The Macroeconomic Effects of Global Supply Chain Reorientation*

Daragh Clancy,[a] Donal Smith,[b] and Vilém Valenta[c]
[a]Central Bank of Ireland and University of Limerick
[b]Organisation for Economic Co-operation and Development
[c]European Central Bank

Policymakers around the world are encouraging the local production of key inputs to reduce risks from excessive dependencies on foreign suppliers. We analyze the macroeconomic effects of supply chain reorientation through localization policies, using a global dynamic general equilibrium model. We proxy non-tariff measures, such as the stricter enforcement of regulatory standards, which reduce import quantity but do not directly alter costs and prices. These measures have, so far, been a key component of attempts to reshore production and are an increasingly popular trade policy instrument in general. Focusing on the euro area, we find that localization policies are inflationary, imply transition costs, and generally have a negative long-run effect on aggregate domestic output. The size (and sign) of the impact depends on whether these policies are implemented unilaterally or induce a retaliation from trade partners, and also the extent to which they reduce domestic competition and productivity. We provide some recommendations for policymakers considering implementing a localization agenda.

JEL Codes: F13, F41, F45, F62.

*We thank Keith Kuester (co-editor), Thomas Conefrey, Aydan Dogan (discussant), Sorcha Foster, Vahagn Galstyan, Pascal Jacquinot, Klaus Masuch, Martin O'Brien, Gerard O'Reilly, Dimitrios Papaoikonomou (discussant), and participants at the International Journal of Central Banking Annual Research Conference, the 29th International Conference for Computing in Economics and Finance, the 25th INFER Annual Conference, the ESCB Research Cluster 2 Annual Workshop, and Central Bank of Ireland and ECB seminars for comments. Matija Lozej provided invaluable advice throughout the project. These views are our own and do not necessarily reflect the views of the CBI, the ECB, or the OECD. Author e-mails: daragh.clancy@centralbank.ie; Donal.SMITH@oecd.org; vilem.valenta@ecb.europa.eu.

European strategic autonomy is goal number one for our generation.

— Charles Michel, President of the European Council

1. Introduction

The COVID-19 pandemic and heightened geopolitical tensions from events such as Brexit, U.S./China trade tensions, and the Russian invasion of Ukraine have increased concerns over the smooth functioning and security of global supply chains. European policymakers, like many others around the world, have introduced legislation to spur the local production of key manufacturing inputs and reduce "excessive dependencies" on external suppliers. These initiatives seek to help Europe achieve *Open Strategic Autonomy*, one of the key policy objectives of the von der Leyen European Commission.[1] Broadly speaking, this term refers to the European Union (EU)'s ability to protect its interests and adopt its preferred economic, defense, and foreign policy without depending heavily on foreign states.

While arguments about comparative advantage, the potential forgone benefits of international specialization, and industry- and product-specific disruptions are familiar, there is less analysis on the macroeconomic effects of supply chain changes resulting from localization policies. Recent supply chain shocks have had large effects, with disruptions in 2021 estimated to have reduced euro-area GDP by around 2 percent and doubled the rate of manufacturing producer inflation (Celasun et al. 2022). These disruptions contributed to the need for a large fiscal response—first to the COVID-19 pandemic, and later to the energy crisis.[2] The large sensitivity of the global

[1]In Appendix A, we discuss a specific piece of legislation that illustrates the concept of Open Strategic Autonomy: the European Chips Act. This legislation aims to bolster the supply of (strategically important) semiconductors and demonstrates the shift in emphasis towards the domestic production of some essential goods. Note that we use the euro area and Europe interchangeably throughout, and that we also use domestic, local, and regional as synonyms.

[2]European countries have allocated over €750 billion in support since the energy crisis erupted, according to a Bruegel database (Sgaravatti, Tagliapietra, and Zachmann 2022). To put this in context, German supports alone are equivalent to almost 7.5 percent of GDP.

economy to the smooth functioning of supply chains suggests that the international trade reconfiguration implied by localization policies could also have sizable impacts on key macroeconomic variables such as output, employment, and inflation.

To analyze this issue, we simulate a (partial) reshoring of production back to Europe in a global dynamic general equilibrium framework. Our model covers three regions: the euro area (EA), the United States (US), and the rest of the world (RW). These economies are linked through bilateral trade and participation in international financial markets, with region-specific calibration. We model the reshoring of production by (permanently) replacing a proportion of imported inputs used in the creation of export goods with locally produced inputs. Thus, localization focuses on the goods in our model most closely related to global supply chains.[3] We model reshoring through a direct change to the export goods' production-function parameters. Our approach is a proxy for non-tariff measures, such as the stricter enforcement of regulatory standards, which reduce import quantity but do not directly alter costs and prices.

We start by analyzing the effects of the EA *unilaterally* reshoring part of its production. In a basic scenario, whereby there is no impact from reshoring on local competition and productivity and no retaliation by trade partners, aggregate output in the economy increases by around 0.5 percent in the *long run*. An important aspect of this economic expansion is the reaction of foreign firms, who *drop* their prices in response to the anticipated fall in demand. Since the reshoring is only partial, the cost savings on remaining imported inputs boosts the competitiveness of EA exporters and allows them to export more. This is despite a real effective exchange rate appreciation from the rise in domestic costs and prices, due to increased demand for factor inputs. The positive wealth effect from increased export earnings facilitates a rise in consumption and a decrease in work effort, with increased investment required for the capital-intensive rise in production.

[3]Our exercise looks at reshoring the production of goods that are solely intended for export. This captures only one component of trade, and production that ends in domestic use may still use foreign inputs in the same way as before. This means that imports that are at the end of the supply chain remain unaffected. Our results, available upon request, are robust to the reshoring of imported final goods.

Another crucial aspect of these long-run results is the rise in foreign demand for EA exports. This occurs because of the reduction in a source of inefficiency: the market power of export firms, which enables them to set a markup over marginal costs. At each stage of the supply chain, producers charge markups (assumed, for now, to be constant over time). Since reshoring effectively shortens the supply chain, the sum of markups along the chain falls. These cost savings facilitate the expansion in demand in all three regions and are key to our finding of increased aggregate output in this basic scenario.

A value-added of our framework is that we can analyze the *medium-term* adjustment process following a decision to reshore. We find that aggregate economic output is lower and inflation is higher initially, while the economy adjusts. Increased costs and prices result in a (real effective) exchange rate appreciation that worsens external competitiveness and leads to a shift in resources from tradable to non-tradable production. Gradually, as lower import prices feed into lower export prices, the effect of the appreciation is fully offset and demand for EA exports rises. This, and the increase in domestic demand for tradable goods (from the decision to reshore), results in a need for greater tradable production, and the transition towards the new steady state is set in motion.

In the basic scenario we have described so far, reshoring leads to higher economic activity in the long run at the cost of increased prices. However, there are several reasons why reshoring might be less benign for local economic activity. We analyze three such scenarios and find that the size (and sign) of the impact of unilateral reshoring on aggregate output depends on the extent to which it results in (i) a (permanent) rise in local firm price markups (from increased market power), (ii) a fall in local firm productivity (from the use of lower-quality local inputs), and (iii) a retaliation by trade partners. We find that the adverse impacts of the markup and productivity shocks resulting from reshoring would likely more than offset the positive impact from moving production back home, resulting in permanently lower domestic aggregate output. Finally, if Europe's trade partners *retaliate* by also reshoring (a symmetric amount of) production, the increase in EA economic activity and inflation is attenuated by a less pronounced wealth effect and, in contrast to the unilateral scenarios, global trade declines.

Related Literature. Our analysis sits within the broad literature examining the role of global supply chains as a mechanism for the propagation and amplification of shocks (e.g., Carvalho et al. 2021). In particular, our work relates to papers examining the potential for countries to reduce their exposure to global supply chains. Rodrik (1998) and Giovanni and Levchenko (2009) find that greater openness increases an economy's exposure to external shocks. In contrast, Caselli et al. (2020) show that international trade reduced volatility in most countries and Bonadio et al. (2021) demonstrate that reduced reliance on foreign inputs does not mitigate pandemic-induced contractions in labor supply. D'Aguanno et al. (2021) find no evidence of a relationship between global value chain integration and macroeconomic volatility.

The onset of the COVID-19 pandemic and the severe supply chain issues seen in many countries has fostered a narrative that countries and regions could be better off reducing their exposure to foreign shocks that propagate into their economies through trade in intermediate goods. Baldwin and Freeman (2021) provide a comprehensive discussion of proposals to reduce this exposure, such as decoupling from global supply chains through greater use of domestic inputs, shortening value chains, and through further diversification of input sources. Additionally, the rising global tensions following Russia's invasion of Ukraine suggests that a more fragmented international system could replace previous norms of ever more open markets and increasing globalization. In particular, strategic geopolitical rivalries may decrease the weight on economic gains from trade. This dynamic, along with factors such as natural disasters, climate-change-induced volatility, and terrorism mean that supply chain disruptions could be a new normal (Grossman, Helpman, and Lhuillier 2021).

Our work fits within the literature providing dynamic general equilibrium analyses of protectionist policies, in particular those using global macroeconomic models to quantify trade policy changes. Faruqee et al. (2008) analyze the effect of a rise in protectionism in response to rising global trade imbalances. They find that imposing import tariffs does not help reduce these imbalances. Lindé and Pescatori (2019) find that although the macroeconomic costs of a trade war are substantial, a fully symmetric retaliation is the best response. Cappariello et al. (2020) consider a rich input-output structure and demonstrate that closer integration amplifies the adverse effects of protectionist trade policies. Other papers to analyze trade policy issues using the EAGLE model framework include Pisani and Vergara Caffarelli (2018), Bolt, Mavromatis, and van Wijnbergen (2019), and Jacquinot, Lozej, and Pisani (2022).

Several recent studies have also examined the economic effects of a global trade fragmentation. Góes and Bekkers (2022) find that Europe could suffer substantial welfare losses from a split into a two-bloc world along geopolitical lines. The size of the effect depends crucially on the extent to which this decoupling reduces the cross-border diffusion of ideas and therefore innovation. A common finding is that distortions to trade from geopolitical fragmentation generally entail higher prices and lower welfare (Javorcik et al. 2022; Attinasi, Boeckelmann, and Meunier 2023; Campos et al. 2023; Felbermayr, Mahlkow, and Sandkamp 2023).[4] More localization may also increase vulnerability to (external and domestic) shocks (OECD 2020).

