CHAPTER 4

What if? The effects of a hard decoupling from China on the German economy[1]

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1 INTRODUCTION

Growing trade and financial integration have been a hallmark of the post-Cold War globalisation era. In the past 20 years, China's meteoric economic rise has pushed global trade interdependencies to hitherto unknown levels. Since its WTO accession in 2001, China has become the world's top manufacturer not only of final goods, but also of intermediate manufactured goods (e.g., Baldwin et al., 2023), giving the country a prominent place in global supply chains. China is the most important trading partner for about 120 countries, among them Germany, Europe's biggest economy. Germany, with its large industrial sector, in particular its large automotive and chemical manufacturing industry, has found in China an important export market that has propelled the growth of German industry. At the same time, German households and firms now import consumer goods and intermediate inputs worth close to 5% of German GDP from China.

This chapter seeks to explore the economic effects of a forced reversal of this trend in the form of a very hard decoupling between China and Germany. We study a hypothetical scenario akin to a 'Cold War 2.0', i.e., a disintegration or fragmentation of the world economy into three distinct blocs: the G7 or 'Western' economics, China and its allies, as well as neutral countries. Moreover, within this framework, we examine an extreme case:

a complete cessation of trade between Germany (as well as the rest of the G7 economies and their allies) and China (and Russia). Following a hard decoupling, international trade will be entirely reoriented towards trade within the two rival blocs and between the two blocs and the neutral countries.

We are aware of the hypothetical and extreme nature of a scenario where trade between the two 'cold war' blocs falls to zero, but the insights gained from this analysis offer valuable perspectives on the economic forces at play. Moreover, by examining such an extreme scenario, we aim to delineate the boundaries of possible outcomes and provide a worst-case perspective on the issue. We do not speculate on what events might trigger such a hard decoupling, nor do we take a stance that this is a likely or desirable outcome.

The insights derived in this chapter will come from a recent model of the global economy with many countries, sectors, and complex international production networks. This model is the Baqaee and Farhi (2021) model, which demonstrated its usefulness last year when it was used to gauge the impact of an end of Russian gas supplies to Germany (Bachmann et al., 2022; Moll et al., 2023). In our setup, the model features 43 countries in the three blocs: a bloc of G7 countries and their allies and a Chinese bloc, as well as a 'rest of the world' bloc that belongs to neither. There are 56 sectors with production interlinkages across sectors and countries. These production interdependencies are disciplined with empirical input-output matrices from the World Input-Output Database (Timmer et al., 2015).

Our main focus is on the economic costs to Germany measured by the fall in gross national expenditure (GNE), which is the welfare-relevant quantity in many macroeconomic and trade models including the Baqaee-Farhi model. GNE, also known as 'domestic absorption', is the economy's total expenditure defined as the sum of household expenditure, government expenditure and investment, that is, $GNE = C + I + G$ in the GDP accounting identity $GDP = C + I + G + X - M$. One reason for focusing on GNE rather than GDP is that GDP may not pick up terms-of-trade effects that arise following a trade shock like the decoupling scenario we consider. While GNE differs conceptually from GDP, for an economy like Germany's, its total value is similar to the more familiar GDP quantity.[2]

Our first key result is that in the event of an abrupt 'cold turkey' decoupling scenario, Germany is likely to experience a GNE loss of approximately 5% on impact in the first few months and 4% over the horizon of one year. The Baqaee and Farhi (2021) model does not incorporate standard short-run business cycle amplification effects, such as Keynesian aggregate demand amplification in the presence of nominal rigidities, so

2   For example, in 2022, German GNE was around €3.79 trillion (see https://data.worldbank.org/ indicator/NE.DAB.TOTL.CN?locations=DE), which was around 98% of GDP.

the corresponding economic costs need to be added on top.[3] With more time to adjust, for instance over a time horizon of three years during which trade and production are reorganised, the decoupling cost would drop to around 2%. In the long run, the German welfare loss from no longer being able to trade with China would be about 1.5% of GNE. From a macroeconomic standpoint, these are severe costs, reflecting China's importance in German and global trade. In the short run, they compare to the GDP falls witnessed in the global financial crisis and during the COVID-19 pandemic. Moreover, part of the costs would be permanent, i.e., German welfare would be lower in every single year going forward. At the same time, while severe, these costs are not devastating and could be managed with appropriate policy (and crises of similar magnitudes have been successfully managed in the past).

It is also clear that for such large changes in the economy's input mix of the type that we are concerned with, natural experiments are rare and uncertainty about the right parameter choices is substantial. It seems plausible to assume, however, that the relevant elasticities of substitution, in particular so-called trade elasticities, are larger in the medium and long run and smaller in the very short run (the 'le Chatelier principle'; see for example Samuelson, 1947, 1983; Milgrom and Roberts, 1996).[4] This time dependence of the elasticities implies that the size of economic losses stemming from a sharp reduction in trade with China depends crucially on the time frame over which adjustments take place and is the key to why our model predicts smaller economic costs in the long run than in the short run.

The same time dependence also has a second key implication: a more gradual decoupling in which the trade cut-off occurs over a time horizon of several years leads to considerably smaller overall costs than a 'cold turkey' decoupling scenario because it avoids the most extreme short-run losses. We illustrate this point with a simple illustrative example in which a full decoupling occurs gradually over a time horizon of three years. The logic is that, in this gradual decoupling scenario, the lowest elasticities that are relevant in the very short run (over the first few months) only apply to a partial trade cut-off (say, a cut in trade flows by 5%) rather than to the full cut-off as they do in the abrupt 'cold turkey' scenario. A related implication is that if, along this gradual decoupling trajectory, an abrupt and full decoupling becomes suddenly dictated by geopolitical events, the economic costs are lower than if firms and households had not started to adjust beforehand.

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3   See the discussion in Section 4.2. While quantifying these additional short-run amplification effects is beyond the scope of this chapter, the 2022 Russian gas cut-off again provides some guidance: analyses using HANK models to quantify these effects increased the cost estimates relative to the analysis from flexible-price models like ours by around 30% (Bayer et al., 2022, 2023; Pieroni, 2023; see also the discussion in Section 4.2) and we are not aware of empirical evidence suggesting higher amplifications effects during this episode. While one cannot simply 'transport' such an amplification factor from one model/model simulation to another, a 30% higher short run cost would be 6.5% over the first few months and 5.2% over the first year.

4   Past experience has shown that the concept of an 'elasticity' is frequently misunderstood by non-economists in the popular debate. For clarity, 'elasticity' is the technical term for a particular model parameter that is distinct from the colloquial use of the term (i.e., meaning ability to stretch). For example, the 'elasticity of substitution' of a production function is a model parameter that governs how substitutable different factors of production are with each other. It is thus incorrect to make statements like "economists assume that markets are elastic" or "the question is whether there is elasticity".

Note that irrespective of whether decoupling is gradual or abrupt and of the elasticities in the model, the scenarios under investigation remain extreme ones: a total decoupling between the 'West' and China bringing trade between the two blocs to zero. We are not modelling a 'small yard, high fence' de-risking (Sullivan, 2023), but a radical 'big yard, high fence' decoupling. By implication, the economic costs of sectoral de-risking policies are likely to be considerably smaller, particularly when introduced gradually. Nevertheless, gradual de-risking policies in critical sectors could likely reduce the costs of a possible subsequent hard decoupling.[5] The logic is the same as before: in these sectors, a gradual reduction in trade flows would reduce interdependence with China but with the lowest elasticities only applying to a partial trade cut-off, thereby avoiding the largest losses. At the same time, the losses from a subsequent hard decoupling would be lower than if no adjustment had occurred because of reduced interdependence in the most critical sectors.

Taken together, our findings provide a rationale for Western countries to embark on a gradual de-risking trajectory rather than waiting for a much more costly 'cold turkey' decoupling dictated by geopolitical events. As noted by Spillner and Wolff (2023), there is often a wide gap between political rhetoric and observed policies and actions by firms.

The logic of our model suggests that the economic costs may ultimately be lower if policymakers start taking systematic actions towards lowering dependence on China now and do so in a targeted way. One can view the relatively low economic costs of gradual de-risking as an insurance premium paid to insure against the possibility of large losses and potential political backlash associated with a hard 'cold turkey' decoupling.

In this chapter, we provide a rigorous academic foundation for the debate on the potential economic repercussions of geopolitical and security policy choices if they arise, for instance, in the context of a conflict over Taiwan. In 2022, the debate on Germany's dependence on Russian gas and the economic costs of the end of Russian gas supplies showed that interest groups become powerful players in real-time decision-making processes when uncertainty is high (Moll et al., 2023). That is why this chapter aims to explore the key issues ex ante, without political decisions being imminent at this point in time. Taking a proactive approach can help to prepare policymakers in Germany and Europe to weigh policy options ahead of time. As in the case of the Russian gas study last year, we will discipline our model simulations with the best available empirical estimates of key parameters and openly discuss the key assumptions and influential modelling choices.

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5   To be clear, and as discussed in Section 3.6, we have not conducted any simulations to capture such sectoral de-risking scenarios; in this part of the chapter, we are just thinking through the logic of the model and taking it to its logical conclusion. But we want to be clear that we are unable to make any quantitative statements about the relative costs and benefits of de-risking scenarios at this point.

The model features various elasticities of substitution that determine the costs of a decoupling such as cross-sectoral elasticities for final and intermediate goods, and between capital and labour. Importantly, the model features a trade elasticity that determines substitution within each sector across goods from different origins. In line with the importance of this elasticity in the trade literature (e.g., Arkolakis et al., 2012), assumptions about the trade elasticity have the largest impact on our cost estimates. The question here is to what extent trade with other countries can serve as an insurance against a disruption of trade with China – and how quickly trade can be reoriented to other countries. If this elasticity is low, it is hard to find alternatives for Chinese goods and the welfare loss of cutting the trade link with China is high. If the elasticity is higher, substitution is easier and welfare costs are much lower.

