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The economic costs of supply chain decoupling

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Abstract:

As countries and firms increasingly seek ways to strengthen the resilience of their supply chains, this paper studies the global economic costs of a decoupling of global supply chains along geopolitical lines as well as in strategic sectors. We explore not only the long-run effects, but also the short-run costs stemming from rigid wages and low substitutability across factors of production and input goods. We find that, in terms of welfare losses, the costs of decoupling are roughly five times higher in the short-run compared to the long-run, while country losses are heterogeneous. A reshaping of global supply chains increases the level of consumer prices in most countries, as well as producer prices, especially for trade-intensive manufacturing sectors. Global supply chain decoupling entails also a reallocation of labour across skill levels. Finally, global trade would decrease substantially, driven by lower trade in intermediate inputs and a higher reliance of countries on domestic production.

Keywords: International trade, trade modelling, global value chains, decoupling

JEL classification: F12, F13, F14, F51, F62

Non-technical summary

The shocks that have hit the global economy over the past few years (e.g., COVID-19 pandemic, the Russian war in Ukraine) have exposed important economic vulnerabilities stemming from economic integration and provided renewed momentum to geopolitical tensions. Fears of a policy-driven reversal of economic integration have started to dominate the political and economic debate. Aiyar et al. (2023) refer to this as a process of geoeconomic fragmentation and warn of the multidimensional repercussions that such process might have.

This paper sets to investigate the global macroeconomic effects of a reconfiguration of supply chains motivated by geopolitical considerations. We start with a central hypothetical scenario in which global supply chains decouple across a China-led East and a US-led West blocs. In this scenario, trade in intermediate goods between the two blocs is fully impeded in all sectors of the economy. This scenario is in line with the recent academic literature on the topic while countries are mechanically allocated to each bloc according to their similarity in voting at the UN General Assembly. In a second step, we investigate three alternative (more realistic) scenarios. First, we assume that the East-West decoupling is limited only to sectors of strategic relevance. This is motivated by recent trade policy initiatives which restrict trade with geopolitical rivals only in key sectors.[1] Second, as it cannot be excluded that, under specific circumstances, trade restrictions apply also against "friendly countries" (e.g., as in the case of the domestic content requirements of the US Inflation Reduction Act (IRA)) the second alternative scenario considers a decoupling among regional free trade areas, limited again to strategic sectors, in the sense that trade in intermediate goods is also impeded with countries/regions that are not part of the same free trade area. Third, another variation of this scenario is where a decoupling among free trade areas affects all sectors of the economy.

[1] A case in point is the adoption from the part of the US of a number of export controls measures aimed to limit the access of Chinese companies to US equipment for the production of semiconductors.

We quantify the economic costs of these scenarios using the state-of-the-art multi-country multi-sector model of Baqaee and Farhi (2023). The model features sectoral production linkages and international trade in both intermediate and final goods, and thereby accounts for *amplification effects* via global production chains and for *substitution effects* via international trade. The model allows to track the propagation of shocks both downstream to consumers and upstream to suppliers, considering both direct and indirect trade linkages. Compared to other workhorse trade and DSGE models, the Baqaee-Farhi model has three main advantages: *(i)* it accounts for non-linearities, *(ii)* it allows to trace at a granular level the country-sector effects of a shock and allows to distinguish between trade in intermediate and final products, and *(iii)* it allows to account for the role of wage rigidities and limited substitution across inputs and production factors.

The model is calibrated on the multi-region Input-Output tables from the Asian Development Bank using data for the year 2017 and covers 73 countries. The extensive coverage of countries in the East bloc (including emerging South-East Asia and Latin America) is a key advantage for a more realistic modelling of East-West decoupling.

The main contribution of this paper to the growing literature on trade fragmentation relates to the modelling of the short-term transition costs which we find to be substantial (i.e., up to 5 times higher compared to the long-term costs). Therefore, focusing only on the long-term equilibrium, as it is the case in most of the existing papers, would underestimate the costs of supply chain decoupling. We model transition costs as short-term rigidities (in wage setting or difficulty to substitute more expensive foreign inputs with cheaper domestic ones) and look at two alternative model setups, *rigid* (sticky wages and reduced substitutability across inputs and factors of production) and *flexible* (flexible wages and a high substitutability between inputs and factors of production), which approximate the short-run and long-run effects of decoupling, respectively.[2]

[2] In an alternative reading, these two setups reflect both the uncertainty around model parameters as well as the potential effect of rigidities and therefore give a range of potential effects of fragmentation.

A second novelty of our work is that, in addition to the welfare and production effects which are the focus of the nascent literature, we look at the impact of decoupling on the price level and on trade. A decoupling shock leads to an increase in the price level, both for consumers and producers and may also have a distributional impact reflected in the relative evolution of wages for low, medium, and high skilled workers. A decoupling would cause substantial trade losses, notably for intermediate products.

From a purely economic perspective, this paper shows that trade fragmentation would be a lose-lose situation both at the global and at the country level and that the costs would be unevenly distributed, with countries more exposed to trade in intermediate goods being more affected compared to relatively more closed economies. While the estimates are subject to both upside and downside risks (depending on the magnitude and scope of any fragmentation scenario), from a purely economic perspective, trade fragmentation would entail sizeable costs in terms of substantially distorted trade, decreased welfare and higher prices.

1. Introduction

In recent years, geopolitical considerations have started to play an increasing role in shaping global trade relations (e.g., China-US tensions over concerns for national security). While criticism of globalization pre-dated the COVID-19 pandemic, the shocks that materialised since 2020 prompted countries to increasingly seek ways to reduce dependency from external suppliers for critical inputs/products. This can be seen in the growing number of trade restrictive measures adopted in recent years,[3] and in the adoption of (industrial) policies encouraging firms to reconfigure their supply chains. The latter aim at bringing the sourcing of critical inputs and/or production operations either back to the home country (re-shoring) or to allied/like-minded countries (friend-shoring). Examples of such policies are China's Dual Circulation strategy, US' CHIPS Act, and EU's Open Strategic Autonomy.[4] While the impact of these initiatives is not yet visible in hard trade data, a survey of 3,000 companies[5] showed that in 2022 a growing number of firms reported reducing the length of supply chains as their primary approach to reconfiguration. In particular, while diversification of the suppliers' base remains the firms' primary strategy to strengthen the resilience of supply chains (47% in 2021 and 48% in 2022), in 2022 about 20% of executives were pursuing regionalisation (versus 12% in 2021), and 15% were pursuing reshoring (versus just 5% in 2021) as their primary strategy.

Against this background, this paper sets to investigate the macroeconomic implications for the global economy of a range of supply chain reconfiguration scenarios motivated

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[3] Recent examples of -restrictive measures applied to GVC trade include: *(i)* the tariffs adopted by the Trump administration in the US as well as the recent US export ban on the sale of semi-conductors to China; *(ii)* in Japan: financial incentives for firms to re-shore from China back to Japan or to other ASEAN countries; *(iii)* the "Reshoring UK" initiative in the UK.

[4] Under the "dual circulation" adopted in 2020, China aims at (1) vertically integrating its production and achieving self-reliance served by its large domestic market, and (2) globalising China's home-grown companies by relying on the Belt and Road Initiative (BRI). EU's "open strategic autonomy" refers to the capacity of the EU to act autonomously in strategically important policy areas; this notably translate in economics by ensuring the resilience of the EU industrial system and its supply of critical inputs. The US CHIPS act of 2022 create large subsidies and incentives for the R&D and production of technological components in the US.

[5] See "Trade in Transition 2023" https://impact.economist.com/projects/trade-in-transition/key-findings-01/

by geopolitical considerations which we call "*supply chain decoupling*".[6] Our central scenario assumes a decoupling of the world economy into a China-led East and a US-led West bloc and that trade in intermediate goods between the two blocs is impeded across all sectors of the economy. Countries are mechanically allocated to each bloc according to the similarity of their voting pattern at the UN General Assembly (UNGA) *vis-à-vis* the US and China respectively.[7] This setup is in line with the most novel literature on the topic and focuses specifically on the impact of friend-shoring global value chains that is the sourcing of intermediate inputs of production from allied/like-minded countries.

In addition, we model three alternative scenarios, namely: a scenario where the East-West decoupling is limited to sectors of strategic relevance, one which considers a decoupling of the world economy into regions that are part of a free trade agreement and where trade in intermediate inputs is impeded only in strategic sectors, and one where the decoupling among regional free trade areas (RFTA) affects all sectors in the economy.

We use the state-of-the-art Baqaee and Farhi (2023) multi-country multi-sector model (henceforth, BF) which features sectoral production linkages and international trade in both intermediate and final goods, thereby accounting for *amplification effects* via global production chains and for *substitution effects* via international trade. The model allows to capture the propagation of shocks both downstream to consumers and upstream to suppliers, considering both direct and indirect trade linkages. Compared to other workhorse trade models as well as to DSGE models, the advantages of the BF model are twofold: *(i)* it accounts for non-linearities while other models largely rely on linear

[6] We prefer the term "supply chain decoupling" to indicate the ongoing trend towards re-shoring/near-shoring of supply chains to the term "trade fragmentation". While the latter is more widely used by commentators and academics alike (see Aiyar et al., 2023), it should be noted that in the trade literature of the early 2000s, the term *trade fragmentation* came to indicate the growing fragmentation of a production process into two or more steps that can be undertaken in different locations but that lead to the same final product (see Deardroff, 2001). As such the term fragmentation more appropriately describes the organization of production in globally integrated supply chains, whereas what we aim to investigate in this paper is a departure from this production model.

[7] Countries voting similarly to the US are allocated to the West bloc (i.e., mostly European countries, and other advanced economies such as Japan, Korea, Australia) while countries voting similarly to China are allocated to the East bloc (i.e., mostly emerging and developing economies).

production functions,[8] *(ii)* it allows a granular quantification of the effects on a country-sector level and allows to distinguish between trade in intermediate and final products. Moreover, differently from other workhorse trade models, the BF model also allows for the inclusion of rigidities. The latter are particularly relevant as transition costs can be substantial, therefore focusing only on the long-term equilibrium can underestimate the costs related to supply chain decoupling.

We calibrate the model on the multi-region Input-Output table from the Asian Development Bank (henceforth, ADB MRIO) using data for the year 2017. The data set covers 73 countries and compared to similar data sets offers an improved coverage of emerging regions such as South-East Asia and Latin America. The higher coverage of countries in the East bloc provides a more realistic modelling of the economic costs from decoupling for those countries.[9]

To account for transition costs, we quantify general equilibrium effects under two alternative model setups, *rigid* (i.e., sticky wages and reduced substitutability across inputs and factors of production) and *flexible (i.e.,* flexible wages and a high substitutability between inputs and factors of production). Given that rigidities are likely to be more binding in the short-term, we assume that the *rigid* setup is a plausible characterisation of the short-term effects, whereas the *flexible* setup better approximates long-run effects as rigidities dissipate over time as the economy adjusts to a new steady state. Typically, the literature on trade decoupling (e.g. Eppinger et al., 2021; Felbermayr et al., 2023; Goes and Bekkers, 2022; Javorcik et al., 2023) focuses on the *flexible* set up and to the best of our knowledge this is one of the first papers exploring the short-run effects of supply chain decoupling.[10]

[8] A key interest of the Baqaee and Farhi (2023) model is that despite non-linearities included, the framework remains tractable from a computational standpoint due to the used of differential hat-algebra.
[9] This is because a limited coverage in the East bloc would constrain the internal market for intermediate goods and therefore increase welfare losses from fragmentation.
[10] In an alternative reading, the polar setups reflect both the uncertainty around model parameters as well as the potential effect of rigidities and therefore give a range of potential effects of fragmentation.