We contribute to this literature in a number of ways. First, we modify a dynamic general equilibrium model of the global economy in order to analyze the transmission of localization policies. This allows for a comprehensive treatment of cross-border macroeconomic interdependences and spillovers between the different regions.

Second, we are able to assess both long-run effects and the transition dynamics of localization policies. We believe that the short- to medium-run effects are crucial from a policy perspective. Our model contains a detailed monetary block and captures inflation dynamics, which is a key concern for supply chain reorientation. These important macroeconomic features are typically highly stylized, or omitted, from static international trade models.

Third, our approach permits an analysis of non-tariff measures (NTMs), which are so far dominating the localization agenda. The generic nature of our shock means it is a suitable proxy for a broad range of NTMs, including potential future new measures. Another

[4]There is, however, substantial cross-country heterogeneity in terms of impact, with small open economies (SOEs) reliant on global supply chains more affected. Clancy, Smith, and Valenta (2023) analyze spillovers to SOEs from the localization policies of (much) larger trade partners and examine the use of fiscal policy instruments to reshore production. See Aiyar et al. (2023) and Ioannou et al. (2023) for comprehensive discussions of the wider economic implications of the changing geopolitical environment.

advantage of our approach is that implementing reshoring through NTMs means that a rise in inflation and an output loss is not a predetermined outcome, as is the case when modeling reshoring through import tariffs and/or a rise in (iceberg) trade costs.

The main limitations of our approach, compared to international trade models, are the lack of differentiation between essential and non-essential productions and less granularity in modeling cross-border linkages.[5] The generic nature of our reshoring shock also does not allow for an analysis of specific policy measures.

Overall, our paper contains a careful analysis of the key aspects of the localization debate, including effects of localization on domestic competition and efficiency. The outline of the paper is as follows. Section 2 provides a brief overview of the model, the modifications to examine global supply chain reorientation, some key details on the calibration, and a brief discussion of the nature of our exercise. We present the results of our simulations of the unilateral reshoring scenarios in Section 3 and the retaliation scenario in Section 4. Finally, in Section 5, we summarize our findings and discuss their policy implications.

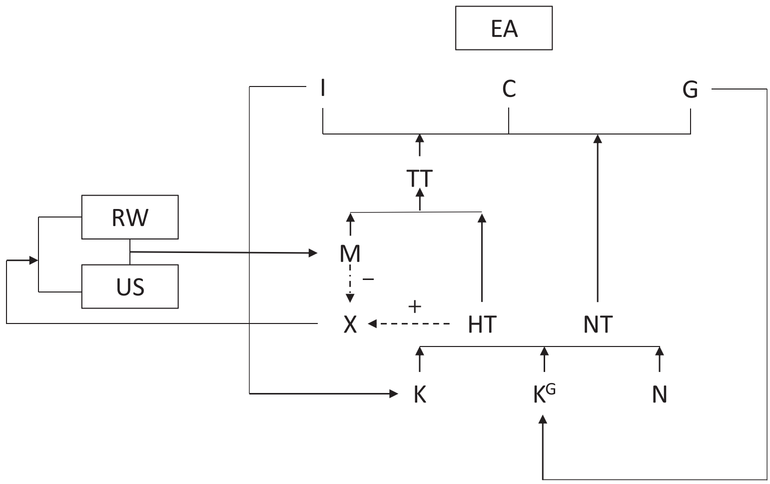
2. Model Overview

We conduct our analysis using an extended version of the EAGLE, a dynamic general equilibrium model. This framework permits the implementation of counterfactual exercises and avoids issues of causal identification faced by empirical studies. Here we only provide an overview of the model, with the reader referred to Gomes, Jacquinot, and Pisani (2012) for details on the original model; Brzoza-Brzezina, Jacquinot, and Kolasa (2014) for the import content of exports component; and Clancy, Jacquinot, and Lozej (2016) for government imports.[6]

[5]See Hunt et al. (2020) and Smith, Kowalski, and van Tongeren (2020) for discussions of the relative strengths and weaknesses of trade and macroeconomic models in assessing large economic shocks.

[6]Further extensions of the EAGLE have added search and matching frictions in the labor market (Jacquinot, Lozej, and Pisani 2018), financial frictions in (country-specific) banking sectors (Bokan et al. 2018), and import tariffs (Jacquinot, Lozej, and Pisani 2022).

Figure 1. Model Structure



Note: This figure shows the structure of our model. We model reshoring through a change to the export goods' production-function parameters. The dashed arrows indicate this *direct* channel of reshoring. However, by affecting the relative price of all goods produced in the economy, and therefore their quantity demanded and supplied, there are considerable *indirect* effects captured by our general equilibrium framework. For conciseness, the figure focuses on the euro-area (EA) economy. The structure of each regional economy is symmetric. US represents the United States, while RW is the rest of the world. M denotes imports, X exports, K private capital, K^G public capital (i.e., infrastructure), N labor, NT non-tradable goods, HT domestically produced tradable goods, TT total tradable goods, I investment, C consumption, and G government spending (which has both current expenditure and capital expenditure components).

We model three regions of the global economy: the euro area (EA), the United States (US), and the rest of the world (RW). The structure of each economy is symmetric and linked with each other through bilateral trade and participation in international financial markets, with bloc-specific calibration. This allows for a comprehensive treatment of cross-border macroeconomic interdependences and spillovers between the different regions. We include a number of real and nominal rigidities in order to match the sluggish reaction of prices and wages found in macroeconomic data. We display the structure of the model in Figure 1.

Each economy features both Ricardian and liquidity-constrained households, firms, and monetary and fiscal authorities. The (infinitely lived) households consume final goods, allocate time between work and leisure, and offer imperfectly substitutable labor services to domestic firms. They use their market power to set wages with a markup over the marginal rate of substitution between labor and consumption. Households own domestic firms and the capital stock, which they rent to firms in a fully competitive market.

Firms produce non-tradable final goods, tradable and non-tradable intermediate goods, and provide intermediation services. Non-tradable final goods are produced by perfectly competitive firms and include consumption goods, investment goods, and public goods. Tradable goods are an aggregate of domestically produced and imported goods. Final goods are produced using domestic tradable and non-tradable intermediate goods and imported goods, combined according to a constant elasticity of substitution technology. Different varieties of intermediate goods are imperfect substitutes, produced under monopolistic competition. This market power allows firms to set nominal prices with a markup over marginal costs. Each intermediate good is produced using domestic and (internationally immobile) labor and capital that are combined according to a Cobb–Douglas technology. Intermediate goods are sold both in the domestic and in the export market. Importantly for our analysis, this implies that there are five types of imports in the model: imports of intermediate goods for private consumption and investment, for government consumption and investment, and for exports.

The monetary authority sets the short-term nominal interest rate according to a standard Taylor-type rule, by reacting to changes in consumer inflation and real output. The fiscal authority sets government consumption and investment expenditures (contributing to domestic capital stock) with an explicit imported component. On the revenue side, the government (exogenously) sets labor income tax rates, and social contributions, capital income tax rates, and consumption tax rates. Public debt is stabilized through a fiscal rule that induces an endogenous adjustment through lump-sum taxes.

2.1 Supply Chain Reorientation

Our analysis focuses on imported inputs used to produce goods for export, as the introduction of localization policies is in response to recent disruptions to global supply chains. These are a composite of imports from the other regions of the world, with the quantity and price of bilateral imports a function of preference shares and the elasticity of substitution from different trading partners. Imported inputs are then combined with domestic tradable inputs, produced using domestic capital and labor. Depending on demand, which is a function of preferences and relative prices, these goods are either packaged with locally produced non-tradables as final goods for private and public consumption and investment or exported for use in other countries' production. More formally, exports in our model are a combination of locally produced tradable inputs and intermediate imports (Armington 1969):

$$X_t(h) = \left[\nu_{X,t}^{\frac{1}{\mu_X}} HT_t^X(h)^{\frac{\mu_X - 1}{\mu_X}} + (1 - \nu_{X,t})^{\frac{1}{\mu_X}} IM_t^X(h)^{\frac{\mu_X - 1}{\mu_X}}\right]^{\frac{\mu_X}{\mu_X - 1}}, \tag{1}$$

where $X_t(h)$ denotes exports of the tradable intermediate good produced by firm h, HT_t^X denotes locally produced tradable goods, IM_t^X denotes intermediate imports destined for re-export, and μ_X represents the intertemporal elasticity of substitution between local tradable goods and imported inputs. In order to examine the macroeconomic effect of supply chain reorientation, we introduce *time-varying* weights of local inputs $\nu_{X,t}$ in the export good bundle:

$$\nu_{X,t} = (1 - \rho_{\nu_X})\overline{\nu_X} + \rho_{\nu_X}\nu_{X,t-1} + \epsilon_{\nu_{X,t}}, \tag{2}$$

allowing us to simulate (permanent or temporary) changes in these weights. One can think of these weights as preferences, formed due to historical linkages, shared language/culture, geographical distance, quality of products, and ease of procurement (such as the existence and/or extent of non-tariff barriers), for example.[7]

In our simulations, we increase the value of $\overline{\nu_X}$, thereby *permanently* increasing the home bias of export firms and causing them to use a greater proportion of local inputs in production. The modeling of this variable as an autoregressive process means that this change is implemented gradually (i.e., the transition speed is dictated by

[7]Our use of these weights to pin down the steady-state import content of exports means they represent a region's revealed (trade) preference.

the size of the parameter ρ_{ν_X}). As we employ a general equilibrium framework, this change will affect costs, prices, and demand for all other goods in the economy. We provide some more details on how this change propagates through the model system in Appendix B.

As our framework does not have internationally mobile firms, we cannot endogenously capture the impact of reshoring on local competition and productivity. Since these are important considerations in the debate surrounding supply chain reorientation, we analyze these as separate scenarios by imposing an additional shock on top of the change in the weight in local inputs in export goods.

