Divided We Fall: Differential Exposure to Geopolitical Fragmentation in Trade†

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Abstract

This paper assesses differences in countries' macroeconomic exposure to trade fragmentation along geopolitical lines. Estimating structural gravity regressions for sector-level bilateral trade flows between 185 countries, we find that differences in individual countries' geopolitical ties act as a barrier to trade, with the largest effects concentrated in a few sectors (notably, food and high-end manufacturing). Consequently, countries' exposure via trade to geopolitical shifts varies with their market size, comparative advantage, and foreign policy alignments. Introducing our estimates into a dynamic many-country, many-sector quantitative trade model, we show that geoeconomic fragmentation—modelled as an increased sensitivity of trade costs to geopolitics and greater geopolitical polarization—generally leads to lower trade and incomes. However, emerging markets and developing economies (EMDEs) tend to see the largest impacts: real per-capita income losses for the median EMDE in Asia are 80 percent larger, and for the median EMDE in Africa 120 percent larger, than for the median advanced economy. This suggests that the costs of trade fragmentation could fall disproportionally on countries that can afford it the least.

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1 Introduction

Over the last decade, geopolitical divisions have come to the forefront of discussions about international trade and trade policy. In 2014, Russia's illegal annexation of Crimea led to the bilateral imposition of economic sanctions, including trade sanctions, between Russia and several major economies. In 2018, the U.S.-China trade war reversed a multi-decade trend of declining trade barriers between the world's two largest economies. The Covid-19 pandemic triggered concerns about the resilience of global supply chains, including to geopolitical risks.[1] Most recently, Russia's war on Ukraine prompted the imposition of heavy bilateral trade sanctions between the E.U. and Russia, and calls by senior U.S. and E.U. policymakers to "friendshore" and "de-risk" critical supply chains.[2] All this has raised the specter of fragmentation of the international trade landscape along geopolitical lines, one aspect of what the IMF has termed *geoeconomic fragmentation*. This paper provides novel evidence of the impact of geopolitics on international trade patterns, and uses it to explore how geoeconomic fragmentation in trade may manifest itself, and how its costs might be distributed across countries.

We show empirically that economies' geopolitical alignment affects international trade patterns, over and above its effect on their propensity to enter economic agreements. However, this effect is small compared with other trade drivers, and concentrated in a few sectors. We then introduce our estimates into a quantitative trade model, assuming that geoeconomic fragmentation manifests itself as a combination of i) an increase in the sensitivity of trade flows to geopolitics that preserves our estimated ranking of sectors in terms of their geopolitical sensitivity; and ii) a shift of geopolitical alliances that results in a more geoeconomically polarized world. We find that this results in income losses for most economies, but with a larger impact on emerging markets and developing economies (EMDEs) in Asia, the Middle East and sub-Saharan Africa. This suggests that the costs of geoeconomic fragmentation in international trade could fall disproportionally on countries that can afford it the least.

We begin with an analysis of sector-level barriers to bilateral goods trade, using a standard structural gravity framework – as in Anderson and van Wincoop (2003) – and taking bilateral trade data from the EORA dataset.[3] After some cleaning, the data covers the full matrix of bilateral internal and

[1]See White House (2021), UK Cabinet Office (2021), G7 (2021).

[2]See Yellen (2022), von der Leyen (2023).

[3]For a comprehensive overview of the empirical gravity literature, including the definition and role of structural gravity modeling, see Head and Mayer (2014).

external expenditure flows for 185 countries, aggregated at the level of 10 broad goods sectors and one services sector, and averaged for the period 2017–19. Alongside standard gravity controls, our regression analysis incorporates a bilateral measure of foreign policy alignment that captures the similarity of economies' geopolitical treaty portfolios. This has been used for empirical studies of country-pair relationships in the international relations literature.[4] Crucially for our purposes, it is built on information about geopolitical treaties, not economic or trade agreements.

We find that closer geopolitical alignment is generally associated with lower trade barriers, but with most of the effect concentrated in a few sectors − notably "transport equipment", "food and beverages", and "other manufacturing". This is over and above the effect of economic agreements, for which we control separately, suggesting the effect may operate through government restrictions on trade in some sensitive goods or uncertainty acting as an additional barrier to trade across geopolitical divides. The finding is robust across different time periods and country samples. It is stronger when we exclude controls for economic agreements suggesting that, in addition to the effect considered throughout most of this paper, geopolitics operates through the selection of countries into economic agreements.

Introducing these estimates into a many-country, many-sector dynamic general equilibrium trade model, we then explore the long-run macroeconomic impacts of possible geoeconomic fragmentation in trade. In principle, such fragmentation could take the form of an increased sensitivity of trade flows to geopolitics (as market participants become more "conscious" of the risks of trade with geopolitically distant countries) or an increased polarization of geopolitical alliances (creating greater geopolitical distances between countries). We explore both possibilities separately, but combine them together for our baseline scenario. Throughout, we assume that the ranking of sectors in terms of our estimated responsiveness of trade barriers to geopolitical alignment is preserved. In this way, our estimates help discipline our fragmentation scenarios, by grounding them in recent empirical evidence on the role of geopolitics in trade. Starting from this baseline, we explore additional, complementary counterfactuals in which we allow economies' trade and foreign policies respond to geoeconomic fragmentation.

In our scenarios, three factors determine the impact of geoeconomic fragmentation on countries. The first is market size. Everything else constant, any given rise in trade barriers leads to larger welfare losses for smaller economies that tend to rely more on international trade. The second factor is compar-

[4]See Leeds et al. (2002) and Chiba et al. (2015).

ative advantage. Economies that rely more strongly on imports in sectors whose trade barriers are highly sensitive to geopolitical alignment experience greater losses from geoeconomic fragmentation. The third factor is pre-existing geopolitical alignment. Economies that are closely aligned with some of the major economies are less affected by fragmentation than economies that are geopolitically distant from all hubs of the world economy. We find that, while fragmentation leads to real-income losses in almost all countries, EMDEs in Asia, the Middle East and sub-Saharan Africa experience the largest impacts, with respective medians that are more than twice as large in some of these regions as for the median advanced economy. This is primarily because these economies are smaller in size and relatively unaligned with major geopolitical blocs. We show that non-aligned economies can reduce the negative fallout from geoeconomic fragmentation through measures like strengthening regional trade, but only to a limited extent.

Our paper relates to a rapidly growing body of literature on geoeconomic fragmentation, some of which is surveyed in IMF (2023). This literature explores different facets of geoeconomic fragmentation including, but not limited to, trade fragmentation.[5] Our work is most comparable with a set of recent papers focused on trade fragmentation. These papers assess the impact of fragmentation by means of scenario analysis in quantitative general equilibrium trade models, and they find long-run global output losses in the range from 1 to 7 percent.[6] However, while these papers broadly agree on the ballpark of the *average* economic losses from geoeconomic fragmentation in trade,

[5]Cerdeiro et al. (2021) use a set of structural models to examine the costs of three different layers of fragmentation (trade, sectoral misallocation, and foreign knowledge diffusion) across different fragmentation scenarios. Their estimated welfare costs range from zero to 8.5 percent when accounting for all three layers of fragmentation. Goes and Bekkers (2022) focus on knowledge diffusion across countries, with the global economy split into Eastern and Western blocs, according to UN voting records. The results show losses ranging from 0.4 percent of GDP for some countries in a mild fragmentation scenario to 12 percent for the most affected countries under full technological decoupling. Aiyar et al. (2023) document empirically that geopolitical alignment shapes bilateral FDI patterns, and that the strength of this effect has increased since 2018.

[6]IMF (2022) examines the impact of eliminating trade in high-tech and energy sectors between rival blocs which are determined based on the UN General Assembly vote condemning Russia's invasion of Ukraine. The results suggest a loss of about 1.2 percent of global GDP, which increases to 1.5 percent when barriers to trade are extended to other sectors. Felbermayr et al. (2022) explore several East-West trade "decoupling" scenarios that double existing NTBs, generally finding welfare losses between 0 and 10 percent across countries. Bolhuis et al. (2023) calibrate their model using a newly constructed production-and-trade dataset with a particular focus on commodities, and introduce fragmentation scenarios ranging from limited restrictions between different country blocs to a full cessation of inter-bloc trade. Depending on trade elasticities and the type of scenario, long-run output is reduced by between 0.2 and 6.9 percent. Javorcik et al. (2022) and Attinasi et al. (2023) model supply-chain decoupling between geopolitical blocs using the quantitative framework of Baqee and Farhi (2023). They obtain global output losses ranging from 0.1 to 5 percent of GDP.

the distribution of these losses across countries is highly contingent on scenario assumptions about the size and incidence of new, fragmentation-induced trade barriers.

Our paper contributes to this literature by setting out a coherent framework for disciplining fragmentation counterfactuals across a large set of sectoral bilateral trade relationships. This framework utilizes evidence of the impact of geopolitical alignment on trade barriers from recent data—specifically, the estimated sensitivity of trade barriers to geopolitical alignment across different sectors—, and builds scenarios that extrapolate from it. This is similar in spirit, and complementary to, the identification of other structural parameters (such as the trade elasticity) from historical evidence, to inform forward-looking or counterfactual scenarios. This approach allows us to identify countries' possible macroeconomic exposure to geoeconomic fragmentation in trade *ex ante*, and to describe the country characteristics that lead to differences in this exposure. We use this approach to cast a spotlight on the possible impact of fragmentation on economies outside the group of major world markets.

The first half of our paper is also related to an empirical literature, at the intersection between economics and political science, which has studied the interaction between conflict and international trade. Several papers in this literature have analyzed this relationship using gravity-style regression models, with mixed results.[7] To the best of our knowledge, our paper is the first to quantify the impact of geopolitical alignment on trade at a sectoral level. By estimating these impacts under assumptions that are compatible with standard quantitative trade models, it dovetails with scenario analyses that utilize these models—and we engage in such an analysis in the second half of the paper.[8]

[7]Pollins (1989a, 1989b) shows that less friendly bilateral political relationships dampen trade. Mansfield and Bronson (1997) find that wars reduce trade, and Keshk et al. (2004) find that militarized interstate disputes dampen trade. In contrast, Morrow, Siverson, and Taberes (1998, 1999) and Mansfield and Pevehouse (2000) find that the effect of such disputes on trade is not statistically significant. Barbieri and Levy (1999) find no evidence that war involving non-major power countries reduces bilateral trade over time, while Anderton and Carter (2001) find that wars involving major powers dampen trade with both other major powers and minor powers. Martin et al. (2008) suggest that although countries trading more bilaterally have a lower probability of conflict, countries that are more open overall are more likely to engage in war because they are less dependent on trade with any given country. Glick and Taylor (2010) find a very strong impact of war on trade and per capita income, using a long time series over the period 1870–1997. Jakubik and Ruta (2023) provide evidence that bilateral trade flows shift towards geopolitical allies during periods of heightened global uncertainty. Campos et al. (2023) document the impact of aggregate trade restrictions on bilateral trade flows and use this evidence to discuss possible trade and welfare consequences if these restrictions increase in a geoeconomically fragmented world.

[8]Our quantitative trade model is a special case of the model used in Cuñat and Zymek (2023). In turn, the latter builds on recent advances in general equilibrium trade modeling (surveyed in Costinot and Rodríguez-Clare, 2014) and designing trade counterfactuals

The remainder of the paper is structured as follows. Section 2 describes the structural gravity framework used to analyze sector-level trade-cost drivers, and presents the estimates of the impact of geopolitical alignment on trade patterns. Section 3 introduces the dynamic many-country, many-sector quantitative trade model used for our trade-cost counterfactuals. Introducing the estimates from Section 2 into the model, Section 4 performs counterfactuals to explore the long-run macroeconomic impacts of various fragmentation scenarios and discusses the results. Section 5 offers concluding remarks.

2 Sensitivity of Bilateral Trade to Geopolitics: Empirical Estimates

2.1 Methodology

2.1.1 Assumptions

We assume that sector-level bilateral trade flows between economies can be represented by a structural gravity equation. Specifically, consider a set of N economies, denoted by $n = 1, ..., N$, and S sectors, denoted by $s = 1, ..., S$. Then:

$$M_{sn'n} = \left(\frac{\tau_{sn'n}}{O_{sn'}P_{sn}}\right)^{-\theta_s} D_{sn'}E_{sn}, \tag{1}$$

where $M_{sn'n}$ is the dollar value of expenditure by country n on country n' output in sector s; $\tau_{sn'n}$ is a measure of the ad-valorem-equivalent trade friction applying to this flow; θ_s is the trade elasticity; $D_{sn'}$ is the dollar value of country n' output in sector s; E_{sn} is the dollar value of country n expenditure on sector s output; and P_{sn} and $O_{sn'}$ are respectively the inward and outward multilateral resistance terms, defined as follows:

$$P_{sn} \equiv \left[\sum_{n'=1}^{N}\left(\frac{\tau_{sn'n}}{O_{sn'}}\right)^{-\theta_s} D_{sn'}\right]^{-\frac{1}{\theta_s}}, \quad O_{sn'} \equiv \left[\sum_{n=1}^{N}\left(\frac{\tau_{sn'n}}{P_{sn}}\right)^{-\theta_s} E_{sn}\right]^{-\frac{1}{\theta_s}}. \tag{2}$$

Equation (1) was first derived in Anderson and van Wincoop (2003) from a specific set of microfoundations. However, it has since been shown to be compatible with many quantitative models of international trade.[9] Two sufficient conditions for obtaining equation (1) are:

1. The share of spending by country n on country n' output in sector s, $v_{sn'n} \equiv M_{sn'n}/E_{sn}$, can be expressed in the following multiplicatively

involving dynamics, most notably Ravikumar et al. (2019).

[9]See Head and Mayer (2014).

separable form:

$$\upsilon_{sn'n} = F_{sn'} \left(\frac{\tau_{sn'n}}{P_{sn}} \right)^{-\theta_s}, \quad P_{sn}^{-\theta_s} \equiv \sum_{n'=1}^{N} F_{sn'} \tau_{sn'n}^{-\theta_s}, \tag{3}$$

where $F_{sn'}$ is some measure of the multilateral attractiveness of n' as a source of imports in sector s.

2. There is market clearing for each origin country:

$$D_{sn'} = \sum_{n=1}^{N} M_{sn'n} = F_{sn'} \sum_{n=1}^{N} \left(\frac{\tau_{sn'n}}{P_{sn}} \right)^{-\theta_s} \frac{E_{sn}}{D_s} \equiv F_{sn'} O_{sn'}^{-\theta_s}. \tag{4}$$

The structural gravity equation above is then obtained by using condition (4) to substitute for $F_{sn'}$ in condition (3). In Section 3, we introduce a model that satisfies conditions (3) and (4) and thus represents one of several possible microfoundations of the structural gravity equation used throughout this section.