Table 1 below summarises the results across all scenarios analysed in this paper. Starting from welfare losses, measured as the change in gross national expenditures, in our central scenario of a generalised decoupling (*upper-left chart*), we find relatively muted long-term welfare losses (i.e., *flexible* scenario) of around -2% and in line with the recent literature (among others, Eppinger et al., 2021; Felbermayr et al., 2023; Goes and Bekkers, 2022; Javorcik et al., 2023). However, under the *rigid* setup welfare losses are roughly 5 times higher. Economic losses would be higher when the generalised decoupling occurs among regional free trade areas (*upper-right chart*) with welfare losses ranging between -3.1% and -15.2%. Turning to a scenario of strategic decoupling (i.e., where trade is impeded only in sectors of strategic relevance), in the case of an East-West divide (*bottom-left chart*), global welfare losses range between -0.7% and -2.9%, whereas in a decoupling scenario among regional free trade areas (*bottom-right chart*) welfare losses are estimated between -1.1% and -4.6%.

Differently from existing studies, we also quantify the effects of decoupling on the price level and on trade volumes which are also reported in table 1. The price level increases across all scenarios in response to a decoupling shock as domestic producers substitute away from cheaper foreign inputs. In our central scenario (*upper-left chart*), the level of global consumer prices increases by 1.8% in the *flexible* and 8.4% in the *rigid* setup. Producer prices would increase as well, particularly in GVC intensive manufacturing sectors. The supply chain decoupling would also cause substantial trade losses, notably for intermediate products. In this scenario imports decline between 19% (*flexible* setup) and 30% (*rigid* setup). If limited only to strategic sectors (*bottom-left chart*), trade decoupling would result in smaller but non-negligible trade losses that range between 6% and 9%. Trade losses are stronger in the case of opposing regional trade blocs and range between 35% and 44% (*bottom-right chart*). Across scenarios, the decline in trade is mainly driven by a fall of trade in intermediates which decreases between 29% and 38% in our central scenario.

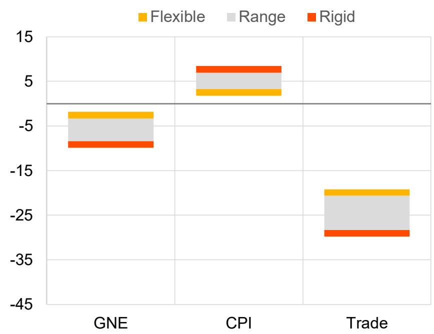
The rest of the paper is organized as follows: **section 2** reviews the literature on trade decoupling, **section 3** presents the most salient features of the Baqaee and Farhi (2023) model and its calibration. **Section 4** details the policy scenarios and **section 5** discusses the model-based estimates. **Section 6** concludes.

Table 1: Result matrix of the effects of alternative decoupling scenarios on global welfare, the price level and trade

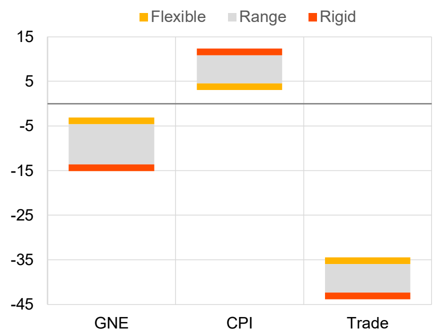
Axis 1: Country blocs

Axis 2: Sectors

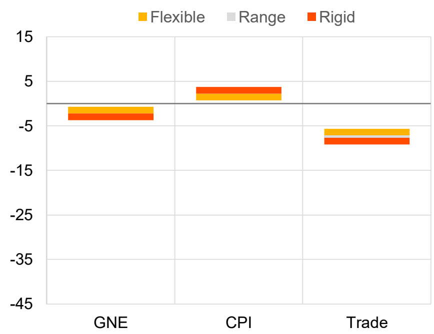
Generalised — Geopolitical (East-West)



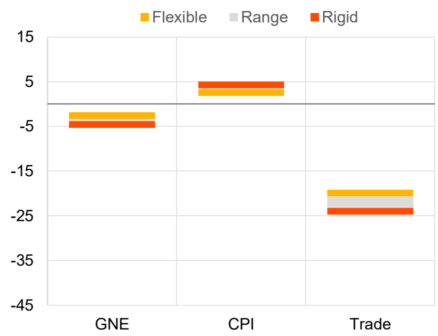
Generalised — Regional (based on free trade areas)



Strategic — Geopolitical (East-West)



Strategic — Regional (based on free trade areas)



Sources: Baqaee and Farhi (2023), Foreign Policy Similarity database, authors' calculations
Notes: Non-linear impact simulated through 25 iterations of the log-linearized model. GNE = Gross National Expenditures. Trade effects are measured by real imports. Results are reported in percentage deviation from steady state.

2. Literature review

This paper relates to the literature on the role of input-output linkages in the transmission of trade shocks. This rich literature has both theoretical (Acemoglu et al., 2012; Blanchard et al., 2016) and empirical grounds (Barrot and Sauvagnat, 2016; Inoue and Todo, 2019), and the conclusions about the role of supply chain linkages on shock propagation are not clear-cut as the effects depend on the nature of the shock (Carvalho and Tahbaz-Salehi 2019), the position in GVC (Ferrari, 2019), and the level of substitutability across inputs (Baqaee and Farhi, 2019). Such an ambiguity is illustrated by Borin et al. (2021) who find that higher GVC participation reduces exposure to demand shocks originating in the domestic market or in the direct trade partner but increases exposure to foreign demand shocks originating further downstream in the supply chains. Some recent literature generally points to a magnifying effect of GVCs in presence of global shocks – such as the Covid-19 pandemic (Sforza and Steininger, 2020; Eppinger et al., 2021). Our paper is in line with this literature, notably with recent analyses exploring the effects of large negative trade shocks such as Brexit (Cappariello et al., 2020) or the US-China trade dispute (Balistreri et al., 2018). We contribute to this literature by using the state-of-the-art model of Baqaee and Farhi (2023), which allows for a more granular quantification (both in terms of economic variables and time horizon) of the impact of a decoupling of GVCs.

This paper is closely related to the rapidly expanding literature on the effects of more fragmented trade flows (see Bolhuis et al., 2023). Generally, the impact is analysed though the lenses of multi-country multi-sector models *à la* Eaton and Kortum (2002) – most notably the Caliendo and Parro (2015) model or its Antràs and Chor (2018) extension – but also by means of large macroeconomic models e.g., METRO in OECD (2020) or World Bank's ENVISAGE in Chepeliev et al. (2022). Estimates of the welfare costs of decoupling are generally relatively similar, ranging from around 3% to 5% of world welfare as shown in **Table 2**, but come with large cross-country heterogeneities as small open economies are affected comparatively more. Illustrative of the uncertainty around the precise contour of trade decoupling, the scenario designs differ across studies. Most consider a global decoupling in which every country raises trade barriers against all partners (OECD, 2020; Bonadio et al., 2021; Eppinger et al., 2021; Chepeliev et al., 2022) while other focus on a bi-polar setup with a US-led bloc facing a China-led (or Russia-led) bloc (Wu et al., 2021; Goes and Bekkers, 2022; Campos et al., 2023).[11] A separate strand of the literature explores whether lower external dependence (i.e. a situation of trade decoupling between all countries) reduces exposure to shocks

[11] Goes and Bekkers (2022) in particular differentiates scenarios depending on whether the East bloc is led by Russia or China. They nevertheless find very similar geopolitical blocs and results in both cases.

compared to the existing level of trade integration. Their findings suggest that a renationalization of GVCs translates into lower resilience to shocks, as reduced diversification increases vulnerability to domestic shocks whose impact becomes stronger and more pervasive (OECD, 2020). Even at the sectoral level, reshoring does not improve resilience (Bonadio et al., 2021).

Table 2: Estimates for the impact of trade decoupling

	Geographies	Scenario	Impact
OECD (2020)	Global	Rise in tariffs (25%), increased subsidies (1% GDP), and halved trade elasticities	Global real GDP losses around 5%
Eppinger et al. (2021)	Global	Closing of trade in intermediates (barriers raised to infinity)	Real income losses from 2.5% (US) to 38% (Luxembourg)
Felbermayr et al. (2021; 2023)	EU *vs.* BRIC	Doubling of non-tariff barriers to trade between blocs	Real income losses of 1.5% in EU and of 4% in BRIC
Lim et al. (2021)	China *vs.* groups of countries (US, AE, ASEAN, RoW)	Rise in tariffs by 5% to 30% (depending on group) and 10% increase in transportation costs	GDP losses around 2% in US and 6% in ASEAN
Wu et al. (2021)	USA vs. China	Suppression of US-China bilateral trade – substituted by domestic or foreign suppliers	Real GDP losses around 2.5% in US and China
Campos et al. (2023)	Three blocs: East (China-led), West (US-led) and neutral	Rise of aggregate trade costs back to historical highs (since 1945)	Global income losses around 1.5%
Chepeliev et al. (2022)	Global	Rise in tariffs (25%), increased subsidies (1% GDP), and halved trade elasticities	Global income losses around 2%
Goes and Bekkers (2022)	Two geopolitical blocs: East (China-led) and West (US-led)	Increase of 150% in non-tariff trade costs	Global income losses around 5%

The contribution of this paper to the recent literature is threefold and relates to: 1) the use of a non-linear model (Baqaee and Farhi, 2023); 2) the modelling of the role of rigidities which in our view are a good proxy for the short-term effects, as they are likely to be more binding in the short term, and 3) a discussion of the effects on nominal variables. A common feature of existing studies (see **Table 2**) is that they generally focus on the long-run impact of trade decoupling by assuming a fully flexible economy. As such, the effects of short-term rigidities are ignored, despite the literature pointing to a significant impact of those (see e.g., Barkema et al., 2019, for the factor reallocation and Knell, 2013, for wage stickiness). Therefore, to remedy this shortcoming, this paper accounts for the role of rigidities and finds that the economic costs are much higher compared to a fully flexible setup. However, when rigidities are excluded, our results are similar to what is found in other papers. A second contribution is that we extend the analysis beyond welfare effects by investigating the impact on nominal variables (mainly consumer and producer prices as well as wages), as this is especially relevant from a central bank perspective. Our paper is closest to Goes and Bekkers (henceforth, GB) (2022) with whom we share a similar bloc design (East *vs.* West) and the central scenario assumption in which trade in intermediates between the blocs is fully shut down. We differ however in four key aspects namely: *(i)* we use of the Baqaee and Farhi (2023) model while GB use the Caliendo and Parro (2015) model extended with endogenous knowledge diffusion, *(ii)* we focus on the impact of short-term rigidities while GB consider a fully flexible economy, *(iii)* we discuss the implications on the price level, and *(iv)* we consider an extended set of scenarios.