To model the potential effect of reduced local competition following a supply chain reorientation, we introduce a *time-varying* elasticity of substitution of tradable firms' goods to increase their market power:

$$HT_{t+k}(h) = \left(\frac{P_{t+k}(h)}{P_{HT,t+k}} \right)^{-\theta_{T_t}} HT_{t+k}, \tag{3}$$

where $HT_t(h)$ is demand for tradable firm h's goods sold in the domestic market, $P_t(h)$ is the firm-specific price of these goods, $P_{HT,t}$ is the aggregate price of tradable goods, θ_{T_t} is the elasticity of substitution for their brand, and HT_t is aggregate demand for tradables (taken as given). Tradable-sector firms can also sell their differentiated output in foreign markets:

$$IM^{CO}_{t+k}(h) = \left(\frac{P_{X,t+k}}{P^{H,CO}_{X,t+k}} \right)^{-\theta_{T_t}} IM^{CO,H}_{t+k}, \tag{4}$$

where $IM^{CO}_t(h)$ is demand for tradable firm h's goods sold in the foreign market CO (either the US or the RW), $P_{X,t}(h)$ is the firm-specific price of these goods, $P^{H,CO}_{X,t}$ is the aggregate price of tradable goods from the euro area (region H) in region CO, and $IM^{CO,H}_t$ is aggregate demand for tradables imports from the euro area in region CO (again, taken as given). By reducing the elasticity of substitution, firms have greater market power and can charge a larger markup over their marginal cost. We model these time-varying elasticities of substitution in a similar way to the weights of local inputs in the export bundle (i.e., as an autoregressive process).

Finally, we also consider the potential side effect of having to use lower-quality goods in areas where Europe is not at the technological frontier. Returning to the example of semiconductors, Europe is substantially behind global leaders (such as South Korea and Taiwan) in terms of advanced chip manufacturing capabilities. To examine this aspect of the supply chain reorientation debate, we implement a shock to the total factor productivity term in the local tradable good firm's production function:

$$Y_{T,t}(h) = max\left\{z_T K_t(h)^{\alpha_T} N_t(h)^{1-\alpha_T} - \psi_T, 0\right\}, \tag{5}$$

where $Y_{T,t}$ is the output of tradable firm h, K_t^D and N_t^D are the firm's capital and labor, the parameter α_T represents the share of capital used in the production of tradable goods, the parameter ψ_T represents fixed costs of production (calibrated to ensure zero profits in the steady state and therefore ruling out an incentive for other firms to enter the market in the long run), and $z_{T,t}$ are (permanent or temporary) sector-specific productivity shocks. As with the other shocks, we model productivity as an autoregressive process to facilitate a gradual transition to the permanent change.

2.2 Calibration

To get a sense of the euro area's trade relationships in the model, we detail the key steady-state ratios and bilateral trade partners in Table C.1. The most important dimension of our analysis relates to international trade. The euro area is the smallest and most open region. Arriola et al. (2020) note that countries that tend to rely more on foreign inputs and ship larger portions of their production to foreign markets are more exposed to global value chain disruptions. Unsurprisingly, given the relative size of the regions, the RW is the EA's largest trading partner for all types of imports. The value of parameters in the model (Tables C.2–C.7) are either based on region-specific empirical evidence, where available, or kept consistent with the original model which uses standard values, prevalent in the literature. See Gomes, Jacquinot, and Pisani (2012) and Clancy, Jacquinot, and Lozej (2016) for details.

It is worth highlighting that we follow the principle that the elasticity of substitution between tradable and non-tradable goods is substantially lower than the elasticity of substitution between different types of tradable goods. We set the (long-run) elasticity of substitution between tradable goods to 2.5 and the (long-run) elasticity of substitution between tradable and non-tradable goods to 0.5. These values come from Faruqee et al. (2008) and are in line with the literature.[8] The elasticities of substitution between local tradable goods and imports (of 2.5) are closer to the macroeconomic literature than the trade literature, which often uses higher values (see, for example, Imbs and Mejean 2015).

Regarding the focus of our study, the value for ν_X is greatest for the US (where only 15 percent of exports contain imported components) and lowest for the RW (where over one-third of exports are composed of imported inputs). The EA lies closer to the middle of this range, with an import content of exports of around one-fifth. The μ_X for each region is set at 1.5, meaning that intermediate imports used in the creation of exports are substitutes and not complements.

Finally, price and wage markups are generally larger in the EA, indicating a somewhat less competitive economy than in the other regions.[9] Markups in the non-traded sector are larger than for the tradable and export sectors in all regions, as they are less exposed to foreign competition. We assume that nominal (price and wage) rigidities are the same across regions.

2.3 Nature of the Exercise

Our approach to modeling localization involves a permanent change to the export goods' production-function parameters. This change in international trade structure is not the endogenous result of an explicit policy decision in the model. As such, this change is efficient, in the sense that it does not impose any deadweight loss, as

[8]Note that because of adjustment costs on bilateral imports, actual *short-run* elasticities in the model are smaller, in line with the empirical evidence (Peter and Ruane 2023). Drozd, Kolbin, and Nosal (2021) model a dynamic elasticity, which is low in the short run but high in the long run, by imposing a convex adjustment cost on trade shares. This represents an interesting avenue for future research within our framework.

[9]Our results are not dependent on this region-specific calibration. We verified this by also assessing the effects of reshoring production in a fully symmetric model, with all regions being of equal size and having the same calibrated values.

would occur if we modeled reshoring using import tariffs, subsidies or through iceberg trade costs for example.[10]

However, we believe that our approach is a useful proxy of a generic rise in non-tariff measures (NTMs). Examples of NTMs include the imposition of local content requirements, stricter quality standards, and alterations in national procurement rules to favor local sellers and promote strategic sectors. Fugazza (2013) provides a comprehensive discussion of these policy instruments. We focus on NTMs, as these are becoming the dominant instrument of trade protectionism (Niu et al. 2018) and are a likely policy tool through which countries may attempt to reshore production (Kratz, Vest, and Oertel 2022). They are also extremely flexible. Grundke and Moser (2019) provide empirical evidence that the stricter enforcement of product standards, a typical form of an NTM, is countercyclical and reacts to business cycle developments. Since NTMs are often de facto, rather than de jure, policy changes, they are less likely to draw attention from trade partners and thereby risk retaliation.[11]

An additional advantage of implementing reshoring with these policy instruments is that changes in prices and output are not a pre-determined outcome. For example, modeling reshoring through import tariffs and/or a rise in (iceberg) trade costs imposes a rise in import prices. Instead, modeling localization measures directly through a change in trade shares does not presuppose a particular response in costs and prices (and, therefore, demand for and production of affected goods). Directly altering trade shares, without imposing cost and price increases, is therefore a close proxy of a localization policy driven by local content, quota, and other legally based trade *volume* distorting NTMs.

These instruments are not barriers that exporters can overcome through price adjustments. They lock out a share of, or all, imports of a product. Other non-tariff barriers can have a similar effect through a prohibitively high cost of compliance. For example, the European Communities (EC) health restrictions on beef imports in

[10]Obstfeld and Rogoff (2000) note that imposing home bias is isomorphic to the effects of trade costs. The size of such costs depend on the elasticity of substitution. Future research could seek to ascertain the value for the elasticity of substitution for which our approach to modeling reshoring becomes inefficient.

[11]Moral suasion is another channel through which governments can encourage desired behavioral changes (Ongena, Popov, and Van Horen 2019).

1989 led to an immediate alteration of trade shares due to the collapse in US beef exports to the EC (Johnson 2017). The change in EC standards meant that US industry would have had to completely restructure to meet the new criteria, an infeasible adjustment for producers. In this case, the NTM essentially ruled out price and cost adjustments to regain trade shares, and US producers in these industries were essentially blocked from the market.

3. Unilateral Reshoring

We utilize scenario analysis to examine the effects of Europe reshoring production. For now, we assume that this is unilateral (i.e., the other regions do not retaliate by also reshoring production). This basic, and arguably simplistic, scenario allows us to explore the main mechanisms through which reshoring policies affect the economy, but without the additional complications resulting from simultaneous changes in the production structure of the other regions.[12]

We model reshoring by increasing the bias for locally produced inputs used in the creation of exports from the other regions in favor of locally produced inputs. We impose this change in the production structure by inducing a permanent 1 percent of GDP decrease, relative to the initial steady state, in the EA's imported inputs used in the production of export goods. This transition occurs gradually, with almost all of the change complete after 10 years. As we solve our model using perfect foresight, all agents in the model are fully aware of the path the shock will take.[13]

[12] After describing the effects from this simple case, we examine more realistic scenarios that also affect local competition and productivity and a retaliation by trade partners. These additions could also capture other salient aspects of international trade that are not endogenous in our model. Feenstra (2018a) notes the particular importance of pro-competitive (i.e., reduced markups) and productivity gains from trade, which he estimates account for roughly 30 and 40 percent, respectively, of total US gains.

[13] Our model is deterministic and is solved using a non-linear Newton-type algorithm in Dynare (see Adjemian et al. 2011 for details). Not having to linearize the model around a given steady state allows us to plot the transition dynamics between the initial and new steady state (i.e., after the supply chain reorientation).

Table 1. Long-Term Effects of Reshoring (% deviation from initial steady state)

	Unilateral	Markups	Productivity	Retaliation
Imported Inputs for Exports (% of Aggregate Output)	–1.0	–1.0	–1.0	–1.0
Aggregate Output	0.5	–0.3	–0.4	0.3
Tradable Output	0.5	–1.4	–1.1	0.5
Non-tradable Output	0.5	0.6	0.2	0.1
Consumption	1.4	1.2	0.6	0.4
Investment	1.9	0.0	0.8	0.9
Hours Worked	–0.1	–0.3	0.0	0.0
Real Effective Exchange Rate	–1.9	–2.3	–1.6	–1.0
Effective Terms of Trade	0.3	0.9	–0.1	1.3
Imports	0.7	1.6	–0.1	–1.6
Exports	1.0	2.5	–0.2	–0.2
Tradable Marginal Costs	0.7	0.1	1.5	0.2
Imports for Re-export Prices	–2.1	–2.1	–1.5	–0.8
Export Prices	–2.5	–3.0	–1.5	–2.3
Domestic Debt	–1.8	–0.4	–0.8	–0.7

Note: This table compares the initial steady-state values to those following a permanent 1 percent of aggregate output reduction in imported inputs used in the production of export goods. "Unilateral" examines the case where the EA enacts this reshoring on its own. "Markups" adds an increase in EA tradable firms' price markups to the unilateral scenario. "Productivity" adds a decrease in EA tradable firms' productivity to the unilateral scenario. "Retaliation" adds a symmetric reduction (i.e., scaled by region size) in the imported content of exports-to-output ratio in both the RW and US regions to the unilateral scenario. All variables are in percentage deviations from the initial steady state, except for the imported inputs for exports (i.e., the reshoring shock), which is in percentage-point deviations.