As in the case of the 2022 cut-off from Russian gas, we would expect the economic costs of a China decoupling scenario to be highly heterogeneous across industries, regions within Germany, and individual companies. So-called 'cascading effects' along the supply chain did not materialise in the case of the Russian gas cut-off (Moll et al., 2023). In the Chinese case, too, we would expect individual sectors to be heavily affected, but this would not drag down the rest of the economy. We would expect individual companies to pay a higher cost from decoupling but without widespread losses across the rest of the economy.

A more systematic analysis of many of the ideas discussed in this chapter will ultimately be published in a longer companion paper (Baqaee et al., 2023). While this more systematic analysis is still work in progress, we present here those results from this other analysis that we view as robust, such as the dependence of the economic cost on the time horizon.

This chapter is organised as follows. Section 2 takes a first look at the data, describing China's importance in German imports and exports. Section 3 introduces the model and its calibration with an emphasis on trade elasticity estimates. It then presents the results from a simulation in which the effects of a decoupling are quantified and contrasts the economic costs of an abrupt 'cold turkey' decoupling with those of a more gradual decoupling scenario. We discuss caveats in Section 4, before concluding in Section 5.

2 TRADE BETWEEN CHINA AND GERMANY

In 2022 – roughly four decades after the beginning of economic opening – China's GDP accounted for 18.5% of the world's total, making it the largest economy in purchasing power parities and the second largest at market exchange rates (IMF, 2023). China's share of global trade has increased dramatically since its WTO accession in 2001, and by 2019 it had become the world's largest exporter and second-largest importer (WTO, 2023). The country's large consumer market and its manufacturing industries have increasingly become the workbench of the global economy, deeply integrated into global production

networks. At the same time, the build-up of China's industries and the construction boom have fuelled economic growth for its trading partners, not least capital goods-exporting economies such as Germany. The rise of China as a global economic superpower has been an important driver of Germany's exports in the past two decades.

Germany and the People's Republic of China established diplomatic relations in 1972. Since the economic reforms initiated by Deng Xiaoping, German trade and investment flows have grown substantially. Germany's exports to China have grown from €1.5 billion in 1990 to around €100 billion in 2022, while its imports from China have grown from little more than €1 billion in 1990 to close to €200 billion in 2022 (Destatis, 2022). In 2022, China was Germany's largest trading partner overall, and its largest import partner and one of the top-five export markets (Destatis, 2022).

2.1 Imports

In 2019, the last year before the pandemic, China's share in German imports was 7.15%.[6] Taking into account that the share of imports in GNE is 32.02% – roughly one third of German income is spent on imported goods – the overall share of imports from China in GNE is about 2.3%.[7] While this is clearly still a macroeconomically relevant number, it is important to see it in the broader context of the size of the German economy.[8]

Table 1 shows that China's share in imports varies significantly across different groups of products (second column) and that the overall importance of products for the German economy in turn also varies greatly (third column). The groups of products in Table 1 are sections drawn from the so Harmonized System, the international standard of names and numbers for the classification of traded goods. The highest Chinese import share can be found in the category "Raw Hides, Skins, Leather, & Furs", yet overall imports in this category only make up 0.15% of Germany's total expenditure.

The sector with the highest share of trade in total expenditure, as well as imports from China in terms of GNE, is "Machinery and Electrical goods" at 8.2% of German GNE and an import share from China of about 14%, resulting in total German expenditures in this category of 1.14% of GNE. Note that this perspective does not allow us to say how easy it would be to substitute these products. Moreover, we will look in greater detail at imports of individual categories of imported metals in Section 4.1, as some imported goods, while having a small share in GNE, may be particularly hard to substitute and an important input for German production.

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6   Data from the Eurostat Comext database.
7   Data on GNE are taken from the World Bank national accounts data, indicator NE.DAB.TOTL.CN.
8   See also Figure 9 in the appendix, which shows that the share of imports from China in German GNE has been remarkably stable since about 2010.

TABLE 1 **SHARE OF CHINA IN GERMAN IMPORTS IN GROSS NATIONAL EXPENDITURE**

Sector	Share of China in total sector trade (%)	Share of total sector trade in GNE (%)	Share in GNE (%)
Animal & Animal Products	3.01	0.67	0.02
Vegetable Products	1.46	1.08	0.02
Foodstuffs	1.11	1.09	0.01
Mineral Products	0.11	2.46	0.00
Chemicals & Allied Industries	2.73	3.98	0.11
Plastics / Rubbers	4.90	1.62	0.08
Raw Hides, Skins, Leather, & Furs	22.65	0.15	0.03
Wood & Wood Products	3.48	0.82	0.03
Textiles	14.34	1.41	0.20
Footwear / Headgear	17.52	0.40	0.07
Stone / Glass	5.45	0.81	0.04
Metals	5.92	2.59	0.15
Machinery / Electrical	13.94	8.20	1.14
Transportation	1.56	4.30	0.07
Miscellaneous	13.46	2.18	0.29
Service	4.98	0.26	0.01
Total	**7.15**	**32.02**	**2.29**

Figure 1 disaggregates the sectors further, with each dot representing a single product group and the red bars denoting weighted averages and thus corresponding to the numbers in the second column in Table 1. For some products, China's share in imports reaches close to 100%, while for most imported goods the share is much more modest.

FIGURE 1 **SHARE OF CHINA IN GERMAN IMPORTS BY HS SECTION AND HS8 CODE IN 2019**
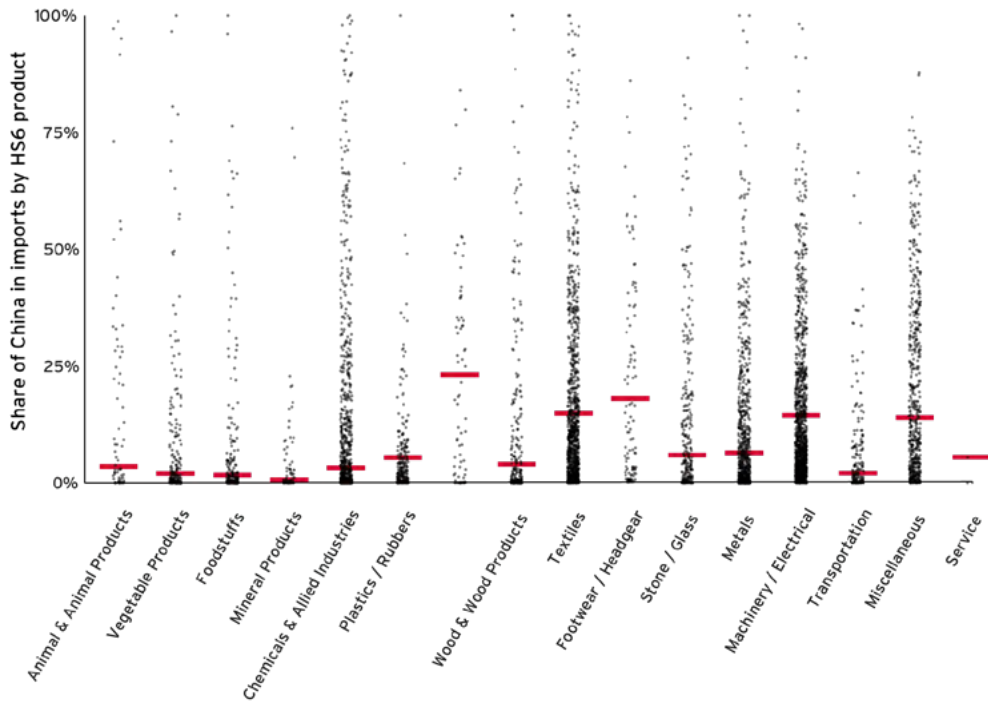
2.2 Exports

The picture on the export side broadly mirrors that of the import side. Table 2 reports the equivalent breakdown of the share of China in a sector's trade flows, the sector's importance in the overall economy, and the combination of both – China's economic importance in a given sector for the German economy as a whole. Note that we use the same denominator GNE to scale exports for direct comparability to the numbers above.[9]

The overall share of exports to China in total exports stood at roughly 6.7% in 2019, which translates to 2.56% of Germany's GNE. The sectoral composition is somewhat different than on the import side. The most important sectors are "Machinery and Electrical goods", followed by "Transportation" – notably driven by the German car industry – as well as "Chemicals and Allied Industries." China is an important export market for products in these sectors, with up to almost 10% of each total sector exports. But here, too, it is important to note that the smaller shares of these sectors in the overall German economy lead to a smaller macroeconomic footprint. Even for the large automotive and chemical industries, exports to China account for less than 1% of GNE (or GDP), and slightly above 1% for the machinery and electrical goods producing sector.[10]

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9   As noted above, in the case of Germany using the actually more applicable indicator of production, GDP, would yield very similar numbers.
10 See Figure 10 in the appendix for the breakdown by product. Again, there is large heterogeneity within individual sectors, but for a very few products the Chinese market accounts for 100% of exports.

TABLE 2 **SHARE OF CHINA IN GERMAN EXPORTS IN GROSS NATIONAL EXPENDITURE**

Sector	Share of China in total sector trade (%)	Share of total sector trade in GNE (%)	Share in GNE (%)
Animal & Animal Products	7.56	0.64	0.05
Vegetable Products	0.54	0.45	0.00
Foodstuffs	1.63	1.17	0.02
Mineral Products	1.03	0.64	0.01
Chemicals & Allied Industries	4.51	5.27	0.24
Plastics / Rubbers	4.31	2.24	0.10
Raw Hides, Skins, Leather, & Furs	3.02	0.10	0.00
Wood & Wood Products	2.93	0.96	0.03
Textiles	1.46	1.06	0.02
Footwear / Headgear	0.44	0.27	0.00
Stone / Glass	3.64	0.91	0.03
Metals	4.53	2.88	0.13
Machinery / Electrical	9.60	11.33	1.09
Transportation	8.39	6.98	0.59
Miscellaneous	8.62	2.99	0.26
Service	2.68	0.20	0.01
Total	**6.72**	**38.08**	**2.56**

As this first look at German-Chinese trade relations shows, there is no doubt that China is a key trading partner for Germany. However, the magnitude of both exports to and imports from China is surprisingly small relative to the size of the German economy. German companies and households bought final and intermediate goods from China equal to 2.3% of total expenditures. Even in the automotive and chemical industries, German exports to China constitute less than 1% of GNE, and about 2.6% in total. The question we address in the following with the help of a quantitative model is what economic effects a hard decoupling, i.e., bringing both imports and exports from China to zero, would entail.