3. Model overview

3.1 The Baqaee and Farhi (2023) model

We rely on the Baqaee and Farhi (2023) multi-country multi-sector model to quantify economic effects from trade decoupling. The model captures rich sectoral interlinkages through production networks and heterogeneities across countries, for example with respect to their endowments with factors of production. It considers a world economy with N different countries and J different sectors; each country is inhabited by one representative household and J producers, where each producer represents one given sector.

Producing sectors: Each sector j in country n produces output Y_n^j subject to a constant elasticity of substitution (CES) production function. These goods can be used either as intermediate goods for production in domestic or foreign sectors or consumed by households, also domestically or abroad. To produce goods, sectors use capital K_n^j and labour, which is differentiated into low skilled $L_n^{low,j}$, medium skilled $L_n^{mid,j}$ and high skilled labour $L_n^{high,j}$. Sectors also use an intermediate goods bundle M_n^j for production. The production technology is specified as follows:

$$Y_n^j = A_n^j \left[(1-\mu_n^j)^{\frac{1}{\theta}} (VA_n^j)^{\frac{\theta-1}{\theta}} + (\mu_n^j)^{\frac{1}{\theta}} (M_n^j)^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}}$$

where θ is the substitution elasticity between the capital-labour aggregate and the intermediate input bundle, μ_n^j the sector specific share of intermediate inputs in output and VA is the capital-labour aggregate. The latter is defined as

$$VA_n^j = \left(\sum_f^F (\alpha_{n,f}^j)^{\frac{1}{\gamma}} \ (f_n^j)^{\frac{\gamma-1}{\gamma}} \right)^{\frac{\gamma}{\gamma-1}}, \qquad \sum_f \alpha_{n,f}^j = 1$$

where γ is the substitution elasticity between factors of production, $\alpha_{n,f}^j$ is the factor intensity of factor f in country-sector nj and $f_n^j \in \{K_n^j, L_n^{low,j}, L_n^{high,j}, L_n^{mid,j}\}$.

The intermediate input bundle M_n^j is itself a nested CES aggregator. It is produced using different intermediate input goods:

$$M_n^j = \left(\sum_i^J (\mu_n^{i\to j})^{\frac{1}{\epsilon}} \ (M_n^{i\to j})^{\frac{\epsilon-1}{\epsilon}} \right)^{\frac{\epsilon}{\epsilon-1}}, \qquad \sum_i \mu_n^{i\to j} = 1$$

where $\mu_n^{i\to j}$ indicates the importance of good i for the intermediate good bundle used in production of sector j in country n. ϵ is the elasticity of substitution between different intermediate goods and $M_n^{i\to j}$ are intermediate goods produced by sector i that are used for production by country-sector nj. Moreover, those intermediate input goods can be sourced locally or abroad:

$$M_n^{i\to j} = \left(\sum_m^N (\mu_{m\to n}^{i\to j})^{\frac{1}{\tau_i}} \ (M_{m\to n}^{i\to j})^{\frac{\tau_i-1}{\tau_i}} \right)^{\frac{\tau_i}{\tau_i-1}}, \qquad \sum_m \mu_{m\to n}^{i\to j} = 1$$

where $\mu_{m\to n}^{i\to j}$ denotes the importance of country m to produce good i used as input in the production function of country-sector nj, τ_i is the sector-specific trade elasticity and $M_{m\to n}^{i\to j}$ are intermediate goods produced by country-sector mi that are used for production by country-sector nj.

Households: Households receive utility from consuming different goods, which can be produced in different countries. Denote C_n^j consumption by the household in country n of goods produced by sector j. Preferences by household n are given by the utility function

$$U(C_n) = \left(\sum_j^J (\zeta_n^j)^{\frac{1}{\sigma}} \, (C_n^j)^{\frac{\sigma-1}{\sigma}}\right)^{\frac{\sigma}{\sigma-1}}, \qquad \sum_j \zeta_n^j = 1$$

where σ is the elasticity of substitution between different final goods and $\zeta_n^j$is the importance of good j in the consumption basket of country n. As for intermediate goods, consumption goods can also be sourced both domestically and internationally:

$$C_n^j = \left(\sum_m^N \, (\zeta_{m\to n}^j)^{\frac{1}{\tau_j}} \, (C_{m\to n}^j)^{\frac{\tau_j-1}{\tau_j}}\right)^{\frac{\tau_j}{\tau_j-1}}, \qquad \sum_m \zeta_{m\to n}^j = 1$$

where $\zeta_{m\to n}^j$ denotes the importance of country m in the good j consumption of country n, and $C_{m\to n}^j$ are consumption goods produced by country-sector mj that are consumed in country n. While households can consume internationally, they supply factors of production domestically. The factor supply is exogenous – at least in the baseline version of the model.

Central banks: central banks target zero nominal GDP growth in domestic prices. They combat the inflationary effects of trade cost shocks by decreasing nominal spending which in turn decreases factor prices (see BF for details).[12]

[12] The model abstract from the role of governments and fiscal policy.

3.2 Workings of the model

By featuring sectoral interlinkages, the model accounts for *amplification effects* of trade shocks through production networks as well as *substitution effects* via international trade. The model response to a trade shock considers the endogenous reactions by a large variety of producers and consumers in an interconnected world economy. The transmission operates primarily through the price channel as higher barriers to trade create an import price shock. As a result, producers substitute away from more expensive foreign inputs, generating a demand shock for their upstream suppliers. The net effect of the substitution decisions by producers on the demand of each supplier may be either positive or negative depending on the latter's exposure to the shock. This also re-allocates production across countries, affecting trade along the way. It also affects demand for factors of production (capital and labour) leading to adjustments in production structures within countries. As the prices of capital and labour adjust, disposable incomes of households and their consumption patterns also change. Since consumption preferences differ by countries (e.g., type of products, provenance), demand for final products is also affected, which propagates upstream to producers. Besides these re-allocation effects, consumers also substitute across products given changes in the prices for final goods. These substitution and re-allocation channels generate general equilibrium effects on prices, demand, and supply, which in turn affects trade, production, and welfare.

Compared to other input-output trade models, the key advantage of the BF model is that it accounts for non-linear production functions while staying tractable from a computational standpoint. BF indeed allows for non-Cobb-Douglas production functions and in that sense their model can be viewed as a generalization of the workhorse input-output trade models such as Caliendo and Parro (2015) or Antràs and Chor (2018). However, in order to make the model tractable in terms of computational time and resources, BF resort to differential hat-algebra – instead of exact hat-algebra as in most of the literature (for example Costinot and Rodriguez-Clare, 2014). In the differential hat-algebra BF chain together local effects and solve a system of differential equations through several iterations – akin to Euler's method.[13] BF show that their approach is significantly faster than using exact hat-algebra through non-linear solvers, with largest improvements if the number of variables increases and if production functions are more non-log-linear. An important implication is that the BF model is able to generate realistically large impacts of trade barriers due to non-linear production networks (Bachmann et al., 2022).

In line with standard input-output models, trade shocks in the BF model can be simulated through either higher tariffs or iceberg trade costs. A major difference between the two shocks is that households will earn income generated from higher tariffs, whereas higher iceberg trade shocks generate no income.[14] The latter can be viewed as Hicks-neutral productivity shocks to the trading technology – meaning that transporting goods from one country to another will require additional costs in primary factors.

A key advantage of the BF model also lies in the possibility to account for nominal rigidities, notably sticky wages, that can magnify the effects of trade shocks in the short-run (Rodriguez-Clare et al., 2020). In most studies, the underlying idea is that trade policy is persistent, so its effects operate at horizons where nominal rigidities would not matter. However, a major consideration for policy makers relates to the effect on wages and subsequently on employment. While it is plausible to assume that the effect should be negligible in the long-run – once the economy has gradually adjusted to a new steady-state – the adjustment might be harsher in the short-run due to such sticky wages. In the BF model, sticky wages are modelled by constant wages ($dlog(w_t) = 0$) and the economy adjusts through employment. In this setup wages remain constant, and the adjustment goes through the supply of primary factors. The opposite happens in the baseline version, where the supply of primary factors is exogenous, and the adjustment

[13] In our application of the Baqaee-Farhi model, we use 25 iterations. The overall effect is the sum of the effects at each iteration, with each iteration using the model solution from the previous iteration as the starting point for the next iteration. Our choice of 25 iterations is based on the empirical verification that the effects tend to be very small after around the 15th iteration – being conservative, we add 10 more iterations to make sure we get closer to the exact hat-algebra non-linear effect.

[14] Technically, the Baqaae and Farhi (2023) model captures bilateral wedges between two producers i and j by adding a fictional intermediary that buys from i and sells to j with a markup.

goes through fully flexible wages. Importantly, the behaviour of the nominal variables is determined to some extent by the conduct of monetary policy with each central bank following a rule where it either targets low domestic inflation or an exchange rate peg.

3.3 Calibration

We depart from the Baqaee and Farhi (2023) original set-up as we use a more recent input-output table which also features a richer set of countries. More specifically, we use the 2017 version of the ADB MRIO table, whereas BF is calibrated on the 2008 WIOD table.[15] This allows us to increase the number of countries from 41 to 73, and importantly to achieve a more balanced sample as the WIOD table is heavily focused on European countries with a limited coverage of emerging regions such as South-East Asia and Latin America. However, for tractability reasons, we group some countries and proceed by *(i)* keeping a similar West-East split as in the initial ADB MRIO table, with West economies accounting for 55% percent of countries and 51% percent of world GDP in the sample, *(ii)* removing the smallest countries in terms of GDP weights, and *(iii)* aggregate countries within the same bloc and with broadly similar exposure to the other bloc.[16] **Table A2** in **Appendix A** provides details of the grouping. Finally, as the BF model features intensities in primary factors (capital, low-, medium-, and high-skilled labour), which are not available in the ADB MRIO tables, we assume that for countries that are both in the 2008 WIOD and the 2017 ADB MRIO tables the same shares as BF apply. For countries that are not in the 2008 WIOD, we apply the average intensities per sector based on the 2008 WIOD. Such approximations are somewhat backed by the literature showing that changes in capital and labour are generally slow and structural (Saenz, 2022).

[15] While a more recent version (2021) is available, we use the 2017 version as *(i)* we want to avoid potential Covid-related temporary distortions that might affect the 2021 table, and *(ii)* the 2021 table has a less granular country coverage.

[16] The downside of using calibration with a very limited number of countries in the East bloc is that the model response to a decoupling shock yields limited reallocation possibilities in this bloc and thereby is likely to overstate (understate) economic losses in the East (West) bloc. By keeping a similar East-West split in the sample compared to the underlying data, we ensure more realistic reallocation opportunities.

