The Dynamics of Trade Fragmentation: a Network approach.*

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Updated version

Abstract

In this paper we analyze the possible consequences of trade fragmentation between large geopolitical blocs. To conduct the analysis, we develop a multi-sector, multi-country model with production and investment networks that capture the linkages both between different sectors and between countries. We simulate different scenarios of trade decoupling between the Western bloc (mainly US, EU and allies), the Eastern bloc (mainly China, Russia and allies) and a third group of neutral countries. In the different scenarios, we simulate an increase in trade costs between the countries of the opposing blocs that replicates a decline in international trade levels to 1990s or Cold War levels. In addition, we include simulations in which such trade disruptions may or may not be anticipated by firms. A return to a Cold War-like trade scenario would imply a short-term decline of up to 5% of real national income in the Western bloc and up to 14% in the Eastern bloc. The long-term effects would be mitigated by greater substitutability between suppliers, but the impact would still be significant, with GNE falling by 2.2% and 6% respectively. In the long run, the increase in the cost of capital goods and the resulting decline in the capital stock would account for more than half of the negative effects.

*The views expressed in this paper are the authors' and do not necessarily reflect those of the European Central Bank, Banco de España or the Eurosystem. We thank for their help... Correspondence to: Javier Quintana (javier.quintana@bde.es)

Non-technical Summary

In this paper, we analyze the possible consequences of trade fragmentation between large geopolitical blocs. To conduct the analysis, we develop a dynamic multi-sector, multi-country model with production and investment networks that capture linkages both between different sectors and across countries. We simulate different scenarios of trade decoupling between the Western bloc (mainly US, EU and allies), the Eastern bloc (mainly China, Russia and allies) and a third bloc of neutral countries. In the different scenarios, we simulate an increase in trade costs between the countries of the opposing blocs that replicates a decline in international trade levels to 1990s or Cold War levels. In addition, we include simulations in which such trade disruptions may or may not be anticipated by firms.

Crucially, our model allows us to distinguish the impact of disruptions on global trade in different types of goods: consumer goods, intermediate goods, or capital goods. In contrast to consumer goods, the cost increase of intermediate goods has an amplified effect due to the role of production networks. Moreover, our paper distinguishes in a novel way the different role of investment goods, which account for a significant share of international trade. Trade disruptions in such goods affect not only their demand in a given period, but also the investment dynamics of economies. In addition, since capital goods, unlike consumer or intermediate goods, do not have full within-period depreciation, disruptions in their trade generate a richer dynamic of aggregate consequences.

An example to illustrate the importance of this channel would be to compare the different economic impacts of stopping natural gas imports from Russia into the European Union with the hypothetical impact of restricting imports of solar panels from China. While both have a relevant weight in the energy supply chain in Europe, natural gas is a consumable input with limited ability to be stored, whose annual consumption must be imported in its entirety each year. Therefore, a disruption in its imports has to be accommodated almost immediately in firms' production through input substitution or with a limited ability to find new suppliers.

On the other hand, a halt in imports of new solar panels from China would not immediately affect electricity generation in Europe because of the stock of panels already installed. While it might affect capital accumulation in the medium to long term, the long-lived nature of such goods allows for a greater degree of adjustment in finding new suppliers of these materials. This example illustrates the importance of taking into account the time horizon needed to replace imports of different materials when discussing strategic autonomy.

Two main forces determine the time profile of the consequences of trade fragmentation. First, the ability to substitute between different suppliers of a given good. The ability of firms to switch suppliers from different countries in the same sector is very limited in the short run, which amplifies the negative effects of a trade disruption. Over time, however, the cost of substituting sources of supply declines, reducing the aggregate impact of the diversion of imports from the opposite bloc. Second, trade decoupling also affects the dynamics of capital accumulation. The higher cost of capital goods imported from the opposite bloc makes investment more expensive and reduces the desired level of capital by firms. This depresses the level of investment for a number of periods as firms gradually depreciate their level of capital. Thus, the increased ease of redirecting imports from the opposite bloc gradually reduces the severe negative short-term effects, while the effects of a lower capital stock accumulate over time.

A return to a Cold War-like trade scenario would imply a short-term decline of up to 5% of real income in the Western bloc and up to 14% in the Eastern bloc. The long-term effects would be mitigated by greater substitutability between suppliers, but the impact would still be significant, with GNE falling by 2.2% and 6% respectively. In the long run, the increase in the cost of capital goods and the resulting decline in the capital stock would account for more than half of the negative effects.

1 Introduction

Geopolitical tensions are currently one of the main threats to the evolution of the economy. For example, the consequences of the trade embargo imposed on Russia following its aggression against Ukraine have significantly impacted the European economy in the post-pandemic period. Looking ahead, a greater decoupling of trade between major geopolitical blocs, which could lead to a reduction in international trade and partially or entirely undo the globalization process of recent decades, may have even greater implications for growth. As a result, a significant policy debate has emerged regarding the feasibility and costs of reducing dependence on potentially adversarial countries, as well as the costs that such a process might entail. Therefore, it is necessary to gain a better understanding of the expected effects of trade fragmentation, the mechanisms through which they would manifest, and the differences across various time horizons.

In this paper, we analyze the possible consequences of trade fragmentation between large geopolitical blocs. To conduct the analysis, we develop a dynamic multi-sector, multi-country model with production and investment networks that capture linkages both between different sectors and across countries. We simulate different scenarios of trade decoupling between the Western bloc (mainly US, EU and allies), the Eastern bloc (mainly China, Russia and allies) and a third bloc of neutral countries. In the different scenarios, we simulate an increase in trade costs between the countries of the opposing blocs that replicates a decline in international trade levels to 1990s or Cold War levels. In addition, we include simulations in which such trade disruptions may or may not be anticipated.

Crucially, our model allows us to distinguish the impact of disruptions on global trade in different types of goods: consumer goods, intermediate goods, or capital goods. In contrast to consumer goods, the cost increase of intermediate goods has an amplified effect due to the role of production networks. Moreover, our paper distinguishes in a novel way the different role of investment goods, which account for a significant share of international trade. Trade disruptions in such goods affect not only their demand in a given period, but also the investment dynamics of economies. In addition, since capital goods, unlike consumer or intermediate goods, do not have full within-period depreciation, disruptions in their trade generate a richer dynamic of aggregate consequences.

