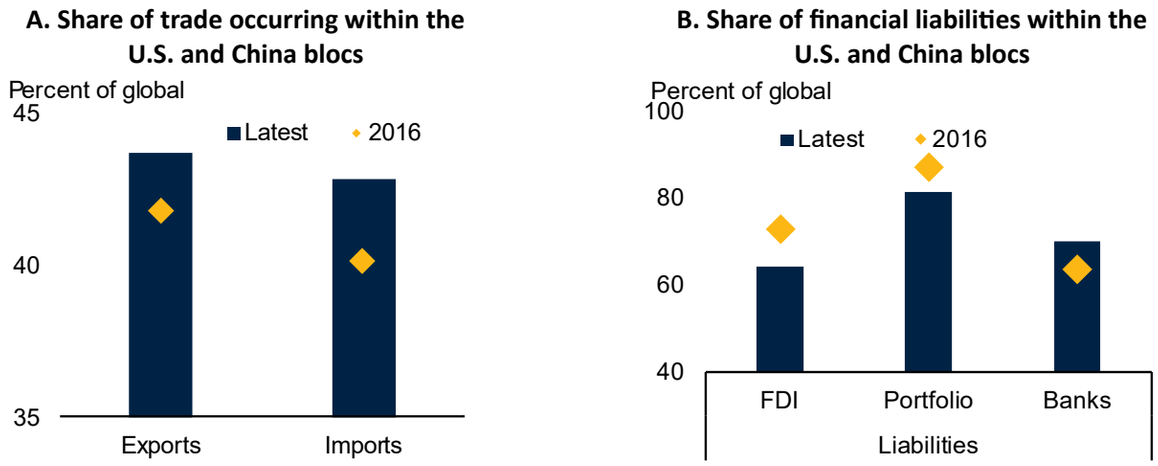
Geoeconomic fragmentation—the splintering of economic relationships along geopolitical lines—has grown since 2016. This has been documented using at least two different approaches, by Gopinath and others (2024) and by IMF (2023a).

Gopinath and others (2024) divide countries into geopolitical blocs. The "U.S. bloc" comprises those countries that are in the closest quartile of ideal point distances to the United States, while the "China bloc" comprises those countries that are in the closet quartile of ideal point distances to China. All other countries are considered non-aligned. They find a recent increase in the share of global bilateral transactions that takes place within the U.S.- and China-related blocs.

Consistent with Gopinath and others (2024) our database indicates that fragmentation in the global trade network has grown since 2016, when the pace of trade restricting measures picked up (World Bank 2023, Kose and Mulabdic 2024). Appendix Figure 1.1 shows the share of global transactions and liabilities that occur within the U.S. and China blocs. The share of global trade taking place within the U.S. and China blocs has risen modestly, from 42 to 44 percent. Similar results are found for lending by global banks, with the caveat that Chinese banks are not among BIS-reporting banks. The share of global liabilities to BIS-reporting banks within the U.S. bloc and the China bloc (based on the sole BIS-reporting banking system in the China bloc, South Africa) has risen from 64 percent in 2016 to 70 percent in 2021. FDI and portfolio liabilities, in contrast, do not exhibit fragmentation, at least based on this approach.

Using a different approach, IMF (2023a) show that the share of global FDI flows occurring among geopolitically close countries has grown. We confirm and broaden this exercise to other economic relationships. Splitting countries into five quintiles by their geopolitical distance to the United States, we find that geoeconomic fragmentation has increased in trade, bank, and FDI liabilities but not in portfolio liabilities (Appendix Figure 1.2).