3 MODEL SIMULATION

In this section, we provide a high-level overview of our quantitative model, a description of how we calibrate the model, and the simulation results showing the economic consequences of a hard decoupling of the German economy from China within the context of a fragmentation of the world economy into three blocs.

3.1 Description of the model

Our quantitative results use the model of the world economy in Baqaee and Farhi (2021). We use this multi-sector model to conduct counterfactual simulations of the macroeconomic effects of cutting trade ties with China.

The Baqaee-Farhi model is a multi-sector model with rich input-output linkages. Each producer in each country combines local labour and capital with materials to produce. Materials are purchased from other sectors in the economy, and each sector in each country can source its materials from different countries. Households in each country earn income from local labour and capital, which they use to purchase final consumption goods. In response to the trade disruption, we assume that prices in each market adjust to equate supply and demand.

The model is designed to address questions in which supply chains or production networks play a key role, specifically how a shock to an upstream product propagates downstream along the supply chain. In our set-up the model features 43 countries in three blocs: a block of G7 countries and their allies, a Chinese bloc, as well as a neutral bloc with countries that belong to neither. Each country has 56 sectors with production interlinkages across sectors and countries. These production interdependencies are disciplined with empirical input-output matrices from the World Input-Output Database (Timmer et al., 2015). Each entry of the World Input-Output matrix represents a country-sector pair, for example, how much each sector in Germany spends on inputs from each sector in China.

To calculate the consequences of decoupling, we must make a key assumption about the substitutability between different intermediate inputs in the production process, in particular between imports from China and other inputs. This degree of substitutability is disciplined by various elasticities of substitution. The model features a nested constant elasticity of substitution (CES) structure. Besides the input-output matrices, the key parameters of the model are the elasticities of substitution: σ is the elasticity of substitution across sectors for final goods (56 sectors); θ is the elasticity of substitution across value-added (labour and capital) and intermediate inputs; γ is the elasticity of substitution between labour and capital; and η is the elasticity of substitution across intermediate input sectors. Finally, there is a trade elasticity ε that determines substitutability, within each sector, across goods from differing origins. [11]

The degree to which these elasticities matter depends also on the ease of reallocation of resources in the economy. A low elasticity of substitution is less of a problem if resources can be reallocated to reinforce weak links and maintain production in other sectors.

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11   The elasticity of substitution between goods from a given industry across different origin countries is $\varepsilon + 1$. We refer to ε as the trade elasticity, as in the literature (e.g., Costinot and Rodriguez-Clare, 2014). Whereas Baqaee and Farhi (2021) allow the trade elasticity to vary across sectors, we assume that it is identical across sectors and experiment with different values. That is, using the notation of Baqaee and Farhi's Appendix M, we impose that the sectoral elasticities of substitution $\theta_i = \varepsilon + 1$ for all sectors i.

For large changes in the economy's input mix of the type that we are concerned with, there is a considerable degree of uncertainty. It seems plausible to assume, however, that the elasticity of substitution is larger in the medium and long run, and smaller in the very short run (the 'le Chatelier principle'; see for example Samuelson, 1947; Milgrom and Roberts, 1996). The size of economic losses stemming from a sharp reduction in trade with China therefore depends crucially on the time frame over which adjustments take place.

Most of our results focus on economic costs of China decoupling scenarios as measured by the fall in gross national expenditure. GNE, also known as 'domestic absorption', is the economy's total expenditure defined as the sum of household expenditure, government expenditure and investment, and is the welfare-relevant quantity in many macroeconomic and trade models including the Baqaee-Farhi model. One reason for focusing on GNE rather than GDP is that GDP may not pick up the terms-of-trade effect through which German consumers become poorer when the price of imported goods rises (e.g., Obstfeld and Rogoff, 1995; Mendoza, 1995).[12]

3.2 Trade elasticity

One key parameter for the magnitude of the welfare shocks of decoupling is the trade elasticity ε. This describes how strongly trade flows react to trade cost changes and is linked to the substitutability of goods from different origins. If this elasticity is low in absolute magnitude, it is hard to find alternatives for Chinese goods that are no longer available and the welfare loss of cutting the trade link with China is high. If the elasticity is higher, substitution is easier and welfare costs are lower (for an in-depth description of how the trade elasticity is key to the quantification of gains from trade, see Arkolakis et al., 2012).

To simulate the impact of de-risking from China on the German economy, ideally we would like to have estimates of an increase in trade costs between China and Germany on trade flows using plausibly exogenous variation for different time horizons, which unfortunately are not available. For the short run, we can draw from recent developments in the literature: Fajgelbaum et al. (2020) find a trade elasticity of 1.5 using the Trump tariffs on China as well as on other trade partners.[13] This number captures the effects over a time horizon of six months to one year. The event-study results of Fajgelbaum

12   Theoretically, the effect is easiest to see in a small open endowment economy with an exogenously given relative price of exports to imports p (which is the country's terms of trade). Real GDP is given by the endowment and therefore not affected by fluctuations in the terms of trade p. However, consumption and welfare decline when the terms of trade p declines, an effect not picked up by real GDP.

13   Fajgelbaum et al. (2020) report –2.5 for –σ for the variety-level import response to import tariffs across different countries. Hence, the trade elasticity is $\varepsilon = \sigma - 1 = 1.5$. Sandkamp (2020) finds estimates in a similar ballpark using plausibly exogenous variation as the analysis focuses on the effect on trade between China and the new member states that inherited the European Union's anti-dumping regime when acceding the Union in 2004.

et al. (2020) suggest coefficients that are half as large in the very short run. To be extra conservative, we assume the trade elasticity in the first few months after the shock to be equal 0.5, rising to 1.5 over the horizon of one year and to 3 over three years, as shown in Figure 2.

FIGURE 2 TRADE ELASTICITY ESTIMATES FROM LITERATURE FOR DIFFERENT TIME HORIZONS
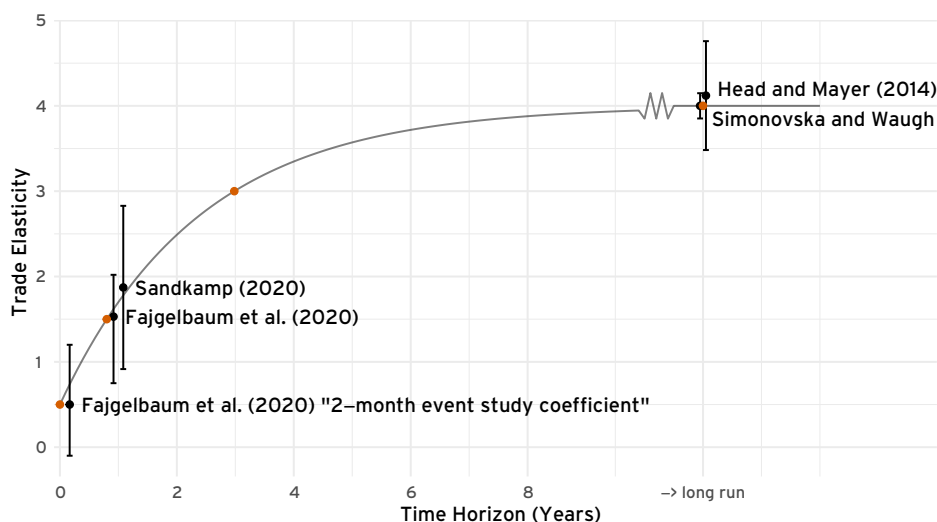
Notes: The figure summarises estimates of the trade elasticity ε. Some papers in the literature do not directly report estimates of ε in which case we convert these estimates to ε. See the text for detail. As expected from the le Chatelier principle, the trade elasticity increases with the time horizon.

For the long run, we choose a trade elasticity of 4, as suggested by Simonovska and Waugh (2014), as the benchmark value, which is also in line with the results of the meta-analysis performed by Head and Mayer (2014) where they report mean and median estimates in the range of 3 to 5. An earlier survey by Anderson and van Wincoop (2004) reports estimates in the literature ranging from 5 to 10. This is also the range that Arkolakis et al. (2012) use in their quantifications. Hence, our choice of the long-run trade elasticity is at the conservative end in the sense that it will generate higher estimates of welfare losses.

Figure 2 summarises the trade elasticity estimates from the literature and how these vary with the time horizon. The figure includes 95% confidence intervals reported in the corresponding papers to illustrate the statistical uncertainty inherent in these estimates. The black solid line fits an illustrative curve through these estimates to construct a mapping from time horizon to trade elasticity. The red dots on the line are the trade elasticities we will use in our main simulation results with values ranging from 0.5 to 4.[14]

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14   As can be seen in the figure, there is scant empirical evidence on trade elasticities for intermediate time horizons above two years, which means that alternative mappings from time horizon to elasticities are possible as well. In particular, the trade elasticity may converge to its long-run value more slowly, perhaps reaching ε = 3 after five years rather than three years. As is evident from Figures 3 and 6, this would not affect our main results much.

In addition to the lowest realistic value used here, we also report results for extremely low trade elasticities of 0.1 and 0.25. We are unaware of any empirical foundation for such low values, but they might still serve a useful purpose as a defence against possible 'this time is different' arguments. We will see that such extremely low hypothetical trade elasticities aggravate the costs by another 1 percentage point, but they do not lead to extreme losses.