The inclusion of a newly constructed input-output matrix for investment goods is a key advantage of our model. Similar to the input-output matrix for intermediate inputs typically used in the literature, this matrix captures the customer-supplier relationships between sector-country pairs in the supply of the goods that firms use in their capital bundles. This feature provides insights into both long-run and transitional mechanisms. The loss of capital goods suppliers from the opposite bloc increases the cost of the capital bundle to firms, which reduces the optimal level of capital in the long run. In contrast to the response to the price of intermediate inputs, the adjustment is gradual because of the durable nature of capital. Similarly, the model replicates the observed precautionary stockpiling of capital goods from the opposite bloc when firms can anticipate the trade fragmentation shock.[1]

Two main forces determine the time profile of the consequences of trade fragmentation. First, the ability to substitute between different suppliers of a given good. According to the literature (see Head and Mayer (2014) or Boehm et al. (2023)), the ability of firms to switch suppliers from different countries in the same sector is very limited in the short run, which amplifies the negative effects of a trade disruption. Over time, however, the cost of substituting sources of supply declines, reducing the aggregate impact of the diversion of imports from the opposite bloc. Second, trade decoupling also affects the dynamics of

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2 Related literature

TBC

We utilize a dynamic general equilibrium version of the model by Baqaee and Farhi (2019), where the dynamics arise from changes in the elasticity of substitution over different periods as well as from the forward-looking behavior of agents regarding consumption and investment, and the capital dynamics exposed to adjustment costs. Huo et al. (2024) model a global network model with capital accumulation. We enhance this model by adding an input-output matrix of investment goods, allowing us to estimate the cost of trade fragmentation on the price of investment goods. This IO matrix for investment is constructed in the spirit of Vom Lehn and Winberry (2022) and Foerster et al. (2022); however, while they build it only for the USA, we have a global-level matrix.

Our results critically depend on the evidence from the literature regarding the values of elasticity of substitution in international trade, considering both their different levels across sectors (Fontagné et al. (2022)) and the variations of these values in the short and medium term (Boehm et al. (2023)).

Several papers already analyze the impact of potential trade fragmentation, with a particular focus on its impact on various European countries (Attinasi et al. (2023) or Baqaee et al. (2023)). Compared to these studies, our work enriches the analysis by providing more detailed mechanisms regarding the dynamics of the impact, especially the role of capital accumulation in this process.

3 Model

We analyzed the impact of trade disruption using a dynamic model with production and investment networks and open economies. This model captures the various relationships between sectors in different economies. Figure 1 graphically illustrates the production function of the firms. Firstly, sectors use the output of other industries as intermediate inputs for their own production.[2] Thus, this channel captures the adjustment of demand in different sectors in response to price changes caused by trade disruption. Additionally, the model also includes the relationship between sectors in the supply of capital goods.[3] Hence, the impact of trade disruption is reflected through the accumulation process of capital in the economy, affecting both investment incentives and the costs of sectors producing capital goods.

3.1 Firms

Within each of the $\mathcal{C}$ countries there are $\mathcal{S}$ firms, each of them producing the local variety of one of the sectors, $Y_{s,c}$.[4] To produce their output, firms transform labor (L), capital (K), energy (E) and other intermediate inputs (M), combined with a level of productivity (Z). Each of the representative firms is competitive and sells its output equal to its production cost.

Firms produce following a nested CES function with constant returns to scale. The production function has the form $((KL)E)M)$. In the first nesting level, firms create value

[2]See Baqaee and Farhi (2019) as a seminal reference.
[3]See Vom Lehn and Winberry (2022) as a seminal reference.
[4]See Table A1 for a the classification of 44 industries.

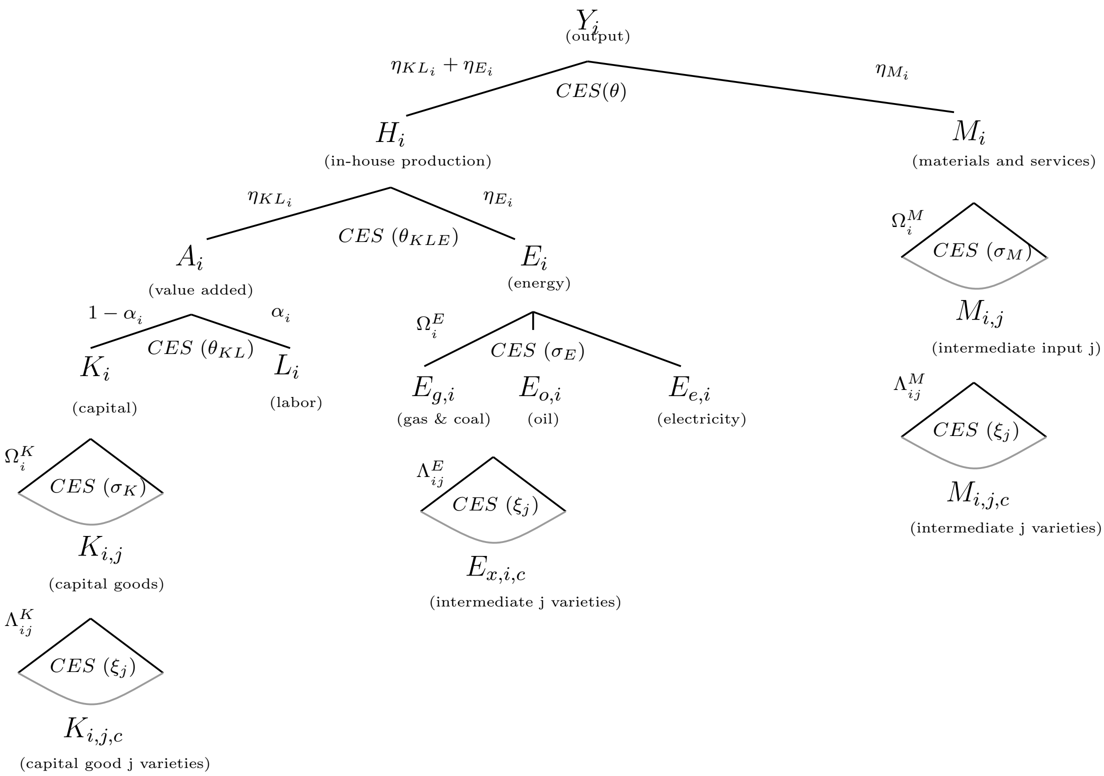

Figure 1: Production Function.