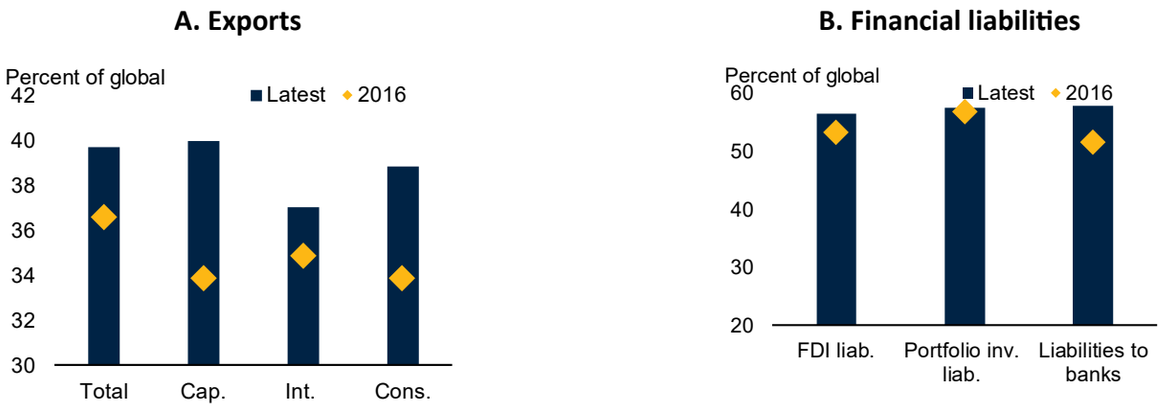
Appendix Figure 1.1: Geoeconomic fragmentation: Economic transactions within geopolitical blocs



Source: Authors' estimates.

Note: Figures show the share of global transactions that occur within a U.S. bloc plus the share of global transactions that occur within a China bloc. Blocs are defined as the quartile of countries with the smallest ideal point distance to the United States and China, respectively. The only BIS-reporting banking system in the China bloc is South Africa's. Since there are no reported liabilities to BIS-reporting banks within the China bloc in 2022-23, the bar for "Banks" shows data for 2021, the last available data.

Appendix Figure 1.2: Share of global transactions that occurs within the same quintile of countries by geopolitical distance



Source: Authors' estimates.

Note: Share of global transactions occurring between countries in the same quintile of geopolitical distance from the United States. Quintiles are defined based on the geopolitical distance (ideal point distance [IPD]) in 2016 and 2022

Appendix 2: Changes in *GeoV* and *GeoC* since 2016

Most countries have not witnessed any significant changes since 2016 in *GeoV* and *GeoC* but a few changes stand out.

Changes in *GeoV* since 2016

On average across all advanced economies, geopolitical realignments outweighed the pivot in transactions towards geopolitically closer export markets. As a result, advanced economies' geoeconomic vulnerability *GeoV* of overall exports, capital goods exports and intermediate goods exports remained within pre-2017 confidence intervals. This was the case both on average and in the majority of advanced economies (Appendix Table 3.1, Appendix Figure 3.1).

In EMDEs, in contrast, the geoeconomic vulnerability of exports, especially of intermediate goods, has declined sufficiently to lower the average *GeoV* below its earlier confidence bands (Appendix Table 3.1). This mainly reflected shifting trade partners. These average changes have been driven by some EMDEs with large declines; for most EMDEs, the changes in geoeconomic vulnerability of exports were too small to move their *GeoV*s outside pre-2017 confidence bands (Figure 4). *GeoV*s of EMDEs' financial liabilities have not changed sufficiently to move beyond pre-2017 confidence bands.