We first discuss the long-term implications of reshoring. This facilitates a comparison of our results with international trade models, which generally focus on comparative statics. We display these long-term results in the second column of Table 1.

This shock raises aggregate output in the economy by around 0.5 percent in the long run.[14] Increasing the share of local inputs used

[14] The quantitative size of this effect is similar for a unilateral 1 percent of GDP reshoring of imported inputs for export goods in both the RW and US regions (an increase in aggregate output of around 0.3 percent). The underlying transmission channel is also the same. These results are available from the authors upon request.

to produce exports decreases demand for the imported component of these goods. Foreign exports firms react to this drop in demand by reducing the price of these goods.[15] Since the reshoring is only partial, the cost savings on remaining imported inputs results in a fall in the marginal cost for EA exporters. This is despite the higher demand for factor inputs feeding through into higher costs, with local tradable good prices rising as a result. The reduction in overall costs allows export firms to reduce their prices, boosting their competitiveness and leading to an increase in foreign demand for their goods. There is a decline in the terms of trade as export prices fall by more than import prices.

The increased demand for local inputs results in an increase in tradable-sector production. Higher domestic demand, and therefore costs and prices, induces a real effective exchange rate (REER) appreciation. There is a positive wealth effect from the REER appreciation and increased export earnings, boosting domestic households' consumption of both imported (consumption and investment) and domestic non-tradable goods. The boost in domestic demand requires an increase in non-tradable production, further boosting aggregate production. Investment also increases, as the positive wealth effect reduces work effort (resulting in higher wages) and the rise in tradable production is driven by increases in capital usage (reducing the rental cost of capital). Domestic debt falls as increased economic activity boosts tax revenue.

A crucial aspect of these long-run results is the rise in foreign demand for EA exports. Why does this occur, when, all else being equal, the reduction in demand for some of their exports to the EA should have a negative effect on the RW and US? The reason all regions benefit in this basic scenario is due to the reduction of a source of inefficiency: the market power of export firms, which enables them to set a markup over marginal costs. At each stage of the supply chain, producers charge markups (assumed, for now, to be constant over time). Since reshoring effectively shortens the supply chain, the sum of markups along the chain falls. This means that

[15] Khalil and Strobel (2021) provide empirical evidence that cuts to tariff import prices as a result of (trade-policy induced) exchange rate appreciations largely offset tariff price increases.

less resources are lost due to inefficiencies from markups.[16] These cost savings facilitate the expansion in demand in all three regions and are key to our finding of increased aggregate output in the basic scenario.

Importantly, despite engaging in unilateral reshoring, these savings are not entirely captured by the EA. This is clear from the roughly 0.5 percent increase in aggregate production in the EA following the reshoring of 1 percent additional output. The RW and US also benefit through the endogenous response of prices and reallocation of production that boosts EA demand for other types of imports and lowers the price of EA exports. The RW and US increase production to meet increased EA demand, and can do so at lower prices due to the cost savings passed on from EA production being less subject to inefficient distortions from firm market power.

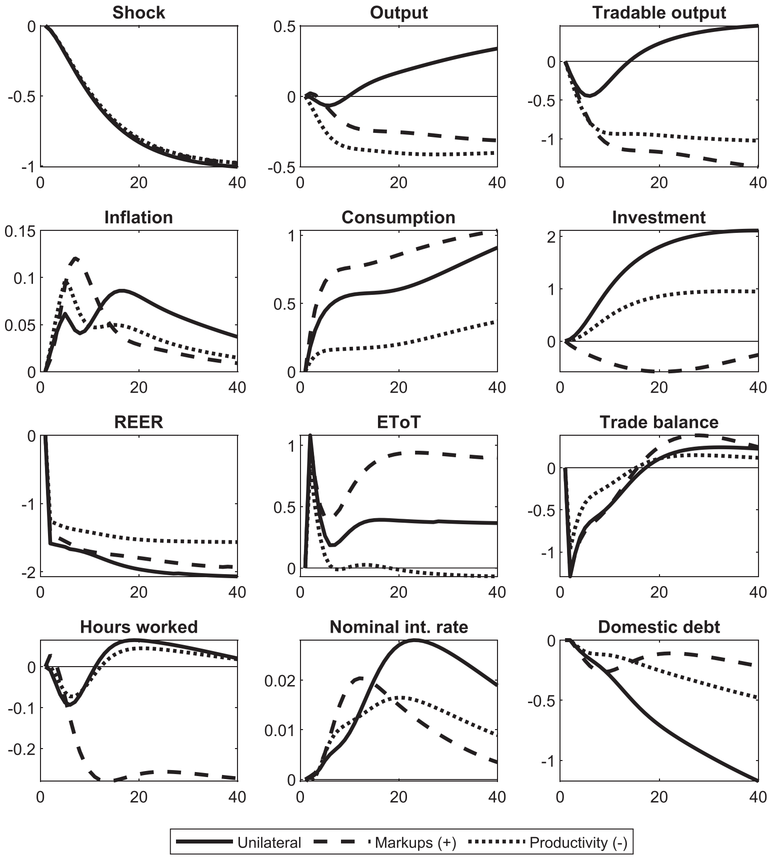
A value added of our framework is the ability to analyze the dynamic response. For policymakers, it is essential to understand the adjustment process. There are some important considerations from the short- to medium-term responses to reshoring production. We display these results (solid line) in Figure 2.

In adjusting to this change, inflation rises by roughly 10 basis points on impact. This effect is highly persistent, with inflation elevated for over a decade. The anticipated rise in production, and therefore factor input costs and prices, results in an expected interest rate differential and an immediate jump in the exchange rate. This appreciation boosts demand for other (i.e., untargeted for localization) imports, and results in a trade deficit. There is local currency pricing, which means the change in exchange rate is not fully passed through to exports (i.e., the appreciation of the euro does not result in an immediate large increase in the price charged in foreign markets). As a result, the increased demand for exports takes some time to materialize, and this weighs on tradable production in the short run. Indeed, this reduction in tradable production is sufficiently large to result in a decrease of aggregate production.

Gradually, as lower import prices (from foreign firms reacting to reduced demand for their goods in EA) feed into lower export prices

[16] In a model where product variety is endogenously determined by firm entry, Bilbiie, Ghironi, and Melitz (2019) demonstrate that markups (and the profits they provide) can be welfare enhancing.

Figure 2. Unilateral Reshoring



Note: This figure shows the effect on the euro area (EA) of a permanent increase in EA-only preferences for domestically produced inputs for export goods (i.e., a partial reshoring of production). We analyze three scenarios: (i) a "unilateral" reshoring; (ii) unilateral plus reduced local competition ("markup"); and (iii) unilateral plus reduced local "productivity." The plotted lines represent transition dynamics between the initial and new steady state. We scale the shock such that the import content of exports-to-output ratio decreases by 1 percentage point in the long run, with almost all of this adjustment complete after 10 years. All variables are in percentage deviations from the initial steady state, except for the imported inputs for exports (i.e., the reshoring shock), consumer price inflation, and the nominal interest rate, which are in percentage-point deviations. Domestic debt is expressed as a nominal value (not as a ratio of GDP). For context, debt is 60 percent of GDP in the initial steady state.

(by reducing their marginal costs), the effect of the appreciation is fully offset and demand for EA exports rises. This, and the increase in domestic demand for tradable goods, results in a need for greater tradable production and the transition towards the new steady state is set in motion.

3.1 Increased Firm Market Power

Greater economic openness exposes local firms to foreign competition. However, efforts to boost local production would likely reduce existing producers' exposure to foreign competition. The large setup costs involved in global supply chains, as well as relaxations in EU state aid rules aimed at facilitating greater public support for existing firms, make it more difficult for new entrants. By signaling a clear increase in preference for local intermediate inputs, localization policies could (unintentionally) increase market power of domestic firms in supported sectors and allow them to increase their price markups.

We now amend our simplified unilateral reshoring scenario to include an additional (permanent) shock to EA tradable-good firms' market power. In the absence of conclusive evidence of what the size of this increase in market power would likely be, we scale this shock to induce a 0.5 percentage point increase in tradable-good price markups (from 30 percent to 30.5 percent). Given the uncertainty as regards the size of this effect, we emphasize that this is a scenario and is largely for illustrative purposes.[17] We nevertheless believe that this calibration is within a plausible range. This increase in markups is similar to increases documented in the literature for typical fluctuations in markups due to business cycle shocks (Nekarda and Ramey 2021).

As before, the shock occurs gradually and is almost fully absorbed after 10 years. We display the results (dashed line) in Figure 2. As in the basic scenario, we first describe the long-run effects. The long-run effect on euro-area output is negative in this

[17]There are a wide range of estimates of the pro-competitive gains from trade. Feenstra (2018b) estimates the US gains from trade (between 1992 and 2005) at just over 1 percent of GDP, of which he ascribes approximately 0.4 percent to decreased markups. However, Costinot and Rodríguez-Clare (2018) estimate gains from trade for the US over a similar period (1995 to 2011) at between 2 and 8 percent of GDP.

scenario, as losses from lower competition more than offset gains from bringing production back home (third column of Table 1). The underlying mechanism is similar to the basic scenario. A decrease in demand for imported inputs in the production of exports results in foreign firms reducing their prices. This boosts the competitiveness of EA exporters, and therefore exports rise despite the REER appreciation. A positive wealth effect spurs consumption and non-tradable-sector production, while lowering work effort.

What is different to the basic scenario is that the greater market power of tradable firms allows them to increase their prices by far more. This reduces demand for tradable goods and therefore tradable sector output falls (while there is an increase in the production of the local input for export goods, these are only one component of overall tradable production). Demand for factor inputs is lower, with investment falling in line with reduced aggregate production.

In terms of the adjustment process, the rise in inflation is much larger than in the basic scenario. This reduces the real interest rate, spurring consumption and resulting in a stronger, but shorter-lived, monetary policy response. Reduced domestic demand due to higher tradable good prices means that investment and employment both decline sharply over the short to medium term. Accordingly, the improvement in public finances is mitigated in this scenario.