In addition to the above, we assume that the ratio of countries' external to internal trade barriers in each sector, $\tau_{sn'n}/\tau_{snn}$, can be written as a log-linear function of country-pair characteristics.[10] Concretely,

$$\ln \left(\tau_{sn'n}/\tau_{snn} \right) = \beta_s^0 + \sum_{l=1}^{L} \beta_s^l u_{n'n}^l, \tag{5}$$

where $\left\{ u_{n'n}^l \right\}_i$ comprises typical country-pair observables used in gravity regressions, such as bilateral distance, cultural similarity, and the presence of trade agreements. Crucially for our purposes, it also contains an empirical measure of countries' bilateral geopolitical alignment. The assumption in equation (5) is implicit in the large majority of empirical studies that leverage the gravity framework.[11]

2.1.2 Estimation

To obtain the impact of different country-pair characteristics—including geopolitical alignment—on trade, we perform an estimation in two steps. First, we use PPML to estimate the full set of $N \times N$ bilateral expenditures, including

[10] Note that, for any country n, equations (1) and (2) are homogeneous of degree zero in $\{\tau_{sn'n}\}_{n'}$. Therefore, countries' international trade flows ($n' \neq n$) are pinned down by the magnitude of external trade frictions relative to internal frictions, $\tau_{sn'n}/\tau_{snn}$.

[11] See Anderson and van Wincoop (2004) and Head and Mayer (2014).

expenditures on domestic goods, in each sector s ,

$$M_{sn'n} = \exp\left\{\Omega_{sn'} + \Pi_{sn} + \delta_{sn'n}\right\}\zeta_{sn'n}, \tag{6}$$

where $\Omega_{sn'}$ is a country-n'-sector-s-exporter fixed effect; Π_{sn} is a country-n-sector-s-importer fixed effect; $\delta_{sn'n}$ is an undirected country-pair-$n'n$-sector-s fixed effect (i.e. $\delta_{sn'n} = \delta_{snn'}$); and $\zeta_{sn'n}$ is an error term. Since the set of importer and exporter fixed effects is not of full rank, the restriction $\Pi_{sN} = 0$ must be imposed for a benchmark country N. We can also specify N reference categories for the country-pair fixed effects for each sector s, so we impose $\delta_{snn} = 0$ for all s and n.[12,13]

Fally (2015) shows that, if equation (6) is estimated by PPML, the properties of the estimator ensure that

$$P_{sn}^{-\theta_s} = \frac{E_{sn}}{E_{sN}} \exp\left\{-\tilde{\Pi}_{sn}\right\}, \quad O_{sn'}^{-\theta_s} = E_{sN} D_{sn'} \exp\left\{-\tilde{\Omega}_{sn'}\right\}, \tag{7}$$

where "tilde" denotes estimates. It follows that

$$-\theta_s \ln\left(\tau_{sn'n}/\tau_{snn}\right) = \tilde{\delta}_{sn'n}, \tag{8}$$

which implies the country-pair fixed effects constitute an exact measure of the bilateral external frictions in a standard structural gravity model, up to the value of the sector-s trade elasticity.

In the second step, we use OLS to estimate the $N\left(N-1\right)/2$ country-pair fixed effects in each sector s,

$$-\tilde{\delta}_{sn'n}/\theta_s = \beta_s^0 + \sum_{l=1}^{L} \beta_s^l u_{n'n}^l + \varepsilon_{sn'n}, ; \quad l \in \begin{Bmatrix} dist, & contig, & lang, & col, \\ wto, & rta, & eu, & align \end{Bmatrix} \tag{9}$$

where $\varepsilon_{sn'n}$ is an error term. This yields $\left\{\tilde{\beta}_s^l\right\}_l$, where $\tilde{\beta}_s^l$ captures the impact of country-pair characteristic $u_{n'n}^l$ on bilateral trade barriers. Here $u_{n'n}^{dist}$ is the log of distance (in km) between the capital cities of n' and n; $u_{n'n}^{contig}$ is a dummy taking value 1 if n' and n are contiguous; $u_{n'n}^{lang}$ is a dummy taking value 1 if both share an official language; $u_{n'n}^{col}$ is a dummy taking value 1 if both share a colonial history; $u_{n'n}^{wto}$ is a dummy taking value 1 if both are WTO members; $u_{n'n}^{rta}$ is a dummy taking value 1 if both are members of the same RTA; and $u_{n'n}^{eu}$ is a dummy taking value 1 if both are EU members. These are

[12] This is without loss of generality as we cannot separately identify the level of internal trade barriers, captured by δ_{snn}, after controlling for exporter-sector and importer-sector fixed effects, Ω_{sn} and Π_{sn}. See also footnote 10.

[13] Overall, there are N^2 observations per sector, and $2N - 1 + N\left(N-1\right)/2$ fixed effects, which is sufficient to identify all fixed effects for any $N \geq 2$.

standard variables typically included in gravity-type regressions. In addition, we include $u^{align}_{n'n}$, the measure of bilateral foreign policy alignment described in Section 2.2.2.

Equations (6) and (9) are most commonly estimated in a single step. The two-step approach we use here is similar to Eaton and Kortum (2002), who regress estimated exporter fixed effects on the proxies for productivity and wages. As discussed in Fally (2005), a PPML-estimation of the structural gravity model is theory-consistent only when the full matrix of bilateral trade flows is used. Since there are data gaps for some the country-pair characteristics we use to explain trade barriers—most importantly the foreign-policy-alignment variable—we perform a theory-consistent identification of bilateral trade barriers and multilateral resistances in the first step following Fally (2005), in a way that does not require our country-pair characteristics. We then separately conduct the analysis of the drivers of bilateral trade barriers in the second step.

2.2 Data

2.2.1 Trade Flows and Gravity Variables

We take sector-level bilateral expenditure flows between economies from the EORA global input-output database (Lenzen et al., 2013). We use the EORA database because of its fairly complete country coverage, as we are particularly interested in the impact of geoeconomic fragmentation on developing and least-developed economies. Unless otherwise specified, we use the simple average of all flows from EORA for the years 2017–19 to average out short-term fluctuations and possible idiosyncratic errors in the EORA data. Our deliberate focus on pre-pandemic data serves to ensure that our analysis avoids conflating the extraordinary disruptions caused by the Covid-19 pandemic and the war in Ukraine with the more enduring structural aspects of international trade.

For compatibility with some of our other data sources, we aggregate EORA data to the level of 10 goods sectors and one service sector. Our empirical analysis and counterfactuals are restricted to the goods sectors, since they constitute by far the largest share of the value of international trade, and the underlying data is likely of better quality. We also bundle some countries included in EORA into one "rest of the world" economy. The resulting dataset covers the full matrix of sector-level bilateral trade flows between 185 economies (including the "rest of the world").

Standard gravity control variables are taken from the CEPII gravity dataset (Conte et al., 2022). Sectoral trade elasticities are aggregated from Caliendo and Parro (2015) for the baseline estimation and from Fontagné et al. (2022)

as a robustness check.[14] We use these elasticities to transform the country-pair fixed effects from our first-stage regressions into trade-barrier-equivalent values for the second stage, as per equation (9).

2.2.2 Bilateral Geopolitical Alignment

Our key variable of interest in the gravity analysis is a measure of geopolitical alignment between country pairs. We follow the Alliance Treaty Obligations and Provisions (ATOP) project in measuring geopolitical alignment on the basis of similarity of countries' geopolitical treaty portfolios (Leeds et al., 2002; Chiba et al., 2015).

The ATOP database contains data on countries' bilateral geopolitical treaty obligations. This makes it possible for any two countries n' and n to construct a variable $treaty_{n'n} \in \{0, 1, 2, 3\}$ coded as follows: 3 = defense and/or offense obligations (regardless of other content); 2 = neutrality and/or consultation obligations (but no defense or offense obligations); 1 = nonaggression pact (but no defense, offense, neutrality, or consultation obligations); 0 = no alliance obligation.[15] Figure 1 maps the strength of geopolitical treaty obligations for Germany, France, and Angola. Germany and France have the strongest alliance treaties with other European countries, Israel, Turkey, the U.S. and Canada (and in case of France, a few Francophone countries in Africa). Angola has defense and/or offense obligations with many sub-Saharan African countries, and a neutrality and/or consultation treaty with Russia.

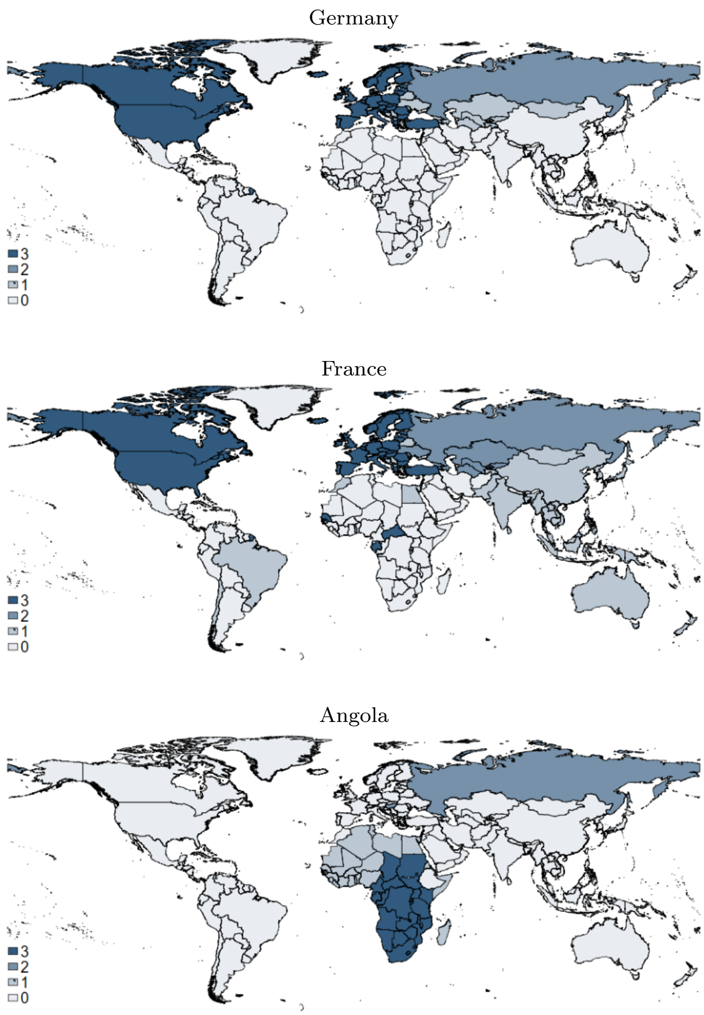
Given $\{treaty_{n'n}\}$, it is then possible to compute an S-score of alliance portfolio similarity for any two countries across their realizations of treaties with every other country, following Signorino and Ritter (1999). This delivers the variable $u^{align}_{n'n}$, which we use in our regressions below. It is bounded between -1 (n' and n have completely opposing alliance portfolios; least aligned) and 1 (n' and n have identical alliance portfolio; most aligned). Larger values are interpreted as representing greater foreign policy similarity and, hence, stronger geopolitical alignment. We compute $\{u^{align}_{n'n}\}_{n'n}$ for the year 2018, for compatibility with our trade data.[16] In our example above, Germany and

[14] Elasticities vary from 0.69 in transport equipment to 15.72 in mining and quarrying. See Appendix Table A3 for the full list.

[15] The coding follows Leeds et al. (2002) and Chiba et al. (2015). Defense and offense obligations represent the strongest form of pact because they require member states to provide military assistance in war. Neutrality and consultation pacts are considered weaker commitments because they stop short of requiring partners to join a conflict, but they require an active effort to support their allies and coordinate policy. Nonaggression pacts are considered the weakest commitments because they may not require any cooperative action on the part of alliance members, other than refraining from conflict with one another.

[16] As would be expected, given the geopolitical treaty obligations evolve slowly over time, $u^{align}_{n'n}$ does not vary much within country pairs across time.

Figure 1: Geopolitical alliance portfolios: Selected countries



Note: Figure shows the strength of bilateral geopolitical treaties of selected countries, as measured by the variable $treaty_{n'n} \in \{0, 1, 2, 3\}$ taken from the ATOP database, and described in Section 2.2.2.

France have a high alignment score (0.85) because of the similarity of their alliance portfolios. In contrast, the alignment score for countries with dissimilar alliance portfolios such as Germany and Angola is much lower (0.21). In practice, values of $u^{align}_{n'n}$ range from -0.29 to 1 for the year 2018, with a median value of 0.54 and a standard deviation of 0.23. Given the slow-changing nature of geopolitical alliances, the geopolitical alignment measure has been fairly constant over the past decade.