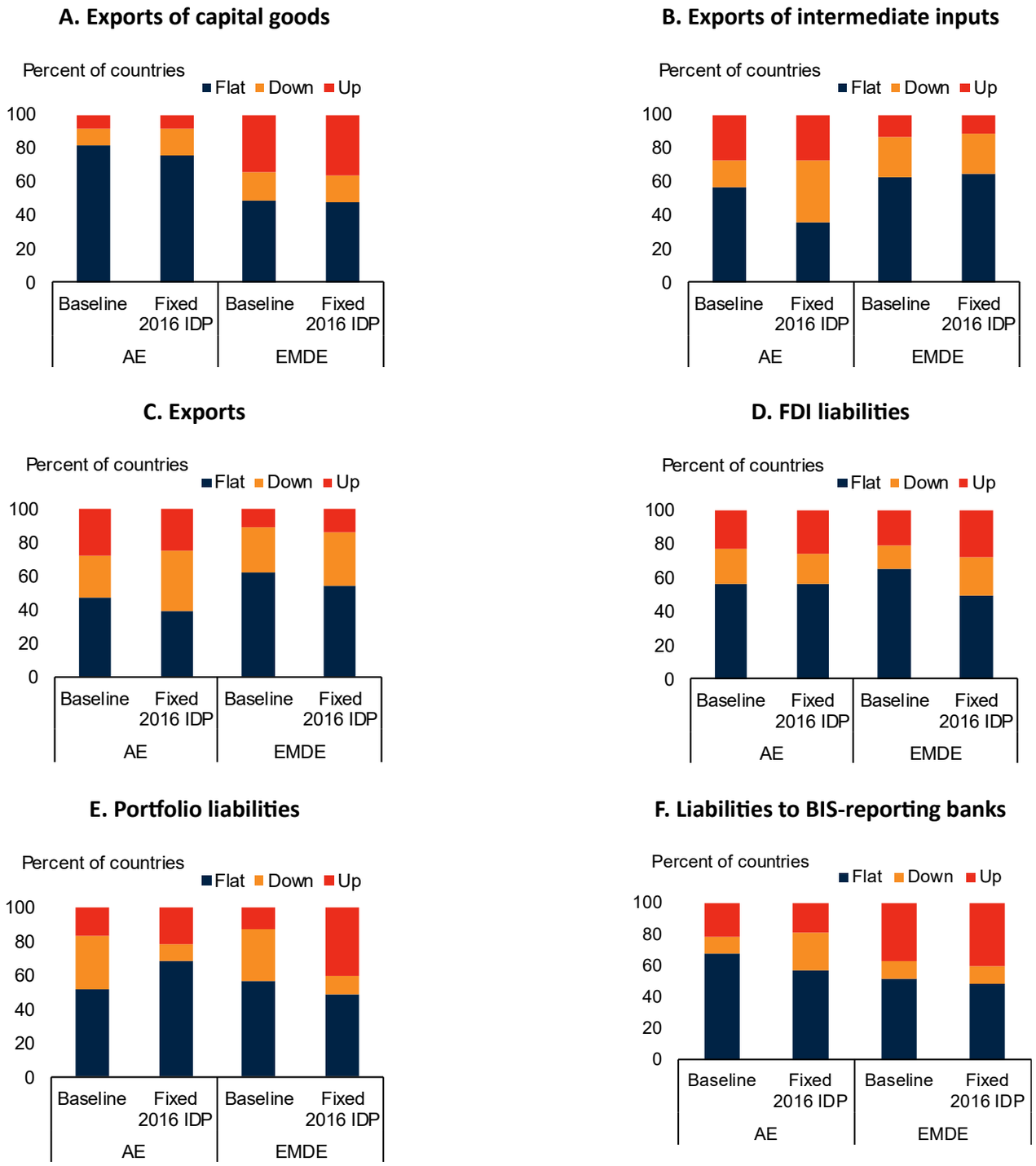
Changes in *GeoC* since 2016

As EMDEs have trimmed their trade-related geoeconomic vulnerabilities, they have also trimmed their geoeconomic connectedness. Appendix Table 3.2 shows the country averages of changes in *GeoC* since 2016 and indicates whether these changes are sufficiently large to move the index outside its pre-2017 confidence band.

Advanced-economy export connectedness has remained broadly stable, as geopolitical realignments approximately offset a shift in export destinations.[14] In EMDEs, geopolitical realignments and shifting export markets have lowered export connectedness in almost equal measure. EMDEs' FDI liabilities have also become significantly less connected as geopolitical stances have shifted. Meanwhile, transaction patterns have changed to increase geoeconomic connectedness of EMDEs' liabilities to global banks. Once again, as for geoeconomic vulnerabilities, in the majority of advanced economies and EMDEs, changes since 2016 have been too small to fall outside pre-2017 confidence bands (Figure 5).