3.2 Reduced Firm Productivity

Reshoring production weakens the interaction of the domestic economy with global supply chains. Openness affects growth positively, as economies that are more open have a greater ability to absorb technological advances generated elsewhere (Barro and Sala-i Martin 1997). Global value chains have important implications for productivity and innovation.[18] Increased competition from foreign

[18] Trade in our model is motivated by the Armington assumption that countries produce unique goods and consumers have a love of variety. However, this setup is silent on potentially important implications of localization policies, such as shift patterns of specialization driving by comparative advantage. Given Arkolakis, Costinot, and Rodríguez-Clare (2012)'s equivalence result for different classes of quantitative trade models, it is unclear whether incorporating such changes in specialization would affect our aggregate results. This represents an important avenue for future research.

suppliers can induce improvements in domestic firms. Firms can have potential gains through specializing in their most productive tasks and from utilizing a wider array of new varieties and higher-quality foreign goods, services, and intangible inputs. Further to these effects, engagement with global firms provides an opportunity for knowledge spillovers to local firms (Criscuolo and Timmis 2017). Reshoring could potentially weaken all of these transmission channels, resulting in the use of lower-quality locally produced inputs.

We next amend our simplified unilateral reshoring scenario to include an additional (permanent) shock to tradable good firms' productivity. Again, in the absence of definitive evidence of how big this shock might be, we induce a 0.5 percent decrease in tradable good productivity for illustrative purposes.[19] As before, the shock occurs gradually and is almost fully absorbed after 10 years. We display the long-term results in the fourth column of Table 1.

We find that reshoring has a negative effect on EA output in this scenario. As in the basic scenario, there is an increase in non-tradable output, consumption, and investment as well as an appreciation of the REER. However, the less efficient use of factor inputs means that the marginal cost of producing tradable goods increases substantially. Export prices fall, but by less than import prices and therefore exports are lower (and the terms of trade improve). Imports are also lower, despite the REER appreciation, because there is no longer a positive wealth effect from increased competitiveness.

The adjustment process is quite similar to the basic scenario, with a key difference being the lower beneficial effect of reshoring on consumption, investment, public finances, and the REER appreciation (results displayed using the dotted line in Figure 2). The main differences largely emerge in the medium term, where the more rapid rise in marginal costs means that exports and tradable production remain lower as external competitiveness is weaker. While the response of inflation is initially larger, the muted effect on domestic demand means that the monetary policy response can also be weaker.

[19]Feenstra (2018b) estimates that productivity account for around 30 percent of the total US gains (1.1 percent of GDP) from trade between 1992 and 2005.

4. Retaliation by Trade Partners

Our analysis has thus far focused on the case of Europe unilaterally reshoring production. In reality, such developments would almost certainly induce retaliation from trade partners.[20] In our framework, retaliation is not endogenous and we model it as an exogenous change. More specifically, we analyze a symmetric form of retaliation. This means that we need to take into account the differential size of the regions. To match the 1 percent of GDP reshoring in the EA, we implement a respective 0.4 percent and 0.65 percent of GDP reductions in RW and US imports of tradable goods for re-export. This ensures the reduction of the same quantity of imports in each region. As before, these changes occur gradually and take roughly 10 years to implement.[21] We display the long-term results in the fifth column of Table 1.

Following a partial reshoring of production by all regions, the long-term effects on the EA economy are quite similar to the unilateral scenario. Indeed, the response of almost all variables has the same sign in the medium to long run, with the prominent exception of foreign trade, which declines in the retaliation scenario. Magnitudes also differ, along with the short-term response of inflation and nominal interest rates. We focus our discussion on the variables that now have an opposite-signed response to the unilateral scenario.

The positive wealth effect from the increase in exports, despite the appreciated exchange rate, reduced work effort in the unilateral scenario. When the other regions retaliate, this effect is no longer present and hours worked no longer decrease. The less pronounced wealth effect also means that imports fall as the rise in domestic demand is dampened. Exports now decrease, despite the reduction

[20] Martin and Vergote (2008) show that retaliation is a necessary feature of an efficient equilibrium in trade agreements. This is because governments do not, or cannot, compensate trade partners for terms-of-trade externalities.

[21] We abstract from analyzing potential knock-on effects on local competition and productivity in this scenario, as this would require us making assumptions regarding differential impacts of decreased competition and productivity across the three regions. Of course, even if technically feasible, the imposition of multiple simultaneous region-specific shocks would raise important concerns over interpretation. Therefore, this scenario is essentially the global equivalent of the basic scenario analyzed in Section 3.

in the marginal cost of producing these goods, due to lower foreign demand for imported inputs for export goods. The increase in economic activity facilitates a fall in domestic debt, with consumption rising from higher labor income (wages and hours worked increase). Investment increases to facilitate the expansion in production in both the tradable and non-tradable sectors.

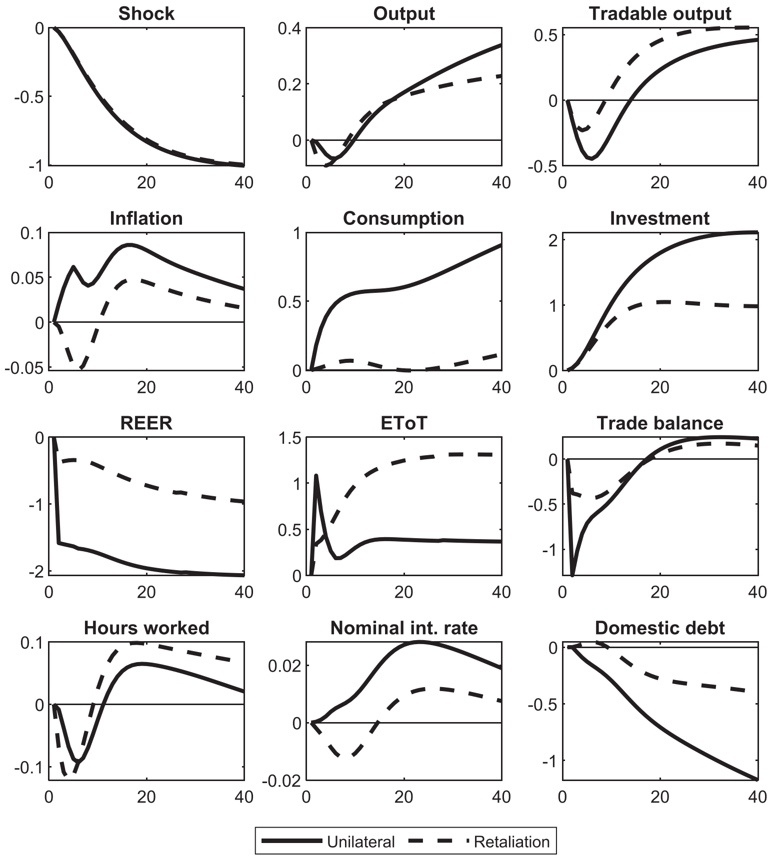
As with the unilateral scenarios, there are some useful insights from analyzing the adjustment process (we display the results from this scenario using the dashed line in Figure 3). On impact, the REER appreciates due to the anticipated rise in factor input costs and therefore prices associated with increased tradable good production. However, this process takes time to play out, and in the short run the reduction in tradable output means there is an initial decline in inflation and nominal interest rates. The decline in exports is sharper than for imports, and a trade deficit opens. As production gradually ramps up, prices and inflation rise and induce a tightening of monetary policy. Domestic debt remains relatively stable initially, before declining once aggregate output begins to increase.

Overall, our analysis shows that retaliation attenuates the positive effect of reshoring on domestic economic activity. However, the savings from the reduction of inefficient distortions remain sufficient for an increase in aggregate production in the EA. However, this result does not include the likely detrimental effects on local competition and productivity (as analyzed in Sections 3.1 and 3.2). Another concern is that international trade decreases in this scenario, with imports and exports in all three regions lower. This fragmentation of the global economy runs counter to the EU's aim to achieve *Open* Strategic Autonomy.

5. Conclusion

The Open Strategic Autonomy agenda is rooted in concerns over and beyond economics. However, European policymakers should consider the economic trade-offs related to the implementation of localization policies and understand the main transmission channels through which these policies affect the economy. We find that a unilateral reshoring of some production by the euro area is inflationary, implies transition costs, and generally has a negative long-run effect on

Figure 3. Symmetric Retaliation



Note: This figure shows the effect on the euro area (EA) of a permanent increase in EA-only preferences for domestically produced inputs for export goods (i.e., a partial reshoring of production). In addition to the "unilateral" reshoring scenario, we now also examine a (symmetric) "retaliation" by trade partners. The plotted lines represent transition dynamics between the initial and new steady state. We scale the shock such that the import content of exports-to-output ratio decreases by 1 percentage point in the long run, with almost all of this adjustment complete after 10 years. All variables are in percentage deviations from the initial steady state, except for the imported inputs for exports (i.e., the reshoring shock), consumer price inflation, and the nominal interest rate, which are in percentage-point deviations. Domestic debt is expressed as a nominal value (not as a ratio of GDP). For context, debt is 60 percent of GDP in the initial steady state.

aggregate domestic output, considering plausible detrimental effects on local competition and productivity. A symmetric retaliation by trade partners also results in persistently higher EA inflation (following the initial decline), although less pronounced than in the unilateral scenario. Retaliation also attenuates any positive effects from reshoring on output and implies a reduction in the volume of overall international trade.

To counter the inflationary pressures of reshoring, it is essential to minimize the crowding out of resources (i.e., capital and labor) that pushes up costs and prices in our simulations. This finding calls for limiting the scope of reshoring, such as by focusing on vital goods that are most susceptible to supply chain disruptions.

Another important finding is that if local tradable firms use their greater market power to increase their markups, this likely negates a positive effect of reshoring on domestic output and amplifies inflationary pressures. Therefore, policymakers should avoid excessively weakening Europe's long-established state aid rules and competition laws, as reduced foreign competition will ultimately undermine the local economy. It could also lead to demands for support in other industries, which are not the focus of reshoring initiatives.[22]

Our results also indicate that if locally produced inputs are inferior to their imported counterparts, reduced productivity amplifies the economic costs of reshoring. As such, policymakers should focus localization policies on goods where there is already an existing comparative advantage in production (or, at least, where the distance from the technological frontier is not too large). Either that, or the economic costs are considered a worthwhile trade-off for an increase in security of supply.