Sectors include both manufacturing and services, the list of sectors is provided in **Table A1** in **Appendix A**. Linkages across sectors and countries are calibrated using input-output tables that provide the degree of linkages across all country-sector pairs.

4. Scenario design

4.1 Policy scenarios

The precise configuration of a potential future supply chain decoupling remains highly uncertain, especially in what concerns the number of blocs, whether a country is part of a bloc or remains neutral, as well at the extent of the decoupling (i.e., across all products and sectors or only for a subset of them). Therefore, we explore four scenarios which differ along two dimensions concerning: *(i)* the logic underlying the decoupling into blocs, and *(ii)* the sectors affected by the decoupling (see **Table 3**). Along the first *dimension* we identify a "geopolitical" decoupling between an East and West bloc, and a "regional" decoupling between countries that belong to different regional free trade areas.[17] Both approaches relate to "friend-shoring" as envisaged by policy makers (Yellen, 2022). The East-West decoupling is our central scenario of a bipolar international order (Nye, 2020) and reflects the scenario studied in most of the literature (see for example Goes and Bekkers, 2022; Javorcik et al., 2023). The second scenario reflects recent policy initiatives that highlight the risk of a decoupling even within geopolitical blocs. One example for this is the US Inflation Reduction Act which aims, among other goals, at attracting investments in domestic green sectors at the expense of countries with which the US does not have a free trade agreement. The second *dimension* focuses on the extent of decoupling and considers two stylised possibilities: a "generalised" decoupling, where higher trade costs affect all 30 sectors of the economy, and a "strategic" decoupling which only targets sectors that are strategic from an economic and national security perspective. This scenario is inspired by the trade-restrictive measures adopted in recent years starting from tariffs adopted by the Trump

[17] We consider four regional free trade agreements: USMCA, EU single market, RCEP, and MERCOSUR.

administration to more recent decisions targeting trade in technological items (e.g. US CHIPS and Science Act adopted in August 2022).[18]

		Table 3: Scenario matrix	
		Axis 1: Country blocs	
		Geopolitical (East-West)	Regional (By regional FTA)
Axis 2: Sectors	Generalised	*Central scenario*	
	Strategic		

Across all scenarios we assume that higher trade costs affect only intermediate products to reflect the fact that most of the measures recently adopted by countries have focused on GVCs rather than trade in final goods. For instance, the US Inflation Reduction Act adopted in August 2022 mostly targets supply chains of electric vehicles and renewable products through domestic content requirements that stipulate that a certain proportion of inputs (batteries for electrical vehicles, critical minerals, steel) should be manufactured in the US, Canada, or Mexico. We impose a trade cost shock through non-tariff barriers (iceberg trade costs) rather than tariffs, again to reflect the way recent measures have been framed (e.g. regulations, norms, customs controls). Moreover, in this stylised setup aimed at shutting down most trade in intermediates between blocs, the magnitude of the increase in iceberg trade costs is 150% in line with similar calibrations in the literature (Goes and Bekkers, 2022; Bachmann et al., 2022).[19]

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[18] These strategic sectors are "electrical and optical equipment", "basic metals and fabricated metals", "machinery", and "transport equipment".

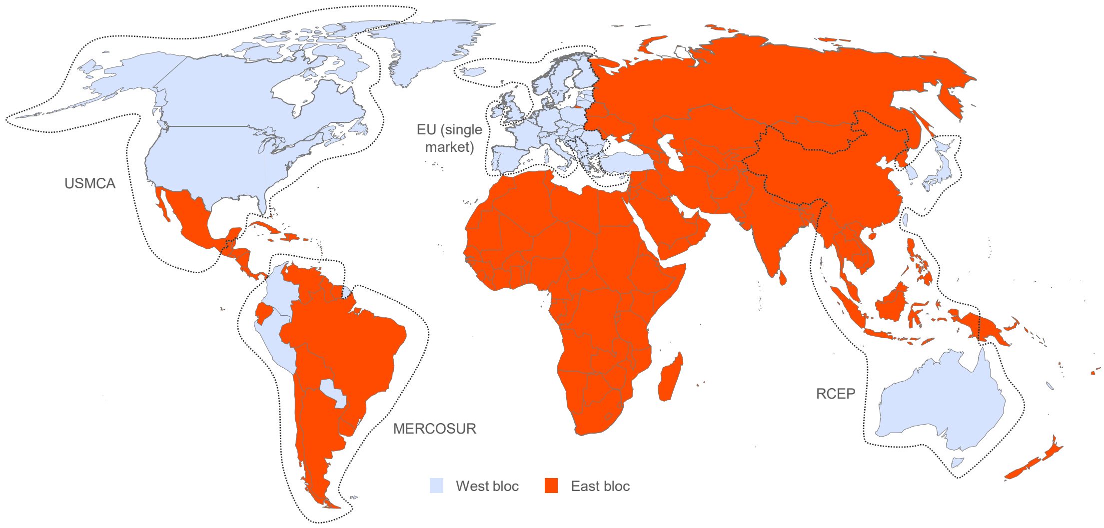
[19] Another hypothetical decoupling scenario studied in the literature features three blocs instead of two three blocs: a West, East and a neutral bloc of countries (see for example Campos et al., 2023). In such a scenario, barriers to trade arise between the East and West bloc, but not *vis-à-vis* neutral countries. While a thorough analysis of such a scenario goes beyond the scope of this paper, compared to our central scenario the results would change as follows: countries in the East and West blocs would still lose in welfare, albeit only slightly less than in our central scenario. Countries belonging to the neutral bloc would see a slight improvement in welfare as they would benefit from some reallocation from countries belonging to the East or West bloc. All in all, global welfare would still decrease but slightly less than in our central scenario.

4. 2 Country blocs

We derive geopolitical blocs mechanically from countries' similarity of voting at the UN General Assembly (UNGA), in line with Goes and Bekkers (2022) and as captured in the Foreign Policy Similarity (FPS) database (Hage, 2017). The latter provides similarity indices between country pairs, measuring whether two countries have voted similarly at the UNGA. The index is calculated for the period 1945 to 2015. In line with the existing literature, we use the US and China as the centroids for the West and East bloc respectively. We allocate countries mechanically to each bloc depending on their voting similarity with the US and China using the most recent information from the FPS database (2015). As shown in **Figure 1**, The West bloc includes European countries and advanced economies such as Japan, Korea, or Australia. Emerging and developing economies, on the opposite, are allocated to the East bloc.[20]

Figure 1. Country blocs

(Mechanical allocation to blocs based on UN voting similarity or on regional FTAs)



Source: Foreign Policy Similarity database of Hage (2017)
Notes: Countries are allocated mechanically to a geopolitical bloc based on the similarity of their voting at the UN General Assembly with China and the US. Africa, Middle East, Ukraine, New Zealand, Israel, and Moldova belong to the "Rest of the World" aggregate in the ADB MRIO tables and are therefore allocated collectively.

[20] As the index aggregates over different votes at the UNGA, we experienced no country with missing voting data (i.e., due to abstaining). The only exception is Taiwan which has no voting rights at the UNGA. We allocate Taiwan to the West bloc.

To ensure the robustness of the bloc decomposition, we run two different checks. First, we base the country allocation on alternative years of the FPS database. The decomposition remains broadly similar, with only three countries switching blocs.[21] We also calibrate geopolitical blocs based the 9 April 2022 vote at the UNGA on the resolution concerning the suspension of the rights of membership of the Russian Federation in the Human Rights Council following its war of aggression against Ukraine – similar to the approach of Campos et al. (2023). The blocs are again very similar to our bloc allocation. This suggests that overall geopolitical relationships have been relatively stable over the last two decades.

Figure 1 shows the mapping of countries to regional free trade agreements (RFTA) in our sample. We focus on larger RFTA, the most recent being the Regional Comprehensive Economic Partnership (RCEP) signed in 2020 between Asia-Pacific countries and effective since January 2022. The other bloc is the USMCA, the RFTA between the US, Mexico and Canada which was signed in November 2018 and replaces the NAFTA. The third bloc is the *Mercado Común del Sur* (MERCOSUR) which groups Latin American countries and dates back to 1995.[22] Finally, we consider the EU single market which includes the EU and four other European countries (Norway, Switzerland, Liechtenstein, and Iceland) linked to the EU via further trade agreements. Countries that do not belong to one of these four RFTA, are treated as neutral and they impose no trade barriers *vis-à-vis* other neutral countries (but they do face barriers to trade with countries belonging to any of the four RFTA). While we consider a decoupling scenario where the EU decouples from other regions with RFTA, we will discuss in the remainder of the article effects on the euro area separate from effects on non-euro area countries.

4.3 Rigid and flexible set-ups

Scenarios are run under two alternative model setups, a *rigid* and a *flexible* setup, which approximate the short-run and long-run effects of trade decoupling respectively. Given

[21] Mexico, Turkey, and Korea.

[22] For simplicity, we include Venezuela in MERCOSUR, despite having been suspended.

the substantially higher economic costs of a fragmentation shock in the short run, their quantification is of great interest from a policy perspective. Propagation channels in the BF model depend on three key parameters: *(i)* the elasticity of substitution across inputs to production ε, *(ii)* the ease of reallocating production factors across sectors γ,[23] and *(iii)* the degree of wage rigidity. In the *flexible* setup wages are flexible and there is high substitutability between inputs and between factors of production; this setup mirrors calibration choices in the recent literature. Under these assumptions, the model predicts a relatively muted response of the global economy as consumers and producers can substitute seamlessly across products, factors of production can be shifted towards sectors facing higher demand, and wages adjust accordingly. In contrast, the *rigid* setup features sticky wages and a low substitutability across inputs and across factors of production.[24] As a result, it generates a stronger reaction as a country's ability to immediately adjust is hindered by low factor mobility and less room to substitute away from more expensive inputs. The resulting drop in domestic production and household income is therefore higher, and so the disruptions to supply of intermediate inputs for downstream sectors and to demand for upstream producers are stronger. This is the amplification mechanism of global production networks. In addition, in presence of sticky wages the economy adjusts to temporary fluctuations in demand (domestic and foreign) by shedding employment which weighs on consumption. Given that rigidities tend to be more binding in the short term and to dissipate gradually, the *rigid* setup could be seen as a close approximation of short-run effects, whereas the *flexible* setup is closer to the long-run equilibrium and the range of results can be viewed from the perspective of the transitory dynamics from the short-run (*rigid* setup) to the long-run

[23] But not across countries since factors of production are not mobile across countries in the Baqaee and Farhi (2023) model. Factors of production are capital, as well as low-, medium-, and high-skilled labour.

[24] Sticky wages are modelled in the Baqaee and Farhi (2023) model as constant wages (no evolution). Under this setup, the economy adjusts through the quantity of labour (employment). This is the opposite of the baseline working of the model where wages respond endogenously but the quantity of labour is fixed and exogenous. It should be noted that in the *rigid* setup, the wages paid to the different types of labour (low, medium, and high skilled) are constant in domestic currency, but the rental rate of capital remains flexible.

effects (*flexible* setup).[25] Beyond this interpretation, these two setups also account for the high uncertainty surrounding substitution elasticities in the literature.