14 In contrast, the GeoC of imports has risen significantly in advanced economies.

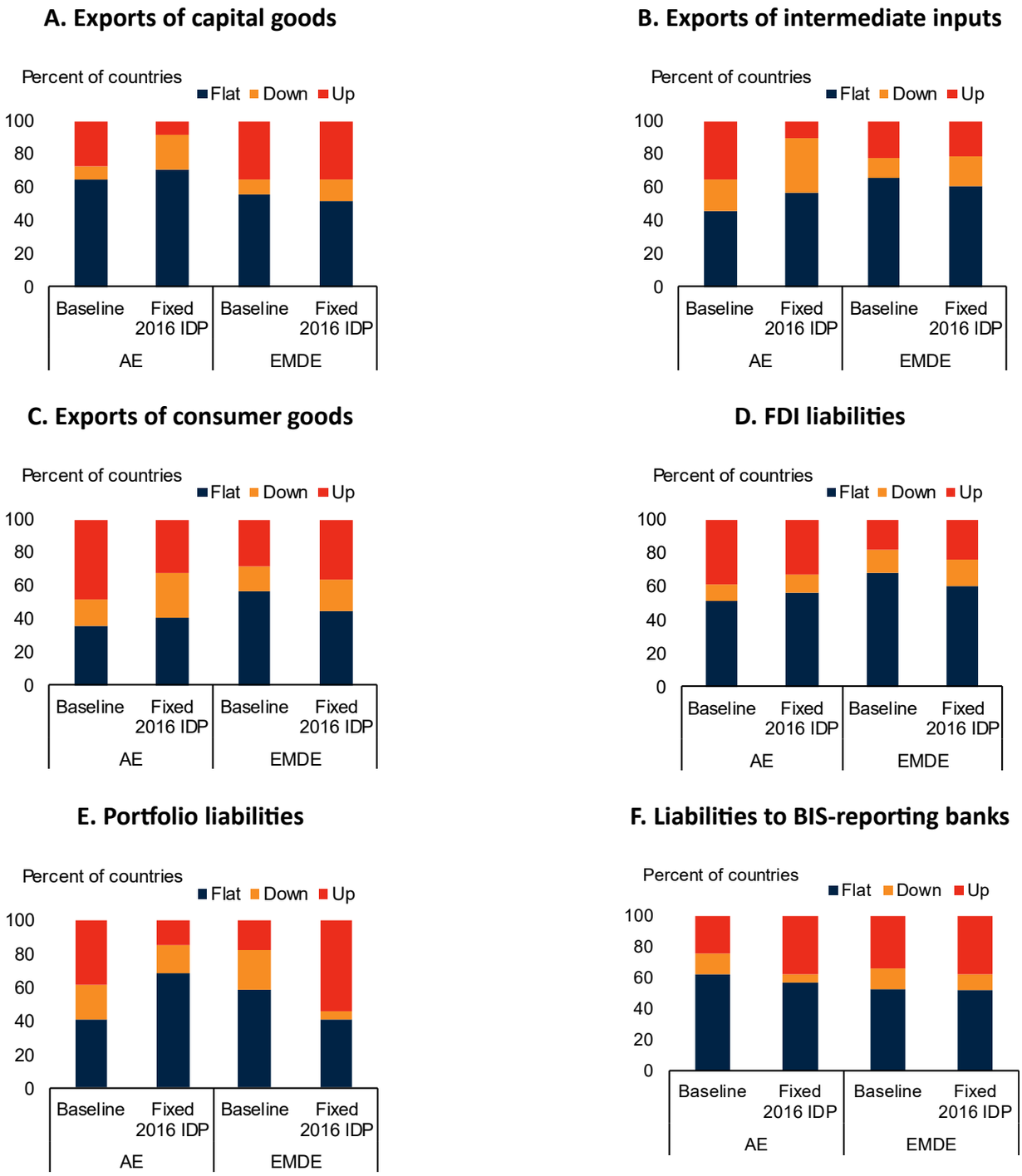
Appendix Figure 2.1: Share of countries with significant changes in *GeoV* since 2016



Source: Authors' estimates.

Note: Charts show the share of economies in which GeoV has significantly risen ("up") or fallen ("down") since 2016 or has changed insignificantly ("flat"), at the 10 percent confidence level.