added by combining capital and labor. Then, to operate the value-added component (A), firms need energy (E), which is complementary to the capital-labor bundle. In a final nesting level, firms combine the capital-labor-energy bundle, or in-house component (H), with intermediate inputs (M) purchased from the other sectors.[5]

$$Y_i \;=\; Z_i \cdot \left[(\eta_{KL,i} + \eta_{E,i}) \cdot H_i^{\frac{\theta-1}{\theta}} + \eta_{M,i} \cdot M_i^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}} \tag{1}$$

where $\eta_{KL,i}$, $\eta_{E,i}$ and $\eta_{M,i}$ are weights of value added, energy expenditure and material expenditure production of the firm.[6] θ is the elasticity with which firms can substitute the home-produced capital-labor-energy component with intermediate inputs bought from other firms.

$$H_i \;=\; \left[\left(\frac{\eta_{KL,i}}{\eta_{KL,i} + \eta_{E,i}} \right) A_i^{\frac{\theta_{KLE}-1}{\theta_{KLE}}} + \left(\frac{\eta_{E,i}}{\eta_{KL,i} + \eta_{E,i}} \right) E_i^{\frac{\theta_{KLE}-1}{\theta_{KLE}}} \right]^{\frac{\theta_{KLE}}{\theta_{KLE}-1}} \tag{2}$$

[5]For the sake of clarity, we omit the time subscript where it does not provide additional information.

[6]This values are respectively calibrated as the share of expenditure in each component over total expenditure of the firm

$$A_i = \left[\alpha_i \cdot L_i^{\frac{\theta_{KL}-1}{\theta_{KL}}} + (1-\alpha_i)\, K_i^{\frac{\theta_{KL}-1}{\theta_{KL}}}\right]^{\frac{\theta_{KL}}{\theta_{KL}-1}} \tag{3}$$

The relationship between the value of θ and θ_{KLE} contains an important mechanism for how a tax that makes the price of energy inputs more expensive operates in the model. First, a value of $\theta_{KLE} < 1$ implies a complementarity between capital and labor use and energy consumption. An increase in energy costs would also imply a higher cost of operating firms' capital, reducing the value of capital to firms and leading to stranded assets. For its part, the value of θ shows the sectors' ability to substitute their own production for intermediate inputs purchased from other firms. A higher value of theta would imply that, in the face of an increase in energy costs, companies will tend to make up for the fall in their own production by purchasing inputs produced by other sectors.

Intermediate Inputs and Energy The bundles of energy and intermediate inputs are, in turn, a combination of the output of other sectors. First, the energy component is the combined energy sources produced by the Energy Mining (D05T06), Refined Petroleum Products (D19) and Electric Power (D35) sectors. The intermediate materials component is a bundle consisting of the rest of the non-energy sectors of the economy. Thus, the consumption of energy (E_i) or intermediate materials (M_i) of a sector i is the combination of different types of goods and services with an elasticity of substitution of σ_E or σ_M

$$X_i = \left(\sum_{j=1}^{S^X} \Omega_{i,j} X_{i,j}^{\frac{\sigma_X-1}{\sigma_X}}\right)^{\frac{\sigma_X}{\sigma_X-1}} \quad \text{for } X = \{M, E\} \tag{4}$$

where the element (i, j) of matrix Ω represent the importance of goods from sector j for sector i. Sets S^M and S^E represents the sets of materials and energy sectors, respectively.

In addition, in the consumption of each good or service j, firms combine the different domestic varieties produced, combined with a constant elasticity of substitution $\xi_{j,t}$

$$X_{ij} \quad = \quad \left(\sum_{h=1}^{C} \lambda_{ijh}^{X} X_{ijh}^{\xi_{j,t}-1/\xi_{j,t}}\right)^{\frac{\xi_{j,t}}{\xi_{j,t}-1}} \quad \text{for } X = \{M, E\} \tag{5}$$

where λ_{ijh} represents the initial share of expenditure by firm i on the variety of good j produced in country h. [7]

Capital and Investment. Similar to the case of intermediate inputs, the bundle of capital goods of each firm i is composed of capital goods produced by different sectors. In addition, the bundle that firm i uses of each type capital good is the result of combining the different national varieties of such capital goods.

$$K_i \quad = \quad \left(\sum_{j=1}^{S} \Omega_{i,j}^{K} \cdot K_{i,j}^{\frac{\sigma_K - 1}{\sigma_K}}\right)^{\frac{\sigma_K}{\sigma_K - 1}} \tag{6}$$

where the element (i, j) of matrix Ω^K represents the importance of investment goods from sector j for the capital bundle of sector i.[8]

$$K_{ij} \quad = \quad \left(\sum_{h=1}^{C} \lambda_{ijh}^{K} K_{ijh}^{\xi_{j,t}-1/\xi_{j,t}}\right)^{\frac{\xi_{j,t}}{\xi_{j,t}-1}} \tag{7}$$

where λ_{ijh}^K represents the initial share of expenditure by firm i on the variety of good j produced in country h.

Each sector accumulates each of the capital goods for the following period. The process of capital accumulation is

$$K_{ijc,t+1} \quad = \quad (1 - \delta_j) \cdot K_{ijc,t} + I_{ijc,t} - \frac{\varsigma}{2}\left(\frac{K_{ijc,t+1}}{K_{ijc,t}} - 1\right)^2 \tag{8}$$

[7] We assume that $\xi_{j,t}$ grows over time, reflecting the relative easiness of substituting suppliers over a longer period. We assume that $\xi_{j,t}$ grows linearly between the short- and long-run values in Fontagné et al. (2022) over 10 years.