We believe there are several other interesting avenues for future research on this topic using our modeling approach. An important aspect, given our finding that localization policies are inflationary, is the monetary policy response. In our simulations, all regions have the same calibrated values in their Taylor rules. Making these values region specific would allow one to analyze how monetary policy

[22]Experience with past initiatives, such as the Common Agricultural Policy, demonstrates that industries can become reliant on public support (Kazukauskas et al. 2013).

could affect the adjustment following localization initiatives. Our model framework is also capable of analyzing other forms of supply chain reorientation. For example, reorientation of production towards "trusted partners" (friendshoring) could be approximated by increasing their share in intermediate good imports from one region at the expense of another.

Appendix A. The European Chips Act

Public policy choices emphasizing security considerations over cost minimization, foreshadowing a less-integrated global economy with shorter supply chains, are already apparent in the sectors providing critical intermediate inputs. As an essential component of electronic devices, semiconductors are vital for the global economy. Post-pandemic shortages forced production slowdowns, and even shutdowns, in many parts of the world and exposed global reliance on a small number of producers in a small number of countries. These few and geographically concentrated production locations must operate at close to full capacity in order to cover the very high capital investment costs, leaving little capacity to accommodate demand volatility.

European policymakers have identified securing the supply of the most advanced chips as an economic and geopolitical priority, with industrial automation equipment highly dependent on their supply. As an example of the disruption due to the global chips shortage, Europe produced over 11 million fewer cars in 2021, a substantial shock that brought production back to 1975 levels (European Commission 2022).

The European Chips Act aims to double Europe's semiconductor global market share, to 20 percent from less than 10 percent currently, by 2030. This requires the mobilization of substantial public and private investment in this industry. Given the high entry barriers and the capital intensity of the sector, the European Commission will allow greater than usually permitted (under state aid rules) public support for chips manufacturing. Through the Important Project of Common European Interest on Microelectronics and Communication Technologies, approval of state aid is possible for facilities where the economic benefit outweighs the potentially negative impact on trade and competition. The legislation also contains mechanisms for greater cooperation and coordination amongst EU member states to provide early warnings of, and reaction to, supply chain bottlenecks.

However, Europe is not alone in seeking to enhance the resilience of its semiconductor supply. In China, a series of initiatives, such as "Made in China 2025," will provide substantial financing to boost this industry. Planned public support, through tax incentives and investment, is orders of magnitude larger again in South Korea and Taiwan, the global leaders in the production of the most advanced semiconductor chips. In the United States, the CHIPs and Science Act has a similar set of aims to the European Chips Act and goes a step further by explicitly stating a partial motivation is to "counter China."

Such legislation marks an important turning point in European industrial policy.[23] After decades of emphasis on reducing costs and maintaining competition, policymakers are beginning to reconsider the efficiency versus resilience trade-off. Since strategic autonomy as a whole is too broad a concept to analyze, we consider the European Chips Act as a proxy for the types of initiatives that policymakers may implement to meet this objective.

Appendix B. Locally Produced Intermediate Inputs

In this appendix, we provide some more details on how changes in the share of imported inputs used in the production of exports can affect the prices and quantities of other goods in the economy.[24] Imported inputs are a composite of tradable goods produced in other regions of the world:

[23]Of course, such a change is not necessarily an improvement. See Tagliapietra, Veugelers, and Zettelmayer (2023) for a critique of the Net Zero Industry Act, which is essentially the EU's response to the U.S. Inflation Reduction Act.

[24]Here we only provide the aspects of the model most directly related to our analysis. We refer the interested reader to Gomes, Jacquinot, and Pisani (2012) for details on the original EAGLE model, Brzoza-Brzezina, Jacquinot, and Kolasa (2014) for the import content of exports component, and Clancy, Jacquinot, and Lozej (2016) for the fiscal extension. These papers also provide detailed discussion on the calibration choices documented in Appendix C.

$$IM_t^X(h) = \left[\sum_{CO \neq H} \left(\nu_{IM^X}^{H,CO} \right)^{\frac{1}{\mu_{IM^X}}} \left(IM_t^{X,H,CO}(h) \left(1 - \gamma_{IM^X}^{H,CO}(h) \right) \right)^{\frac{\mu_{IM^X}-1}{\mu_{IM^X}}} \right]^{\frac{\mu_{IM^X}}{\mu_{IM^X}-1}}, \tag{B.1}$$

where IM_t^X denotes imported inputs used by firm h to produce export goods, ν_{IM^X} represents the share of imports from each region in total imports (and so must sum to one), μ_{IM^X} is the intertemporal elasticity of substitution between imports from different trading partners, and $\gamma_{IM^X}^{H,CO}$ are (quadratic) adjustment costs on bilateral imported inputs for export goods of firm h. Firm h then combines these intermediate-good imports with local (i.e., regional) tradable inputs, produced using regional capital K_t and labor L_t subject to productivity shocks z_T and fixed costs ψ_T:

$$Y_{T,t}(h) = max \left\{ z_T K_t(h)^{\alpha_T} N_t(h)^{1-\alpha_T} - \psi_T, 0 \right\} \tag{B.2}$$

to produce exports goods X_t:

$$X_t(h) = \left[\nu_{X,t}^{\frac{1}{\mu_X}} HT_t^X(h)^{\frac{\mu_X-1}{\mu_X}} + (1-\nu_{X,t})^{\frac{1}{\mu_X}} IM_t^X(h)^{\frac{\mu_X-1}{\mu_X}} \right]^{\frac{\mu_X}{\mu_X-1}} \tag{B.3}$$

that are in turn used as inputs in other countries' production of (public and private) consumption, investment, and export goods. Importantly for our analysis, $\nu_{X,t}$ represents the time-varying weight of local goods HT_t^X in the export good bundle and μ_X represents the intertemporal elasticity of substitution between local and foreign tradable goods. The marginal cost $MC_{T,t}$ of producing regional intermediate tradable goods is

$$MC_{T,t} = \frac{1}{z_{T,t} K_{G,t}^{\alpha_G} (\alpha_T)^{\alpha_T} (1-\alpha_T)^{1-\alpha_T}} \left(R_t^K \right)^{\alpha_T} \left((1+\tau_t^{W_f}) W_t \right)^{1-\alpha_T}, \tag{B.4}$$

where α_T is the capital share in the tradable sector; α_G determines the productivity of public capital $K_{G,t}$; $\tau_t^{W_f}$ is the labor tax rate paid by firms; W_t are wages; and R_t^K is the rental cost of capital. The marginal cost of producing export goods $MC_{X,t}$ is therefore

$$MC_{X,t} = \left[\nu_{X,t}[MC_{T,t}]^{1-\mu_X} + 1 - \nu_{X,t}[P_{IM^X,t}]^{1-\mu_{X,t}}\right]^{\frac{1}{1-\mu_{X,t}}}, \tag{B.5}$$

where the aggregate price of imported inputs for re-export is

$$P_{IM^X_,t} = \left[\sum_{CO \neq H} \nu_{IM^X}^{H,CO} \left(\frac{P_{IM,t}^{H,CO}}{\gamma_{IM^X}^{H,CO,\dagger}(h)}\right)^{1-\mu_{IM^X}}\right]^{\frac{1}{1-\mu_{IM^X}}}, \tag{B.6}$$

where $P_{IM,t}^{H,CO}$ is the price of imports in region H produced by firms in region CO and $\gamma_{IM^X}^{H,CO,\dagger}$ is the derivative of bilateral import adjustment costs. Demand for local tradables produced by firm h is then

$$HT_t^X(h) = \nu_{X,t}\left(\frac{MC_{T,t}}{MC_{X,t}}\right)^{-\mu_X} X_t, \tag{B.7}$$

where X_t is aggregate demand for tradables (taken as given), while demand for imported inputs is

$$IM_t^X(h) = (1 - \nu_{X,t})\left(\frac{P_{IM^X,t}}{MC_{X,t}}\right)^{-\mu_X} X_t. \tag{B.8}$$

Firms producing tradable goods sell their (differentiated) output in the domestic and foreign markets, charging different prices (set in local currency) in each market. The price-setting process is analogous for the (domestic) tradable and non-tradable goods, so to save space we only provide details of pricing in foreign markets. In setting prices abroad, tradable firms use their monopoly power to set their prices with a markup over marginal costs:

$$\frac{\tilde{P}_{X,t}}{P_{X,t}} = \frac{\theta_X}{\theta_X - 1}\frac{f_{X,t}}{g_{X,t}} \tag{B.9}$$

$$f_{X,t} = X_t MC_{X,t} + \beta\xi_X E_t \left[\frac{\Lambda_{I,t+1}}{\Lambda_I, t} \left(\frac{\Pi_{X,t+1}}{\Pi_{X,t+1}^{\chi_X} \bar{\Pi}^{(1-\chi_X)}} \right)^{\theta_X} f_{X,t+1} \right] \tag{B.10}$$

$$g_{X,t} = P_{X,t} X_t + \beta\xi_X E_t \left[\frac{\Lambda_{I,t+1}}{\Lambda_I, t} \left(\frac{\Pi_{X,t+1}}{\Pi_{X,t+1}^{\chi_X} \bar{\Pi}^{(1-\chi_X)}} \right)^{\theta_X - 1} g_{X,t+1} \right], \tag{B.11}$$

where θ_X is the elasticity of substitution between different export brands and the ratio $f_{X,t}/g_{X,t}$ reflects the fact that only a fraction of export firms can change their prices in every period (i.e., some firms may be stuck with the same price for a number of periods). In this staggered framework (Calvo 1983) prices evolve according to

$$P_{X,t} = \left[\Xi_X \left(\Pi_{X,t-1}^{\chi,X} \bar{\Pi}^{1-\Xi_X} P_{X,t-1} \right)^{1-\theta_X} + (1-\chi_X) \left(\tilde{P}_{X,t} \right)^{1-\theta_X} \right]^{\frac{1}{1-\theta_X}}. \tag{B.12}$$