Table 1: Impact of closer foreign policy alignment on bilateral trade barriers by sector

Dep. variable: Ln value of bilateral imports (net of MRTs)	1	2	3	4	5	6	7	8	9	10
Panel A: Full set of controls										
ln(distance, km)	0.054	0.054	0.161	0.106	0.056	0.046	0.095	0.077	0.765	0.091
	(0.003)***	(0.004)***	(0.012)***	(0.005)***	(0.003)***	(0.002)***	(0.005)***	(0.004)***	(0.045)***	(0.005)***
1 = contiguous	-0.171	-0.077	-0.436	-0.124	-0.101	-0.061	-0.174	-0.099	-1.616	-0.125
	(0.021)***	(0.014)***	(0.068)***	(0.032)***	(0.020)***	(0.012)***	(0.030)***	(0.023)***	(0.270)***	(0.041)***
1 = common language	-0.042	0.003	-0.050	0.009	-0.009	-0.003	0.014	0.019	0.186	-0.006
	(0.007)***	(0.004)	(0.023)**	(0.010)	(0.006)*	(0.004)	(0.009)	(0.008)**	(0.074)**	(0.011)
1 = colonial relationship	-0.195	-0.092	-0.835	-0.387	-0.205	-0.129	-0.298	-0.327	-2.846	-0.437
	(0.020)***	(0.014)***	(0.075)***	(0.033)***	(0.018)***	(0.013)***	(0.030)***	(0.024)***	(0.269)***	(0.036)***
1 = WTO members	-0.058	-0.038	-0.251	-0.081	-0.065	-0.036	-0.066	-0.088	-0.646	-0.097
	(0.005)***	(0.009)***	(0.019)***	(0.008)***	(0.005)***	(0.003)***	(0.008)***	(0.006)***	(0.065)***	(0.009)***
1 = RTA	-0.058	-0.015	-0.361	-0.105	-0.057	-0.062	-0.111	-0.134	-0.934	-0.084
	(0.006)***	(0.004)***	(0.020)***	(0.008)***	(0.005)***	(0.004)***	(0.009)***	(0.007)***	(0.077)***	(0.009)***
1 = EU members	-0.136	-0.083	-0.616	-0.390	-0.195	-0.177	-0.407	-0.358	-5.162	-0.380
	(0.013)***	(0.012)***	(0.042)***	(0.017)***	(0.010)***	(0.008)***	(0.022)***	(0.013)***	(0.218)***	(0.019)***
Foreign policy alignment (-1,1)	-0.014	0.023	-0.249	-0.148	-0.073	-0.024	-0.098	-0.025	-0.340	-0.192
	(0.010)	(0.010)**	(0.034)***	(0.015)***	(0.008)***	(0.006)***	(0.014)***	(0.011)**	(0.124)***	(0.016)***
R2	0.13	0.04	0.17	0.20	0.19	0.22	0.19	0.22	0.21	0.17
Panel B: Excluding controls for economic agreements										
ln(distance, km)	0.070	0.059	0.255	0.145	0.075	0.067	0.137	0.120	1.218	0.125
	(0.003)***	(0.003)***	(0.011)***	(0.005)***	(0.003)***	(0.002)***	(0.005)***	(0.004)***	(0.046)***	(0.005)***
1 = contiguous	-0.178	-0.079	-0.479	-0.127	-0.106	-0.064	-0.175	-0.108	-1.548	-0.128
	(0.022)***	(0.014)***	(0.074)***	(0.034)***	(0.021)***	(0.013)***	(0.032)***	(0.025)***	(0.309)***	(0.044)***
1 = common language	-0.040	0.005	-0.042	0.022	-0.004	0.003	0.029	0.029	0.400	0.007
	(0.007)***	(0.004)	(0.024)*	(0.010)**	(0.006)	(0.004)	(0.009)***	(0.008)***	(0.080)***	(0.011)
1 = colonial relationship	-0.218	-0.103	-0.952	-0.436	-0.232	-0.153	-0.348	-0.379	-3.386	-0.482
	(0.022)***	(0.014)***	(0.084)***	(0.034)***	(0.019)***	(0.014)***	(0.031)***	(0.025)***	(0.297)***	(0.038)***
Foreign policy alignment (-1,1)	-0.028	0.014	-0.311	-0.193	-0.094	-0.045	-0.147	-0.066	-0.974	-0.236
	(0.010)***	(0.009)	(0.035)***	(0.015)***	(0.008)***	(0.006)***	(0.015)***	(0.011)***	(0.130)***	(0.016)***
R2	0.10	0.04	0.11	0.15	0.13	0.15	0.13	0.13	0.12	0.12
N	14,535	14,535	14,535	14,535	14,535	14,535	14,535	14,535	14,535	14,535
# Countries	185	185	185	185	185	185	185	185	185	185
Fixed effects:										
- Constant term:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Table reports the estimation results from the regression in equation (9) with a full vector of bilateral country-pair characteristics. Standard errors in parentheses. Every column reports the results for one sector: 1 – Agriculture and fishing; 2 – Mining and Quarrying; 3 – Food & Beverages; 4 – Textiles & Apparel; 5 – Wood & Paper; 6 - Petroleum, Chemical and Non-Metallic Mineral Products; 7 – Metal Products; 8 – Electrical Machinery; 9 – Transport Equipment; 10 – Other. Every regression has 14,535 observations covering 185 countries. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively.

2.3 Results

This section focuses on the results from our second-step estimations. Recall from Section 2.1.2 that we purge bilateral expenditure flows of origin and destination fixed effects in the first step. In the second step, we then estimate equation (9) with OLS. We generally expect countries that are more aligned in terms of their foreign policy to have lower trade barriers ($\beta_s^{align} > 0$), after controlling for other determinants of bilateral trade barriers traditionally included in the gravity regressions.

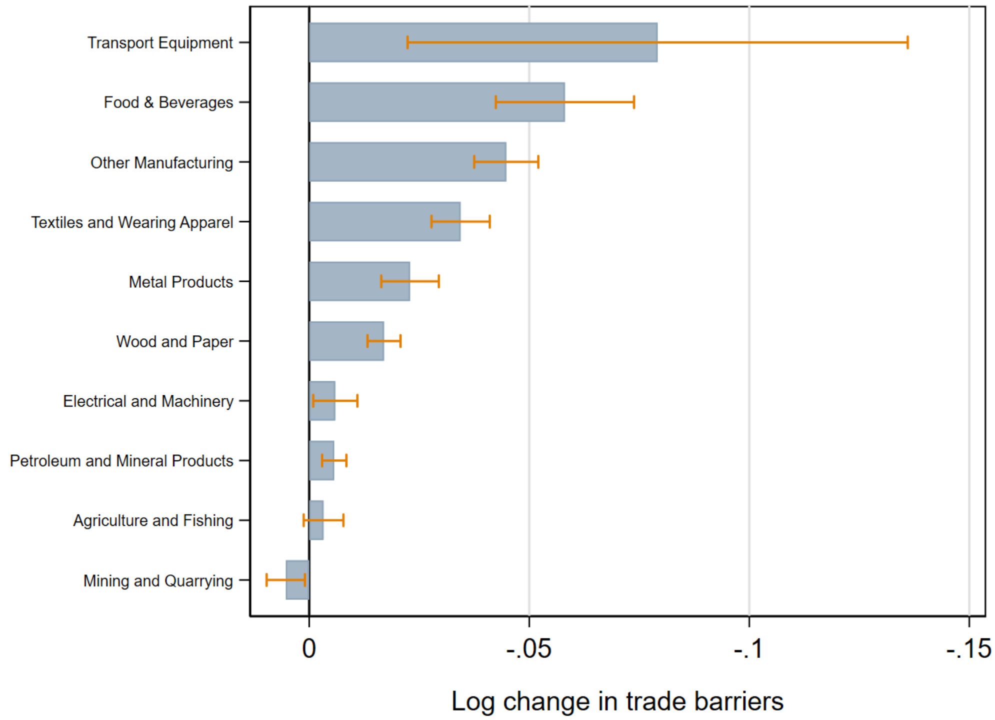
2.3.1 Baseline Results

Table 1 (Panel A) reports the baseline estimates $\left\{\tilde{\beta}_s^l\right\}_s$ across 10 tradable goods sectors with a full set of bilateral control variables. The coefficients can be interpreted as the effects of country-pair characteristics on bilateral trade barriers. Closer foreign policy alignment is associated with lower trade barriers in nine goods sectors out of the 10 analyzed. In eight sectors the effect is also statistically significant. Reassuringly, standard gravity controls predominantly have the expected sign: while larger distance between trading partners positively affects trade frictions in all sectors, common border, common language and membership in trade agreements decrease bilateral trade barriers. We use the coefficients on the foreign policy alignment from Table 1 (Panel A) in the counterfactual exercises in Section 4.

Figure 2 plots the effects of a one standard deviation (0.233 points) increase in foreign policy alignment on sectoral trade barriers. The effects are strongly heterogeneous across sectors. After accounting for trade elasticities, trade barriers in the "transport equipment" sector are the most sensitive to geopolitical alignment—a one standard deviation increase in foreign policy alignment decreases trade barriers in the sector by almost 8 percent. Trade barriers in "food and beverages" and "other manufacturing" are the second- and third-most sensitive to geopolitics.

To gauge the economic importance of foreign policy alignment relative to more traditional drivers of trade costs, we use our estimates of the drivers of trade barriers to perform a variance decomposition on bilateral trade barriers. In Figure 3 we illustrate the contribution of geographic attributes, economic agreements, and cultural variables to variation in bilateral trade barriers across country pairs. The share of total explained variance ranges from 11 percent ("Mining and quarrying") to 21 percent ("electric machinery") and is dominated by geographic factors along with economic agreements. Differences in foreign policy alignments currently play a minor role, roughly on par with that of cultural variables such as language and colonial history. This seems a reason-

Figure 2: Sectoral trade impact of closer foreign policy alignment



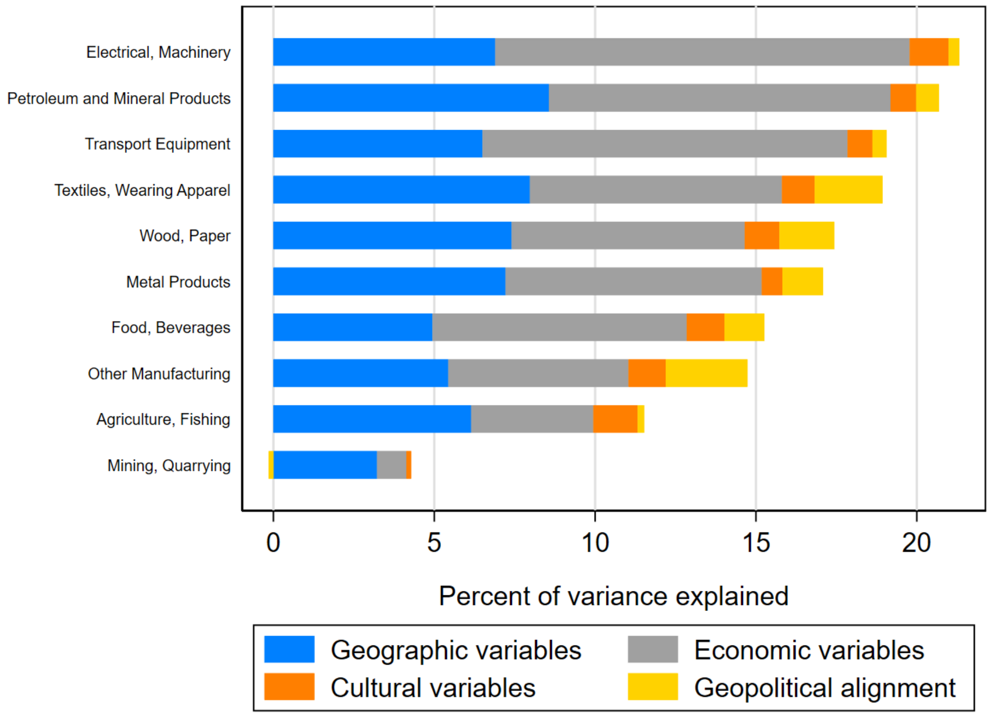
Note: Figure shows the estimated impact of a one standard-deviation increase in foreign policy alignment on bilateral trade barriers in each of 10 broad manufacturing sectors ($-\tilde{\beta}^l_s/\theta_s \times sd[u^{align}_{n'n}]$, as defined in Section 2.1.2 and 2.2), along with 95-percent confidence intervals. Regressions cover bilateral trade between 185 countries, and use bilateral expenditure flows from EORA (averaged for the period 2017–19), CEPII gravity controls, and a measure of bilateral foreign policy alignment using S-scores from ATOP for the year 2018. For data sources and description, see Section 2.2.

able quantitative assessment of the relatively minor importance that had been attached to geopolitics in international trade in recent decades. In Section 4, our counterfactual scenarios explore the consequences if this importance were to grow in the future.

2.3.2 Robustness Checks

The results in Table 1 (Panel A) support the hypothesis that closer foreign policy alignment has negative effect on effective bilateral trade barriers, even after conditioning on joint membership in economic or trade agreements. This may be because of (explicit or implicit) government restrictions on trade in sensitive goods with perceived geopolitical rivals, or because of a lower level of trust or heightened degree of business uncertainty acting as additional barriers to trade across geopolitical divides for private firms. In addition, it seems likely that geopolitical alignment also affects countries' choices to enter into various economic or trade agreements. This mechanism is indirectly supported by the results in Table 1 (Panel B), in which we exclude the controls for economic

Figure 3: Drivers of cross-country-pair variation in trade barriers



Note: Figure shows the share of the variance of estimated bilateral trade barriers explained by different (groups of) variables for each of 10 sectors. Geographic variables encompass bilateral distance and contiguity. Economic variables encompass membership in the WTO, an RTA, and the EU single market. Cultural variables encompass the presence of a common language or colonial relationship. The contribution of each variable (group) to the variation in bilateral trade barriers is based on fitted values obtained from estimating equation (9). The contribution of variable $u^l_{n'n}$ to the variance of -$\tilde{\delta}_{sn'n}/\theta_s$ is defined as $Cov(u^l_{n'n}, -\tilde{\delta}_{sn'n}/\theta_s)/Var(-\tilde{\delta}_{sn'n}/\theta_s)$. For data sources and description, see Section 2.2.

agreements $u^{wto}_{n'n}$, $u^{rta}_{n'n}$ and $u^{eu}_{n'n}$. In this specification, foreign policy alignment has an even greater effect on trade barriers, with the estimated coefficients almost doubling in some cases. This suggests that our baseline estimates may understate the total effect of foreign policy alignment on trade barriers, because geopolitics also operates through countries' propensity to seek closer ties through economic or trade agreements. We return to this point in Section 4.4.1.

We subject our baseline results to a range of robustness checks, which are detailed in Appendix A.1. First, we show that the estimated elasticities of sectoral trade barriers with respect to foreign policy alignment are fairly stable across time. This supports the assumption that these estimates reflect inherent, unchanging sector characteristics. Second, we replicate our findings for different sub-samples of country pairs. This addresses the concern that our estimates may be driven by a particular subset of bilateral relationships. Third, we scale our first-stage regression output using an alternative set of trade elasticities taken from Fontagné et al. (2022). We find that this delivers a broadly similar ranking of sectors in terms of the sensitivity of their trade barriers to foreign policy alignment, but with a notable difference for one sector. In Section 4, we perform our baseline geoeconomic fragmentation scenarios with both sets of elasticities, and demonstrate that any sector-level differences resulting from the choice of elasticities do not materially impact the headline macro outcomes of the scenarios.

3 Model

The model used in this section is a special case of the dynamic trade model in Cuñat and Zymek (2023). Economies differ in their reliance on, and productivity in, multiple sectors, and sectoral inputs are differentiated by country of origin à la Armington (1969). As a result, there is trade between and within sectors. Forward-looking agents make consumption and savings decisions, but their lifespans may end each period with a constant probability as in Blanchard (1985). Consequently, the model has a steady state that is independent of initial conditions, despite permitting international asset trade in incomplete asset markets. This makes it possible to analyze steady-states under counterfactual trade-cost configuration by means of exact-hat algebra.

3.1 Assumptions

3.1.1 Preferences and Endowments

There are many economies, denoted by $n = 1, ..., N$. Time lasts forever, and there is no aggregate uncertainty. There is a unit mass of agents in each economy that face a constant probability of death, ξ, every period. An exogenous mass ξ of agents is also born, so that net population growth is zero everywhere. Agents in n discount the future at rate ρ and are endowed with H_{nt} units of human capital, which they supply inelastically in domestic labour markets at wage w_{nt}. H_{nt} grows exogenously at gross rate γ for all n: $H_{nt+1} = \gamma H_{nt}$. Agents are born without wealth, but can accumulate it through savings, and actuarially fair life insurance is available.