[8] See Quintana (2023) for a description of the building of the investment matrix Ω^K.

where δ_i is the rate of depreciation of good j. Firms face convex adjustment cost to change their level of capital.

Since the investment input-output network allows us to identify which sector-country pairs produce the capital goods that all other firms use, the cost of the capital bundle of firm i can be expressed by Equation (9). This is an important mechanism for propagating the effects of trade decoupling, since losing access to capital suppliers from the opposite bloc increases the return that firms must receive to compensate for the investment. Similarly, Equation (9) is an additional source of gradual capital adjustment, since a sudden increase (decrease) in investment demand endogenously increases (decreases) the price of the investment bundle, which encourages firms to follow a smoother path in adjusting their capital levels.

$$P_i^I = \left(\sum_{j=1}^{S} \Omega_{i,j}^K \cdot P_{ij}^{1-\sigma_K} \right)^{\frac{1}{1-\sigma_K}} \qquad P_{i,j}^I = \left(\sum_{h=1}^{C} \lambda_{ijh}^K \cdot P_{jc}^{1-\xi_{j,t}} \right)^{\frac{1}{1-\xi_{j,t}}} \tag{9}$$

Labor. Labor is imperfectly mobile across sectors with an elasticity υ. The amount of labor in each sector is

$$L_i \;=\; \omega_L \left(\frac{W_i}{W_c} \right)^{\upsilon} \cdot L_c \tag{10}$$

where L_c is the quantity of labor in country c, as a function of the aggregate wage.

3.2 Households

In every country there is a representative household which owns all the firms in the country and supplies labor. Households' preferences are represented by the function

$$U \;=\; \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left(\log C_t - \frac{L_t^{1+1/\mu}}{1+1/\mu} \right) \tag{11}$$

where μ is the Frisch elasticity of labor supply and β the discount factor.

$$C_i = \left(\sum_{j=1}^{S} \Omega_{i,j}^{C} C_{c,j}^{\frac{\sigma_C - 1}{\sigma_C}}\right)^{\frac{\sigma_C}{\sigma_C - 1}} \tag{12}$$

where the (i, j) element of matrix Ω^C represents the importance of goods from sector j on the basket consumption of country's i household.

Also, within the consumption of a given good j, households combine the different domestic varieties produced in each country, combined with an elasticity of ξ_j

$$C_{ij} = \left(\sum_{h=1}^{C} \lambda_{ijh}^{C} C_{ijh}^{\xi_j - 1/\xi_j}\right)^{\frac{\xi_j}{\xi_j - 1}} \tag{13}$$

where λ_{ijh}^{C} represents the share of expenditure by the household in country i on the variety of good j produced in country h.

The household budget constraint states that households in each country derive their income from wages, income from the country's firms and the lump-sum rebate of carbon tax revenues. Households use their income for capital investment in the country's firms and final consumption.

$$P_c^C \cdot C_c + P_c^K \cdot I_c = W_c \cdot L_c + \Pi_c + \tau_c \tag{14}$$

where P_c^C is the price of the consumption-bundle for country c household, C_c is aggregate consumption, P_c^K is the price of the investment-bundle for country c firms, I_c is aggregate investment, W_c is average wage across sectors, L_c is aggregate employment, Π_c is the revenue of country c firms -discounted of wages and intermediate inputs-, and τ_c is the lump-sum rebate.[9]

[9]Implicitly, this budget constraint imposes an additional disruption of financial flows between blocs.

3.3 Nominal variables

The disruption of global value chains due to trade decoupling causes a shock to the relative prices of labor, intermediate inputs, and capital goods, both across sectors and across countries. However, in the absence of additional assumptions, price levels are not determined in the model. Thus, it is necessary to impose some normalization or rigidities in order to be able to say something about the evolution of price levels. Since the frequency of our analysis is annual, the most natural variable on which to impose rigidities is nominal wages rather than goods prices. Specifically, we analyze the implications for the evolution of the price level under two different assumptions about the behavior of nominal wages in the Western bloc. First, we assume nominal rigidities of nominal wages. It should be noted that under this assumption, the effects on the price level capture only the cost-push shock resulting from trade fragmentation, but not the potential reaction of wages. Therefore, given that the trade fragmentation shock is inflationary, this scenario is likely underestimating the final effect on the price level.

In a second scenario, we impose indexation of nominal wages such as

$$\hat{w}_t = {}^1\!/\!_3 \cdot \pi_t + {}^1\!/\!_3 \cdot \pi_{t-1}$$

It should be noted that this normalization does not affect the real variables in the model, since it does not impose any additional changes in the relative price relationship. For example, while these assumptions fix the values of nominal wages, real wages and labor supply are fixed by the Frisch elasticity.

With respect to nominal exchange rates, we also assume that they are perfectly flexible and that they adjust so that the law of one price holds for producers - that is, the price a producer receives for his goods, once expressed in his local currency, is the same regardless of the location of the buyer.

4 Data and Calibration

Production parameters: We calibrate the model using the Inter Country Input Output (ICIO) tables provided by the OECD with data for the year 2019. These tables contain information on trade flows between 44 sectors in 66 countries, in addition to information on total gross output and value added. Crucially for our analysis, these trade flows distinguish between intermediate consumption, final consumption by households and government, and goods for gross fixed capital formation.

These data allow us to calibrate the parameters of the production function of different sectors by estimating the weight of each good in an industry's intermediate input bundle, as well as the particular national variety of that good that is imported into each country's industry.

Capital matrix: to construct the capital matrix, we use two data sources. First, from the data in the ICIO tables, we can obtain the sales of investment goods that each sector-country pair makes to each country. However, these flows only show the destination country, not each of the sectors within that country. To expand this column into a full square matrix, we use the World KLEMS tables (supplemented by national accounts tables) as a second source of data. From these tables we can obtain information on the different assets in which each sector invests[10], although they do not contain information on the origin of these assets. In this way, we only need to impute between which sectors the producers of each specific type of capital are in order to link the two tables and have a complete supplier-customer matrix for investment goods, analogous to the one available for intermediate inputs.