Adjusting the share of local inputs in export goods, of course, affects prices and quantities all along the supply chain. As an illustration, consider the effect of a change in preferences for local intermediate inputs on demand for (final) consumption goods Q_t^C. These are a bundle comprising tradables TT_t^C and non-tradable NT_t^C intermediates:

$$Q_t^C = \left[\nu_C^{\frac{1}{\mu_C}} \left(TT_t^C \right)^{\frac{\mu_C - 1}{\mu_C}} + (1-\nu_C)^{\frac{1}{\mu_C}} \left(NT_t^C \right)^{\frac{\mu_C - 1}{\mu_C}} \right]^{\frac{\mu_C}{\mu_C - 1}}, \tag{B.13}$$

where ν_C represents the share of tradables in the final consumption good and μ_C represents the intertemporal elasticity of substitution between tradable and non-tradable goods. Tradables are themselves a bundle of locally produced HT_t^C and imported IM_t^C consumption goods:

$$TT_t^C = \left[\nu_{TC}^{\frac{1}{\mu_{TC}}} \left(HT_t^C \right)^{\frac{\mu_{TC} - 1}{\mu_{TC}}} + (1-\nu_{TC})^{\frac{1}{\mu_{TC}}} \left(IM_t^C \right)^{\frac{\mu_{TC} - 1}{\mu_{TC}}} \right]^{\frac{\mu_{TC}}{\mu_{TC} - 1}}, \tag{B.14}$$

where ν_{TC} represents the share of local inputs in the tradable consumption good and μ_{TC} represents the intertemporal elasticity of substitution between local tradable consumption goods and imported consumption goods. Demand for local tradables used for consumption goods is

$$HT_t^C = \nu_{TC} \left(\frac{P_{HT,t}}{P_{TTC,t}} \right)^{-\mu_{TC}} TT_t^C, \tag{B.15}$$

where $P_{HT,t}$ is the price of the local tradable input and $P_{TT,t}$ is the aggregate price of tradable consumption goods. The price of the latter is

$$P_{TT^C,t} = \left[\nu_{TC} [P_{HT,t}]^{1-\mu_{TC}} + 1 - \nu_{TC} [P_{IM^C,t}]^{1-\mu_{TC}} \right]^{\frac{1}{1-\mu_{TC}}}, \tag{B.16}$$

which in turn affects the price of final consumption goods $P_{C,t}$:

$$P_{C,t} = \left[\nu_C [P_{TT^C,t}]^{1-\mu_C} + 1 - \nu_C [P_{NT^C,t}]^{1-\mu_C} \right]^{\frac{1}{1-\mu_C}}. \tag{B.17}$$

Finally, the market clearing condition for locally produced tradable good h is

$$\begin{aligned} Y_{T,t}(h) = {} & HT_t^C(h) + HT_t^I(h) + HT_t^{GC}(h) + HT_t^{GI}(h) \\ & + \sum_{CO \neq H} HT_t^{X,H,CO}(h), \end{aligned} \tag{B.18}$$

which therefore implies that a change in preference for local inputs in export goods will affect demand for tradable and final consumption goods by changing $P_{HT,t}$.

Appendix C. Model Calibration

Table C.1. Key Steady-State Ratios (as a % of aggregate output)

	EA	RW	US
Domestic Demand			
Private Consumption	58.5	58.6	65.9
Public Consumption	20.5	16.6	14.7
Private Investment	17.0	21.0	15.0
Public Investment	4.0	4.0	4.0
Trade			
Total Imports	27.9	11.3	17.1
Private Consumption Goods	14.0	2.6	6.9
Public Consumption Goods	1.2	1.0	0.9
Private Investment Goods	8.6	4.1	7.2
Public Investment Goods	0.4	0.4	0.4
Import Content of Exports	3.7	3.2	1.8
Bilateral Trade			
Imported Consumption Goods	14.0	2.6	6.9
From EA	—	1.1	1.3
From RW	13.2	—	5.6
From US	0.7	1.5	—
Imported Investment Goods	8.6	4.1	7.2
From EA	—	1.4	1.2
From RW	5.7	—	6.0
From US	2.8	2.7	—
Imported Goods for Re-exports	3.7	3.2	1.8
From EA	—	1.3	0.4
From RW	3.2	—	1.4
From US	0.4	1.9	—
Size of Region (% of World Output)	20.0	49.0	31.0

Note: Euro area (EA), rest of the world (RW), and the United States of America (US). Rounding may affect totals.

Table C.2. Household and Firm Behavior

	EA	RW	US
Households			
Subjective Discount Factor	$1.03^{\frac{1}{4}}$	$1.03^{\frac{1}{4}}$	$1.03^{\frac{1}{4}}$
Depreciation Rate (Private Capital)	0.025	0.025	0.025
Int. Elasticity of Substitution	1.00	1.00	1.00
Habit Formation	0.70	0.70	0.70
Frisch Elasticity of Labor (Inverse)	2.00	2.00	2.00
Intermediate-Goods Firms			
Tradable—Bias toward Capital	0.30	0.30	0.30
Non-tradable—Bias toward Capital	0.30	0.30	0.30
Final Consumption Goods			
Subst. btw. Local and Imported	2.50	2.50	2.50
Subst. Imported	2.50	2.50	2.50
Bias toward Local Tradables	0.24	0.92	0.56
Subst. btw. Tradable and Non-tradable	0.50	0.50	0.50
Bias toward Tradables	0.35	0.35	0.35
Final Investment Goods			
Subst. btw. Local and Imported	2.50	2.50	2.50
Subst. Imported	2.50	2.50	2.50
Bias toward Local Tradables	0.25	0.83	0.24
Subst. btw. Tradable and Non-tradable	0.50	0.50	0.50
Bias toward Tradable	0.75	0.75	0.75
Export Goods			
Subst. btw. Local and Imported	1.50	1.50	1.50
Subst. Imported	2.50	2.50	2.50
Bias toward Local Tradables	0.80	0.65	0.85

Table C.3. Government Behavior

	EA	RW	US
Consumption Expenditure			
Domestic Consumption Goods (% of Output)	20.5	16.6	14.7
Imported Consumption Goods (% of Output)	1.2	0.9	1.0
Quasi-Share of Govt. Cons.	0.75	0.80	0.80
Complementarity of Consumption	0.29	0.33	0.33
Subst. btw. Local and Imported	2.50	2.50	2.50
Subst. Imported	2.50	2.50	2.50
Bias toward Local	0.73	0.80	0.66
Subst. btw. Tradable and Non-tradable	0.50	0.50	0.50
Bias toward Tradable	0.80	0.80	0.80
Investment Expenditure			
Domestic Investment Goods (% of Output)	4.0	4.0	4.0
Imported Investment Goods (% of Output)	0.4	0.4	0.4
Subst. btw. Local and Imported	2.50	2.50	2.50
Subst. Imported	2.50	2.50	2.50
Bias toward Local	0.54	0.60	0.46
Subst. btw. Tradable and Non-tradable	0.50	0.50	0.50
Bias toward Tradable	0.80	0.80	0.80
Depreciation Rate (Public Capital)	0.025	0.025	0.025
Taxation			
Consumption Tax Rate	0.183	0.077	0.077
Labor Income Tax Rate	0.122	0.154	0.154
Capital Tax Rate	0.19	0.16	0.16
SSC Rate Paid by Firms	0.219	0.071	0.071
SSC Rate Paid by Households	0.118	0.071	0.071
Fiscal Rule			
Target Public Debt (% of Annual Output)	60.0	60.0	60.0
Sensitivity of Lump-Sum Taxes to Debt	0.1	0.1	0.1

Table C.4. Monetary Policy

	EA	RW	US
Inflation Target	1.02	1.02	1.02
Interest Rate Inertia	0.87	0.87	0.87
Sensitivity to Inflation Gap	1.70	1.70	1.70
Sensitivity to Output Growth	0.10	0.10	0.10

Table C.5. Real and Nominal Rigidities

	EA	RW	US
Real Rigidities			
Investment Adjustment	6.00	4.00	4.00
Import Adjustment (Cons.)	5.00	5.00	5.00
Import Adjustment (Inv.)	2.00	2.00	2.00
Import Adjustment (Inter.)	2.00	2.00	2.00
Nominal Rigidities			
Wage Stickiness	0.75	0.75	0.75
Wage Indexation	0.75	0.75	0.75
Price Stickiness (Local)	0.75	0.75	0.75
Price Indexation (Local)	0.50	0.50	0.50
Price Stickiness (Imported)	0.75	0.75	0.75
Price Indexation (Imported)	0.50	0.50	0.50
Price Stickiness (Services)	0.75	0.75	0.75
Price Indexation (Services)	0.50	0.50	0.50

Table C.6. Price and Wage Markups (implied elasticity of substitution)

	EA	RW	US
Tradables	1.30 (4.3)	1.20 (6.0)	1.20 (6.0)
Non-tradables	1.50 (3.0)	1.30 (4.3)	1.30 (4.3)
Exports	1.30 (4.3)	1.20 (6.0)	1.20 (6.0)
Wages	1.30 (4.3)	1.16 (7.3)	1.16 (7.3)

Table C.7. Bilateral Trade Relations (% of category total)

	EA	RW	US
Imported Consumption Goods			
From REA	—	42.3	18.8
From RW	94.3	—	5.6
From US	5.7	57.7	—
Imported Investment Goods			
From REA	—	34.1	16.7
From RW	66.3	—	83.3
From US	33.7	65.9	—

References

Adjemian, S., H. Bastani, M. Juillard, F. Mihoubi, G. Perendia, M. Ratto, and S. Villemot. 2011. *Dynare: Reference Manual*, Version 4.

Aiyar, S., J. Chen, C. H. Ebeke, R. Garcia-Saltos, T. Gudmundsson, A. Ilyina, A. Kangur, T. Kunaratskul, S. L. Rodriguez, M. Ruta, et al. 2023. "Geoeconomic Fragmentation and the Future of Multilateralism." Staff Discussion Note No. 2023/001, International Monetary Fund.

Arkolakis, C., A. Costinot, and A. Rodríguez-Clare. 2012. "New Trade Models, Same Old Gains?" *American Economic Review* 102 (1): 94–130.

Armington, P. S. 1969. "A Theory of Demand for Products Distinguished by Place of Production." *Staff Papers* (International Monetary Fund) 16 (1): 159–78.

Arriola, C., S. Guilloux-Nefussi, S.-H. Koh, P. Kowalski, E. Rusticelli, and F. van Tongeren. 2020. "Efficiency and Risks in Global Value Chains in the Context of Covid-19."

Attinasi, M.-G., L. Boeckelmann, and B. Meunier. 2023. "Friend-Shoring GVCs: A Model-Based Assessment." *Economic Bulletin* (European Central Bank) 2/2003: Box 3.

Baldwin, R., and R. Freeman. 2021. "Risks and Global Supply Chains: What We Know and What We Need to Know." NBER Working Paper No. 29444.