Agents' period utility is logarithmic in final consumption each period, and we denote by $C_{nt}(t')$ the final consumption in period t of an agent in economy n who was born in period t'. The optimal-savings problem of an agent born in period t' can be expressed as

$$\max_{\{C_{nt}(t')\}_{t=t'}^{\infty}} \sum_{t=t'}^{\infty} \left(\frac{1-\xi}{1+\rho} \right)^{t-t'} \ln C_{nt}(t') \tag{10}$$

subject to

$$P_{nt} C_{nt}(t') + A_{nt+1}(t') = w_{nt} H_{nt} + \frac{R_t}{1-\xi} A_{nt}(t'), \ A_{nt'}(t') = 0, \tag{11}$$

where P_{nt} denotes the price of final consumption in economy n and period t; R_t is the aggregate return to wealth, which is equal across economies (as we discuss below); and $A_{nt}(t')$ is the wealth that a cohort-t' member has at the beginning of period t, before the uncertainty about their death has been resolved; and $1/(1-\xi)$ is the additional return on their assets from life insurance received by surviving agents.

3.1.2 Technologies

In each country n, firms assemble a non-traded aggregate "all-purpose" good by using inputs from many sectors, $s = 1, ..., S$:

$$X_{nt} = \prod_{s=1} \left(\frac{X_{snt}}{\sigma_{sn}} \right)^{\sigma_{sn}}, \tag{12}$$

where $\sigma_{sn} \in (0,1)$; $\sum_s \sigma_{sn} = 1$; X_{nt} is the output of the good; and X_{snt} is the quantity of sector-s inputs used. The sector-s input is also non-tradable, but firms assemble it from tradable, place-specific varieties:

$$X_{snt} = \left(\sum_{n'=1}^{N} x_{sn'nt}^{\frac{\theta_s}{1+\theta_s}} \right)^{\frac{1+\theta_s}{\theta_s}}, \tag{13}$$

where $\theta_s \geq 0$; and $x_{sn'nt}$ represents the use of the economy-n' variety in the production of the sector-s input by economy n. The economy-n variety in sector s is produced with the Cobb-Douglas technology

$$Q_{snt} = z_{sn} \left(\frac{K_{snt}^{\alpha} H_{snt}^{1-\alpha}}{1-\mu_s} \right)^{1-\mu_s} \left(\frac{J_{snt}}{\mu_s} \right)^{\mu_s}, \tag{14}$$

where $\alpha, \mu_s \in (0,1)$. K_{snt} and H_{snt} respectively represent the capital and efficiency units of labour used; J_{snt} denotes the use of the economy-n final good as intermediate input in s; and shifter z_{sn} describes the economy-sector-specific efficiency of production.

The non-traded aggregate good in n can be used to provide one unit of final consumption, one unit of intermediate input for one of the economy-sector-specific varieties, J_{snt}, or $1/\eta_n > 0$ units of investment, I_{nt}: $X_{nt} = C_{nt} + \eta_n I_{nt} + \sum_s J_{snt}$. Parameter η_n thus captures (inversely) the investment efficiency of economy n. Investment adds to the economy's capital stock according to:

$$K_{nt+1} = I_{nt} + (1-\delta) K_{nt}, \tag{15}$$

where $\delta \in (0,1)$; K_{nt} is the capital stock of n in period t.

3.1.3 Market Structure

All markets are perfectly competitive. International trade is subject to iceberg transport costs: $\tau_{sn'n} \geq 1$ units of the economy-n', sector-s variety must be shipped for one unit to arrive in country n. Production factors can move freely between activities within economies, but cannot move across borders.

Agents in all economies can trade in a one-period international riskless bond (which is in zero net supply) in a competitive global bond market. One unit of bond holdings at the end of period t pays a nominal return of R_t. The wealth that a cohort-t' member has at the beginning of period t is $A_{nt}(t') \equiv \eta_n P_{nt-1} K_{nt}(t') + B_{nt}(t')$.

3.2 Equilibrium Conditions

3.2.1 Prices

Equilibrium prices satisfy

$$P_{nt}^C = P_{nt}^J = \frac{P_{nt}^I}{\eta_n} = \prod_{s=1}^{S} \left[\sum_{n'=1}^{N} \left(\tau_{sn'n} p_{sn't}\right)^{-\theta_s} \right]^{-\frac{\sigma_{sn}}{\theta_s}} \equiv P_{nt}, \tag{16}$$

where P_{nt}^C, P_{nt}^I and P_{nt}^I respectively denote the final-consumption price, the intermediates price, and the investment price; and

$$p_{snt} = \frac{1}{z_{sn}} f_{nt}^{1-\mu_s} P_{nt}^{\mu_s}, \quad f_{nt} \equiv \left(\frac{r_{nt}}{\alpha}\right)^{\alpha} \left(\frac{w_{nt}}{1-\alpha}\right)^{1-\alpha} \tag{17}$$

where f_{nt} is the factor cost in economy n.

3.2.2 Optimal Consumption and Investment

The Euler equation for an individual born in period t' in country n and alive in period t is

$$\frac{C_{nt+1}(t')}{C_{nt}(t')} = \frac{P_{nt}}{P_{nt+1}} \frac{R_{t+1}}{1+\rho}. \tag{18}$$

Aggregate final consumption in n is a weighted average of the final consumption of all members of country-n cohorts alive in period t:

$$C_{nt} = \sum_{t'=-\infty}^{t} \xi \left(1-\xi\right)^{t-t'} C_{nt}\left(t'\right). \tag{19}$$

In addition, no arbitrage between physical capital and the riskless bond requires

$$R_{t+1} = \frac{\alpha}{\eta_n} \frac{f_{nt+1}}{P_{nt}} k_{nt+1}^{\alpha-1} + \left(1-\delta\right) \frac{P_{nt+1}}{P_{nt}}, \tag{20}$$

where $k_{nt} \equiv K_{nt}/H_{nt}$.

3.2.3 Market Clearing Conditions

The equilibrium value of sector-s imports by country n from country n' is,

$$M_{sn'nt} = \frac{\left(\tau_{sn'n} p_{sn't}\right)^{-\theta_s}}{\sum_{n''=1}^{N} \left(\tau_{sn''n} p_{sn''t}\right)^{-\theta_s}} \sigma_{sn} P_{nt} \left(C_{nt} + \eta_n I_{nt} + J_{nt}\right), \tag{21}$$

and market clearing requires

$$p_{snt} Q_{snt} = \sum_{n'=1}^{N} M_{snn't};\ f_{nt} k_{nt}^{\alpha} H_{nt} = \sum_{s=1}^{S} \left(1-\mu_s\right) p_{sn} Q_{snt};\ P_{nt} J_{nt} = \sum_{s=1}^{S} \mu_{sn} p_{sn} Q_{snt}, \tag{22}$$

$$\sum_{n=1}^{N} f_{nt} k_{nt}^{\alpha} H_{nt} = \sum_{n=1}^{N} P_{nt} \left(C_{nt} + \eta_n I_{nt}\right). \tag{23}$$

Note that equations (21) and (22) imply that conditions (3) and (4) are satisfied in the model and, therefore, sectoral trade flows in each period can be represented by a gravity equation as in (1) with $D_{sn't} \equiv p_{snt} Q_{snt}$ and $E_{snt} \equiv \sigma_{sn} P_{nt} \left(C_{nt} + \eta_n I_{nt} + J_{nt}\right)$.

3.2.4 Equilibrium Definition

An equilibrium in the model is a sequence of prices $\{f_{1t}, ..., f_{Nt}, R_{t+1}\}_{t=0}^{\infty}$ that satisfy (15)-(23) for all $t \geq 0$, given some initial capital stocks $\{k_{10}, ..., k_{N0}\}$ and cross-country wealth distribution $\{R_0 A_{10}, ..., R_0 A_{N0}\}$.

3.3 Exact-Hat Algebra

3.3.1 Comparison of Steady States

The model outlined above has a unique stable steady state that is independent of the cross-country wealth distribution in period 0. In this steady state, all prices are constant and all real variables grow at rate γ. As shown in Cuñat and Zymek (2023), we can compare steady states for different configurations of bilateral trade barriers by means of exact-hat algebra.[17]

For a given endogenous variable x_{nt} that is constant in steady state, we can write its steady-state value as x_n for given trade barriers, and define x'_n as its alternative steady-state value after an exogenous change in trade barriers. Then, defining $\hat{x}_n \equiv x'_n / x_n$,

$$\hat{v}_{sn'n} = \frac{\left[\hat{\tau}_{sn'n}\hat{f}_{n'}\left(\prod_{s=1}^{S}\hat{v}_{sn'n'}^{\frac{1}{\theta_s}\frac{\sigma_{sn'}}{1-\sum_s \sigma_{sn'}\mu_s}}\right)^{\mu_s}\right]^{-\theta_s}}{\sum_{n'=1}^{N}\left[\hat{\tau}_{sn'n}\hat{f}_{n'}\left(\prod_{s=1}^{S}\hat{v}_{sn'n'}^{\frac{1}{\theta_s}\frac{\sigma_{sn'}}{1-\sum_s \sigma_{sn'}\mu_s}}\right)^{\mu_s}\right]^{-\theta_s} v_{sn'n}}, \tag{24}$$

$$\hat{f}_n \hat{k}_n^{\alpha} h_n = \sum_{s=1}^{S}(1-\mu_s)\sum_{n'=1}^{N}\hat{v}_{snn'}v_{snn'}\sigma_{sn'}q'_{n'}\hat{f}_{n'}\hat{k}_{n'}^{\alpha}h_{n'}, \tag{25}$$

$$q'_n \hat{f}_n \hat{k}_n^{\alpha} h_n = \sum_{s=1}^{S}\sum_{n'=1}^{N}\hat{v}_{snn'}v_{snn'}\sigma_{sn'}q'_{n'}\hat{f}_{n'}\hat{k}_{n'}^{\alpha}h_{n'}, \tag{26}$$

$$1 = \left(\prod_{s=1}^{S}\hat{v}_{snn}^{-\frac{1}{\theta_s}\frac{\sigma_{sn}}{1-\sum_s \sigma_{sn}\mu_s}}\right)\hat{k}_n^{\alpha-1}, \tag{27}$$

$$\hat{y}_n = \left(\prod_{s=1}^{S}\hat{v}_{snn}^{-\frac{1}{\theta_s}\frac{\sigma_{sn}}{1-\sum_s \sigma_{sn}\mu_s}}\right)\hat{k}_n^{\alpha}, \tag{28}$$

where $h_n \equiv f_n k_n^{\alpha_n} H_{nt} / \sum_n \left(f_n k_n^{\alpha_n} H_{nt}\right)$.

3.3.2 Geoeconomic Fragmentation Counterfactuals

The main counterfactuals we consider result from changes in bilateral trade barriers due to (i) a change in the sensitivity of trade barriers to countries' geopolitical alignment; (ii) changes in countries' geopolitical alignments; or (iii) some combination of the two. Throughout most of the analysis, all other determinants of trade barriers are held constant.

Using our estimates from Section 2, we can thus write

$$\hat{\tau}_{sn'n} = \begin{cases} \exp\left\{-\frac{1}{\theta_s}\left(\hat{\beta}_s^{align}\hat{u}_{n'n}^{align} - 1\right)\tilde{\beta}_s^{align}u_{n'n}^{align}\right\} & \text{if } n' \neq n \\ 1 & \text{otherwise} \end{cases}. \tag{29}$$

[17] By imposing identical discount rates and capital shares for all countries, we ensure that all countries would have the same steady-state interest rate in hypothetical financial autarky and, as a result, net international asset positions and trade balances are zero in steady state even when asset trade is permitted. For a discussion of the general case with a non-degenerate steady-state international asset distribution and steady-state macro imbalances, see Cuñat and Zymek (2022).

In Section 4.1, we describe how we discipline $\{\hat{\beta}_s^{align}\}_s$ and $\{\hat{u}_{n'n}^{align}\}_{n'n}$.

3.4 Calibration

To operationalize equations (24)-(28), we need two types of information. The first type are a set of parameters for sectoral expenditure shares by country, $\{\sigma_{sn}\}_{s,n}$, sectoral input shares and trade elasticities, $\{\mu_s, \theta_s\}_s$, and a capital share in production, α. The second type are "status quo" *steady-state* sectoral bilateral trade shares, $\{v_{sn'n}\}_{s,n',n}$, and world GDP shares, $\{h_n\}_n$.

Calibrating the parameters is relatively straightforward. We take sectoral expenditure shares by country straight from EORA for the period 2017–19.[18] We compute sectoral input shares by dividing total global spending on inputs in each sector from EORA by total global output. Sectoral trade elasticities are aggregated from Caliendo and Parro (2015). The resulting sectoral parameters are reported in Appendix Table A3. Finally, we set $\alpha = .406$, which is the U.S. capital share for 2018 from PWT, edition 10.0 (Feenstra et al., 2015).

Appendix A.2 shows how to compute "status quo" steady-state sectoral bilateral trade shares and world GDP shares. This involves taking observed trade and GDP shares from EORA, and capital stocks from PWT, and solving for their corresponding steady state values assuming constant trade barriers. The computations can be performed in a manner akin to the exact-hat algebra in Section 3.3.1.

4 Counterfactuals

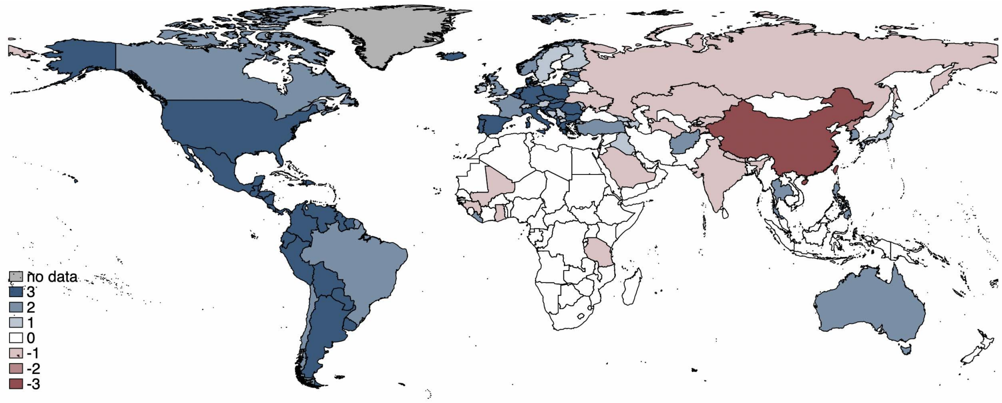
4.1 Scenarios

4.1.1 Geopolitical Polarization

The first scenario explores the effect of stronger treaty ties within two rival geopolitical blocs. We do this by increasing economies' bilateral foreign policy alignment with others that are part of the same geopolitical bloc, and reducing it with those that are not. This leads to a polarization of bilateral alignments, with economies becoming more closely aligned with some of their already-closest geopolitical partners, and less aligned with everyone else. We analyze the resulting effect on trade and incomes, assuming that the sensitivity of trade barriers to geopolitical alignment remains unchanged from our estimates in Section 2.3.