3.3 Data sources and key parameters

As mentioned above, the model is disciplined by the most recent version of the World Input-Output Database (the 2016 release). It includes information on final goods expenditure, intermediate goods expenditure, value-added, and factor income for 43 countries and 56 sectors from the year 2000 to 2014. We designate the year 2014 as the steady state of the model and calibrate the shares of final expenditure, intermediate input, value-added, and factors for each country. These calibrated shares serve as inputs to calculate the standard form input-output matrix, following the methodology outlined in Baqaee and Farhi (2021). Subsequently, this matrix is reordered and aggregated based on the country blocs described below.

It is worth noting that an empirically disciplined multi-sector model like the Baqaee-Farhi model reflects an important feature of modern advanced economies: manufacturing typically accounts for a moderate share of aggregate economic activity. This is true even for Germany, which is often viewed as an industrial powerhouse: German manufacturing accounts for 'only' about 23% of total employment and 25% of value added. This is a natural consequence of the structural transformation process during which manufacturing activity is replaced by the service sector. Put differently, some observers seem to be under the mistaken impression that the structure of the German economy is still that of earlier time periods like the 1970s.

All 43 countries are categorised into three blocs: Friends, Rivals, and Neutrals. The Friends bloc includes the G7 countries (Canada, Germany, France, the United Kingdom, Italy, Japan, and the United States), two large economies in the European Union (Spain and the Netherlands), and one composite country that aggregates the remaining 22 EU countries in the sample. This totals ten countries, representing 54% of world GDP in 2014. The Rivals bloc comprises China and Russia, accounting for 15% of world GDP.[15] Finally, the Neutrals bloc comprises the remaining 11 countries in the sample, including the 'rest of the world' as one composite country. We set the elasticities of substitution to $(\sigma, \theta, \gamma, \eta) = (0.9, 0.5, 1, 0.2)$, following the literature in Baqaee and Farhi (2021) and Atalay (2017), but test the robustness of our key results to more extreme parameters, specifically $(\sigma, \theta, \gamma, \eta) = (0.01, 0.01, 0.01, 0.01)$.

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15   Note that in 2022 the Rivals bloc's share in world GDP stood at about 22%. With roughly similar import shares in GNE between 2014 and 2022 for Western countries, this has likely a limited impact on the simulation results.

TABLE 3 'COLD TURKEY' DECOUPLING: GROSS NATIONAL EXPENDITURE CHANGE FOR DIFFERENT TRADE ELASTICITIES

Trade elasticity	Benchmark parameters	Very low elasticities
$\varepsilon = 0.5$	−5.00%	−5.83%
$\varepsilon = 1.5$	−2.97%	−3.32%
$\varepsilon = 3$	−1.65%	−1.78%
$\varepsilon = 4$	−1.26%	−1.34%
$\varepsilon = 0.1$	−5.92%	−6.15%
$\varepsilon = 0.25$	−5.62%	−6.38%

Note: The table reports simulation results from the Baqaee and Farhi (2021) model for the economic costs to Germany of a cold turkey decoupling scenario (as described in the text) for different values of the trade elasticity ε. The first column, labelled ''Benchmark parameters'', uses the benchmark values for the model's other elasticities from Baqaee and Farhi (2021), whereas the column labelled ''Very Low Elasticities'' uses the extreme paramterisation described in Section 3.3 to probe robustness.

FIGURE 3 COLD TURKEY DECOUPLING OVER TIME
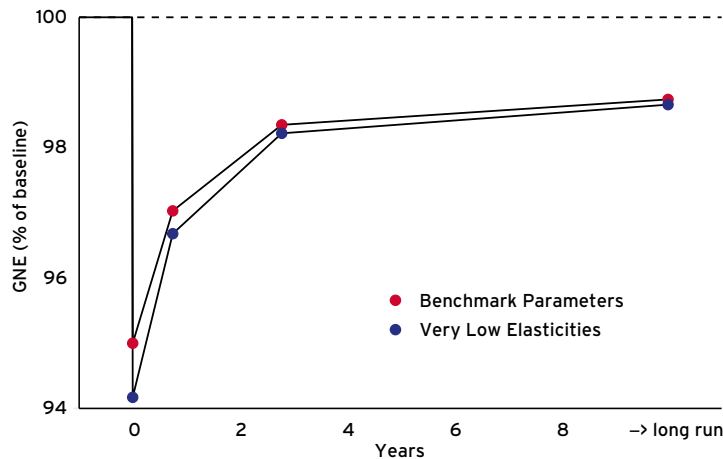
Notes: Figure uses the mapping from time horizon to trade elasticities in Figure 2 to provide an illustration of the likely time path of such a decoupling scenario. Because the trade elasticity increases with the time horizon (the le Chatelier principle), the economic costs decrease with time.

3.4 Key results

In all simulations, we assume prohibitively high trade costs between members of the Friends bloc and members of the Rivals bloc, so that trade flows between the two blocs drop to zero. Other trade costs are left unaltered and trade flows within the blocs, as well as with the Neutral bloc, will endogenously adjust.[16]

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16 Note that since the Russian invasion of Ukraine, Western countries have already significantly decreased their imports from Russia. The results below are thus conservative, assuming a decoupling – even partial – has not yet occurred.

Table 3 summarises the German welfare losses in response to the full decoupling for a range of long-run to extremely short-run trade elasticities, which we will now discuss in turn in detail.

As discussed in Section 3.3, plausible magnitudes of the trade elasticity crucially depend on the time horizon considered. By running our simulation with different short-run and long-run elasticities, we obtain estimates for the welfare effects over different horizons.

We begin with an extremely low trade elasticity of 0.5 for the very short run, which is even lower than the elasticity that empirical studies found over two-month horizons in the case of the Trump tariffs (Fajgelbaum et al., 2020). We consider this a conservative value even in the very short run over the period of one quarter. In this case, the German welfare loss amounts to 5.0%, rising to 5.8% if we also set the other elasticities in the model to very low levels. Lowering the trade elasticity even further to 0.25 (and hence the time frame of our consideration to the extreme short run) only adds comparatively minor additional welfare losses and puts the total loss at 5.6%. Finally, we consider an extreme case in which we put the trade elasticity close to zero, specifically to 0.1. We do not consider this value to be a realistic one even in the very short run, but see it as a useful worst-case scenario to put an upper bound on the welfare losses. Even such an extreme value does not substantially change the welfare loss estimate: it rises by an additional 0.3 percentage points to -5.9%.

Over the important horizon of one year, we consider an elasticity of 1.5 as conservative. In this case, the German welfare loss of decoupling amounts to 3–4% depending on the other parameters. Compared to other countries, this is at the high end of damages in the Friends bloc, but below the losses experienced by China (4.8%) and Russia (12.3%). It is important to stress that in any scenario we study, the losses are larger for China and its allies.

Figure 3 summarises these model simulations for different trade elasticities and shows the economic costs of a decoupling scenario over time. As already mentioned, a key idea in economics is that elasticities increase with the time horizon (the le Chatelier principle). As illustrated in Figure 2, this also applies to trade elasticities which increase substantially over time. We can use this idea to convert the results in Table 3 into the time dimension and trace out the economic costs for Germany of a 'cold turkey' decoupling from China over time. In the very short run, when the trade elasticity is low, German GNE drops by around 5% in the first few months and by 3–4% in the first year, with business cycle amplification effects coming on top.

For the new long-run steady-state results, which characterises a world with three blocs, we assume a trade elasticity of four. As the trade elasticity increases, the economic costs become more muted before settling at a permanent GNE loss. We estimate a permanent welfare loss of 1.26% in response to both losing access to an export market and the opportunity to source any products from the Rivals bloc. This is at the high end of the losses incurred by Friends countries, as Germany is particularly strongly integrated with

the Rivals bloc. In Europe, only the Netherlands experiences a loss of larger magnitude, while the losses of all the other European countries range between 0.47% and 0.69%. The North American Friends countries lose 0.51% (United States) and 0.86% (Canada). The only other country in the Friends bloc with losses of the same magnitude as Germany in this scenario is Japan (1.24% loss) due to its proximity to and resulting strong pre-shock integration with China. While our focus is on the effects in Germany specifically and the Friends countries more generally, it is worth noting that China and Russia are affected much more severely and face welfare losses of 2.05% and 4.94% in the long run, and up to 7.8% and 21.5% in the short run, respectively. The higher welfare losses for the Rivals bloc are intuitive, as a much larger share of their international trade relations is affected due to the large economic size of the Friends bloc.

Figures 4 and 5 illustrate the global trade adjustments in the long run. Initially, the largest share of international trade takes place within the Friends bloc (see Figure 4), followed by trade between the Friends and the Neutrals blocs. As the Rivals bloc is the smallest of the three, trade flows between Friends and Rivals are also of a smaller magnitude: Friends export seven to eight times more to other Friends than to Rivals, and import almost five times more from other Friends than from Rivals. Nevertheless, at about 2.5% of global GDP, total trade between the Friends and Rivals blocs is non-negligible. As expected, in response to the decoupling (see Figure 5), the largest change happens to trade between Trade and Rivals, which drops to zero. Both Friends and Rivals react by increasing trade within their blocs. They also both trade more with the Neutrals bloc, though in an asymmetric fashion, with Friends increasing imports and lowering exports and Rivals lowering imports and increasing exports. This asymmetry reflects the initial trade imbalance between the Friends and Rivals blocs. Prior to decoupling, Friends import more from Rivals than they export to Rivals. Hence, in response to the shock, Friends primarily look for new partners to source from, while Rivals primarily look for new markets to serve.