Appendix Figure 2.2: Share of countries with significant changes in *GeoC* since 2016



Source: Authors' estimates.

Note: Charts show the share of economies in which GeoC has significantly risen ("up") or fallen ("down") since 2016 or has changed insignificantly ("flat"), at the 10 percent confidence level.

Appendix Table 2.1: Changes in *GeoV* since 2016

	Advanced economies	EMDEs	
Exports	0.00	-0.13	*
Due to shifting transactions	-0.01	-0.09	*
Due to geopolitical shifts	0.01	-0.04	
Exports of capital goods	-0.07	0.03	
Due to shifting transactions	-0.07	0.08	*
Due to geopolitical shifts	0.00	-0.05	
Exports of intermediate inputs	0.02	-0.08	*
Due to shifting transactions	0.00	-0.08	*
Due to geopolitical shifts	0.02	0.00	
Exports of consumer goods	0.03	0.00	
Due to shifting transactions	0.02	0.04	
Due to geopolitical shifts	0.01	-0.04	
Inward FDI stock	-0.01	0.02	
Due to shifting transactions	0.03	0.02	
Due to geopolitical shifts	-0.04	0.00	
Portfolio liabilities	-0.07	-0.07	
Due to shifting transactions	-0.02	0.00	
Due to geopolitical shifts	-0.05	-0.07	
Liabilities to BIS-reporting banks	-0.07	-0.01	
Due to shifting transactions	-0.01	0.03	
Due to geopolitical shifts	-0.06	-0.04	

	Advanced economies	EMDEs	
Imports	0.03	-0.10	*
Due to shifting transactions	0.01	-0.06	*
Due to geopolitical shifts	0.02	-0.04	
Imports of capital goods	0.02	-0.09	*
Due to shifting transactions	-0.03	-0.15	*
Due to geopolitical shifts	0.05	0.06	*
Imports of intermediate inputs	0.08	-0.02	
Due to shifting transactions	0.03	-0.08	*
Due to geopolitical shifts	0.05	0.06	*
Imports of consumer goods	0.07	0.04	
Due to shifting transactions	0.00	-0.01	
Due to geopolitical shifts	0.07	0.05	

Source: Authors' estimates.

Note: Table shows unweighted cross-country averages of changes in GeoV since 2016 (excluding seven microstates). Changes to shifting transactions are calculated as changes in Geo V assuming fixed ideal point distances at 2016 levels. Changes due to geopolitical shifts are the residual.

Appendix Table 2.2: Changes in *GeoC* since 2016

	Advanced economies		EMDEs	
Exports	0.01		-0.05	*
Due to shifting transactions	-0.02		-0.03	
Due to geopolitical shifts	0.03		-0.02	
Exports of capital goods	0.01		0.00	
Due to shifting transactions	-0.03		0.01	
Due to geopolitical shifts	0.04	*	-0.01	
Exports of intermediate inputs	0.03		-0.04	*
Due to shifting transactions	-0.01		-0.02	
Due to geopolitical shifts	0.04	*	-0.02	
Exports of consumer goods	0.06	*	-0.01	
Due to shifting transactions	0.01		0.01	
Due to geopolitical shifts	0.05	*	-0.02	
Inward FDI stock	0.03		-0.05	*
Due to shifting transactions	0.02		-0.01	
Due to geopolitical shifts	0.01		-0.04	*
Portfolio liabilities	-0.03		0.00	
Due to shifting transactions	0.00		0.03	
Due to geopolitical shifts	-0.03		-0.03	
Liabilities to BIS-reporting banks	0.00		0.03	
Due to shifting transactions	0.02		0.04	*
Due to geopolitical shifts	-0.02		-0.01	

	Advanced economies		EMDEs	
Imports	0.06	*	-0.02	
Due to shifting transactions	0.02		-0.01	
Due to geopolitical shifts	0.04	*	-0.01	
Imports of capital goods	0.15	*	-0.06	*
Due to shifting transactions	0.02		-0.03	*
Due to geopolitical shifts	0.13	*	-0.03	*
Imports of intermediate inputs	0.11	*	-0.07	*
Due to shifting transactions	0.01		-0.04	*
Due to geopolitical shifts	0.10	*	-0.03	
Imports of consumer goods	0.13	*	-0.03	*
Due to shifting transactions	0.01		0.00	
Due to geopolitical shifts	0.12	*	-0.03	*

Source: Authors' estimates.