[18] Unless otherwise indicated, we take the simple average of all flows reported in EORA across the years 2017–19 before performing the parameter calculations.

Figure 4: Strength of geopolitical treaty obligation vis-à-vis the U.S. relative to China



Note: Strength of geopolitical treaty obligation by country n' towards n is measured by the variable $treaty_{n'n} \in \{0, 1, 2, 3\}$ taken from the ATOP Database, and described in Section 2.2. Strength of treaty obligation towards the U.S. relative to China is defined as $treaty_{nUSA} - treaty_{nCHN}$. Based on this measure, economies are divided into three blocs: a Western bloc ($treaty_{nUSA} > treaty_{nCHN}$; blue shading), an Eastern bloc ($treaty_{nUSA} < treaty_{nCHN}$; red shading), and a non-aligned bloc ($treaty_{nUSA} = treaty_{nCHN}$; no color).

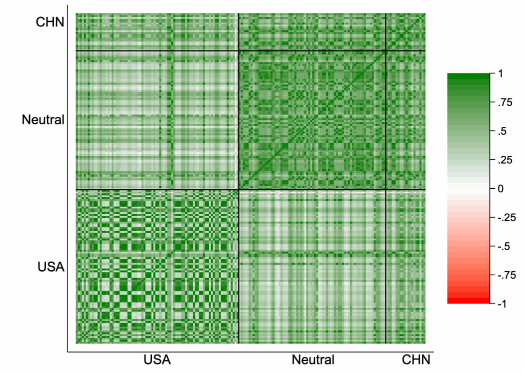
To define geopolitical blocs, we turn to the information on the strength of geopolitical treaty ties that underpins our measure of bilateral foreign policy alignment. As described in Section 2.2, that measure is based on the similarity of incidence and strength of economies' bilateral geopolitical treaties, captured by the variable $treaty_{n'n}$. Figure 4 maps relative treaty strength with the U.S. versus China in the year 2018 for each economy n in our data, defined as $treaty_{nUSA} - treaty_{nCHN}$. This measure ranges from -3 to 3. Using it, we group economies into three blocs: a U.S.-centered Western bloc that has stronger treaty ties with the U.S. than with China ($treaty_{nUSA} > treaty_{nCHN}$; blue shading); a China-centered Eastern bloc that has stronger treaty ties with China than with the U.S. ($treaty_{nCHN} > treaty_{nUSA}$; red shading); and a non-aligned bloc that has no or equally strong treaties with the U.S. and China ($treaty_{nUSA} = treaty_{nCHN}$; no color).

Having thus defined two main geopolitical blocs, as well as the non-aligned bloc, we assume that members of the Western and Eastern blocs increase their treaty strength with economies in their bloc by 1, unless they are already at the maximum value of 3; and decrease their treaty strength with all other economies by 1, unless they are already at the minimum value of zero. The bilateral treaties of countries in the non-aligned bloc are assumed to stay unchanged. This is intended to capture a plausible strengthening of countries' treaty relationships in accordance with their pre-existing positioning along an East-West axis.

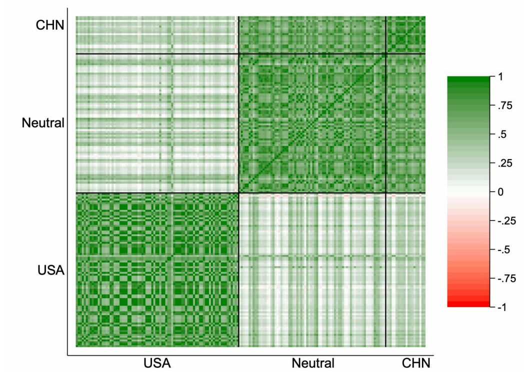
Panel A of Figure 5 provides a heatmap overview of the baseline geopolitical

Figure 5: Heatmap of bilateral geopolitical alignment

Panel A: Bilateral alignment in 2018 based on ATOP



Panel B: Counterfactual bilateral alignment under "polarization" scenario



Note: Figure shows bilateral geopolitical alignment, based on similarity of alliance portfolio computed from the ATOP database, as defined in Section 2.2.2. Panel A shows actual bilateral alignment measure for 2018. Panel B shows counterfactual bilateral alignment measure under the "increased geopolitical polarization" scenario described in Section 4.1.1 below. Countries are allocated to blocs based on their 2018 geopolitical treaty strength vis-à-vis the U.S. relative to China, with U.S. bloc defined as $treaty_{nUSA} > treaty_{nCHN}$, China bloc as $treaty_{nUSA} < treaty_{nCHN}$, and a non-aligned neutral bloc as $treaty_{nUSA} = treaty_{nCHN}$.

alignment measure $u^{align}_{n'n}$ for all 185 economies in our data, grouped into a U.S.-centered Western bloc, a China-centered Eastern bloc, and a non-aligned bloc. As the figure shows, bilateral alignment is generally larger within these blocs than across blocs $-$ but there is a lot of heterogeneity in bilateral alignment patterns.

Panel B of Figure 5 illustrates the polarization of geopolitical alignments. Bilateral alignments within each of the three blocs rise, while alignments between blocs decrease. Note that non-aligned economies are also affected, despite the assumption that their treaty relationships remain unchanged: this is because the strengthening of treaties within the Western and Eastern blocs causes the (unchanged) treaty portfolio of a typical non-aligned economies to become more dissimilar from that of a typical Western- or Eastern-aligned country, and relatively more similar to that of other non-aligned countries.

Given our estimates from Section 2.3, the resulting change in alignments, $\{\hat{u}^{align}_{n'n}\}_{n'n}$, lowers trade barriers within blocs, but raises trade barriers between them.

4.1.2 Increased Geopolitical Sensitivity of Trade Barriers

The second scenario assumes a doubling of the sensitivity of trade barriers to foreign policy alignment: $\hat{\beta}^{align}_{s} = 2$ for all s. This is intended to capture an increase in the force of the mechanisms (such as government restrictions, or firms' risk perceptions) by which differences in foreign policy alignment translate into higher effective trade barriers.

We impose a doubling of the sensitivity of trade barriers to foreign policy alignment because, holding other factors constant, this would result in a doubling of the share of the variation in trade barriers that could be attributed to foreign policy alignment. Based on the decomposition of the drivers of trade barriers in Section 2.3.1, the change would put foreign policy alignment ahead of cultural factors as a driver of trade barriers, but still leave it behind geography and economic agreements. This seems a reasonable bound on the relative importance that geopolitical factors might assume in explaining trade barriers and trade patterns. By construction, from equation (29), imposing $\hat{\beta}^{align}_{s} = 2$ for all s implies a relative increase in trade barriers i) for sectors with a high pre-existing sensitivity to foreign policy alignment; and ii) country pairs whose bilateral alignment is relatively low.

4.1.3 Increased Geopolitical Polarization and Increased Geopolitical Sensitivity of Trade Barriers

The third scenario combines the assumptions made in Sections 4.1.1 and 4.1.2 together. It constitutes our baseline geoeconomic fragmentation scenario, and captures both the emergence of more clearly delineated geoeconomic blocs, and the possibility that hindrances to trade across geopolitical divides will increase.

4.2 Impact of Fragmentation on Real Incomes

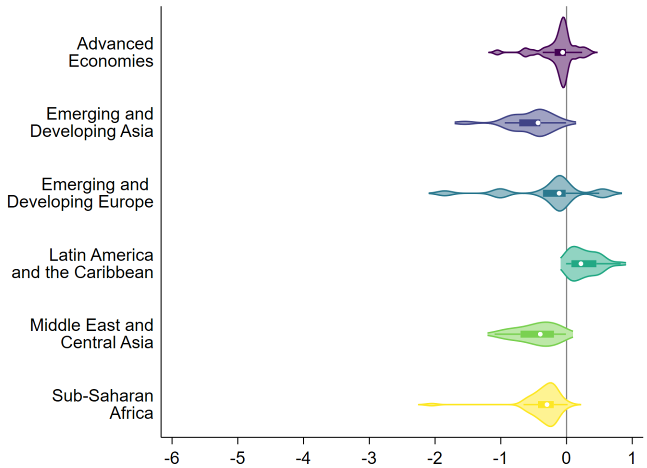
Figure 6 shows the distribution of real per-worker GDP changes in steady state under the different scenarios by country groups. Panel A displays the outcomes under Scenario 1 ("polarization only"). The median economy experiences a modest real-income loss of about 0.2 percent. Moreover, about one quarter of economies actually experience real-income gains. This is not surprising: the scenario implies rises in trade barriers for some pairs of economies (those trading across blocs), but declines in trade barriers for others (those trading within). For countries that see their trade barriers with major partners decline, the net effect on openness and real income is positive. This is well illustrated by the Latin American and Caribbean economies, which are among the biggest winners in this scenario. The ATOP treaty data places them mostly into the Western bloc and, as a result, they see a significant decline in trade barriers with the U.S., a major market in their vicinity.

Panel B shows the distribution of outcomes under Scenario 2 ("increased geopolitical sensitivity of trade"). This scenario delivers much more significant real-income losses for the median economy, at about 1 percent. This is because it implies a much more uniform rise in trade barriers across country pairs. As a result, the large majority of economies in our data experience some real-income decline. The impacts are also relatively uniformly distributed across regions, with the smallest median income loss in emerging and developing Asia (0.7 percent) and the largest in the Middle East and Central Asia (1.5 percent).

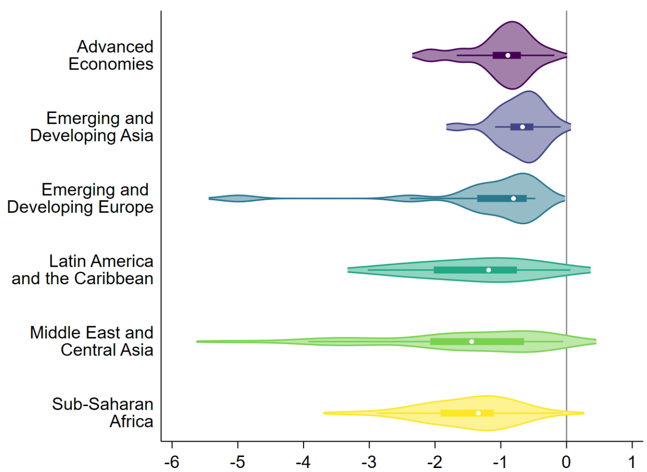
Finally, Panel C shows the distribution of outcomes under the combined Scenario 3, our baseline. This scenario delivers the largest losses for the median economy across the world as a whole (1.3 percent), as well as the largest variation in real-income losses. Notably, advanced economies suffer the smallest income losses if geoeconomic fragmentation manifests itself as greater geopolitical polarization combined with a greater sensitivity of trade barriers to geopolitical alignment, at about 0.9 percent for the median advanced economy. By contrast, the median impact is 80 percent larger in emerging and developing Asia, more than 120 percent larger in sub-Saharan Africa, and 150 percent larger in the Middle East and Central Asia. About one quarter of economies in sub-Saharan Africa and the Middle East and Central Asia experience real-income losses in excess of 3 percent. This suggests that the costs of trade fragmentation along geopolitical lines could fall disproportionally on countries that can afford it the least.

Figure 6: Impact of fragmentation scenarios on steady-state real GDP per worker

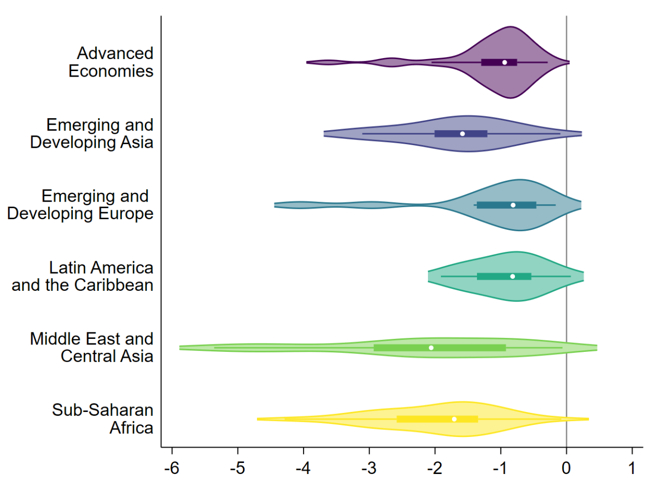
Panel A: Geopolitical polarization



Panel B: Increased geopolitical sensitivity of trade barriers



Panel C: Increased polarization and increased geopolitical sensitivity



Note: Figure shows the distribution of real GDP per worker changes in steady state by region under different fragmentation scenarios. The "geopolitical polarization" scenario is defined in Section 4.1.1. The "increased geopolitical sensitivity" scenario is defined in Section 4.1.2. The "combined" scenario is defined in Section 4.1.3. Steady-state real GDP changes are computed by means of exact-hat algebra, as described in Section 3.1.

4.3 Drivers of Differential Exposure to Geoeconomic Fragmentation in Trade

4.3.1 Decomposing the Baseline Change in Trade Barriers

Having established that poorer countries suffer relatively larger real-income losses in our baseline geoeconomic fragmentation scenario, a natural next question is why some countries appear to be more exposed to welfare losses than others. In our analysis, there are three factors that determine the extent of a country's exposure to the fallout from geoeconomic fragmentation.

The first of these determinants is market size: even a uniform increase in all international trade barriers would result in relatively larger real-income losses for smaller economies (in terms of their share of world GDP). This is because, everything else constant, smaller economies rely more on international trade than larger economies—an immediate implication of the "gravity"-patterns of international trade. However, the rise in trade barriers we impose is not uniform across sectors and country pairs. This gives rise to the other two determinants of exposure.