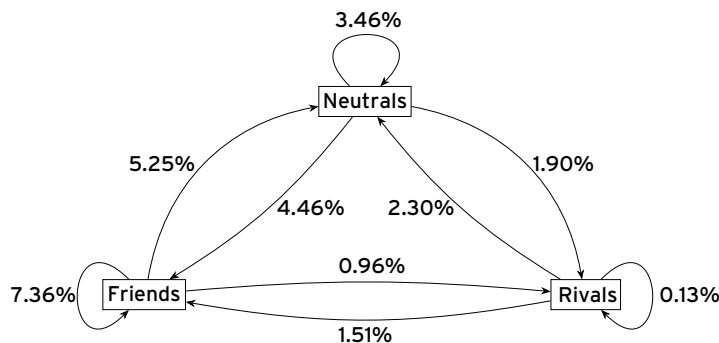FIGURE 4 **TRADE FLOWS AMONG FRIENDS, RIVALS, AND NEUTRALS (% OF GLOBAL GDP)**
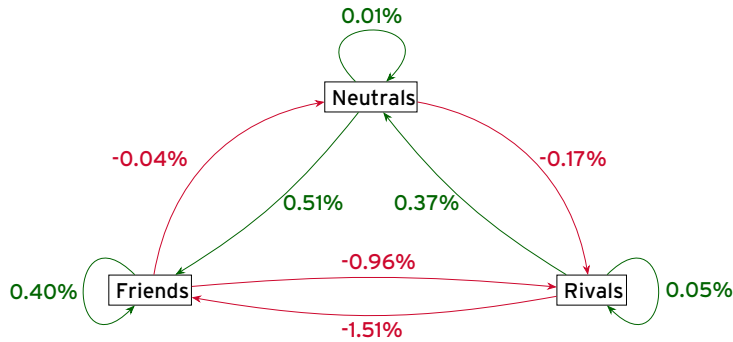
FIGURE 5 **CHANGE IN TRADE FLOWS AMONG FRIENDS, RIVALS, AND NEUTRALS (% OF GLOBAL GDP)**

To gain further insight into the welfare effects, we make use of a decomposition proposed by Baqaee and Farhi (2021), who decompose the total welfare change into a 'technology effect' and a 'reallocation effect'. The former isolates the welfare effects due to the changes in imported materials while otherwise keeping the allocation in the economy constant, while the latter quantifies the effects of reallocating productive resources across producers for given technology and imported materials. The reallocation effect hence captures whether the factoral terms-of-trade change in or against the country's favour. We find that the technology effect (-0.96%) explains about three quarters of the overall welfare loss and the reallocation effect (-0.30%) contributes the remaining quarter.

3.5 Discussion of magnitude

Our simulation results suggest that German welfare costs of decoupling fall in the range of 1.3% in the long run and potentially up to more than 5% in the very short run. The numbers beg the question: are these large welfare costs?

Since World Warr II, the German economy has shrunk in only eight years (1967, 1975, 1982, 1993, 2002, 2003, 2009, 2020) (German Council of Economic Experts 2023).[17] In all these cases except the two most recent ones, GDP dropped by 1% (1993) or less (all other cases). Hence, even our lower, long-run estimate implies losses that are greater than in the third-strongest recession the Federal Republic of Germany has ever gone through. These are severe costs. Also, unlike typical business cycle movements, a decoupling from China implies a permanent downward shift of welfare.

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17   It is also projected to shrink slightly in 2023 (European Commission, 2023).

Our estimated welfare loss over the horizon of one year of 3–4% is of a similar magnitude to the COVID recession of 2020 (-3.7%). For comparison, Dhingra and Sampson (2022), in their survey article on Brexit, conclude that in the three years from the referendum up to 2019, Brexit reduced British GDP by 2-3%. As this is also a medium-run assessment, our results suggest that the economic effects of a China decoupling in Germany may be of comparable magnitude to the economic effects of Brexit in the UK.

Finally, in the very short run, the low trade elasticity consideration leads to a welfare loss (-5% to -5.9%) in the first few months that is roughly as strong as in the deepest recession Germany has experienced on an annual basis, namely, the Great Recession induced by the Global Financial Crisis in 2008/09 (-5.7%). A hard decoupling of China would likely lead to a deep recession comparable to the experience in 2008/09.

The scenario under investigation is a specific case of deglobalisation. To gauge how the magnitude of the China decoupling scenario compares to even more extreme cases of deglobalisation for Germany, we additionally simulate scenarios in which the EU member states cut trade ties with all non-EU partners. The long-run German welfare effect of a full European decoupling from the world economy is a much more severe loss of 9.0%. We also consider the most extreme deglobalisation scenario possible for Germany, namely, full autarky of the country. This would lead to a welfare loss of 31.8% for Germany even in the long-run case with a high trade elasticity. These numbers indicate that deglobalisation and cutting European and German trade links to other partners could indeed lead to catastrophic outcomes for Germany according to our quantitative model. Cutting 'only' those links to China and its allies, however, is not sufficient for such truly catastrophic costs to materialise.

3.6 'Cold turkey' decoupling versus gradual decoupling

How important is the time horizon over which decoupling takes place? To answer this question, we can simulate a number of such alternative scenarios. These will ultimately be presented and analysed more systematically in the scientific version of this chapter (Baqaee et al., 2023). In the meantime, preliminary results using this approach suggest that the time horizon is very important and that a gradual decoupling scenario is likely to be considerably less costly than an immediate 'cold turkey' decoupling. This result is closely linked to the important idea of the le Chatelier principle that elasticities increase with the time horizon which applies, in particular, to the trade elasticity (see the empirical evidence in Section 3.2).

To illustrate the importance of the time horizon, Figure 6 shows the economic costs of a sudden decoupling (again linking the different levels of the trade elasticity considered to the different time horizons, as in Figure 2) and contrasts this cost path to an alternative decoupling scenario in which the decoupling takes place more gradually over a time

horizon of three years. The abrupt decoupling is illustrated by the solid line in the figure, with the red dots referring to the specific selected choices of trade elasticities discussed above. The gradual decoupling alternative is illustrated by the dotted line in Figure 6.

FIGURE 6 **'COLD TURKEY' DECOUPLING VERSUS GRADUAL DECOUPLING VERSUS GRADUAL DE-RISKING**
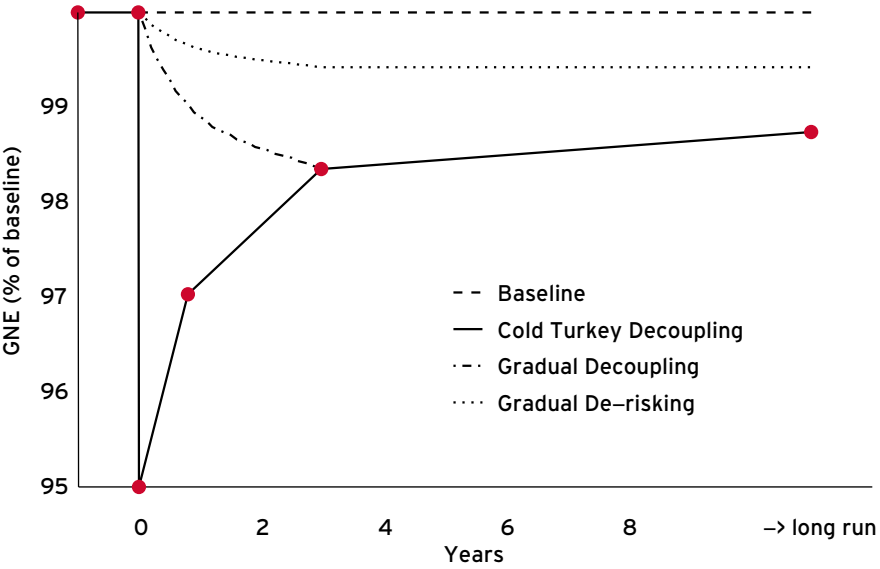
Matching the previous discussion, the costs of abrupt decoupling are potentially severe in the very short run, but fade considerably once the economy has had a few years to adjust to the new situation. Importantly, however, the losses never fade completely but stabilise at a long run value of 1.3%, which we identified using the long-run elasticity of 4. The sharp short-term reaction to decoupling is driven by the assumption that, in the short run, substitution between inputs from different source countries is very difficult. It is therefore the suddenness of the shock that drives the worst effects.

In line with this intuition, we see a very different time path of the economic costs if we consider a gradual decoupling that reduces trade with the Rivals bloc to zero in small steps over a span of three years, rather than trade immediately stopping. In such a gradual decoupling scenario, the deep initial GNE drop can be avoided, while the losses then converge to those obtained for the sudden policy scenario. Hence, while gradual decoupling ends up at the same new long-run equilibrium and thus the same permanent GNE losses, it reaches this new equilibrium at a much lower cumulative cost by allowing some trade to still take place in a transition period.

Our model can also be used to simulate the effects of alternative intermediate scenarios. One instructive scenario is that the Western and Chinese blocs are on a gradual decoupling trajectory of the type just discussed but then experience a 'cold turkey' decoupling starting from a position of partially severed trade flows. For example, suppose that halfway through a gradual decoupling, a full decoupling suddenly becomes dictated by geopolitical events (so after 1.5 years in the three-year decoupling example just discussed). While we do not show such a scenario in Figure 6, it is clear from the logic of the figure that the corresponding costs will be between that of the two scenarios shown there. This means, in particular, that the welfare losses from a 'cold turkey' decoupling that follows a period of adjustment during which trade routes and supply chains are reorganised are lower than the losses from a 'cold turkey' decoupling that follows a period in which no adjustment took place ('business as usual').

Throughout this chapter, we have considered hard decoupling scenario in which trade between the Western and Chinese blocs drops to zero (either immediately or over several years as in this subsection). Of course, most options on the table for policymakers are considerably less extreme. For example, US policy makers often describe their approach as 'small yard, high fence' (Sullivan, 2023) to emphasise that trade restrictions are 'carefully tailored' toward specific sectors or products, such as advanced semiconductor technology exports to China. Our model can in principle also be used to analyse more targeted 'de-risking' scenarios such as these. Naturally, such less extreme scenarios would have smaller economic costs for the German economy than the hard decoupling scenarios analysed here. In other words, our scenario should be interpreted as a worst-case scenario that allows us to bound the costs of alternative and less extreme de-risking scenarios.