Although most of the literature focuses on the long run effects of trade shocks, the *rigid* setup is motivated by economic theory which documents sticky wages, namely the fact that nominal wages are usually not observed to decrease (McLaughlin, 1994; Dickens et al., 2007) and adjust infrequently and with some delay to shocks. For instance, Taylor (1980) assumes that wages are constant for a period of generally around one year. This reflects institutional arrangements like those prevailing in the unionized manufacturing sector (Cecchetti, 1987) as well as contracts with pre-determined wage changes set in advance (Taylor 1983). Beyond the theoretical literature, wage stickiness is observed in empirical studies (Le Bihan et al., 2012). The second ingredient of the *rigid* setup relates to lower elasticities of substitution, reflecting difficulties for producers to adjust their network of suppliers and their factors of production in the short-term. Barkema et al. (2019) show empirically that supply chains are highly inflexible in the short-term. To some extent, these rigidities account for Keynesian demand-side effects in the model: rising prices reduce households' disposable income, leading to spending cuts which set in motion a standard Keynesian multiplier effect. That is, the decrease in aggregate demand is met by a decrease in aggregate supply which results in lower households' disposable income, in turn implying lower spending, and so on.

The calibration of the elasticities is summarised in **Table 4**. In addition to the two abovementioned elasticities of substitution across intermediate inputs (ε) and factors of production (γ), the model also features elasticities of substitution across value-added and intermediate inputs (θ), and, for households, across consumption goods (σ). In the *flexible* setup, elasticities of substitution are taken from the upper bound estimates of Atalay (2017) – which are broadly in line with recent estimates from Boehm et al. (2019)

[25] The short-run perspective relates to an approximative horizon of one year after the shock, in line with the literature on sticky wages (see Taylor, 1980). The long-run perspective relates an approximative horizon of at least 6 years after the shock (see Peter and Ruane, 2019 for a discussion of timing around substitution elasticities).

and Oberfield and Raval (2021). In the *rigid* setup, elasticities are based on the lower 10% range of estimates in Atalay (2017). The elasticity of substitution across factors in the *rigid* set-up follows the calibration of the severe scenario in Bachmann et al. (2022).

Table 4: Elasticities of substitution

	Flexible	Rigid
ε	0.2	0.1
σ	0.9	0.9
θ	0.5	0.2
γ	1.0	0.5
τ_i	See Baqaee and Farhi (2023)	

5. Main results

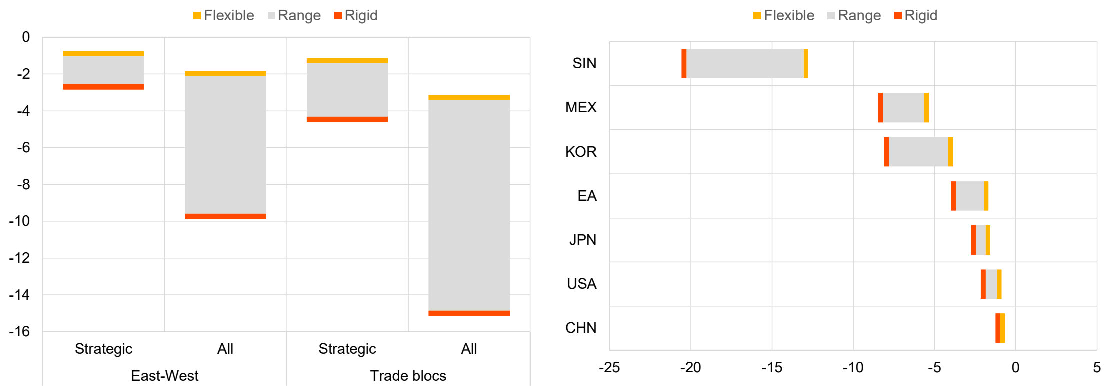
5.1 Welfare

While welfare losses depend on the specific scenario under consideration, all simulations suggest that losses could be sizeable in the short run. From a global perspective (**Figure 2**, panel a) welfare losses, as captured by the change in Gross National Expenditure (GNE), are estimated to range between 0.7% (*flexible* setup, East-West decoupling across strategic sectors) and 15.2% (*rigid* setup, decoupling by trade blocs across all sectors). Comparing the range of possible outcomes across scenarios, losses are more than twice as high in case of a generalised decoupling compared to a strategic one. Losses are also non-negligibly higher in the case of a decoupling by regional blocs, reflecting the fact that such a scenario with five different blocs would entail many more barriers to trade compared to the East-West geopolitical scenario. But larger differences come on account of the model setup with losses in the *rigid* setup being around 5 times higher than in the *flexible* setup. In line with the interpretation discussed above, this suggests that losses could be substantial in the short run (*rigid* setup). Once the rigidities dissipate, losses are gradually absorbed as substitute inputs of production are found either *via* increased domestic production or within-bloc trade. This in turn increases employment and reduces the price of inputs, limiting the losses from trade decoupling in the long run (*flexible* setup). Moreover, our findings that welfare losses are around 2% in the *flexible* set-up for the East-West generalised decoupling (our central scenario) are comparable to estimates from the recent literature (Felbermayr et al., 2021; 2023; Goes and Bekkers, 2022). However, our focus on the role of rigidities adds to the current debate as we highlight that though the long-run impact of decoupling can be muted, the short-run effects could be much more severe and should therefore be taken into consideration in the academic and policy debate.

Figure 2. Welfare (GNE) effects from decoupling

(% deviation from steady state)

a) Global losses – alternative scenarios b) Losses by country – central scenario



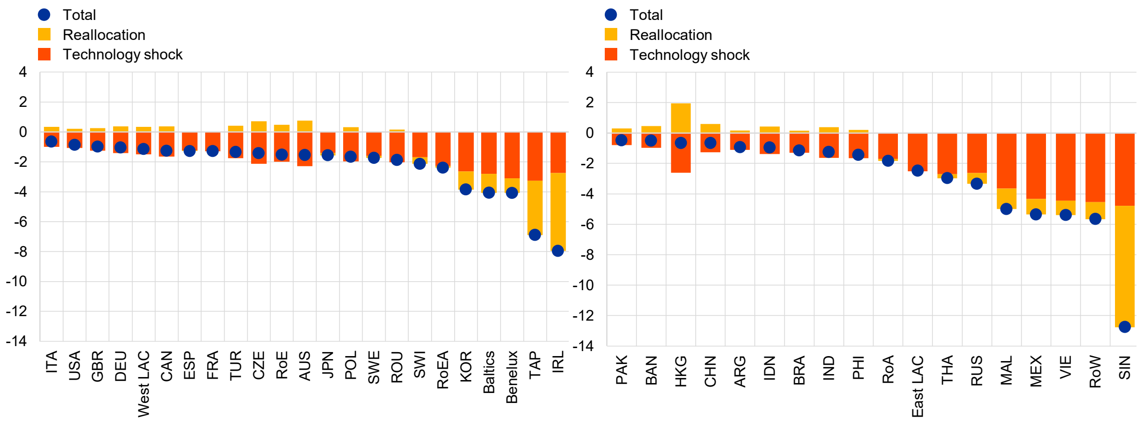
Sources: Baqaee and Farhi (2023), Foreign Policy Similarity database, authors' calculations
Notes: Non-linear impact simulated through 25 iterations of the log-linearized model. Panel b) refers to the central scenario of an East-West geopolitical divide across all 30 sectors.

Our results also point to a significant degree of heterogeneity in welfare losses across countries. Focusing on our central scenario (i.e., East-West generalised decoupling) (**Figure 2**, panel b), we find that welfare losses range between 0.5% and 12.8% in the *flexible* setup and between 0.9% and 20.6% in the *rigid* setup. While all countries lose from decoupling, it is those countries that rely more heavily on GVC trade and which trade extensively with other blocs that experience the largest losses. By contrast, large economies such as the US and China, experience smaller losses as their large internal market allows them to substitute more easily towards domestic inputs following the shock. This result is line with findings in the recent literature (e.g., Eppinger et al., 2021). It is worth noting that the euro area, despite its large size, stands to lose relatively more under this scenario, given its higher trade openness compared to both the US and China but also because its internal market less integrated than these countries.

Figure 3. Decomposition of welfare (GNE) effects in the central scenario

(p.p., contributions to deviation from steady state)

a) West b) East



Sources: Baqaee and Farhi (2023), Foreign Policy Similarity database, authors' calculations
Notes: Non-linear impact simulated through 25 iterations of the log-linearized model. Results refer to the central scenario of an East-West geopolitical divide across all 30 sectors, simulated with the flexible setup.

Decomposing welfare losses into the direct impact of the shock and the indirect reallocation effects draws a cartography of (relative) "winners" and "losers". In the BF framework, changes in real GNE can be decomposed into the impact of the initial (technology) shock (for a given initial allocation of resources) and reallocation effects. The impact of the initial shock depends on how much a country's consumption is exposed to trade barriers (i.e., the share of foreign products in the consumption basket), either directly or indirectly through supply chains. The second component captures reallocation effects stemming from the endogenous reaction of consumers and producers to the increase in trade barriers, as they substitute away from more expensive foreign inputs/goods, thus causing a re-allocation of production across countries. This re-allocation of production affects welfare since households' disposable income depends on the remuneration of factors of production.[26] **Figure 3** shows the decomposition of the

[26] A complementary interpretation is given by Baqaee and Farhi (2023) and relates to Viner (1937)'s *"factoral terms-of-trade"*. There, the reallocation effects capture how changes in prices of production factors affect households: *(i)* through their income as households are remunerated by factors, and *(ii)* through their consumption which is exposed to factors, directly and indirectly via supply chains. This boils down to considering, for each factor, whether households are net sellers or net buyers.

welfare effects for the West (panel a) and the East (panel b) blocs, in our central scenario for the *flexible* setup. While the impact of the initial shock is welfare-decreasing across all economies, re-allocation effects are heterogenous and point to some "winners" which are able to offset, at least partially, some of the initial technology shock through positive re-allocation effects. In the BF model, these re-allocation effects depend highly on the direct and indirect exposure to the foreign bloc: economies that are reliant on trade with the foreign bloc, such as Singapore (SIN), will be more negatively affected. Finally, losses tend to be marginally higher in the East than the West – in line with the literature (Lim et al., 2021; Felbermayr et al., 2021).