The second determinant is comparative advantage. From equation (29) and our assumption in 4.1.2, economies that import more in sectors in which trade barriers are especially sensitive to geoeconomic alignment see a larger increase in the cost of imported goods than economies that import less in those sectors. The third determinant is (changes in) countries' foreign policy alignments. From equation (29) and our assumption in 4.1.2, trade barriers rise more for economies that are (or become) more geopolitically "distant" from major trading partners than for economies that are (or become) more closely aligned with major trade partners. In the following, we aim to assess more formally the relative quantitative importance of these different drivers for the differential impact our baseline fragmentation counterfactual has across countries.

To this end, Appendix A.3 proposes a decomposition of trade-barrier changes in our baseline scenario of the form:

$$\ln \hat{\tau}_{sn'n} = \ln \hat{\tau} + \ln \hat{\tau}_s^{\beta} + \ln \hat{\tau}_{n'n}^{u} + \ln \hat{\tau}_{n'n}^{\triangle u} + \eta_{sn'n} \qquad \forall\, n' \neq n, \tag{30}$$

where $\ln \hat{\tau}$ is the weighted average change in bilateral international trade barriers across all sectors and country pairs; $\ln \hat{\tau}_s^{\beta}$ is the relative effect of geoeconomic fragmentation on sector-s trade barriers that is due to the difference in sensitivity to foreign policy alignment of sector s from the average sector; $\ln \hat{\tau}_{sn'n}^{u}$ is the relative effect on countries n and n' due to the difference of their bilateral alignment from the world average; $\ln \hat{\tau}_{sn'n}^{\triangle u}$ is the relative effect that is due to the difference in their alignment *change* from the world average; and $\eta_{sn'n}$ is a residual that is uncorrelated with the other right-hand-side terms to a first order. By construction, the weighted average of $\ln \hat{\tau}_s^\beta$, $\ln \hat{\tau}_{sn'n}^u$, $\ln \hat{\tau}_{sn'n}^{\triangle u}$, and $\eta_{sn'n}$ across all sectors and country pairs is zero.

We now perform partial counterfactuals, introducing the component trade-barrier changes from the right-hand-side of equation (30) individually into our model. Define $\hat{y}_n(\{\hat{\tau}\}_{sn'n})$ as the change in country-n real income if all bilateral international trade barriers are increased in the same proportion, corresponding to the weighted average change in our baseline scenario. Then any variation in $\hat{y}_n(\{\hat{\tau}\}_{sn'n})$ must be due to the differences in the size of economies. By analogous definition, the primary source of variation in $\hat{y}_n(\{\hat{\tau}_s^\beta\}_{sn'n})$ is differences in economies' import baskets. Finally, the primary source of variation in $\hat{y}_n(\{\hat{\tau}_{sn'n}^u\}_{sn'n})$ and $\hat{y}_n(\left\{\hat{\tau}_{sn'n}^{\triangle u}\right\}_{sn'n})$ is differences in countries' bilateral alignments and alignment changes, respectively.

4.3.2 Quantitative Role of Different Determinants of Exposure

Table 2 compares the variance in real-income changes generated by the partial counterfactuals with those from our baseline geoeconomic fragmentation scenario. Note that this does not represent an *exact* decomposition of the variation in our baseline real-income change for two reasons. First, the main components of trade-barrier changes identified in equation (30) capture most, but not all of, the variation in our baseline trade-barrier changes, with the remainder of the variation due to $\{\eta_{sn'n}\}_{sn'n}$. Second, even if it were possible to decompose $\ln \hat{\tau}_{sn'n}$ linearly without a residual term, the mapping from trade-barrier changes into real-income changes is non-linear. Nevertheless, the variance comparison in Table 2 turns out to be informative about the relative quantitative role of the different determinants of economies' heterogeneous exposure to geoeconomic fragmentation.

As can be seen from the table, introducing the same (average) trade-barrier change across all sectors and country pairs generates more than half of the variation in real-income changes that we obtain in our baseline geoeconomic fragmentation scenario. This suggests that economy size is the primary reason for the differential exposure to geoeconomic-fragmentation losses that emerges from our analysis. Differences in countries alignments and alignment changes together can generate another one third of the baseline variation in real-income changes. This leaves little to be explained and, correspondingly, differences in import baskets can account for less than one tenth of the baseline income-change variance.

Summing up, we compute real-income losses in a data-grounded scenario of

Table 2: Variance comparison, full geoeconomic fragmentation scenario vs. partial counterfactuals

Component	x	$Cov[x, \hat{y}_n(\{\hat{\tau}_{sn'n}\}_{sn'n})]$	$\frac{Cov[x,\hat{y}_n(\{\hat{\tau}_{sn'n}\}_{sn'n})]}{Var[\hat{y}_n(\{\hat{\tau}_{sn'n}\}_{sn'n})]}$
All	$\hat{y}_n(\{\hat{\tau}_{sn'n}\}_{sn'n})$	2.467	1.000
Size	$\hat{y}_n(\{\hat{\tau}\}_{sn'n})$	1.264	0.512
Import basket	$\hat{y}_n(\{\hat{\tau}_s^{\beta}\}_{sn'n})$	0.238	0.097
Alignments	$\hat{y}_n(\{\hat{\tau}_{sn'n}^{u}\}_{sn'n})$	0.541	0.219
Alignment changes	$\hat{y}_n(\left\{\hat{\tau}_{sn'n}^{\triangle u}\right\}_{sn'n})$	0.332	0.135

Note: Table compares the cross-country variance of real GDP per worker changes under the full baseline geoeconomic fragmentation scenario with a range of partial counterfactuals that isolate individual drivers of economies' exposure to fragmentation. The "Baseline" scenario is defined in Section 4.1.3. The partial counterfactuals are described in Section 4.3.1 and Appendix A.3. Steady state real-GDP changes computed by means of exact-hat algebra, as described in Section 3.1.

how geoeconomic fragmentation may alter global trade barriers and trade patterns. We find that the resulting real-income losses are sizeable, especially for relatively poorer economies in Emerging and Developing Asia, the Middle East and Central Asia and sub-Saharan Africa. Quantitatively, the primary reasons for the relatively high exposure of incomes in these regions to geoeconomic fragmentation appear to be their economies' relatively small economic mass, and their geopolitical positioning relative to the plausibly emerging Western and Eastern blocs. The next subsection provides an overview of a few additional and alternative counterfactual experiments.

4.4 Additional and Alternative Counterfactuals

4.4.1 Economic Agreements Based on Geopolitical Alignment

In our baseline regressions described in Section 2.3.1, we ascertain the impact of foreign policy alignment on sectoral bilateral trade barriers after controlling for country pairs' memberships in the WTO, RTAs and the EU single market. As shown in Section 2.3.2, once we drop these controls, the magnitude of the effect of foreign policy alignment on trade barriers increases. One way to interpret this finding is that foreign policy alignment, in addition to its direct barrier-reducing effects, also promotes joint participation in economic agreements, which in turn reduce trade barriers. Appendix A.4.1 describes a variant of our baseline geoeconomic fragmentation scenario in which we adopt this assumption, and let membership in economic agreements be fully determined by foreign policy alignment.

The resulting real-income losses from geoeconomic fragmentation can be seen in column 4 of Table 3. As would be expected, geoeconomic fragmentation has a significantly larger impact on real incomes under this assumption, with median losses for the different regions increasing by between 60 percent and 100 percent. This serves to highlight that our baseline counterfactual errs on the side of conservatism by assuming that the patterns of economic agreements remain unaffected by changes in foreign policy alignments and an increase in their perceived importance. Assuming the exact opposite—that economic agreements are fully determined by foreign policy alignment—delivers much more profound income losses from geoeconomic fragmentation.

4.4.2 Alternative Trade Elasticities

Our baseline analysis relies on estimated trade elasticities taken from Caliendo and Parro (2015). However, as discussed in Section 2.3.2 and Appendix A.1, using a more recent set of trade-elasticity estimates from Fontagné et al. (2022) delivers a slightly different assessment of the sensitivity of trade barriers in different sectors to foreign policy alignment. To assess whether these differences have a material effect on our headline findings, we repeat our baseline geoeconomic fragmentation counterfactual using the elasticities from Fontagné et al. (2022).

As column 5 of Table 3 shows, the alternative set of elasticities somewhat reduces the magnitude of the income losses from geoeconomic fragmentation across all countries. This is primarily because the trade elasticities for several quantitatively important sectors, notably "Food" and "Transport Equipment", are larger according to Fontagné et al. (2022) than according to Caliendo and Parro (2005). In turn, larger trade elasticities result in smaller welfare losses from trade-barrier increases in standard gravity-class trade models. However, the real-income losses from geoeconomic fragmentation remain sizeable even with the alternative set of elasticities, and the distribution of these losses across country groups remains broadly unchanged.

4.4.3 "Neutral" Economies Respond to Fragmentation

One limitation of our analysis so far is that the "neutral" economies which we do not assign either to the Western or the Eastern bloc are assumed to keep their policies and alignments constant in the face of geoeconomic fragmentation. As shown in Sections 4.2 and 4.3, closer alignment with a major geopolitical bloc can offset some of an economy's exposure to the fallout from geoeconomic fragmentation. Below, we explore two scenarios in which "neutral" economies are allowed to implement policies that limit possible income losses from fragmentation—first, by signing new trade agreements and, second, by choosing a major bloc to join.

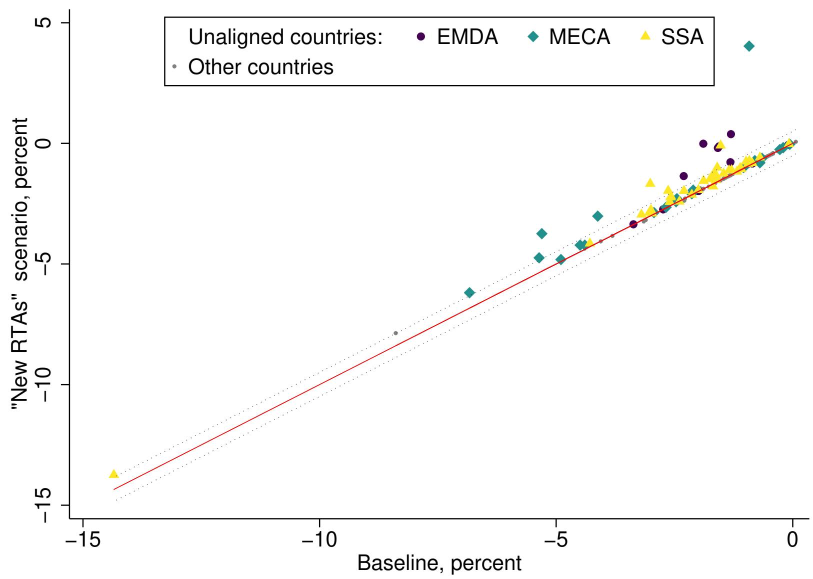
Table 3: Overview of real-income changes across different counterfactual scenarios

		(1)	(2)	(3) **Baseline**	(4) **Alternative counterfactuals**	(5)	(6)	(7)
		Polarization	Increased geosensitivity	**Polarization and increased geosensitivity**	Endogenous RTAs	$\{\theta_s\}_s$ from Fontagne et. al. 2022	New RTAs	New blocs
Advanced Economies	Median	-0.06	-0.89	-0.94	-1.58	-0.91	-0.94	-0.92
	1st quartile	-0.18	-1.12	-1.30	-2.28	-1.29	-1.30	-1.28
	3rd quartile	-0.01	-0.70	-0.75	-1.37	-0.75	-0.75	-0.74
Emerging And Developing Asia	Median	-0.43	-0.67	-1.58	-2.78	-1.23	-1.21	-1.60
	1st quartile	-0.72	-0.85	-2.01	-3.75	-1.88	-1.97	-1.97
	3rd quartile	-0.40	-0.50	-1.20	-2.08	-1.04	-0.67	-1.13
Latin America And The Caribbean	Median	-0.11	-0.81	-0.83	-1.38	-0.76	-0.84	-0.80
	1st quartile	-0.36	-1.36	-1.41	-2.85	-1.33	-1.42	-1.41
	3rd quartile	-0.01	-0.61	-0.46	-0.82	-0.39	-0.46	-0.46
Middle East And Central Asia	Median	0.22	-1.18	-0.82	-1.61	-0.64	-0.82	-0.81
	1st quartile	0.07	-2.02	-1.36	-2.34	-1.10	-1.36	-1.33
	3rd quartile	0.45	-0.75	-0.54	-1.05	-0.39	-0.54	-0.53
Sub-Sahara Africa	Median	-0.40	-1.44	-2.10	-4.05	-1.33	-2.05	-1.97
	1st quartile	-0.70	-2.07	-3.15	-5.85	-2.34	-3.02	-2.99
	3rd quartile	-0.19	-0.65	-0.92	-1.52	-0.66	-0.86	-0.94

Note: Table shows the distribution of real GDP per worker changes in steady state by region under different fragmentation scenarios. The "geopolitical polarization" scenario is defined in Section 4.1.1. The "increased geopolitical sensitivity" scenario is defined in Section 4.1.2. The combined "Baseline" scenario is defined in Section 4.1.3. The "endogenous RTA" scenario is defined in Section 4.4.1. The scenario with elasticities from Fontagné et al. (2022) is defined in Section 4.4.2. The "new RTAs" and "new blocs" scenarios are defined in Section 4.4.3. Steady-state real GDP changes are computed by means of exact-hat algebra, as described in Section 3.1.

We begin with the assumption that, alongside the trade-barrier changes from our baseline geoeconomic fragmentation scenario, "neutral" economies in Emerging and Developing Asia, the Middle East and Central Asia, and Africa sign new RTAs with all other "neutral" economies in their region with which an RTA is not already in place. The details of this scenario are provided in Appendix A.4.2. It is inspired by recent efforts in Asia (CPTPP and RCEP) and Africa (AfCFTA) to promote deeper regional trade integration.

Figure 7: Welfare changes in the baseline and "new RTAs" scenario



Note: Figure plots welfare changes in the "new RTAs" scenario, as discussed in Section 4.4.3 (vertical axis), versus baseline scenario (horizontal axis) in percent of GDP. The colored labels represent non-aligned countries (EMDA - Emerging and Developing Asia, MECA - Middle East and Central Asia, SSA - Sub-Saharan Africa). The red line is a 45-degree line, dashed lines represent 0.5 percentage points deviation from the red line.