The same logic regarding the dependence of decoupling costs on the time horizon also applies to less extreme de-risking scenarios. To illustrate both these points, Figure 6 also shows the stylised path in a hypothetical gradual de-risking scenario. While we have not conducted model simulations to quantify such de-risking policies, the key takeaways are that the costs would be (a) smaller than those of a hard decoupling scenario, and (b) smaller if the de-risking is gradual rather than 'cold turkey'. However, it is also clear that gradual de-risking also has a price.

Taking the model's logic one step further, gradual de-risking policies in critical sectors may have the potential to substantially reduce the costs of a possible subsequent hard decoupling. In these sectors, a gradual reduction in trade flows would reduce interdependence with China, but with the lowest elasticities only applying to a partial trade cut-off, thereby avoiding the largest losses. At the same time, the losses from a subsequent hard decoupling would be lower than if no adjustment had occurred because of reduced interdependence in the most critical sectors.

Note that while these qualitative statements follow relatively directly from the logic of our model, in particular the time-dependence of elasticities, their quantitative counterparts are an open question because we have not simulated the corresponding scenarios. An important question for future work is how much various gradual de-risking scenarios would reduce the costs of a possible subsequent 'cold turkey' decoupling and at what economic costs.

4 CAVEATS

In the following section, we examine a number of potential caveats to the simulation results. While these results suggest severe but not devastating impacts of a hard decoupling on the German economy, certain subtleties and dimensions remain outside the scope of the model due to aggregation and abstraction.

Specifically, we focus on four key caveats that could magnify the impact: strategic raw material imports from China, which are integral to numerous German industries; short-run business cycle amplification; long-run effects on investment and capital accumulation; and finally, the implications for German foreign direct investment (FDI) in China, a cornerstone of economic interdependence between the two nations.

4.1 Strategic raw materials

While most goods and services can be substituted in the long run, raw materials pose a unique challenge due to their inherent scarcity as natural resources. Germany relies heavily on specific raw materials crucial to key industries, and shortages of these materials could significantly disrupt the economy. For instance, when China restricted magnesium exports – an essential component for aluminium production – in 2021, it raised concerns within the German automotive and aviation industries.[18] Given China's significant role in the market for raw materials, when evaluating the costs of decoupling from China it is important to consider this mechanism as well as the fact that the sector aggregation of our model is high to capture it.

We will next analyse how dependent Germany is on China with respect to the supply of raw materials. To identify the relevant raw materials, we adopt the European Commission's definition, focusing on the 16 critical raw materials outlined in the EU Raw Materials Act (52018PC0368, Annex 1). These raw materials are deemed critical due to their pivotal role in key technologies and strategic industries such as defence while facing a high supply risk, often due to a highly concentrated supplier market. The listed critical raw materials include bismuth, boron, cobalt, copper, gallium, germanium, lithium, magnesium, manganese, natural graphite, nickel, platinum, rare earths, silicon metal, titanium, and tungsten.

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18   https://www.politico.eu/article/eu-leaders-alarm-china-magnesium-crunch/

To understand Germany's exposure to China, we look at the share of Germany's imports from China of total imports for the respective raw materials. To do so, we use data on imports from Eurostat's Comext database and map the CN8 product codes to the raw materials using the concordance proposed by the factsheets provided by SCRREEN.[19] In Figure 7, each dot corresponds to one CN8 product. We define dependency on China as high whenever the import share is higher than 65%.

Several notable facts emerge. First, Germany exhibits high dependency on nine out of six- teen critical raw materials. Second, among these nine materials, five – titanium, natural graphite, manganese, cobalt, and bismuth – offer relatively manageable substitution options due to the availability of alternative suppliers. Third, the automotive and high-tech sectors, which are particularly reliant on the four critical raw materials (gallium, magnesium, rare earths, and tungsten) with high dependency on China and little potential for short-run substitutability from other source countries due to China's dominant role in worldwide production, face considerable risk when decoupling from China.[20] However, it is once again important to see even these large sectors in relation to the total German economy – for example, the automotive industry accounts for around 5% of German GDP. Even if we were to significantly underestimate the burden put on this sector by decoupling, it is unlikely to alter the general magnitude of German welfare losses we quantified in Section 3.

FIGURE 7 GERMANY'S IMPORTS OF RAW MATERIALS FROM CHINA (%)
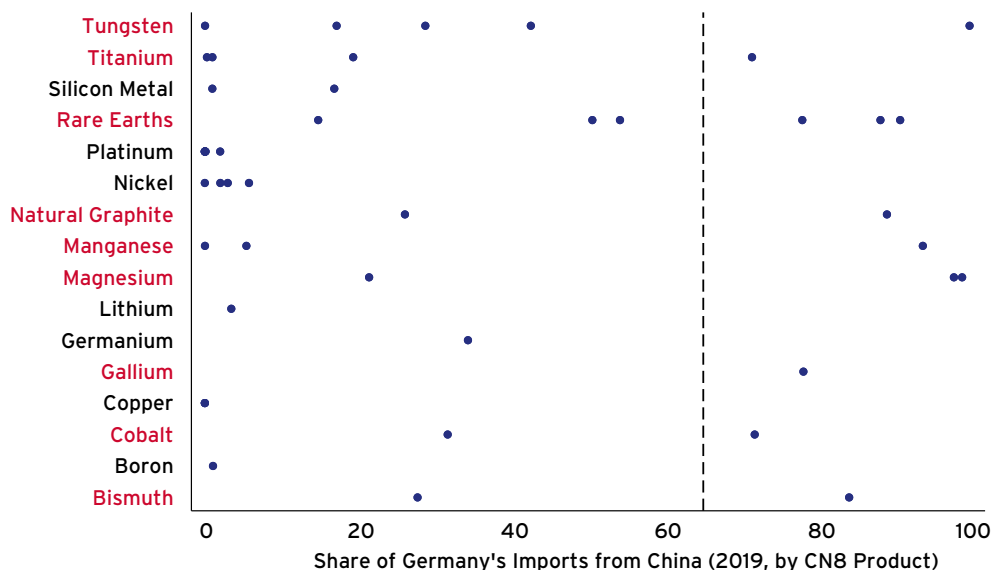
19   https://scrreen.eu/crms-2023/
20   Information on the production as well as use of raw materials comes from SCREEN, available at https://scrreen.eu/crms-2023/

As in the Russian gas cut-off of 2022, in the scenario of a sudden lack of these important and rare raw materials, alternatives would likely materialise – albeit with some time lag. Recently discovered deposits of rare earths in Sweden have been heralded as a potential solution for a more diversified sourcing portfolio for Western economies.[21] Even in a pre-crisis setting, the mine operator and independent researchers suggested a time frame between 10 and 15 years to develop a fully operational facility. However, the 2022 Russian gas cut-off has shown that in crisis times, mitigation strategies often accelerate these processes: new terminals for liquefied natural gas (LNG), which had been planned for years and were forecast to take years to go online, were built in just a few months.[22] It appears likely that in a crisis scenario where certain raw materials are suddenly in short supply, alternative sourcing options would also become available sooner than current planning suggests.

We conclude this section by discussing a case study that sheds light on how an economy is able to adjust to a shortage of a strategic raw material of the type discussed in this section, namely, the Chinese rare earth embargo against Japan in 2010.[23]

In 2010, China effectively implemented an export embargo on rare earths to Japan. Superficially, this resembled a textbook example of effective sanctions: China was virtually the sole supplier of rare earths, while these were an important input for Japanese industry.[24] As noted by Gholz and Hughes (2021), in the short run, Japanese firms reduced demand both at the intensive and extensive margin. Firms for which rare earths were crucial to their inputs came up with ways to use raw materials more effectively, thus pushing the technology frontier outwards. For example, glass manufacturing companies started recycling cerium polish, which requires the rare earth mineral cerium. Other firms such as headphone manufacturers that previously bought rare earths due to their low cost – rather than because they were critical to the production process – substituted away completely. In the medium to long term, Japanese firms were working on technological innovations to either reduce usage of rare earths or enable substitution with different materials. Reductions on the consumer side, such as post-consumption recycling, appear to play a lesser role due to practical difficulties. On the supply side, it took two years for alternative producers to enter the market, even though investments in these projects had started long before the embargo. The Japanese government subsequently supported

21 See, for example, https://www.dw.com/en/explainer-what-the-rare-earths-find-in-sweden-might-mean-for-the-eu/a-64375644.
22 See, for example, https://www.berliner-zeitung.de/wirtschaft-verantwortung/statt-in-acht-jahren-leitung-fuer-erstes-lng-terminal-in-rekordzeit-fertiggebaut-li.296981, which cites industry sources which claim that under usual circumstances, the construction of the first LNG terminal in Wilhelmshaven that was opened in December 2023, only four months after the final cut-off from Russian gas, "would have taken six to eight years from planning to operations."
23 This example is taken from an online appendix to Bachmann et al. (2022) available at https:// benjaminmoll.com/RussianGas_Substitution/, which also includes other case studies regarding economies' ability to substitute in the face of adversity. See also the 36 cases studies in the appendix of Moll et al. (2023) describing how German firms and households substituted natural gas and gas-intensive products in the aftermath of the 2022 cut-off from Russian gas.
24 Some authors have argued that the embargo was not fully effective (e.g. Johnston, 2013). However, the embargo seems to have triggered some substitution by Japanese firms, so it arguably must have been effective to some extent.

one of the firms via a long-term supply contract, which ensured its survival amidst price fluctuations in the years after the embargo subsided. Overall, the economic costs of the Chinese rare earths embargo for the Japanese economy were relatively muted.

4.2 Short-run business cycle amplification

The Baqaee and Farhi (2021) model is a real model with no further business cycle amplification and therefore omits some of the channels through which a large trade shock may affect the economy. In particular, the model omits standard Keynesian demand-side effects in the presence of nominal rigidities as well as amplification effects due to financial frictions. As we now explain, these may be particularly relevant in the short run and therefore for the 'cold turkey' decoupling scenario, but relatively less so for the gradual decoupling scenario, therefore further strengthening our argument that a gradual decoupling has much lower economic costs.