*Note: Table shows unweighted cross-country averages of changes in GeoC since 2016 (excluding seven microstates). Changes due to shifting transactions are calculated as changes in GeoC assuming ideal point distances of 2016. Changes due to geopolitical shifts are the residual. * indicates that the changes was sufficiently to move the index outside its pre-2017 confidence band at the 10 percent significance level.*

Appendix 3: Correlates of GeoC

What makes a geoeconomic connector? Which country characteristics are associated with greater values of *GeoC?* In this appendix, we examine this question in a panel estimation of *GeoC* on a range of country characteristics that are plausible correlates of global integration. This exercise does not capture the direction of causality. But the correlations it uncovers could guide future work investigating causal channels.

Openness: Free trade areas. The vast majority of countries are members of some regional trade agreement. Larger free trade areas may include a more numerous set of countries spanning a broader geopolitical spectrum. This would tend to increase each member's *GeoC* in trade and in FDI liabilities (since free trade agreements often also cover preferential access for investment). We capture the size of free trade agreements in the logarithm of total GDP (in millions of U.S. dollars, from the IMF's World Economic Outlook database) of partner countries in the free trade area that a reporting country belongs to.

Openness: Tariffs. Countries with lower average import tariffs, many of which are intermediate inputs, may be better able to cover the fixed cost associated with entering export markets and may be more integrated into global supply chains.[15] Greater access to export markets may drive up GeoC in exports. We capture this in countries' trade-weighted average tariff (in percent, from the World Bank's WITS database).

Openness: Logistics. Separate from tariffs, a poor logistics environment can present obstacles that can only be surmounted at an expense to trading firms. For example, Djankov, Freund, and Pham (2010) have estimated that each day that a product is delayed in transit translates to 1 percent less trade. Hence, poor logistics may discourage all but the closest trading partners. To capture these broader non-tariff obstacles to trade, we include the World Bank's *Logistic Performance Index* (in index points). A higher index represents a more efficient logistics environment.

Openness: Capital account openness. The ability to repatriate profits is a critical consideration for foreign direct investment as well as for shorter-term capital flows such as portfolio investment and foreign bank lending (Kaminsky and Schmukler 2003; Brafu-Insaidoo and Biekpe 2014). Greater capital account openness would be expected to be associated with greater attractiveness to a broader set of investment partners and, hence, greater *GeoC*. We capture capital account openness with the index of Chinn and Ito (2006), which is available to 2021.

Financial development. Especially for financial liabilities, deeper and more sophisticated financial markets and institutions facilitate entry and exit and, therefore, may attract a wider range of investors. This could raise *GeoC*, especially for liquid financial liabilities that are transacted through financial markets.[16] To capture this, we include the IMF's Financial Market Efficiency index. Higher indices indicate more efficient financial markets.

Controls. We control for economic and geographic gravity, and for supply chain integration. *First,* if entry into foreign markets incurs a fixed cost, larger economies are likely to be able to maintain a more diversified set of economic ties. Larger countries can therefore be expected to have larger *GeoC*, for any given set of country characteristics. We control for this effect in the regression by adding the logarithm of the country's own nominal GDP (in millions of U.S. dollars, from the IMF's World Economic Outlook database). *Second,* countries that are close to the largest economies will more easily be able to rely on transacting with a limited number of neighboring countries and, hence, are likely to have a lower *GeoC*. This effect is likely to matter most for transactions that cannot easily be conducted at arm's length, such as FDI. We capture this with the logarithm of the nominal U.S. dollar GDP-weighted average of each country's geodesic distance from all other countries in the world. *Third,* countries that are more embedded in a global value chain may have more concentrated links with a limited number of downstream and upstream trade partners rather than with a broad set of partners. We capture integration into global value chains with a "forward integration" measure, defined as domestic value added in

15 Ideally, we would include an index of FDI restriction such as the OECD's index of FDI regulatory restrictiveness. Unfortunately, this index is only available for 47 economies—not even one-quarter of the sample with available *GeoC* data.