Figure 7 illustrates that more regional trade integration does have the potential to offset some of the losses to "neutral" economies from geoeconomic fragmentation. However, for most economies in the three relatively "neutral" regions, the income losses avoided are smaller than 0.5 percentage points. As a result, the global distribution of real-income losses is hardly altered compered with our baseline scenario (column 6 of Table 3). This is partly because there are already a number of RTAs present in these regions, and partly because we estimate the trade-barrier reducing effect of the average RTA to be modest (see Table 1). It would suggest that, in order for regional trade integration to play a substantial role in limiting the fallout from geoeconomic fragmentation, countries would need to pursue more ambitious integration agreements than the average RTA in our sample and complement it with other trade-promoting measures.[19]

"Neutral" Economies Join Major Blocs

"Neutral" economies may also offset the losses stemming from geoeconomic fragmentation by more closely aligning their foreign policy with one of the two major geopolitical blocs. In this counterfactual, we let economies opportunistically join the bloc with which they enjoy the strongest pre-existing trade ties (see detail in Appendix A.4.3) and then introduce geoeconomic fragmentation as in the baseline scenario (see section 4.1.3). The purpose of the scenario is to give a sense of the economic damages "neutral" economies can expect to avoid by actively choosing a side.[20]

Figure 8 illustrates that geopolitical realignment has somewhat greater potential to offset the impact of geoeconomic fragmentation than the new trade agreements explored in the previous subsection: "neutral" economies moderate their losses compared to the baseline fragmentation scenario by 0.8 percentage points on average. However, the gains from lower trade barriers with one of the two geopolitical blocs are generally not sufficient to offset the overall losses from the increased sensitivity of trade barriers to geopolitical distance coupled with increased distances. Consequently, the least aligned economies still experience significant welfare losses in this scenario.

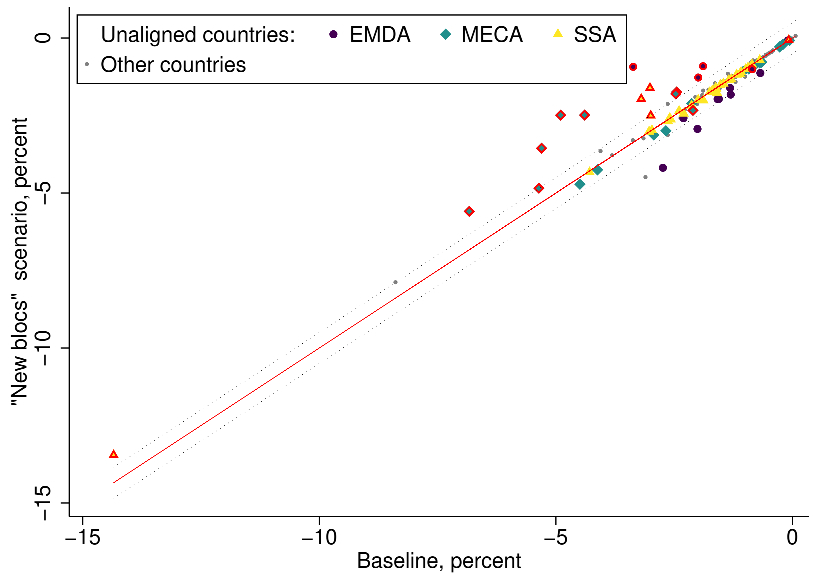
5 Conclusion

This paper assesses the macroeconomic impact across countries of a possible fragmentation of international trade along geopolitical lines. To this end, it assembles novel sector-level evidence on the role geopolitical alignment already plays in shaping trade patterns between economies. Interpreting these findings through the lens of structural gravity, it shows that geopolitical distance acts as a barrier to trade, even after controlling for standard trade determinants, including the presence of trade agreements. However, this effect is stronger in

[19]For a discussion of this in the context of the AfCFTA agreement, see ElGanainy et al. (2023).

[20]Note that only considering its pre-fragmentation trade shares is not necessarily optimal from the vantage point of a "neutral" economy choosing a bloc to join. This is because others' choices may influence an economy's outcomes in any given bloc. Ideally, one may therefore wish to analyze the Nash equilibrium of a global economy in which "neutral" economies choose their ideal blocs given the choices made by all other economies. Such an analysis is beyond the scope of our paper.

Figure 8: Welfare changes in the baseline and "new blocs" scenario



Note: Figure plots welfare changes in the "new blocs" scenario, as discussed in Section 4.4.3 (vertical axis), versus baseline scenario (horizontal axis) in percent of GDP. The colored labels represent non-aligned countries (EMDA - Emerging and Developing Asia, MECA - Middle East and Central Asia, SSA - Sub-Saharan Africa). The red marker outline identifies countries that switched blocs in the "New blocs" scenario. The red line is a 45-degree line, dashed lines represent 0.5 percentage points deviation from the red line.

some sectors—notably, food and high-end manufacturing—than in others.

We use this evidence to discipline geoeconomic fragmentation scenarios in a many-country, many-sector dynamic trade model, and find that the long-run impact of fragmentation is sizeable and highly heterogeneous across countries. In particular, smaller economies and those not closely aligned geopolitically with a major global market suffer the largest real-income losses. For the median EMDE in Asia, losses are 80 percent larger than for the median advanced economy, and they are respectively 120 percent and 150 percent larger for the median EMDE in the Middle East and sub-Saharan Africa. We find that potential measures that non-aligned countries could take to mitigate the fallout from geoeconomic fragmentation—such as deepening regional trade integration—would only reduce their losses to a limited extent.

Our findings have several policy implications. First, and most obviously, it would be ideal to avoid or limit the fragmentation of the global trade landscape. Previous studies have already shown that higher trade barriers would imply efficiency losses for the global economy. Our work adds to this robust evidence that there are also equity grounds to be concerned about geoeconomic fragmentation, as some of the world's poorest economies would likely be worst affected. Second, there may be scope for economies that do not clearly belong in any major geoeconomic bloc to limit their losses by seeking closer integration with other non-aligned partners in their regions. However, such economic integration efforts would need to be wide-reaching and ambitious to offset their likely income losses due to geoeconomic fragmentation. Third and finally, to the extent that geoeconomic fragmentation cannot be avoided, EMDEs may need to brace for a decade in which global trade trends no longer act as a tailwind as in recent decades, but as a headwind instead.

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A Appendix

A.1 Robustness Checks

A.1.1 Different Time Periods

We perform the estimation described in Section 2.1.2 for different years between 1993 and 2018. Table A1 reports the resulting estimates of the effect of foreign policy alignment on bilateral trade barriers. The estimated effects mostly retain their expected negative sign. Moreover, the ranking of sectors in terms of the responsiveness of trade barriers to foreign policy alignment appears to be stable over time. This suggests that sensitivity of trade-barriers to geopolitics is an inherent sector characteristic that varies little, even over the span of decades. It supports one of the key assumption made in our geoeconomic fragmentation scenarios of Section 4, which holds that—even as geopolitics becomes a more important driver of trade barriers—a sector's place in the ranking of trade sensitivity to foreign policy alignment remains unchanged.

A.1.2 Different Country-Pair Samples

We also repeat the estimation from Section 2.1.2 for different sub-samples of exporting and importing countries, with results reported in Table A2. We consider samples in which exporting or importing countries belong only to the group of advanced economies or EMDEs. In all sub-samples and across most sectors, foreign policy alignment is estimated to have negative effect on bilateral trade barriers. The ranking of sectors in terms of trade sensitivity to foreign policy alignment is also broadly preserved.

The estimated effects of foreign policy alignment are larger in absolute terms when the sample is restricted to country pairs in which at least one partner (exporter or importer) is an advanced economy. While data quality is a concern in our use of the EORA database, this is less pertinent in relation to trade flows that involve advanced economies, which tend to be more accurately reported. For this reason, it is reassuring that our results are, if anything, stronger if we limit ourselves to pair observations that involve at least one advanced economy.

Table A1: Sensitivity of bilateral trade barriers to foreign policy alignment by sector and year

Dep. variable: Ln value of bilateral imports (net of MRTs)	1	2	3	4	5	6	7	8	9	10
1993	-0.036	-0.007	-0.127	-0.140	-0.076	0.018	-0.038	0.019	-0.455	-0.152
	(0.010)***	(0.013)	(0.037)***	(0.017)***	(0.011)***	(0.006)***	(0.014)***	(0.013)	(0.142)***	(0.016)***
1998	-0.030	-0.013	-0.041	-0.099	-0.008	0.044	-0.003	0.066	-0.504	-0.121
	(0.010)***	(0.009)	(0.038)	(0.018)***	(0.018)	(0.006)***	(0.014)	(0.014)***	(0.150)***	(0.017)***
2003	0.012	0.060	-0.167	-0.128	0.010	-0.000	-0.057	0.001	-0.417	-0.162
	(0.010)	(0.016)***	(0.036)***	(0.019)***	(0.019)	(0.006)	(0.014)***	(0.014)	(0.202)**	(0.016)***
2008	0.010	0.035	-0.280	-0.081	-0.022	-0.026	-0.098	-0.001	-1.082	-0.172
	(0.011)	(0.008)***	(0.034)***	(0.024)***	(0.031)	(0.006)***	(0.012)***	(0.026)	(0.137)***	(0.022)***
2013	-0.003	0.022	-0.330	-0.140	-0.062	-0.027	-0.107	-0.069	-1.233	-0.217
	(0.009)	(0.007)***	(0.032)***	(0.017)***	(0.008)***	(0.006)***	(0.012)***	(0.011)***	(0.122)***	(0.016)***
2018	-0.014	0.023	-0.249	-0.148	-0.073	-0.024	-0.098	-0.025	-0.340	-0.192
	(0.010)	(0.010)**	(0.034)***	(0.015)***	(0.008)***	(0.006)***	(0.014)***	(0.011)**	(0.124)***	(0.016)***

Table A2: Sensitivity of bilateral trade barriers to foreign policy alignment by sector and country group

Dep. variable: Ln value of bilateral imports (net of MRTs)	1	2	3	4	5	6	7	8	9	10
All	-0.014	0.023	-0.249	-0.148	-0.073	-0.024	-0.098	-0.025	-0.340	-0.192
	(0.010)	(0.010)**	(0.034)***	(0.015)***	(0.008)***	(0.006)***	(0.014)***	(0.011)**	(0.124)***	(0.016)***
AE exporters	-0.075	-0.048	-0.792	-0.394	-0.176	-0.121	-0.281	-0.245	-1.491	-0.347
	(0.022)***	(0.016)***	(0.073)***	(0.029)***	(0.017)***	(0.013)***	(0.031)***	(0.021)***	(0.285)***	(0.031)***
EMDE exporters	-0.034	0.018	-0.256	-0.144	-0.080	-0.033	-0.122	-0.035	-0.771	-0.228
	(0.011)***	(0.012)	(0.039)***	(0.017)***	(0.009)***	(0.007)***	(0.016)***	(0.013)***	(0.134)***	(0.018)***
AE importers	-0.115	-0.026	-0.824	-0.312	-0.240	-0.132	-0.371	-0.250	-2.605	-0.398
	(0.020)***	(0.015)*	(0.068)***	(0.028)***	(0.016)***	(0.012)***	(0.030)***	(0.021)***	(0.268)***	(0.032)***
EMDE importers	0.004	0.022	-0.164	-0.135	-0.037	-0.015	-0.061	-0.008	-0.029	-0.169
	(0.011)	(0.012)*	(0.040)***	(0.017)***	(0.010)***	(0.007)**	(0.016)***	(0.013)	(0.142)	(0.019)***

Note: Tables report the estimation results from the regression in equation (9) with a full vector of bilateral country-pair characteristics. Standard errors in parentheses. Every column reports results for one sector: 1 – Agriculture and fishing; 2 – Mining and Quarrying; 3 – Food & Beverages; 4 – Textiles & Apparel; 5 – Wood & Paper; 6 - Petroleum, Chemical and Non-Metallic Mineral Products; 7 – Metal Products; 8 – Electrical Machinery; 9 – Transport Equipment; 10 – Other. Every regression has 14,535 observations covering 185 countries. *, **, and *** indicate statistical significance at 10%, 5%, and 1%, respectively

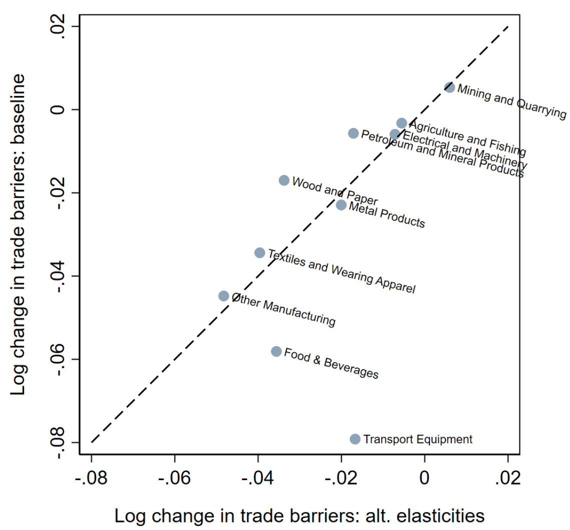
A.1.3 Different Trade Elasticities

In our baseline estimations, with results reported in Section 2.3.1, we convert our first-stage bilateral fixed-effect estimates into trade-barrier-equivalent values using trade elasticities taken from Caliendo and Parro (2015). Here, we instead perform the conversion using a more recent set of elasticity estimates from Fontagné et al. (2022).

Both sets of elasticities are reported in Table A3. For most sectors, the elasticities are comparable in size. The one notable exception is "transport equipment", with Caliendo and Parro (2015) estimating an elasticity of 0.69 and Fontagné et al. (2022) estimating an elasticity of 3.27. As a result, with the exception of this sector, the effect of foreign policy alignment on trade barriers is found to be similar irrespective of which set of elasticities is used. This is shown in Figure A1 below. However, "transport equipment" is an important sector for our analysis, both because it accounts for a large share the value of international trade flows and because, with our baseline set of trade elasticities, it stands out as the sector in which trade barriers are potentially most sensitive to foreign policy alignment.

For this reason, we perform our main geoeconomic fragmentation scenarios with both sets of elasticities in Section 4. We show in Section 4.4.2 that the choice of elasticities does not affect our headline findings materially either way.

Figure A1: Impact of closer foreign policy alignment on bilateral trade barriers by sector under different trade elasticities



This Figure plots the estimated effects of geopolitical alignment on trade barriers using trade elasticities from Caliendo and Parro (2015) (vertical axis) and Fontagné et al. (2022) (horizontal axis)

A.2 Calibration

In this section, we describe how we obtain the steady-state sectoral bilateral trade shares, $\{v_{sn'n}\}_{s,n',n}$, and world GDP shares, $\{h_n\}_n$, using observed data from EORA and the structure of our model, assuming unchanged trade barriers.