Barro, R. J., and X. Sala-i Martin. 1997. "Technological Diffusion, Convergence, and Growth." *Journal of Economic Growth* 2 (1): 1–26.

Bilbiie, F. O., F. Ghironi, and M. J. Melitz. 2019. "Monopoly Power and Endogenous Product Variety: Distortions and Remedies." *American Economic Journal: Macroeconomics* 11 (4): 140–74.

Bokan, N., A. Gerali, S. Gomes, P. Jacquinot, and M. Pisani. 2018. "EAGLE-FLI: A Macroeconomic Model of Banking and Financial Interdependence in the Euro Area." *Economic Modelling* 69 (January): 249–80.

Bolt, W., K. Mavromatis, and S. van Wijnbergen. 2019. "The Global Macroeconomics of a Trade War: The EAGLE Model on the US-China Trade Conflict." CEPR Discussion Paper No. 13495.

Bonadio, B., Z. Huo, A. A. Levchenko, and N. Pandalai-Nayar. 2021. "Global Supply Chains in the Pandemic." *Journal of International Economics* 133 (November): Article 103534.

Brzoza-Brzezina, M., P. Jacquinot, and M. Kolasa. 2014. "Can We Prevent Boom-Bust Cycles during Euro Area Accession?" *Open Economies Review* 25 (1): 35–69.

Calvo, G. A. 1983. "Staggered Prices in a Utility-Maximizing Framework." *Journal of Monetary Economics* 12 (3): 383–98.

Campos, R., J. Estefanía-Flores, D. Furceri, and J. Timini. 2023. "Geopolitical Fragmentation and Trade." Forthcoming in *Journal of Comparative Economics*.

Cappariello, R., S. Franco-Bedoya, V. Gunnella, and G. I. Ottaviano. 2020. "Rising Protectionism and Global Value Chains: Quantifying the General Equilibrium Effects." Technical Report, Bank of Italy.

Carvalho, V. M., M. Nirei, Y. U. Saito, and A. Tahbaz-Salehi. 2021. "Supply Chain Disruptions: Evidence from the Great East Japan Earthquake." *Quarterly Journal of Economics* 136 (2): 1255–1321.

Caselli, F., M. Koren, M. Lisicky, and S. Tenreyro. 2020. "Diversification through Trade." *Quarterly Journal of Economics* 135 (1): 449–502.

Celasun, O., M. N.-J. H. Hansen, M. A. Mineshima, M. Spector, and J. Zhou. 2022. "Supply Bottlenecks: Where, Why, How Much, and What Next?" IMF Working Paper No. 2022/031.

Clancy, D., P. Jacquinot, and M. Lozej. 2016. "Government Expenditure Composition and Fiscal Policy Spillovers in Small Open Economies within a Monetary Union." *Journal of Macroeconomics* 48 (June): 305–26.

Clancy, D., D. Smith, and V. Valenta. 2023. "Reshoring Production in Small Open Economies." Technical Report, Central Bank of Ireland.

Costinot, A., and A. Rodríguez-Clare. 2018. "The US Gains from Trade: Valuation Using the Demand for Foreign Factor Services." *Journal of Economic Perspectives* 32 (2): 3–24.

Criscuolo, C., and J. Timmis. 2017. "The Relationship between Global Value Chains and Productivity." *International Productivity Monitor* 32 (Spring): 61–83.

D'Aguanno, L., O. Davies, A. Dogan, R. Freeman, S. Lloyd, D. Reinhardt, R. Sajedi, and R. Zymek. 2021. "Global Value Chains, Volatility and Safe Openness: Is Trade a Double-Edged Sword?" Financial Stability Paper No. 46, Bank of England.

Drozd, L. A., S. Kolbin, and J. B. Nosal. 2021. "The Trade-Comovement Puzzle." *American Economic Journal: Macroeconomics* 13 (2): 78–120.

European Commission. 2022. "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A Chips Act for Europe." Technical Report, European Commission.

Faruqee, H., D. Laxton, D. Muir, and P. Pesenti. 2008. "Would Protectionism Defuse Global Imbalances and Spur Economic Activity? A Scenario Analysis." *Journal of Economic Dynamics and Control* 32 (8): 2651–89.

Feenstra, R. C. 2018a. "Alternative Sources of the Gains from International Trade: Variety, Creative Destruction, and Markups." *Journal of Economic Perspectives* 32 (2): 25–46.

———. 2018b. "Restoring the Product Variety and Pro-competitive Gains from Trade with Heterogeneous Firms and Bounded Productivity." *Journal of International Economics* 110 (January): 16–27.

Felbermayr, G., H. Mahlkow, and A. Sandkamp. 2023. "Cutting through the Value Chain: The Long-Run Effects of Decoupling the East from the West." *Empirica* 50 (1): 75–108.

Fugazza, M. 2013. "The Economics Behind Non-tariff Measures: Theoretical Insights and Empirical Evidence." Policy Issues in International Trade and Commodities Study Series No. 57, UNCTAD.

Giovanni, J. D., and A. A. Levchenko. 2009. "Trade Openness and Volatility." *Review of Economics and Statistics* 91 (3): 558–85.

Góes, C., and E. Bekkers. 2022. "The Impact of Geopolitical Conflicts on Trade, Growth, and Innovation." arXiv preprint arXiv:2203.12173.

Gomes, S., P. Jacquinot, and M. Pisani. 2012. "The EAGLE: A Model for Policy Analysis of Macroeconomic Interdependence in the Euro Area." *Economic Modelling* 29 (5): 1686–1714.

Grossman, G. M., E. Helpman, and H. Lhuillier. 2021. "Supply Chain Resilience: Should Policy Promote Diversification or Reshoring?" NBER Working Paper No. 29330.

Grundke, R., and C. Moser. 2019. "Hidden Protectionism? Evidence from Non-tariff Barriers to Trade in the United States." *Journal of International Economics* 117 (March): 143–57.

Hunt, B., R. Portillo, S. Mursula, and M. Santoro. 2020. "Modeling Trade Tensions: Different Mechanisms in General Equilibrium." IMF Working Paper No. 2020/279.

Imbs, J., and I. Mejean. 2015. "Elasticity Optimism." *American Economic Journal: Macroeconomics* 7 (3): 43–83.

Ioannou, D., J. J. Pérez, H. Geeroms, I. Vansteenkiste, P.-F. Weber, A. M. Almeida, I. Balteanu, I. Kataryniuk, M. G. Attinasi, K. Buysse, et al. 2023. "The EU's Open Strategic Autonomy from a Central Banking Perspective. Challenges to the Monetary Policy Landscape from a Changing Geopolitical Environment." ECB Occasional Paper No. 2023/311.

Jacquinot, P., M. Lozej, and M. Pisani. 2018. "Labor Tax Reforms, Cross-Country Coordination, and the Monetary Policy Stance in the Euro Area: A Structural Model-Based Approach." *International Journal of Central Banking* 14 (3): 65–140.

———. 2022. "Macroeconomic Effects of Tariffs Shocks: The Role of the Effective Lower Bound and the Labour Market." *Journal of International Money and Finance* 120 (February): Article 102528.

Javorcik, B., L. Kitzmueller, H. Schweiger, and A. Yıldırım. 2022. "Economic Costs of Friendshoring." Working Paper No. 274, European Bank for Reconstruction and Development.

Johnson, R. 2017. "The US-EU Beef Hormone Dispute." Technical Report, Congressional Research Service.

Kazukauskas, A., C. Newman, D. Clancy, and J. Sauer. 2013. "Disinvestment, Farm Size, and Gradual Farm Exit: The Impact of Subsidy Decoupling in a European Context." *American Journal of Agricultural Economics* 95 (5): 1068–87.

Khalil, M., and F. Strobel. 2021. "US Trade Policy and the US Dollar." Discussion Paper No. 49/2001, Deutsche Bundesbank.

Kratz, A., C. Vest, and J. Oertel. 2022. "Circuit Breakers: Securing Europe's Green Energy Supply Chains." Technical Report, European Council on Foreign Relations.

Lindé, J., and A. Pescatori. 2019. "The Macroeconomic Effects of Trade Tariffs: Revisiting the Lerner Symmetry Result." *Journal of International Money and Finance* 95 (July): 52–69.

Martin, A., and W. Vergote. 2008. "On the Role of Retaliation in Trade Agreements." *Journal of International Economics* 76 (1): 61–77.

Nekarda, C. J., and V. A. Ramey. 2021. "The Cyclical Behavior of the Price-Cost Markup." *Journal of Money, Credit and Banking* 52 (S2): 319–53.

Niu, Z., C. Liu, S. Gunessee, and C. Milner. 2018. "Non-tariff and Overall Protection: Evidence across Countries and over Time." *Review of World Economics* 154 (4): 675–703.

Obstfeld, M., and K. Rogoff. 2000. "The Six Major Puzzles in International Macroeconomics: Is There a Common Cause?" In *NBER Macroeconomics Annual 2000*, Vol. 15, ed. B. S. Bernanke and K. Rogoff, 339–90. MIT Press.

Ongena, S., A. Popov, and N. Van Horen. 2019. "The Invisible Hand of the Government: Moral Suasion during the European Sovereign Debt Crisis." *American Economic Journal: Macroeconomics* 11 (4): 346–79.

Organisation for Economic Co-operation and Development. 2020. "Shocks, Risks and Global Value Chains: Insights from the OECD METRO Model." Technical Report.

Peter, A., and C. Ruane. 2023. "The Aggregate Importance of Intermediate Input Substitutability." NBER Working Paper No. 31233.

Pisani, M., and F. Vergara Caffarelli. 2018. "What Will Brexit Mean for the British and Euro-Area Economies? A Model-Based Assessment of Trade Regimes." Temi di discussione No. 1163, Bank of Italy.

Rodrik, D. 1998. "Why Do More Open Economies Have Bigger Governments?" *Journal of Political Economy* 106 (5): 997–1032.

Sgaravatti, G., S. Tagliapietra, and G. Zachmann. 2022. "National Policies to Shield Consumers from Rising Energy Prices." Technical Report, Bruegel.

Smith, D., P. Kowalski, and F. van Tongeren. 2020. "Modelling Trade Policy Scenarios: Different Horses for Different Courses." Technical Report, Organisation for Economic Co-operation and Development.

Tagliapietra, S., R. Veugelers, and J. Zettelmeyer. 2023. "Rebooting the European Union's Net Zero Industry Act." Technical Report, Bruegel.