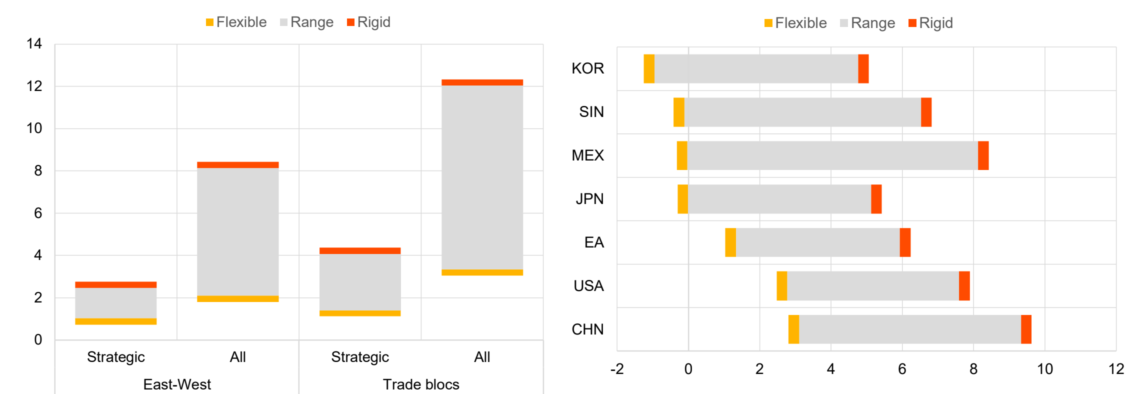
5.2 Prices

A decoupling of global value chains would also have an impact on the price level, as producers would have to substitute away from more expensive foreign inputs. As in the case of welfare losses, the impact is markedly lower if only strategic sectors are affected by decoupling since prices in other sectors are not directly impacted as shown in **Figure 4** (panel a). Focusing on our central scenario, the increase in the level of consumer prices at world level ranges between 1.8% (*flexible* setup) and 8.4% (*rigid* setup).

Figure 4. Consumer prices effects from decoupling

(% deviation from steady state)

a) Global – alternative scenarios b) By country – central scenario



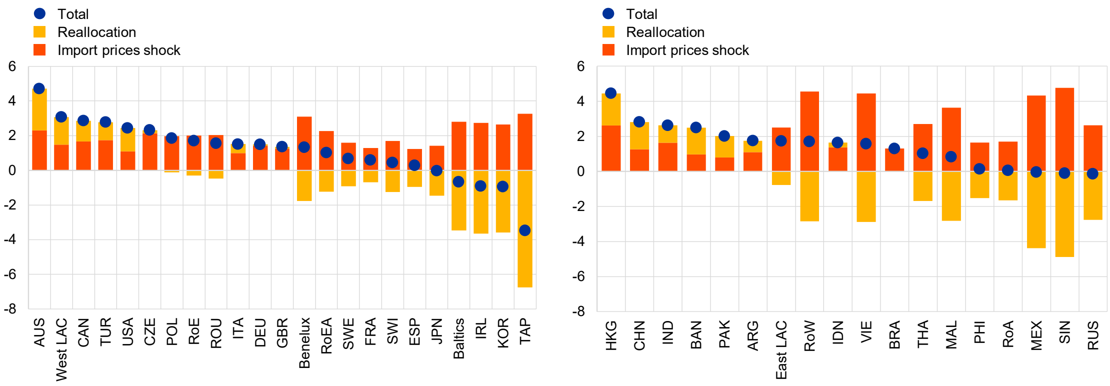
Sources: Baqaee and Farhi (2023), Foreign Policy Similarity database, authors' calculations
Notes: Non-linear impact simulated through 25 iterations of the log-linearized model. Panel b) refers to the central scenario of an East-West geopolitical divide across all 30 sectors.

Price increases at the country level also show large heterogeneities, reflecting differences in both the direct impact of the import price shock and the indirect reallocation effects. **Figure 4** (panel b) shows the effect on consumer price levels for individual countries for the central scenario of an East-West decoupling across all sectors. For all economies, the price increase in the *rigid* setup is manyfold the impact of the flexible one. For example, for the euro area prices increase by 6.2% in the *rigid* compared to 1.0% in the *flexible* setup. Sizeable country heterogeneities can also be observed, with the CPI level increasing by 9.6% in China and by 7.9% in the US for the *rigid* setup.

Figure 5. Decomposition of consumer prices effects in the central scenario

(p.p., contributions to deviation from steady state)

a) West b) East



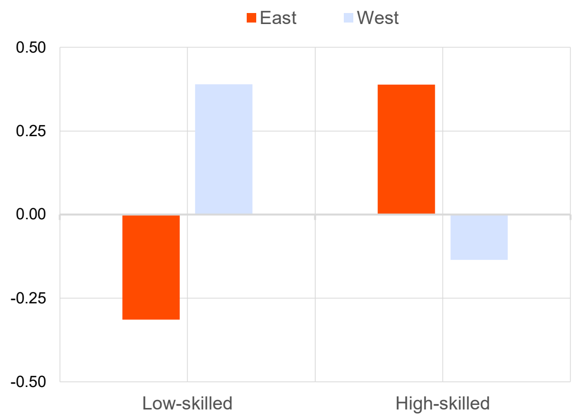
Sources: Baqaee and Farhi (2023), Foreign Policy Similarity database, authors' calculations
Notes: Non-linear impact simulated through 25 iterations of the log-linearized model. Results refer to the central scenario of an East-West geopolitical divide across all 30 sectors, simulated with the flexible setup.

These heterogeneous effects can be related to the two drivers of the price impact as shown in **Figure 5.** On the one hand, the decoupling leads to a rise in import prices with an upward effect for both the price of imported final goods and for domestically produced final goods which use foreign intermediate inputs. This first impact is inflationary for all countries. On the other hand, as discussed above, production is re-allocated across countries. This second impact can be negative or positive for a country depending on whether more producers decide to substitute *away from* or *towards* this country's domestic producers respectively. If the impact is negative, domestic production declines, exerting a disinflationary effect as wages need to decline to adapt to lower production.[27] In some cases, this second effect can more than offset the first and result in a negative price effect, e.g., Taiwan (TAP).

Trade decoupling can also have re-distributive effects as captured by the relative evolution of wages across different skill levels (i.e., low, medium, and high). **Figure 6** shows the evolution of wages relative to those of medium skilled workers. Focusing on the West bloc, trade decoupling re-distributes income towards low-skilled workers whose wages evolve more favourably than high skilled workers. In response to trade decoupling, West countries would import fewer goods from the East bloc requiring low-skilled labour inputs, as production would be re-shored within the West bloc. This would increase demand and thereby wages for low skilled labour. In the East bloc, symmetrically, wages of low-skilled workers would fall relative to high skilled labour, and the opposite effect occurs on high-skilled labour, resulting overall in distributional effects – albeit of a limited magnitude.

Figure 6. Wage differentials in the central scenario

(p.p. deviation from steady state, relative to medium-skilled labour)



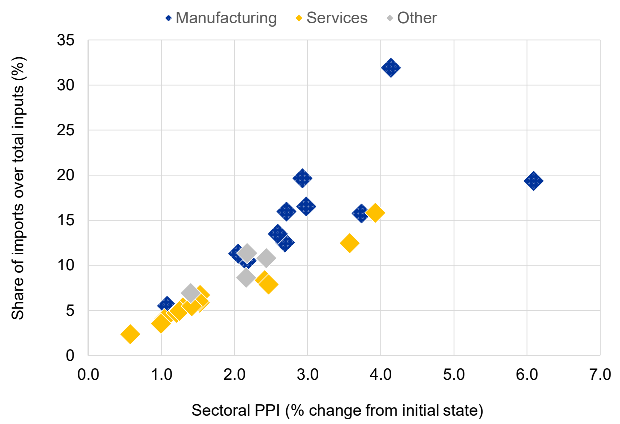
Sources: Baqaee and Farhi (2023), Foreign Policy Similarity database, authors' calculations
Notes: Non-linear impact simulated through 25 iterations of the log-linearized model. Results refer to the central scenario of an East-West geopolitical divide across all 30 sectors, simulated with the flexible setup.

[27] Countries that experience positive re-allocation effects on GNE in **Figure 3** have also in general positive re-allocation effects on CPI in **Figure 5**. This is because if production increases domestically, so do wages, leading to both an increase in CPI and higher households' disposable income.

Finally, a sectoral view shows that the price impact is greater for import-intensive manufacturing sectors. **Figure 7** depicts the impact on the level of global producer prices at the sectoral level on the x-axis, related to the import-intensity of sectoral production (measured by the share of imports in total inputs) on the y-axis. A clear correlation appears, with a 0.8 coefficient, showing that sectors more reliant on global supply chains would suffer more from decoupling. As a result, the impact tends to be greater in manufacturing than in services given differences in import-intensity: on average, manufacturing sectors experience an increase of 3.0% in producer prices compared with roughly half (1.8%) for services.

Figure 7. Sectoral producer prices effects in the central scenario

(x-axis: % deviation from steady state; y-axis: share of imports in total inputs)



Sources: Baqaee and Farhi (2023), Foreign Policy Similarity database, authors' calculations
Notes: Non-linear impact simulated through 25 iterations of the log-linearized model. Results refer to the central scenario of an East-West geopolitical divide across all 30 sectors, simulated with the flexible setup.

Several caveats apply regarding the price effects reported above: the BF framework reflects general equilibrium responses of relative prices where results are presented relative to the initial steady state and do not allow to directly infer inflation dynamics. Modelling the latter would require a dynamic framework, as well as embedding the expectations channel (see e.g., Nunes, 2010; Fuhrer, 2017) and a monetary policy rule based explicitly on inflation dynamics – rather than the change in relative prices.

5.3 Trade

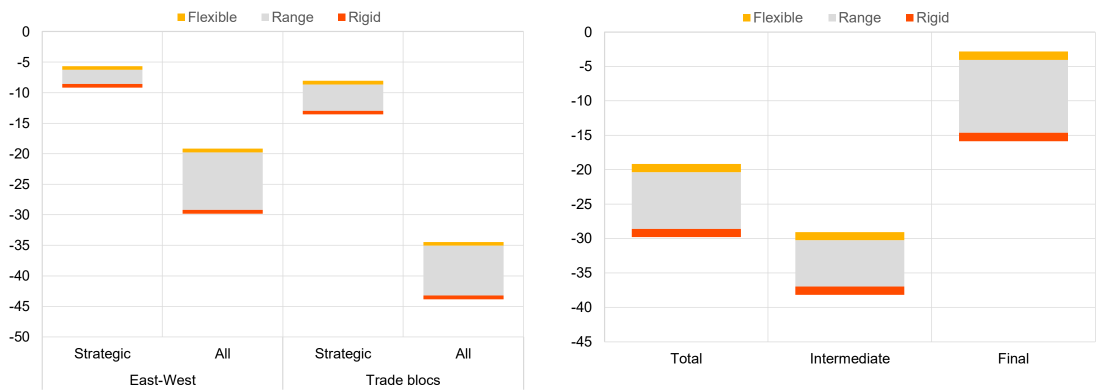
Trade decoupling would cause substantial trade losses, notably for intermediate products. **Figure 8** (panel a) shows that in our central scenario (i.e., generalised geopolitical decoupling) the fall in real imports would be between 19% (*flexible* setup) and 30% (*rigid* setup). In a strategic geopolitical decoupling, losses would range between 6% and 9%. The effects are larger in the case of a decoupling along regional trade blocs with losses of up to 35%-44% in that case. The decline is mainly driven by a fall of trade in intermediates which would drop between 29% and 38% in our central scenario (**Figure 8,** panel b). Trade in final goods would decline between 3% and 16%, despite not being the direct target of the trade barriers. This reflects on the one hand reduced overall demand on account of lower aggregate welfare, and on the other hand substitution away from more expensive foreign-produced GVC-intensive final products towards domestically produced final goods.