16 In principle, it could also increase access to trade credit but, in practice, there is no significant correlation with *GeoC* for trade relationships.

percent of all other countries' exports using data available to 2018 from the UNCTAD-Eora *Global Value Chain Database.*

Specifically, we estimate a random effects panel regression of *GeoC* on relevant combinations of these variables.[17] We add year fixed effects to allow for common shocks like the global financial crisis or the COVID-19 pandemic. The sample includes 77-104 EMDEs and covers 2002-22 depending on the transaction under consideration. The results are shown in Appendix Table 3.1.

As expected, we find that exports are geoeconomically significantly more connected when the trade regime is more open and efficient: when tariffs are lower, logistics are more efficient, and the country is part of a larger free trade area.

Factors associated with export connectedness (or lack thereof) do not seem to spill over into FDI. Instead, financial market development appears to matter for diversified sources of FDI: connectedness in FDI liabilities is significantly higher when capital accounts are more open and financial markets are more efficient.

Financial development also appears to attract more diversified sources of portfolio investment and bank lending. For both portfolio investment liabilities and liabilities to BIS-reporting banks, countries with more open capital accounts and more efficient financial markets are significantly more geoeconomically connected. For connectedness of bank liabilities only the size of the local economy appears to matter, again perhaps reflecting the concentration of BIS-reporting banks in advanced economies.

Appendix Table 3.1: Country characteristics associated with a greater *GeoC*

	Exports	FDI liabilities	Liabilities to BIS-reporting banks	Portfolio liabilities
Log nominal GDP (billions of U.S. dollars)	0.0338**	0.0286*	0.0517***	0.0677***
	(0.0145)	(0.0161)	(0.00801)	(0.0113)
Log average distance (km)	0.173†	0.322***		
	(0.113)	(0.120)		
Average tariff (percent)	-0.000279***	0.00185		
	(5.22e-05)	(0.00374)		
Logistic Performance Index (index points)	0.0526*	-0.0455		
	(0.0313)	(0.0647)		
Forward global value chain integration (percent of foreign exports)	-0.0494**	-0.102**		
	(0.0214)	(0.0434)		
Log nominal GDP of partner countries in common global or regional free trade area (billions of U.S. dollars)	0.302***	0.489**		
	(0.101)	(0.202)		
Capital account openness (index points)		0.0162*	0.00609	0.0457***
		(0.00950)	(0.00848)	(0.0129)
Financial Market Efficiency Index (index points)		0.116**	-0.0186	0.0832†
		(0.0499)	(0.0274)	(0.0512)
Constant	-4.972***	-8.138***	-0.770***	-0.992***
	(1.422)	(2.508)	(0.185)	(0.269)
Observations	920	750	1,692	1,507
Number of economies	104	102	118	129

Source: Authors's estimates; Bailey, Strezhnev, and Voten (2017); CEPII; Comtrade; OECD; World Bank.

*Note: ***, **, *, † indicates statistical significance at the 1, 5, 10, and 15 percent levels, respectively. Results from a random effects panel regression, with robust standard errors, of the geoeconomic connector index for each of the five economic transactions on the policy variables indicated in the rows. All tax havens in the sample are advanced economies.*

17 Since many of the variables included here are slow-moving, fixed effects would absorb most of their variation. For FDI and portfolio investment liabilities, where there are extreme outliers that likely reflect valuation changes, we drop observations in the top and bottom deciles by share of FDI or portfolio investment liabilities in GDP.

Appendix 4: Robustness tests

Several robustness tests restrict the sample of countries used to construct indices. Notwithstanding some material differences in levels, the resulting indices generally still correlate significantly with the baseline index.

Balanced sample over time

Many country pairs have only intermittent economic transactions across years. Excluding all such pairs with only intermittent transactions could improve the comparability of indices over time.