Trade elasticities: trade elasticity (ξ_{it}) is a key variable for understanding both the magnitude and the dynamics of the aggregate effects of trade fragmentation. The ability of

[10]KLEMS considers nine different types of capital goods: computer hardware, communication equipment, computer software and databases, research and development, transportation equipment, other machinery and weapons, cultivated assets, dwellings, and other buildings and structures

firms to redirect the supply of their previously imported products from the opposite bloc can be expected to be limited in the short run, but to increase over longer time horizons. We base our analysis on values in Fontagné et al. (2022), using his short- and medium-term estimates. We assume that the elasticities grow linearly between their short-run and long-run values over 10 years, reaching their long-run values at t=10. Table A1 shows the sector-specific short ($\xi_{i,1}$) and long term ($\xi_{i,10}$) values of trade elasticities.

Production elasticities: following the literature in Atalay (2017) and Baqaee and Farhi (2019), we set the labor-capital elasticity (θ_{KL}) equal to 0.9; the elasticity between intermediate inputs and in-house production (θ) equal to 0.5; the elasticity between different intermediate inputs (σ_M), energy sources (σ_E) and capital goods (σ_K) equal to 0.2, and the elasticity of household consumption across sectors (σ_C) equal to 0.9. Following Böhringer and Rivers (2021), we set the elasticity between energy and value added (θ_{KLE}) equal to 0.4.

5 Scenarios

We simulate two different scenarios, Cold War and Back to the 1990s, simulated through an increase in trade costs between the countries of West and East blocs. See Table A2 for the allocation of countries across different geopolitical blocs. The increase in costs occurs either in intermediate goods, capital goods or final consumption goods.

Therefore, we model geopolitical fragmentation as bilateral iceberg costs, so that the price paid for good j produced in country c' will be different depending on whether country c is the industry or household i.

$$P_{ic,jc'} = (1 + \tau_{c,c'}) \cdot P_{jc} \qquad \text{where } c, c' \in W, E, N \tag{15}$$

Although the simulated price impact would be analogous to the introduction of a tariff on imports from the opposite bloc, we assume that trade costs are iceberg-type costs and therefore no government revenue is raised.

- **Cold War scenario**
  - Increase of 150% in the trade between blocs
  - $\tau_{W,E} = \tau_{E,W} = 1.5$
- **Back to the 90s scenario**
  - Increase of 50% in the trade between blocs
  - $\tau_{W,E} = \tau_{E,W} = 0.5$
- Increase in trade costs affects both households and firm purchases
- Dead-weight cost, not revenue.
- In anticipation scenarios, the shock takes place after period t=5.
- Trade costs expected to be permanent.

6 Results

The time profile of the GDP response to trade fragmentation is different depending on whether the observed channel is the disruption of intermediate inputs or of investment goods. the increase in the cost of importing intermediate goods from the opposite bloc has an immediately larger effect and begins to decline thereafter. this is a result of the period-by-period consumable nature of intermediate goods and therefore the response adjusts in a fully flexible manner in each period according to how restrictive the substitutability between national varieties is. On the contrary, the contribution of the capital component accumulates over time, not reaching its full magnitude in the initial periods. The reason is that, while the additional investment in imported capital goods from the opposite bloc falls completely in the first periods, the capital stock with which the sectors operate is only gradually reduced.

This difference in reaction is also observed in trade flows between blocs. The fall in trade in intermediate goods is more gradual than in the case of investment goods because there are no inter-temporal incentives for firms to adjust their demand for intermediate goods and their response is weighted by the increase in trade costs (constant) with the cost of substituting suppliers of their goods (decreasing). On the contrary, the fall is sharper at first and the fall in investment remains depressed until the sectors reach the desired new level of capital by letting it depreciate.

Comments:

- Because of non-linearities, the disruption in intermediate inputs under the Cold War shock is sufficiently large to make the overall GDP losses strictly decreasing.
- Under a more limited trade disruption, as in the Back to the 90s scenario, the effect of sluggish investment delays the peak of GDP losses.
  - Same would happen with less restrictive assumption on short-term trade elasticities.
- This result is due to the non-linearities of the model and the assumption of complementarity between inputs. Thus, while the contribution of capital increases over the years in both scenarios, the disruption in the Cold War scenario is large enough to offset this effect, while in the Back to the 90s scenario the disruption in the intermediate input supply chain is not large enough to reverse the U-shape of the effect.
- Similarly, even without backwards wage indexation, the scenario with limited trade disruption has endogenous persistence of inflation.

- Neutral country benefits from trade diversion and access to relatively cheaper capital goods. As long as augmented trade costs between opposing blocs reduces demand for capital-supplying sectors, general equilibrium effects implies cheaper access from neutral countries than do not suffer such costs.

- Anticipated scenario reduces costs because trade disruption happens under less restrictive elasticities of substitution and also because countries can run a limited stockpiling of capital goods from opposite blocs.