Figure 8. Real import losses from decoupling

(% deviation from steady state)

a) Global – alternative scenario

b) By type of products – central scenario

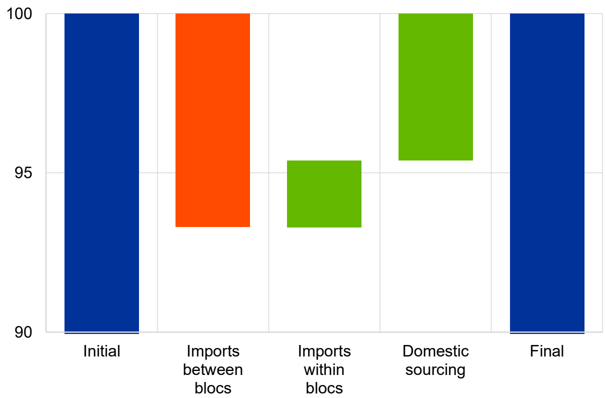


Sources: Baqaee and Farhi (2023), Foreign Policy Similarity database, authors' calculations
Notes: Non-linear impact simulated through 25 iterations of the log-linearized model. Panel b) refers to the central scenario of an East-West geopolitical divide across all 30 sectors.

The model results also show that losses in trade flows between the blocs are not fully compensated for by trade diversion within each bloc, causing sizeable net trade losses. The large decline in trade discussed above reflects partly a re-composition of trade flows with a substitution of foreign products by domestically produced inputs. **Figure 9** presents diversion effects for trade in intermediates at world level. The decline of the imports between blocs (red bar) is only partially compensated for by a rise in imports within blocs. Domestic sourcing rises more substantially, despite becoming more expensive, thereby weighing on trade flows.

Figure 9. Sourcing of intermediate inputs (world) in the central scenario

(p.p., market share)



Sources: Baqaee and Farhi (2023), Foreign Policy Similarity database, authors' calculations
Notes: Non-linear impact simulated through 25 iterations of the log-linearized model. Results refer to the central scenario of an East-West geopolitical divide across all 30 sectors, simulated with the flexible setup.

5.4 Alternative blocs

While the design of country blocs in the two geopolitical scenarios is mechanical (i.e., we follow the similarity in voting at the UNGA), we conduct a sensitivity analysis on several countries to determine which bloc they would choose to join based purely on economic instead of geopolitical incentives. We do so for India, Mexico, and Brazil whose voting patterns have not been consistently aligned with either the US or China over time. As all of them are allocated to the East bloc in our baseline, we run for each country an alternative scenario where it is allocated to the West instead of the East bloc. **Figure 10** (panel a) compares the results to our baseline estimates for welfare losses both at country and at world level. We find that global losses are only marginally affected by alternative country allocations. At the country-level, however, results are more heterogenous as

Brazil would gain relatively little from joining the West bloc, whereas for Mexico the decline in welfare losses would be more significant. India on the other hand would lose more from joining the West bloc. The findings can be explained by geographical proximity being Mexico and Brazil closes to the US and India closer to China, something which is mirrored by stronger trade ties.

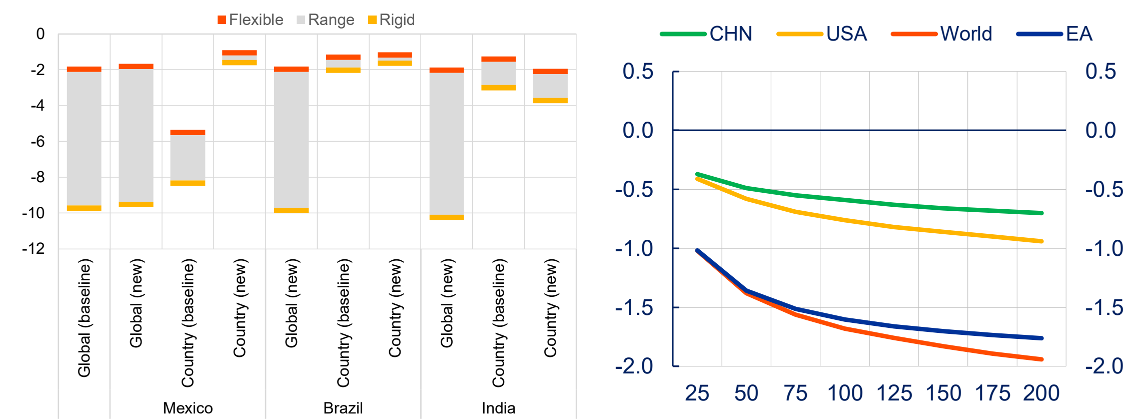
Another robustness check relates to the sensitivity of our results to the magnitude of the increase in iceberg trade costs. While our quantification of decoupling effects is based on a 150% increase of iceberg trade costs, **Figure 10** (panel b) shows the welfare losses for our central scenario (East-West decoupling across all sectors) for alternative iceberg trade cost shock magnitudes spanning from 25% to 200%. We find that the marginal impact of trade barriers decreases with the shock magnitude, in line with findings by Eppinger et al. (2021).

Figure 10. Welfare losses in alternative scenario designs

(% deviation from steady state)

a) Country allocation for key countries

b) Magnitude of iceberg trade cost shock



Sources: Baqaee and Farhi (2023), Foreign Policy Similarity database, authors' calculations
Notes: Non-linear impact simulated through 25 iterations of the log-linearized model. Results refer to the central scenario of an East-West geopolitical divide across all 30 sectors.

6. Conclusion

In this paper we show, by means of scenario analysis, that trade decoupling can have substantial negative effects on welfare, the price level, and trade flows. We also show that in the short run the impact of trade decoupling is several times higher than in the long run, as workers cannot adjust their wages and producers cannot swiftly shift their network of suppliers. Beyond welfare, trade decoupling has also a material impact on prices and trade, and our estimates point to some distributional effects across workers. Trade losses would be sizeable, reflecting a re-composition of trade flows with trade in intermediate inputs *between* blocs almost completely impeded and diverted only partly into increased trade *within* blocs. Our findings are robust to a number of alternative scenarios. Beyond this paper, Attinasi et al. (2023a), who calibrate the increase in iceberg trade costs in such a way that brings trade in intermediate between blocs back to its mid-1990s level, find an impact of about 1% to 5% on global welfare.

This article abstracts from several concerns which we intend to address in future research: in the short term, other factors beyond sticky wages and low substitutability could drive even larger losses. These are for example the presence of critical inputs difficult to substitute (e.g., lithium or rare minerals) which could lead to temporary production stoppages, or financial amplification mechanisms (for example in the form of rising risk premia as in Berthou et al. (2018)). In the longer run, transmission channels not considered here such as cross-border knowledge diffusion and investment could also weigh on growth (Cai et al., 2022).

In conclusion, from a purely economic perspective, trade fragmentation would be a lose-lose situation given the costs it entails at both the global and the country level. While the above estimates are subject to both upside and downside risks, trade fragmentation would entail sizeable costs in terms of substantially distorted trade, decreased welfare and higher prices. Beyond the economic effects, trade decoupling can have detrimental effects on the provision of global public goods such as climate change, especially if such decoupling happens along sectors that are critical for the green transition. The latter requires, by definition global solutions (Georgieva et al., 2022; Aiyar et al, 2023), as no country has sufficient incentives or financial capacity to solve the problem on its own. Therefore a global decoupling would risk delaying the implementation of climate policies (Attinasi et al. 2023b).

References

Acemoglu, D., Carvalho, V., Ozdaglar, A., & Tahbaz-Salehi, A. (2012). "The Network Origins of Aggregate Fluctuations", *Econometrica*, 80(5), 1977–2016

Aiyar, S., Chen, J., Ebeke, C., Garcia-Saltos, R., Gudmundsson, T., Ilyina, A., Kangur, A., Kunaratskul, T., Rodriguez, S., Ruta, M., Schulze, T., Soderberg, G., & Trevino, J. (2023). "Geoeconomic Fragmentation and the Future of Multilateralism", *Staff Discussion Notes*, No. 2023/001, International Monetary Fund

Antràs, P., & Chor, D. (2018). "On the Measurement of Upstreamness and Downstreamness in Global Value Chains", in Ing, L., & Yu, M. (eds), *World Trade Evolution: Growth, Productivity and Evolution*, 126–194

Atalay, E. (2017). "How Important Are Sectoral Shocks?", *American Economic Journal: Macroeconomics*, 9(4), 254–280

Attinasi, M. G., Boeckelmann L. &, Meunier B. (2023a). "Friend-shoring global value chains: a model-based analysis", *Economic Bulletin Box*, 2, European Central Bank

Attinasi, M. G., Boeckelmann L. &, Meunier B. (2023b). "Unfriendly friends: Trade and relocation effects of the US Inflation Reduction Act", *VoxEU*.

Bachmann, R., Baqaee, D., Bayer, C., Kuhn, M., Löschel, A., Moll, B., Peichl, A., Pittel, K., & Schularick, M. (2022). "What if? The economic effects for Germany of a stop of energy imports from Russia", *ECONtribute Policy Brief*, No 28/2022.

Balistreri, E., Böhringer, C., & Rutherford, T. (2018). "Quantifying Disruptive Trade Policies", *CESifo Working Paper*, No 7382

Baqaee, D., & Farhi, E. (2019). "The Macroeconomic Impact of Microeconomic Shocks: Beyond Hulten's Theorem", *Econometrica*, 87(4), 1155–1203

Baqaee, D., & Farhi, E., (2023). "Networks, Barriers, and Trade", *Econometrica*, forthcoming

Barkema, J., Bayoumi, T., & Cerdeiro, D. (2019). "The Inflexible Structure of Global Supply Chains", *IMF Working Papers*, No 2019/193, International Monetary Fund

Barrot, J., & Sauvagnat, J. (2016). "Input Specificity and the Propagation of Idiosyncratic Shocks in Production Networks", *Quarterly Journal of Economics*, 131(3), 1543–1592

Berthou, A., Jardet, C., Siena, D., & Szczerbowicz, Z. (2018). "Costs and consequences of a trade war: a structural analysis", *Rue de la Banque*

Blanchard, E., Bown, C., & Johnson, R. (2016). "Global Supply Chains and Trade Policy", *NBER Working Papers*, No 21883, National Bureau of Economic Research

Boehm, C., Flaaen, A., & Pandalai-Nayar, N. (2019). "Input Linkages and the Transmission of Shocks: Firm-Level Evidence from the 2011 Tōhoku Earthquake", *The Review of Economics and Statistics*, 101(1), 60–75

Bolhuis, A. M., Chen, J., & Kett, B. (2023). "Fragementation in Global Trade: Accounting for Commodities" IMF Working Paper, No. WP 23/73

Bonadio, B., Huo, Z., Levchenko, A., & Pandalai-Nayar, N. (2021). "Global supply chains in the pandemic", *Journal of International Economics*, 133

Borin, A., Mancini, M., & Taglioni, D. (2021), "Measuring Exposure to Risk in Global Value Chains", *Policy Research Working Paper*, No 9785, World Bank

Cai, J., Li, N., & Santacreu, A. M. (2022). "Knowledge Diffusion, Trade, and Innovation across Countries and Sectors", *American Economic Journal: Macroeconomics*, 14 (1), 104–145

Caliendo, L., & Parro, F. (2015). "Estimates of the Trade and Welfare Effects of NAFTA", *Review of Economic Studies*, 82(1), 1–44

Cappariello, R., Franco-Bedoya, S., Gunnella, V., & Ottaviano, G. (2020). "Rising Protectionism and Global Value Chains: Quantifying the General Equilibrium Effects", *Working Paper Series*, No 2360, European Central Bank

Campos, R., Furceri, D., Estefania-Flores, J., & Timini, J. (2023). “Trade fragmentation”, *Journal of Comparative Economics,* forthcoming.