We can take average sectoral bilateral trade shares and world GDP shares from EORA for the period 2017–19. Denote these as $\{v_{sn'n0}\}_{s,n',n}$ and $\{h_{n0}\}_n$, respectively. We can also take capital stocks per worker for 2018 from PWT, denoting them as $\{k_{n0}\}_n$. In the same logic as the exact-hat algebra in Section 3.3.1, we can then write:

$$\frac{v_{sn'n}}{v_{sn'n0}} = \frac{\left\{\frac{f_{n'}}{f_{n'0}}\left[\prod_{s=1}^{S}\left(\frac{v_{sn'n'}}{v_{sn'n'0}}\right)^{\frac{1}{\theta_s}\frac{\sigma_{sn'}}{1-\sum_s \sigma_{sn'}\mu_s}}\right]^{\mu_s}\right\}^{-\theta_s}}{\sum_{n'=1}^{N}\left\{\frac{f_{n'}}{f_{n'0}}\left[\prod_{s=1}^{S}\left(\frac{v_{sn'n'}}{v_{sn'n'0}}\right)^{\frac{1}{\theta_s}\frac{\sigma_{sn'}}{1-\sum_s \sigma_{sn'}\mu_s}}\right]^{\mu_s}\right\}^{-\theta_s} v_{sn'n0}}, \tag{31}$$

$$\frac{f_n}{f_{n0}}\left(\frac{k_n}{k_{n0}}\right)^{\alpha} h_{n0} = \sum_{s=1}^{S}(1-\mu_s)\sum_{n'=1}^{N}\frac{v_{snn'}}{v_{snn'0}} v_{snn'0}\sigma_{sn'}q_{n'}\frac{f_{n'}}{f_{n'0}}\left(\frac{k_{n'}}{k_{n'0}}\right)^{\alpha} h_{n'0}, \tag{32}$$

$$q_n\frac{f_n}{f_{n0}}\left(\frac{k_n}{k_{n0}}\right)^{\alpha} h_{n0} = \sum_{s=1}^{S}\sum_{n'=1}^{N}\frac{v_{snn'}}{v_{snn'0}} v_{snn'0}\sigma_{sn'}q_{n'}\frac{f_{n'}}{f_{n'0}}\left(\frac{k_{n'}}{k_{n'0}}\right)^{\alpha} h_{n'0}, \tag{33}$$

$$\frac{R-(1-\delta)}{R_0-(1-\delta)\frac{P_{n1}}{P_{n0}}} = \left[\prod_{s=1}^{S}\left(\frac{v_{snn}}{v_{snn0}}\right)^{-\frac{1}{\theta_s}\frac{\sigma_{sn'}}{1-\sum_s \sigma_{sn'}\mu_s}}\right]\left(\frac{k_n}{k_{n0}}\right)^{\alpha-1}. \tag{34}$$

Note that everything needed to solve for $\{v_{sn'n}/v_{sn'n0}\}_{s,n',n}$ and $\{f_n/f_{n0}\}_n$ in equations (31)-(34) is known, except $\{[R-(1-\delta)]/R_0-(1-\delta)P_{n1}/P_{n0}\}_n$. We assume that the U.S. economy is close to steady state as of 2018, which lets us use equation (20) to obtain

$$\frac{R-(1-\delta)}{R_0-(1-\delta)\frac{P_{n1}}{P_{n0}}} = \frac{P_{USA,1}Y_{USA,1}/\left(P^I_{USA,0}K_{USA,1}\right)}{P_{n1}Y_{n1}/\left(P^I_{n0}K_{n1}\right)}. \tag{35}$$

The right-hand side of this equation can then be computed using real GDP, capital stock and investment price data from PWT, treating 2018 as "period 0" and 2019 as "period 1".

A.3 Decomposition of Trade-Barrier Changes

As described in Sections 3.3.2 and 4.1, the trade-cost changes introduced in our baseline counterfactual have two components: an increase in the sensitivity of trade barriers to foreign policy alignment that is uniform across sectors, $\hat{\beta}_s^{align} = \hat{\beta}$ for all s; and a set of changes in bilateral alignments, $\left\{\triangle u_{n'n}^{align}\right\}_{n'n}$, where $\triangle u_{n'n}^{align} \equiv \left(\hat{u}_{n'n}^{align} - 1\right) u_{n'n}^{align}$. Hence, we can write equation (29) as

$$\ln \hat{\tau}_{sn'n} = -\frac{\tilde{\beta}_s^{align}}{\theta_s}\left[\left(\hat{\beta} - 1\right) u_{n'n}^{align} + \hat{\beta}\triangle u_{n'n}^{align}\right] \qquad \forall\, n' \neq n. \tag{36}$$

Then the average rise in import barriers faced by country n can be written as

$$\ln \hat{\tau}_n = -\sum_{n'\neq n}\sum_{s=1}^{S} \omega_{sn'n}\frac{\tilde{\beta}_s^{align}}{\theta_s}\left[\left(\hat{\beta} - 1\right) u_{n'n}^{align} + \hat{\beta}\triangle u_{n'n}^{align}\right], \tag{37}$$

where $\omega_{sn'n} \equiv M_{sn'n}/\sum_s \sum_{n'\neq n} M_{sn'n}$; and $M_{sn'n}$ is the 2017–19 average import value by country n from n' in sector s. As equation (37) makes clear, the increase in import barriers faced by country n as a result of geoeconomic fragmentation is driven by three factors:

1. the exposure of the import basket of country n to sectors which are sensitive to geopolitical alignment, represented by $\sum_s \sum_{n'\neq n} \omega_{sn'n}\tilde{\beta}_s^{align}/\theta_s$.

2. the initial alignment of country n with its trade partners, represented by $\sum_s \sum_{n'\neq n} \omega_{sn'n} u_{n'n}^{align}$.

3. the change in alignment of country n vis-Ã -vis its trade partners, represented by $\sum_s \sum_{n'\neq n} \omega_{sn'n}\triangle u_{n'n}^{align}$.

Now define $\omega_n = \sum_s \sum_{n'\neq n} M_{sn'n}/\sum_n \sum_s \sum_{n'\neq n} M_{sn'n}$, and

$$\ln \hat{\tau} \equiv \sum_{n=1}^{N}\sum_{n'\neq n}\sum_{s=1}^{S} \ln \omega_{sn'n}\omega_n \hat{\tau}_{sn'n}, \tag{38}$$

$$\frac{\beta}{\theta} \equiv \sum_{n=1}^{N}\sum_{n'\neq n}\sum_{s=1}^{S} \omega_{sn'n}\omega_n \frac{\tilde{\beta}_s^{align}}{\theta_s}, \tag{39}$$

$$u \equiv \sum_{n=1}^{N}\sum_{n'\neq n}\sum_{s=1}^{S} \omega_{sn'n}\omega_n u_{sn'n}, \tag{40}$$

$$\triangle u \equiv \sum_{n=1}^{N}\sum_{n'\neq n}\sum_{s=1}^{S} \omega_{sn'n}\omega_n \triangle u_{sn'n}. \tag{41}$$

Under these definitions, $\ln \hat{\tau}$ is the average change in import barriers due to geoeconomic fragmentation across countries; β/θ is the alignment sensitivity of the average country's import basket; u is the average bilateral foreign policy alignment; and $\triangle u$ is the average change in bilateral foreign policy alignment. We can then decompose the change in trade barriers applying to imports by country n from country n' in sector s as follows:

$$\ln \hat{\tau}_{sn'n} = \ln \hat{\tau} + \ln \hat{\tau}_s^{\beta} + \ln \hat{\tau}_{n'n}^{u} + \ln \hat{\tau}_{n'n}^{\triangle u} + \eta_{sn'n} \qquad \forall\, n' \neq n, \tag{42}$$

where

$$\ln \hat{\tau}_s^{\beta} \equiv -\left(\hat{\beta} - 1\right) u \left(\frac{\tilde{\beta}_s^{align}}{\theta_s} - \frac{\beta}{\theta}\right), \tag{43}$$

$$\ln \hat{\tau}_{n'n}^{u} \equiv -\left(\hat{\beta} - 1\right) \frac{\beta}{\theta} \left(u_{n'n} - u\right), \tag{44}$$

$$\ln \hat{\tau}_{n'n}^{\triangle u} \equiv -\frac{\beta}{\theta} \left(\triangle u_{n'n}^{align} - \triangle u\right). \tag{45}$$

Here, $\ln \hat{\tau}_s^{\beta}$ is the relative effect of geoeconomic fragmentation on the bilateral trade barrier that is due to the difference in sensitivity to foreign policy alignment of sector s from the average sector; $\ln \hat{\tau}_{sn'n}^{u}$ is the relative effect due to the difference of the bilateral alignment of countries n and n' from the world average; and $\ln \hat{\tau}_{sn'n}^{\triangle u}$ is the relative effect that is due to the difference in the alignment *change* between the two countries from the world average. The term $\eta_{sn'n}$ is a residual that is uncorrelated, to a first order, with the other right-hand-side terms. Note that, given the definitions above, the weighted average of $\ln \hat{\tau}_s^{\beta}$, $\ln \hat{\tau}_{sn'n}^{u}$, $\ln \hat{\tau}_{sn'n}^{\triangle u}$, and $\eta_{sn'n}$ is zero by construction.

A.4 Additional and Alternative Counterfactuals

A.4.1 Economic Agreements Based on Geopolitical Alignment

In Section 2.3.2, we show that the magnitude of the estimated responsiveness of trade barriers to geopolitical alignment, $\tilde{\beta}_s^{align}$, generally rises if we omit economic agreements from the regressions (Tables 1 and 2).

One interpretation of this finding is that that foreign policy alignment, in addition to its direct barrier-reducing effects, also promotes joint participation in economic agreements. Formally,

$$u_{n'n}^{WTO} = \upsilon^{WTO} + \lambda^{WTO} u_{n'n}^{align} + \varepsilon_{n'n}^{RTA}, \tag{46}$$

$$u_{n'n}^{RTA} = \upsilon^{RTA} + \lambda^{RTA} u_{n'n}^{align} + \varepsilon_{n'n}^{RTA}, \tag{47}$$

$$u_{n'n}^{EU} = \upsilon^{EU} + \lambda^{EU} u_{n'n}^{align} + \varepsilon_{n'n}^{RTA}. \tag{48}$$

Denote the coefficient estimate for variable l in sector s from Table 1 as $\tilde{\beta}_s^{l,T1}$, and from Table 1 (Panel B) as $\tilde{\beta}_s^{l,T2}$. Then the assumptions in equations (46)-(48) imply:

$$\tilde{\beta}_s^{align,T2} = \tilde{\beta}_s^{align,T1} + \tilde{\beta}_s^{WTO,T1}\tilde{\lambda}^{WTO} + \tilde{\beta}_s^{RTA,T1}\tilde{\lambda}^{RTA} + \tilde{\beta}_s^{EU,T1}\tilde{\lambda}^{EU}. \tag{49}$$

That is, the estimates of the sensitivity of trade barriers to foreign policy alignment in Table 1 (Panel B) encompass the direct effect of alignment on trade barriers (from Table 1, Panel A) as well as the indirect effect via the role of foreign policy alignment in fostering economic agreement that, in turn, promote trade. On this basis, we repeat out baseline geoeconomic fragmentation experiment using $\left\{\tilde{\beta}_s^{align,T2}\right\}_s$ as the sectoral sensitivities of trade barriers to geopolitics, and we interpret the resulting income effects as the outcome when foreign policy alignments are allowed to affect trade barriers directly as well as indirectly via the likelihood of participation in economic agreements.

A.4.2 "Neutral" Economies Sign New RTAs

Assume that, alongside geoeconomic fragmentation, a number of country pairs sign new RTAs. Then equation (29) becomes:

$$\hat{\tau}_{sn'n} = \begin{cases} \exp\left\{-\frac{1}{\theta_s}\left(\hat{\beta}_s^{align}\hat{u}_{n'n}^{align} - 1\right)\tilde{\beta}_s^{align}u_{n'n}^{align} - \frac{1}{\theta_s}\tilde{\beta}_s^{RTA}\triangle u_{n'n}^{RTA}\right\} & \text{if } n' \neq n \\ 1 & \text{otherwise} \end{cases}, \tag{50}$$

where $\{\hat{\beta}_s^{align}\}_s$ and $\{\hat{u}_{n'n}^{align}\}_{n'n}$ are still disciplined as described in Section 4.1, and $\triangle u_{n'n}^{RTA}$ represents changes in the RTA dummy.

In the first of the two counterfactuals discussed in Section 4.4.3, we impose that $\triangle u_{n'n}^{RTA} = 1$ if i) economies n' and n both belong to the "neutral" bloc of countries; and ii) economies n' and n both belong in either Emerging and Developing Asia region, or the Middle East and Central Asia region, or the Africa region. Otherwise, we set $\triangle u_{n'n}^{RTA} = 0$. This amounts to assuming that "neutral" economies sign new RTAs with other "neutral" countries in their respective regions, where such RTAs are not already in place, and that the trade-promoting impact of these RTAs is the same as for the average RTA in our sample, given by the estimates $\{\tilde{\beta}_s^{RTA}\}_s$ from Section 2.3.1.

A.4.3 "Neutral" Economies Join Major Blocs

For each "neutral" economy, we calculate the share of trade with the Eastern and Western blocs, as defined in Section 4.1.1, based on the 2017–19 trade data described in Section 2.2.1. Then, we assign the economy to one of the two blocs if its trade share with that bloc is at least 10 percentage points larger than the trade share with the other bloc. If its trade shares with the Eastern and Western blocs are within 10 percentage points of each other, the economy is assumed to remain "neutral". Using this assignment rule, 18 of the "neutral" economies join the Western bloc, while 1 economy joins the Eastern bloc. Having assigned the economies to their respective blocs, we perform the same baseline fragmentation scenario as in section 4.1.3.

Table A3: Sector sample, input shares and trade elasticities

Sector code (s)	Sector name	Input share (μ_s)	Trade elasticity, (θ_s) CP 2015	FGO 22
1	Agriculture and fishing	.434	8.11	4.78
2	Mining and quarrying	.405	15.72	13.97
3	Food and beverages	.697	2.55	4.16
4	Textiles and wearing apparel	.691	5.56	4.83
5	Wood and paper	.667	9.95	5.01
6	Petroleum, chemical and non-metallic mineral products	.716	15.06	5.01
7	Metal products	.738	6.15	7.03
8	Electrical and machinery	.685	8.19	6.80
9	Transport equipment	.743	.69	3.27
10	Other manufacturing	.667	5.00	4.64
11	Services	.432	5.00	5.00

Note: "Input share" shows the calibrated sectoral Cobb-Douglas share on intermediate inputs, computed from EORA for the period 2017–19 as described in Section 3.4. "Trade elasticity" shows the calibrated sectoral trade elasticity: CP 2015 is aggregated from Caliendo and Parro (2015), and Costinot and Rodríguez-Clare (2014), and FGO 22 is aggregated from Fontagné et al. (2022).