To be clear, our flexible-price model does include what many lay people would call 'demand-side effects', namely, that increasing consumer prices of goods previously imported from China erode purchasing power and consumer welfare. But it omits the feedback from the drop in aggregate consumption to production and employment: rising prices of goods previously imported from China drag down consumer spending, and this feeds back into production and employment which further drags down consumption, and so on.

This important mechanism is operational in standard macroeconomic models with nominal rigidities that are consistent with empirical evidence on household consumption behaviour, in particular heterogeneous agent New Keynesian (HANK) models consistent with the large observed marginal propensities to consume. See, for example, Bayer et al. (2022), Bayer et al. (2023), Pieroni (2023), and Auclert et al. (2023) for analyses emphasising this mechanism in the context of rising energy prices (e.g., following the 2022 cut-off of Germany from Russian gas).

Particularly in the case of a full and immediate 'cold turkey' decoupling, we would expect such amplification effects to be potent. Given that the model omits such effects, the model-implied short-run GNE losses in this scenario of around 5% are likely an underestimate of the true effect. Analyses of such effects for the case of the energy crisis have shown that they can amplify the overall effects substantially, for example increasing GNE losses from around 2.3% to around 3% (i.e. by around 30%) (Bayer et al., 2022; Pieroni, 2023). Applying a similar 30% amplification factor to the short-run GNE losses in the short-run decoupling scenario would increase these from 5% to 6.5% – a very substantial economic cost, but still not catastrophic.

In the case of the gradual decoupling scenario discussed in Section 3.6, such effects are likely more muted. This further strengthens the argument that the economic losses from a gradual decoupling strategy are considerably smaller than those from an immediate 'cold turkey' event.

4.3 Long-run effects on investment and capital accumulation

Given that the Baqaee and Farhi (2021) model is a static model, another omission from our analysis are the standard long-run effects on investment and capital accumulation (as in a neoclassical growth model). Alvarez (2017) and Kleinman et al. (2023) show how to incorporate capital accumulation into quantitative trade models of the type used here in a tractable fashion, and the latter also analyse a US-China decoupling scenario. While they find that modelling capital accumulation changes various model predictions in interesting ways, they do not find that it drastically amplifies the long-run effects of policy counterfactuals relative to static models. In line with this result is the standard result from the neoclassical growth model that capital accumulation amplifies productivity changes by a factor of $1/(1 - \alpha)$, where α is the capital share which typically takes values of around 1/3 so that $1/(1 - \alpha) = 1.5$.[25] Applying this factor to the long-run GNE losses of 1.26% yields 1.89%. We are thus relatively confident that, even taking into account the effects on investment and capital accumulation, the long-run welfare losses from decoupling would remain below 2% of GNE. We plan to explore these issues in more detail in the scientific version of this chapter (Baqaee et al., 2023).

FIGURE 8 **BILATERAL FDI STOCK BETWEEN GERMANY AND CHINA OVER TIME**
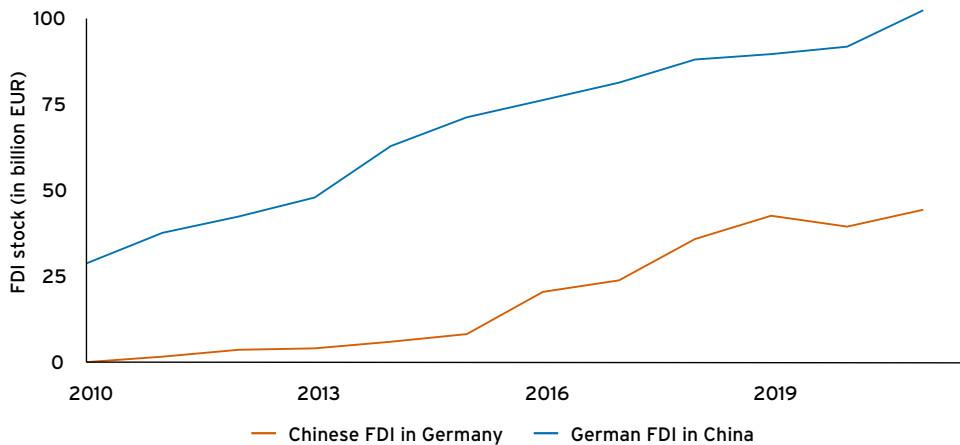
25 Consider a neoclassical growth model with production function $Y = AK^{\alpha}L^{1-\alpha}$ where A is productivity, K is capital, L is labour, and α is the capital share. Then the steady state value of the capital stock is:

$$K^* = \left(\frac{\alpha A}{\rho + \delta}\right)^{\frac{1}{1-\alpha}}$$

where ρ is the discount rate and δ is the depreciation rate. It follows that steady-state production $Y^* = A(K^*)^{\alpha}L^{1-\alpha}$ and consumption $C^* = Y^* - \delta K^*$ are both proportional to $A^{\frac{1}{1-\alpha}}$ meaning that any percentage change in productivity A is amplified by a factor of $\frac{1}{1-\alpha}$. The final step in the argument is that gains and losses from trade effectively show up in economy-wide productivity (e.g., Alvarez, 2017).

4.4 Foreign direct investment

China and Germany are not only linked through trade; in the past years, companies from both countries have increasingly invested in the other economy. In 2019, German firms held FDI stock worth about €90 billion, while Chinese-owned FDI stock in Germany stood at about €43 billion.[26] Figure 8 shows that since 2010, both economies have seen a persistent increase in bilateral FDI, with German FDI in China being about twice as high as Chinese FDI in Germany.

Table 4 breaks down these stocks by broad sectors. As in Tables 1 and 2, once viewed within the bigger perspective of its share in the total economy, these seemingly large figures become quite small in terms of shares in GNE. For example, the German car industry's share of China in its total sector FDI stock is almost a quarter. Taking into account the share of this sector's global FDI stock in total GNE (3.37%), German FDI from the automobile sector in China suddenly loses its overall economic significance, making up just 0.79% of GNE. Total FDI profits reaped by German companies in China stands at 0.44% (Bundesbank, 2023).

In an extreme scenario, as simulated above, where a complete decoupling takes place, one could argue that not only would trade be affected by sudden restrictions, but also FDI profits could not be repatriated and FDI stock may even have to be written off. In this unlikely scenario, it would also be likely that this action takes place on both sides, i.e., Chinese FDI in Germany would also be confiscated. As the numbers above show, while not insignificant, disrupting investment would also not be catastrophic.

Another way to look at the possible impact of the investment channel is to gauge the significance of the affected German-owned companies in China in a global perspective. Table 5 shows a steady increase in the number of companies, the number of employees of those companies, as well as their annual turnover. In comparison with global figures from 2020, with German investors owning more than 40,000 firms outside of Germany, employing more than 8 million workers, and generating an annual turnover of more than €3.1 trillion, these numbers are – again – rather small.

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26   Data from Jungbluth et al. (2023) and Heritage Foundation & American Enterprise Institute (2022).

TABLE 4 **SHARE OF CHINA IN GERMAN FDI STOCKS AND PROFITS IN GROSS NATIONAL EXPENDITURE IN 2019**

Sector	Share of China in total sector FDI (%)	Share of total sector FDI in GNE (%)	Share in GNE (%)
Chemical Products	9.44	2.88	0.27
Pharmaceutical Products	4.98	1.14	0.06
Electromedical Devices	7.94	0.99	0.08
Electrical Equipment	22.32	0.88	0.20
Mechanical Engineering	14.27	1.41	0.20
Automobile and Parts	23.50	3.37	0.79
Energy Supply	-	1.24	-
Motor Vehicles Maintenance	-	6.79	-
Information and Communication	0.60	2.62	0.02
Banking	2.12	2.21	0.05
Investment Companies	-	3.06	-
Insurance, Reinsurance, etc.	1.75	2.33	0.04
Other Financial Activities	2.83	0.43	0.01
Real Estate	1.14	1.69	0.02
Company Management	0.01	2.28	0.00
Other Services	1.52	0.92	0.01
Total	**6.47**	**42.43**	**2.74**

TABLE 5 **SIZE MEASURES FOR GERMAN FIRMS IN CHINA**

	2010	2015	2020
Number of companies	1,451	2,096	2,394
Employees (in thousands)	463	706	750
Annual turnover (in million Euros)	122,615	264,752	330,868

Source: Data from Deutsche Bundesbank & Bertelsmann Foundation (Jungbluth et al., 2023).

4.5 Other channels

Another potential mechanism that is abstracted from in the model is international migration. A decoupling between Germany and China would likely lead to a decrease in the number of Chinese migrants in Germany, and vice versa. This in turn could have implications for the labour market and human capital flows.

Chinese residents in Germany, numbering 149,550, constitute approximately 1.1% of the foreign population and a mere 0.18% of the total German population (Destatis, 2023). Meanwhile, Germans in China represent a small fraction of the population. Foreigners make up only about 0.06% of the total Chinese populace (Bickenbach and Liu, 2022). Among these, Germans are the second largest group of Europeans. Net migration flows between Germany and China saw a decrease of 4,159 from 2015 to 2020. These figures highlight the relatively minor scale of human capital movement between the two countries. Consequently, while migration is an integral aspect of global economic interactions, in the specific case of Germany and China, its broader effects from decoupling appear to be minimal. This suggests that migration-related factors are unlikely to significantly magnify the impacts of economic decoupling between Germany and China.

5 CONCLUSION

This chapter has examined the economic implications of a hypothetical 'hard decoupling' of the German economy from China, in a scenario that entails a broader decoupling of a G7/Western bloc from China and its allies. Our findings show that the costs of such a decoupling scenario would be serious, but not devastating. Particularly in a 'cold turkey' situation in which an immediate and total separation between Germany and other Western countries and China occurs, the potential economic contraction could be as severe as a reduction equivalent to 5% of gross national expenditure in the first year alone. It is vital, however, to recognise that these assumptions and scenarios represent the extreme end of the spectrum, likely constituting an upper bound on the potential economic fallout in less extreme scenarios.