6.1 Cold War Scenario

Figure 2: Results of Cold War Scenario

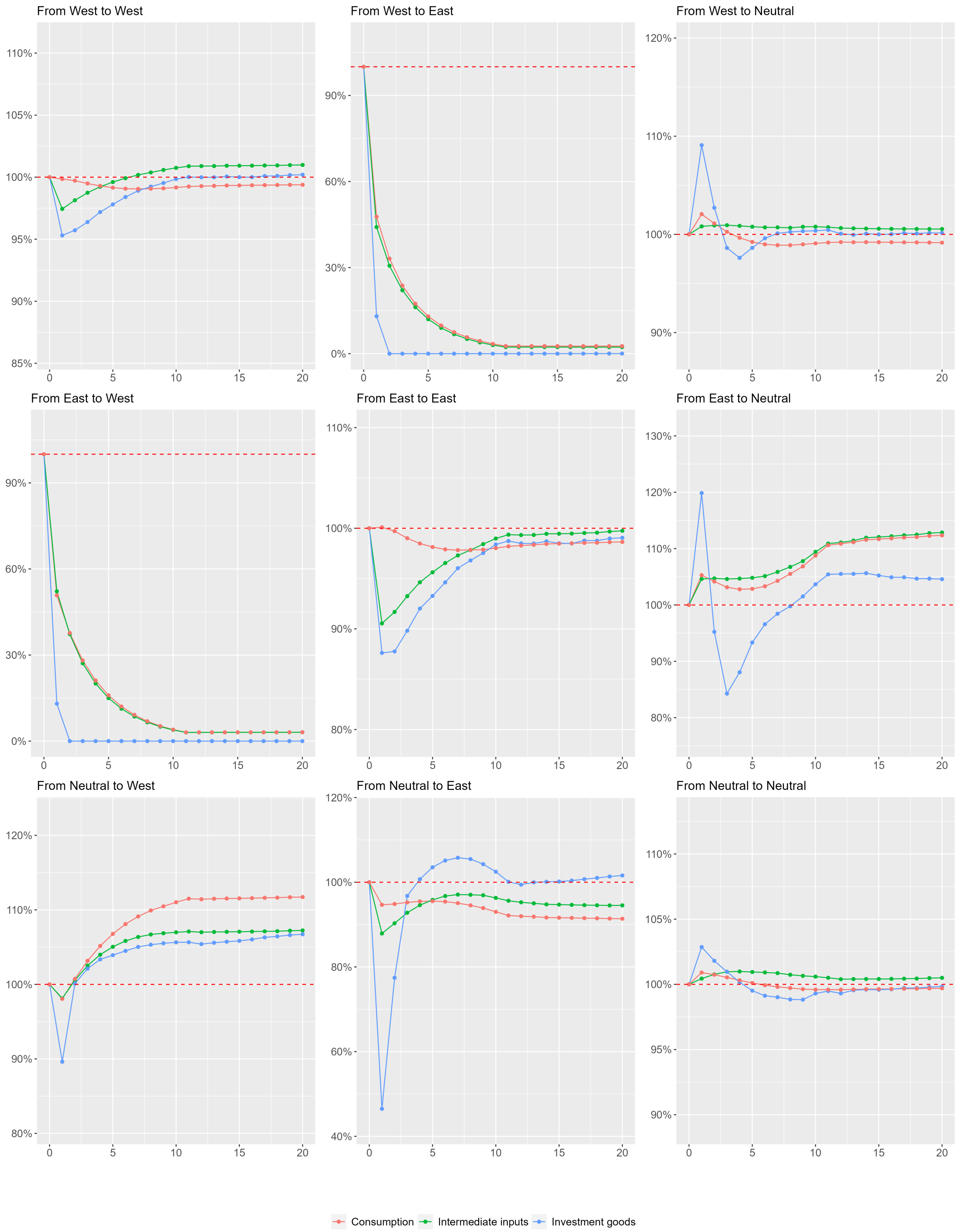

Figure 3: Trade changes of Cold War Scenario

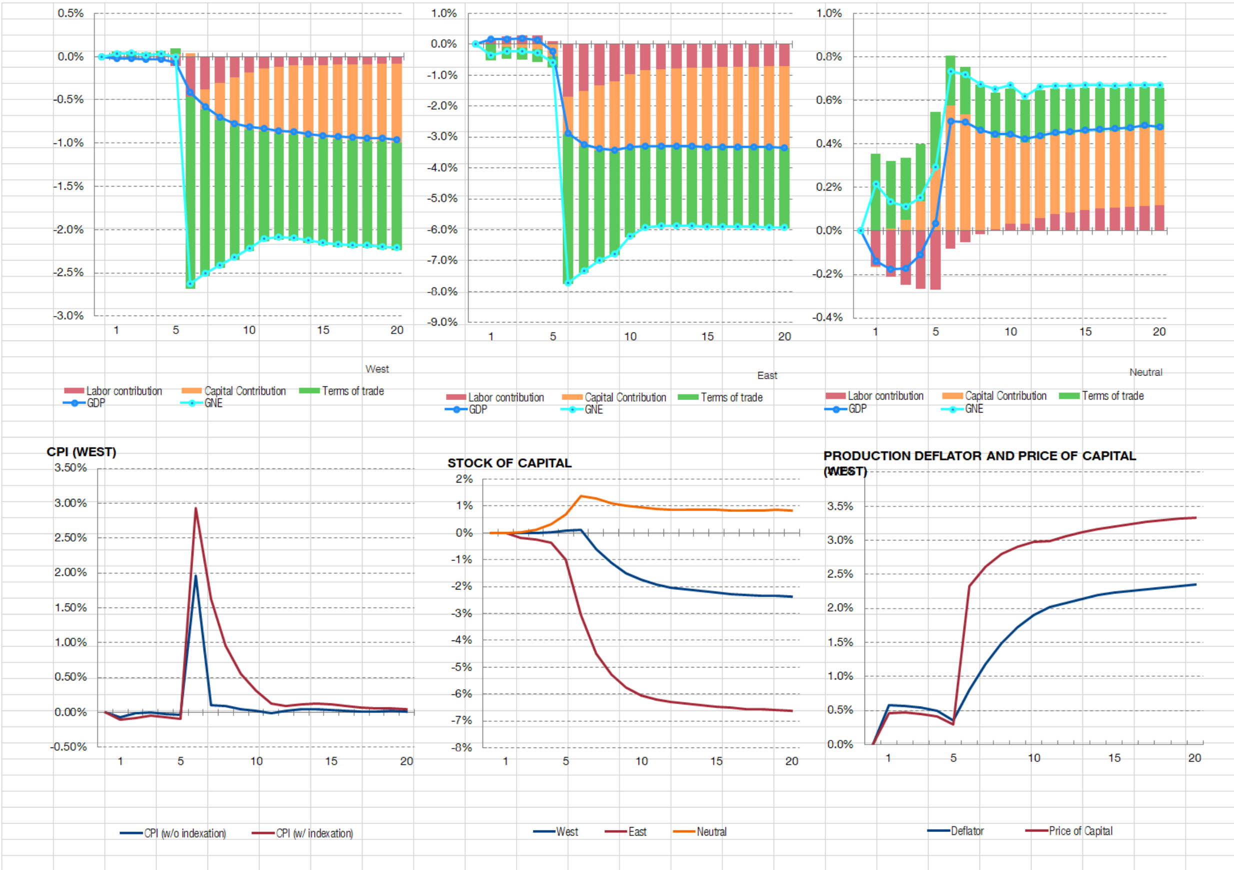

Figure 4: Results of Cold War Scenario with Anticipation

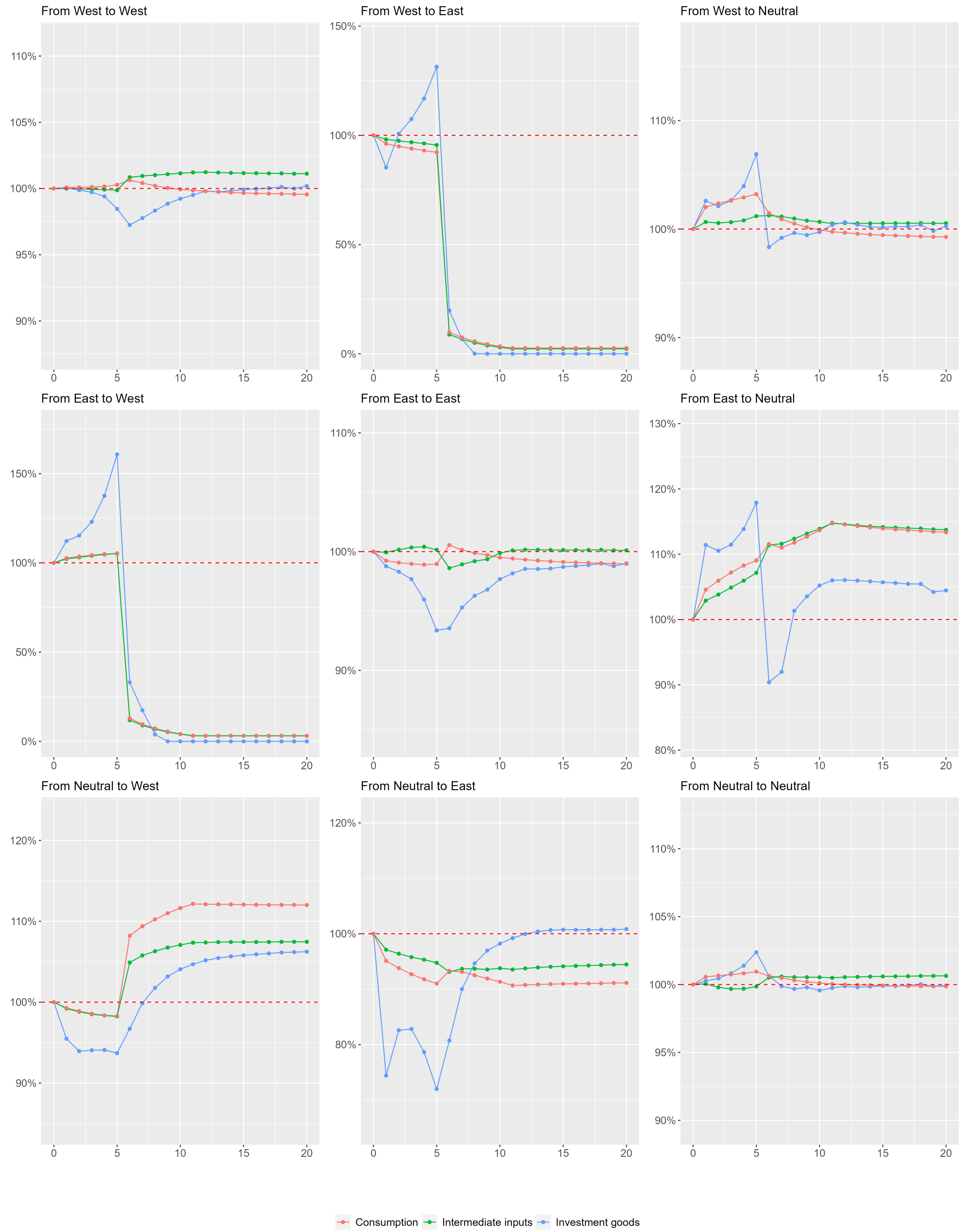

Figure 5: Trade changes of anticipated Cold War Scenario

6.2 Back to 90s Scenario

Figure 6: Results of Cold War Scenario with Anticipation

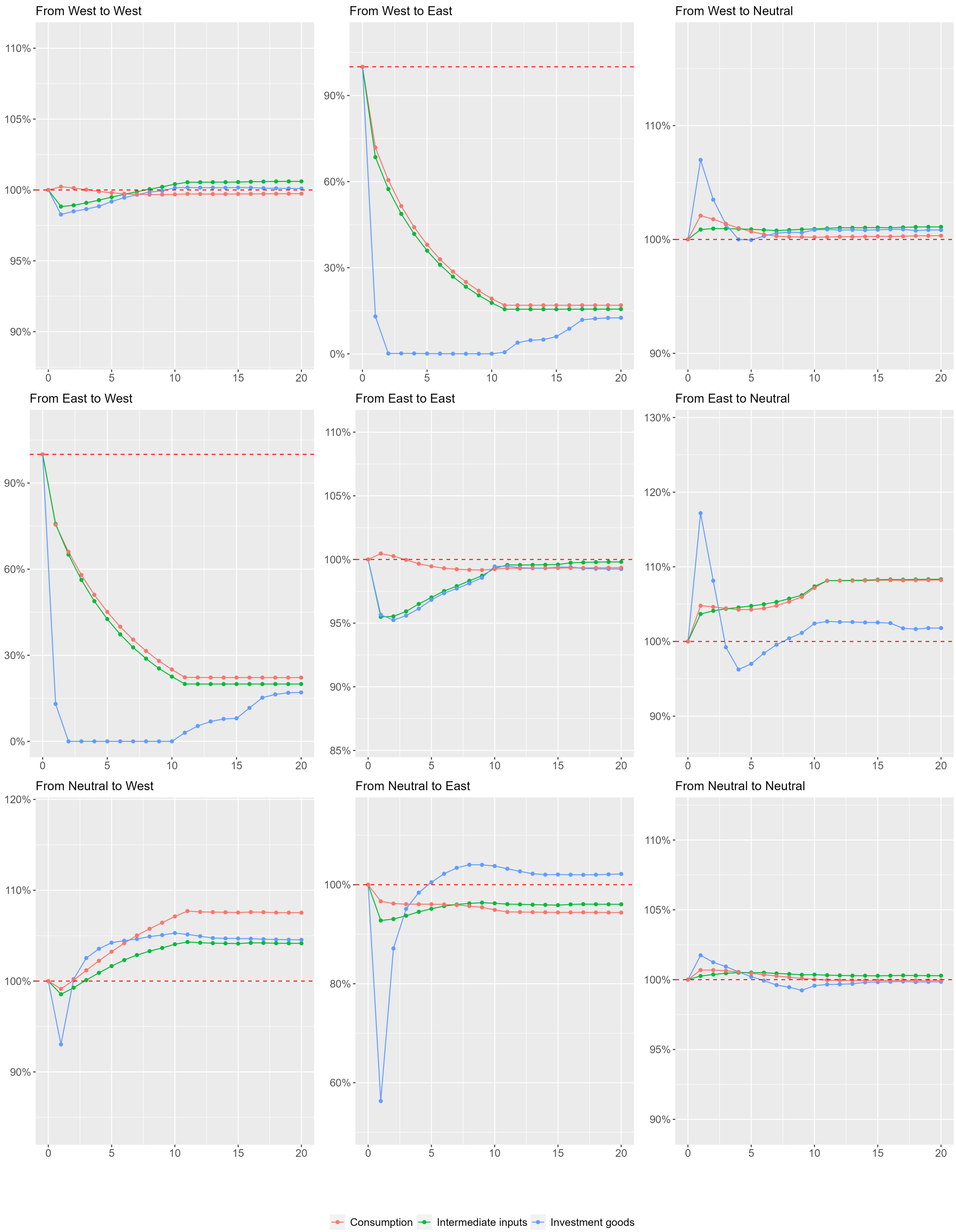

Figure 7: Trade changes of Back to 90s Scenario

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A Figures and Tables

Table A1: Short- and long-run trade elasticities

	Sector	Short-run	Long-run
D01T02	Agriculture, hunting, forestry	0.15	2.91
D03	Fishing and aquaculture	0.15	2.91
D05T06	Mining and quarrying, energy producing products	0.18	3.41
D07T08	Mining and quarrying, non-energy producing products	0.18	3.41
D09	Mining support service activities	0.18	3.41
D10T12	Food products, beverages, and tobacco	0.22	4.17
D13T15	Textiles, textile products, leather, and footwear	0.24	4.71
D16	Wood and products of wood and cork	0.45	8.80
D17T18	Paper products and printing	0.42	8.21
D19	Coke and refined petroleum products	0.19	3.67
D20	Chemical and chemical products	0.45	10.56
D21	Pharmaceuticals, medicinal chemical, and botanical products	0.55	10.56