As a robustness test, the indices are recalculated to include only country-pairs that have full data coverage for every year in the sample period. This results in a large number of country pairs being dropped from the calculation of the indices (Appendix Table 4.1). For trade, which is the most complete dataset, about one-third of the observations are dropped over 2002-23. For FDI and portfolio liabilities as well as liabilities to BIS-reporting banks, where data coverage is much patchier and transactions may be lumpier, one-half or less of the observations are dropped.

We test the correlations between these alternative indices and the baseline indices in a series of panel regressions shown in Appendix Table 4.2. The results suggest a statistically significant correlation for all indices. As expected, these correlations are highest (0.7-1) for trade-related variables.

Balanced sample across series

Data are available for a much larger number of country pairs for trade transactions than for financial transactions, either because of poorer reporting or because of genuinely fewer transactions. This complicates all comparisons across transactions.

To cross-check the role played by country-pair availability, we remove all country pairs for which data are unavailable for any series for the period 2009-22. This implies dropping more than three-quarters of the sample for the different transactions over this period (Appendix Table 4.1).

Dropping these observations makes a quantitative, but not a qualitative, difference to *GeoV.* The correlations between these indices and the baseline *GeoV* indices (column III of Appendix Table 4.2) fall to 0.2-0.6 percent, but they remain statistically highly significant. The largest declines in the correlations are for trade transactions. This suggests that countries' much larger group of trading partners relative to reported financial partners helps explain their greater connectedness in trade relative to finance. For *GeoC*, unsurprisingly, the deletion of these observations from the sample makes a major difference to all series. Correlations with baseline *GeoC* indices become near-zero except for exports and for portfolio investment liabilities and liabilities to BIS-reporting banks, the two series with the fewest numbers of dropped observations.

Appendix Table 4.1: Number of observations dropped in alternative index calculations

	Baseline sample	Balanced sample for each transaction	Balanced sample for all transactions
Exports	544,892	357,874	8,806
Exports of capital goods	446,238	241,878	8,806
Exports of intermediate inputs	521,288	298,452	8,806
Exports of consumer goods	514,088	285,558	8,806
Inward FDI stock	112,902	55,300	8,806
Portfolio liabilities	69,594	35,882	8,806
Liabilities to BIS-reporting banks	34,257	19,431	8,806

Source: Authors' estimates.

Note: Number of observations included or dropped in the baseline calculation by the requirement that a country pair has to have data available in every year of the balance-sample period (indicated in the header).

Appendix Table 4.2: Correlations between baseline indices and indices derived from different samples

	Balanced sample for each transaction		Balanced sample for all transactions	
	I. GeoV	II. GeoC	III. GeoV	IV. GeoC
Exports	0.937***	0.877***	0.279***	0.0598*
	(0.00576)	(0.00622)	(0.0205)	(0.0323)
Exports of capital goods	0.560***	0.570***	0.150***	-0.0134
	(0.0120)	(0.0130)	(0.0276)	(0.0438)
Exports of intermediate inputs	0.774***	0.780***	0.314***	0.0260
	(0.0101)	(0.0111)	(0.0236)	(0.0375)
Exports of consumer goods	0.720***	0.689***	0.318***	0.0553
	(0.0107)	(0.0130)	(0.0233)	(0.0359)
Inward FDI stock	0.777***	0.556***	0.350***	0.0719
	(0.0146)	(0.0163)	(0.0257)	(0.0497)
Portfolio liabilities	0.901***	0.528***	0.536***	0.0843**
	(0.0167)	(0.0208)	(0.0336)	(0.0397)
Liabilities to BIS-reporting banks	0.940***	0.716***	0.666***	0.140***
	(0.0134)	(0.0208)	(0.0331)	(0.0380)

Source: Authors' estimates.

Note: Coefficient estimates in columns I and II are from a panel regression of each index using a balanced sample (i.e. removing country-year pairs that are not available for every year in the sample period) or the baseline unconstrained sample. Coefficient estimates in columns III and IV are from a panel regression of each index using a fully balanced sample across series (i.e. removing country-year pairs that are not available for every series for every year in the sample period) or the baseline unconstrained sample.

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