Carvalho, V., & Tahbaz-Salehi, A. (2019). “Production Networks: A Primer”, *Annual Review of Economics*, 11(1), 635-663

Cecchetti, S. (1987). “Indexation and Incomes Policy: A Study of Wage Adjustment in Unionized Manufacturing”, *Journal of Labor Economics*, 5(3), 391–412

Chepeliev, M., Maliszewska, M., Osorio-Rodarte, I., Seara e Pereira, M. F., & van der Mensbrugghe, D. (2022). “Pandemic, Climate Mitigation, and Reshoring: Impacts of a Changing Global Economy on Trade, Incomes, and Poverty”, *Policy Research Working Paper*, No 9955, World Bank

Costinot, A., & Rodriguez-Clare, A. (2014). “Trade theory with numbers: quantifying the consequences of globalization”, *Handbook of International Economics*, 4, 197

Deardorff, A. V. (2001). “Fragmentation in simple trade models”. *The North American Journal of Economics and Finance*, *12*(2), 121-137

Dickens, W., Goette, L., Groshen, E., Holden, S., Messina, J., Schweitzer, M., Turunen, J., & Ward, M. (2007). “How Wages Change: Micro Evidence from the International Wage Flexibility Project”, *Journal of Economic Perspectives*, 21(2), 195–214

Eaton, J., & Kortum, S. (2002). “Technology, Geography, and Trade”, *Econometrica*, 70(5), 1741–1779

Eppinger, P., Felbermayr, G., Krebs, O., & Kukharskyy, B. (2021). “Decoupling Global Value Chains”, *CESifo Working Paper Series*, No 9079

Felbermayr, G., Gans, S., Mahlkow, H., & Sandkamp, A. (2021). “Decoupling Europe”, *Kiel Policy Brief*, No 153, Kiel Institute for the World Economy

Felbermayr, G., Mahlkow, H., & Sandkamp, A. (2023). “Cutting through the value chain: The long-run effects of decoupling the East from the West”. *Empirica*, 1-34

Ferrari, A. (2019). “Global Value Chains and the Business Cycle”, *mimeo*

Fuhrer, J. (2017). “Expectations as a source of macroeconomic persistence: Evidence from survey expectations in a dynamic macro model”, *Journal of Monetary Economics*, 86(C), 22-35

Georgieva, K., Gopinath, G., & Pazarbasioglu, C. (2022). “Why We Must Resist Geoeconomic Fragmentation—And How”, *IMF blog*

Goes, C., Bekkers, E. (2022). “The impact of geopolitical conflicts on trade, growth, and innovation”, *Staff Working Paper*, No. ERSD-2022-9, World Trade Organization

Hage, F. (2017). “Choice or Circumstance? Adjusting Measures of Foreign Policy Similarity for Chance Agreement”, in *Political Analysis*, 287–305

Inoue, H., & Todo, Y. (2019). “Firm-level propagation of shocks through supply-chain networks”, *Nature Sustainability*, 2(9), 841–847

Javorcik, B., Kitzmueller, L., Schweiger, H., & Yildirim, M. (2023). “Economic costs of friend-shoring”, *mimeo*

Knell, M. (2013). “Nominal and real wage rigidities. In theory and in Europe”, *Journal of Macroeconomics*, 36, 89-105

Le Bihan, H., Montornès, J., & Heckel, T. (2012). “Sticky Wages: Evidence from Quarterly Microeconomic Data”, *American Economic Journal: Macroeconomics*, 4(3), 1–32

Lim, B., Yoo, J., Hong, K., Cheong, I. (2021). “Impacts of Reverse Global Value Chain (GVC) Factors on Global Trade and Energy Market”, *Energies*, 14(12), 3417

Mc Laughlin, K. (1994). “Rigid Wages?”, *Journal of Monetary Economics*, 34(3), 383–414

Nunes, R. (2010). “Inflation Dynamics: The Role of Expectations”, *Journal of Money, Credit, and Banking*, 42(6), 1161–1172

Nye, J. (2020). “Power and Interdependence with China”, *The Washington Quarterly*, 43(1), 7–21

Oberfield, E., & Raval, D. (2021). “Micro Data and Macro Technology”, *Econometrica*, 89(2), 703–732

OECD (2020). “Shocks, risks and global value chains: insights from the OECD METRO model”, *Technical report*

Rodriguez-Clare, A., Ulate, M., & Vasquez, J. (2020). “New-Keynesian Trade: Understanding the Employment and Welfare Effects of Trade Shocks”, *Working Paper Series*, No 2020-32, Federal Reserve Bank of San Francisco

Sáenz, L. F. (2022). “Time-varying capital intensities and the hump-shaped evolution of economic activity in manufacturing”, *Journal of Macroeconomics*, 73

Sforza, A., & Steininger, M. (2020). “Globalization in the Time of Covid-19”, *CESifo Working Paper Series*, No 8184

Trade in transition 2023. (2023). Economist Impact. https://impact.economist.com/projects/trade-in-transition /key-findings/

Taylor, J. (1980). “Aggregate Dynamics and Staggered Contracts”, *Journal of Political Economy*, 88(1), 1–23

Taylor, J. (1983). “Union Wage Settlements during a Disinflation”, *American Economic Review*, 73(5), 981–993

Viner, J. (1937). *Studies in the theory of international trade*. Harper and Brothers

Wu, J., Wood, J., Huang, X. (2021). “How does GVC reconstruction affect economic growth and employment? Analysis of USA–China decoupling”, *Asian-Pacific Economic Literature*, 35(1), 67–81

Yellen, J. (2022). *“The future of the global economy and US economic leadership”*, speech at a special edition of Atlantic Council Front Page, April 13th

Appendix A: complementary tables and charts

Table A1. List of sectors

Manufacturing
Food, beverages, and tobacco
Textiles and textile products and leather & footwear
Wood and products of wood & cork
Pulp, paper, paper, printing & publishing
Coke, refined petroleum, and nuclear fuel
Chemicals and chemical products, and rubber & plastics
Other non-metallic mineral
Basic metals and fabricated metals
Machinery, not elsewhere classified (n.e.c.)
Electrical and optical equipment
Transport equipment
Manufacturing, n.e.c., and recycling
Services
Wholesale and retail sales, maintenance and repair of motor vehicles and motorcycles
Retail trade, except of motor vehicles and motorcycles; repair of household goods
Hotels and restaurants
Inland transport
Water transport
Air transport
Other supporting and auxiliary transport activities; activities of travel agencies
Post and telecommunications
Financial intermediation
Real estate activities
Renting of machinery & equipment and other business activities
Public administration and defence; compulsory social security
Education
Health and social work; other community, social and personal services; private households with employed persons
Electricity, gas, and water supply
Others
Agriculture, hunting, forestry, and fishing
Mining and quarrying
Construction

Sources: ADB, authors
Notes: some sectors of the initial ADB table have been aggregated for computational tractability. Sectors in grey are those defined as "strategic" sectors based on recent trade-restricting policies.

Table A2. Country groups on ADB input-output table

	Bloc	Group	Share in world GDP
Countries in both WIOD and ADB (79,6% of world GDP in PPP terms)			
Australia	West		1.00
Austria	West	Rest of EA	0.37
Belgium	West	Benelux	0.45
Bulgaria	West	Rest of Europe	0.12
Brazil	East		2.34
Canada	West		1.38
Switzerland	West		0.46
People's Republic of China	East		18.58
Cyprus	West	Rest of EA	0.03
Czech Republic	West		0.32
Germany	West		3.29
Denmark	West	Rest of Europe	0.25
Spain	West		1.37
Estonia	West	Baltics	0.04
Finland	West	Rest of EA	0.20
France	West		2.28
United Kingdom	West		2.33
Greece	West	Rest of EA	0.24
Croatia	West	Rest of EA	0.09
Hungary	West	Rest of Europe	0.25
Indonesia	East		2.49
India	East		7.21
Ireland	West		0.41
Italy	West		1.87
Japan	West		3.78
Republic of Korea	West		1.71

Lithuania	West	Baltics	0.08
Luxembourg	West	Benelux	0.06
Latvia	West	Baltics	0.05
Mexico	East		1.80
Malta	West	Rest of EA	0.02
Netherlands	West	Benelux	0.76
Norway	West	Rest of Europe	0.26
Poland	West		0.99
Portugal	West	Rest of EA	0.27
Romania	West		0.45
Russia	East		2.87
Slovak Republic	West	Rest of EA	0.13
Slovenia	West	Rest of EA	0.07
Sweden	West		0.42
Turkiye	West		2.05
Taiwan	West		1.00
United States	West		15.47
Rest of the World	East		-
New countries from ADB (5,7% of world GDP in PPP terms)			
Bangladesh	East		0.83
Malaysia	East		0.68
Philippines	East		0.71
Thailand	East		0.91
Viet Nam	East		0.80
Kazakhstan	East	Rest of Asia	0.37
Mongolia	East	Rest of Asia	0.03
Sri Lanka	East	Rest of Asia	0.20
Pakistan	East		0.93
Fiji	East	Rest of Asia	0.01
Laos	East	Rest of Asia	0.04
Brunei Darussalam	East	Rest of Asia	0.02

Bhutan	East	Rest of Asia	0.01
Kyrgyz Republic	East	Rest of Asia	0.02
Cambodia	East	Rest of Asia	0.06
Maldives	East	Rest of Asia	0.01
Nepal	East	Rest of Asia	0.09
Singapore	East		0.43
Hong Kong	East		0.32
Argentina	East		0.75
Bolivia	East	Eastern Latin America	0.07
Chile	East	Eastern Latin America	0.36
Colombia	West	Western Latin America	0.60
Ecuador	East	Eastern Latin America	0.14
Paraguay	West	Western Latin America	0.07
Peru	West	Western Latin America	0.32
Uruguay	East	Eastern Latin America	0.06
Venezuela	East	Eastern Latin America	0.12
Rest of Latin America	East	Eastern Latin America	0.09

Sources: ADB, IMF, authors

Note: the belonging to a bloc (West or East) is determined before the grouping, following the methodology outlined in ***section 3****, to ensure that country groups are composed of countries belonging to the same bloc.*

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