D22	Rubber and plastics products	0.45	6.75
D23	Other non-metallic mineral products	0.25	4.79
D24	Basic metals	0.38	7.39
D25	Fabricated metal products	0.22	4.22
D26	Computer, electronic and optical equipment	0.27	5.14
D27	Electrical equipment	0.21	4.11
D28	Machinery and equipment, nec	0.26	5.01
D29	Motor vehicles, trailers, and semi-trailers	0.46	8.92
D30	Other transport equipment	0.46	8.99
D31T33	Manufacturing nec; repair and installation of machinery and equipment	0.21	4.06
D35	Electricity, gas, steam, and air conditioning supply	0.17	3.27
D36T39	Water supply; sewerage, waste management and remediation activities	0.17	3.27
D41T43	Construction	0.17	3.27
D45T47	Wholesale and retail trade; repair of motor vehicles	0.17	3.27
D49	Land transport and transport via pipelines	0.17	3.27
D50	Water transport	0.17	3.27
D51	Air transport	0.17	3.27
D52	Warehousing and support activities for transportation	0.17	3.27
D53	Postal and courier activities	0.17	3.27
D55T56	Accommodation and food service activities	0.17	3.27
D58T60	Publishing, audio-visual and broadcasting activities	0.17	3.27
D61	Telecommunications	0.17	3.27
D62T63	IT and other information services	0.17	3.27
D64T66	Financial and insurance activities	0.17	3.27
D68	Real estate activities	0.17	3.27
D69T75	Professional, scientific, and technical activities	0.17	3.27
D77T82	Administrative and support services	0.17	3.27