On the analytical side, it is important to stress the dependence of our results on estimates of a key parameter, namely, trade elasticity. The capacity to reorient trade towards alternative countries is a key factor in mitigating the adverse effects of decoupling from China. A lower trade elasticity means it is harder to replace Chinese goods, thereby escalating the welfare losses associated with severing trade links. The time horizon is of central importance here. Long-run trade elasticities of 4 or above result in a welfare cost of between 1% and 2%. Yet in the short run, the cost are likely to be higher by up to a factor of three.

While other European countries would also face significant economic repercussions, Germany's situation is particularly acute due to its deep trade ties with China. It is crucial to

underscore that this chapter does not argue that such a hard decoupling scenario is likely or desirable. Our aim is to provide the best possible estimate of the economic costs of such an outcome, however likely or unlikely it may seem. Understanding the costs of choices driven by geopolitical and security policies is vital for policymakers, businesses, and the public.

REFERENCES

Alvarez, F (2017), "Capital accumulation and international trade", *Journal of Monetary Economics* 91(C): 1–18.

Anderson, J.E. and E. van Wincoop (2004), "Trade Costs", *Journal of Economic Literature* 42(3): 691–751.

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

Atalay, E. (2017), "How important are sectoral shocks?", *American Economic Journal: Macroeconomics* 9(4): 254–280.

Auclert, A., H. Monnery, M. Rognlie, and L. Straub (2023), "Managing an Energy Shock: Fiscal and Monetary Policy", Working Paper.

Bachmann, R., D. Baqaee, C. Bayer, M. Kuhn, A. Löschel, B. Moll, A. Peichl, K. Pittela nd M Schularick (2022), "What if? The Economic Effects for Germany of a Stop of Energy Imports from Russia", ECONtribute Policy Brief No. 28.

Baldwin, R.E., R. Freeman, and A. Theodorakopoulos (2023), "Hidden Exposure: Measuring U.S. Supply Chain Reliance", *Brookings Papers on Economic Activity,* Fall.

Baqaee, D. and E. Farhi (2021), "Networks, Barriers, and Trade", Working Paper, UCLA.

Baqaee, D., E. Farhi, J. Hinz, B. Moll, M. Schularick, F.A. Teti, J. Wanner, and S. Yang (2023), *The Impact of China De-Risking on the German Economy: A Quantitative Analysis*, Technical Report (work in progress).

Bayer, C., A. Kriwoluzky, and F. Seyrich (2022), "Energieembargo gegen Russland würde Wirtschaft in Deutschland kalkulierbar belasten, Fiskalpolitik wäre in der Verantwortung", Technical Report 80, DIW Aktuell.

 Bayer, C., A. Kriwoluzky, and F. Seyrich et al. (2023), *Makroökonomische Effekte der finanz- und wirtschaftspolitischen Maßnahmen der Entlastungspakete I – III sowie des wirtschaftlichen Abwehrschirms*, DIW Berlin, Politikberatung kompakt.

Bickenbach, F. and W.-H. Liu (2022), "Goodbye China: What Do Fewer Foreigners Mean for Multinationals and the Chinese Economy?", *Intereconomics* 57(5): 306–312.

Bundesbank (2023), "Direktinvestitionsstatistiken: Tabellen der Statistischen Fachreihe", Technical Report.

Costinot, A. and A. Rodriguez-Clare (2014), "Trade Theory with Numbers: Quan- tifying the Consequences of Globalization", Chapter 4 in G. Gopinath, E. Helpman, and K. Rogoff (eds), *Handbook of International Economics*, Vol. 4, North Holland.

Destatis (2022), "Die Volksrepublik China ist erneut Deutschlands wichtigster Handelspartner" (www.destatis.de/DE/Themen/Wirtschaft/Aussenhandel/ handelspartner-jahr.html).

Destatis (2023), "Ausla¨nderzentralregister" (www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Bevoelkerung/Migration-Integration/Tabellen/auslaendische-bevoelkerung-staatsangehoerigkeit-jahre.html).

Dhingra, S. and T. Sampson (2022), "Expecting Brexit", *Annual Review of Economics* 14: 495–519.

European Commission (2023), *Summer 2023 Economic Forecast: Easing growth momentum amid declining inflation and robust labour market* (https://ec.europa.eu/ commission/presscorner/detail/en/ip_23_4408).

Fajgelbaum, P.D., P.K. Goldberg, P.J. Kennedy, and A.K. Khandelwal (2020), "The Return to Protectionism", *Quarterly Journal of Economics* 135(1): 1–55.

German Council of Economic Experts (2023), "Business Cycles of the German Economy" (www.sachverstaendigenrat-wirtschaft.de/en/topics/ business-cycles-and-growth/konjunkturzyklus-datierung.html).

Gholz, E. and L. Hughes (2021), "Market structure and economic sanctions: the 2010 rare earth elements episode as a pathway case of market adjustment", *Review of International Political Economy* 28(3): 611–634.

Head, K. and T. Mayer (2014), "Gravity Equations: Workhorse, Toolkit, and Cookbook", Chapter 3 in G. Gopinath, E. Helpman, and K. Rogoff (eds), *Handbook of International Economics*, Vol. 4, North Holland.

Heritage Foundation & American Enterprise Institute (2022), "China Global Investment Tracker" (www.aei.org/china-global-investment-tracker/).

IMF – International Monetary Fund (2023), *World Economic Outlook: Navigating Global Divergences*, October.

Johnston, A.I. (2013), "How New and Assertive Is China's New Assertiveness?", *International Security* 37(4): 7–48.

Jungbluth, C., J. Matthes, S. Beer, G. Sebastian, M.J. Zenglein, F. Strack, and F. Schaff (2023), "Gewinne deutscher Investoren in China – eine erste empirische Bestandsaufnahme", Technical Report.

Kleinman, B., E. Liu, S.J. Redding, and M. Yogo (2023), "Neoclassical Growth in an Interdependent World", Princeton University Economics Department Working Paper, May.

Mendoza, E. (1995), "The Terms of Trade, the Real Exchange Rate, and Economic Fluctuations", *Journal of International Economics* 36(1): 101-137.

Milgrom, P. and J. Roberts (1996), "The Lechatelier Principle", *The American Economic Review* 16(2): 173–179.

Moll, B., M. Schularick, and G. Zachmann (2023), "The Power of Substitution: The Great German Gas Debate in Retrospect", *Brookings Papers on Economic Activity*.

Obstfeld, M. and K. Rogoff (1995), "The Intertemporal Approach to the Current Account", in G. Grossman and K. Roggoff (eds), *Handbook of International Economics*, Vol. 3, North-Holland.

Pieroni, V. (2023), "Energy Shortages and Aggregate Demand: Output Loss and Unequal Burden from HANK", *European Economic Review* 154, 104428.

Samuelson, P.A. (1947), *Foundations of Economic Analysis,* Harvard University Press,.

Samuelson, P.A (1983), *Foundations of Economic Analysis,* Vol. 197, Harvard University Press.

Sandkamp, A. (2020), "The Trade Effects of Antidumping Duties: Evidence from the 2004 EU Enlargement", *Journal of International Economics* 123, 103307.

Simonovska, I. and M.E. Waugh (2014), "The Elasticity of Trade: Estimates and Evidence", *Journal of International Economics* 92(1): 34–50.

Spillner, O. and G. Wolff (2023), "China "De-risking": A Long Way from Political Statements to Corporate Action", DGAP Policy Brief.

Sullivan, J. (2023), "Remarks by National Security Advisor Jake Sullivan on Renewing American Economic Leadership at the Brookings Institution", White House, 27 April (www.whitehouse.gov/briefing-room/speeches-remarks/2023/04/27/remarks-by-national-security-advisor-jake-sullivan-on-renewing-american-economic-leadership-at-the-brookings-institution/).

Timmer, M.P., E. Dietzenbacher, B. Los, R. Stehrer, and G. J. Vries (2015), "An Illustrated User Guide to the World Input–Output Database: the Case of Global Automotive Production", *Review of International Economics* 23(3): 575–605.

WTO – World Trade Organization (2023), *World Trade Report 2023: Re-globalization for a secure, inclusive and sustainable future.*

APPENDIX: ADDITIONAL FIGURES

FIGURE 9 **SHARE OF IMPORTS FROM CHINA AND OTHER COUNTRIES IN GERMAN GROSS NATIONAL EXPENDITURE OVER TIME**
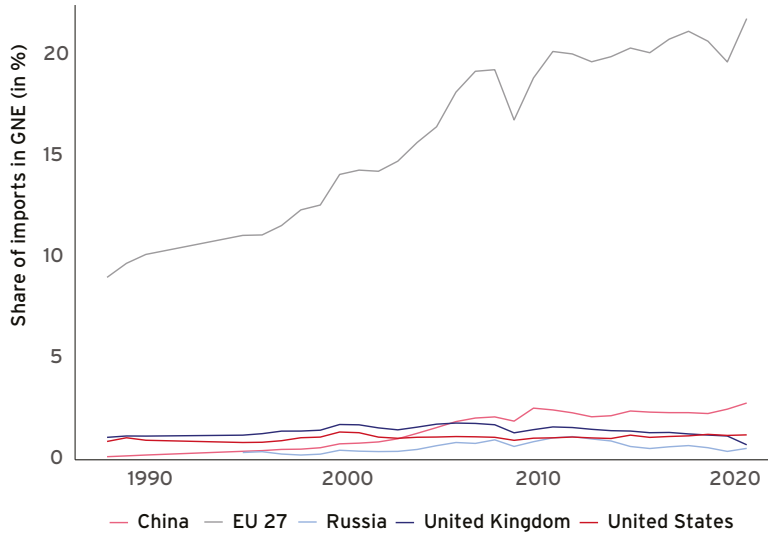
FIGURE 10 **SHARE OF CHINA IN GERMAN EXPORTS BY HS SECTION AND HS8 CODE IN 2019**