D84	Public administration and defence; compulsory social security	0.17	3.27
D85	Education	0.17	3.27
D86T88	Human health and social work activities	0.17	3.27
D90T93	Arts, entertainment, and recreation	0.17	8.35
D94T96	Other service activities	0.17	8.35

Based on Fontagné et al. (2022)

Table A2: Countries allocation by geopolitical blocs

West/US-bloc	**Neutral**	**East/China-bloc**
United States	India	China
United Kingdom	Türkiye	Laos
Canada	Brazil	Russia
Japan	Mexico	Hong Kong
South Korea	Indonesia	
France	Malaysia	
Germany	Singapore	
Italy	Thailand	
Spain	Argentina	
Austria	Chile	
Belgium	Colombia	
Luxembourg	Costa Rica	
Netherlands	Peru	
Finland	Saudi Arabia	
Greece	Brunei	
Ireland	Myanmar	
Malta	Morocco	
Portugal	Tunisia	
Cyprus	Vietnam	
Slovakia	South Africa	
Estonia	Cambodia	
Latvia	Kazakhstan	
Lithuania	Philippines	
Croatia	Rest of the World	
Slovenia		
Denmark		
Norway		
Sweden		
Iceland		
Bulgaria		
Hungary		
Poland		
Romania		
Czechia		
Switzerland		
Australia		
New Zealand		
Israel		
Taiwan		

Table A3: Parameters

Variable		Value	Source
ς	Capital adjustment cost	.4	Vom Lehm & Winberry (2022)
μ	Frisch elasticity	1	
β	Discount rate	.95	
υ	Labor adjustment cost	1	Horvath (2000)
Ω^X, λ^X, α	Expenditure shares,		ICIO OECD
η	and production parameters		
Ω^K, δ	Investment matrix and dep. rate		KLEMS, ICIO OECD