MEASURING THE IMPACTS OF THE EUROPEAN UNION'S APPROACH TO OPEN STRATEGIC AUTONOMY

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CONTENTS

Executive summary 5

1 Introduction 10

2 Understanding the concept of strategic autonomy 11

2.1 Background and context 11

2.2 A classification of measures to assess strategic autonomy and its impacts 13

3 Modelling the impacts of strategic autonomy on trade costs 42

3.1 Implications of the classification for approaches to modelling 42

3.2 Gravity modelling – baseline estimates 43

3.2.1 Overview 43

3.2.2 Approach and results: services 46

3.2.3 Approach and results: goods 48

3.3 Counterfactual modelling 50

3.3.1 Scenarios 51

3.3.2 Magnitude of trade cost impacts 55

3.3.3 Policy discussion 57

4 Modelling economic impacts 59

4.1 Summary of key findings 59

4.2 Overview of approach 60

4.3 Modelling results 63

4.3.1 Overall welfare effects 63

4.3.2 Trade effects – EU 66

4.3.3 Trade effects by partner 74

4.4 Policy discussion 78

Bibliography 83

Annex A – Services trade – detailed results 86

Annex B – Goods trade – detailed results 94

Annex C – Selected country results from the NQTM 99

Annex D – Detailed description of the NQTM 107

Consumption side 107

Production side 108

Trade costs and equilibrium 109

Counterfactual simulation 111

About this report

The European Centre for International Political Economy (ECIPE) has asked Frontier Economics to conduct research into the short and long term macro-economic impacts of new EU policies and regulations that change the conditions for cross-border economic exchange with the EU. Many of these policies are labelled as component parts of an ambition to pursue "strategic autonomy" for Europe's economy. While the precise meaning of strategic autonomy is unclear, it is notable that Europe's broader agenda for regulations and external economic policy in recent years have changed to become substantially more focused on policies that reduce economic openness. The purpose of this project is to estimate the wider economic effects of this agenda.

Specifically, Frontier Economics has been asked to:

1) List and evaluate important trade, regulatory and "strategic autonomy" measures proposed under the heading of strategic autonomy.
2) Estimate the macro-economic impacts of all the measures that are deemed important for Europe's economic openness.

Frontier Economics has conducted its research independently using state-of-the art methodologies in its work.

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Executive summary

Strategic autonomy creates the potential for trade restrictions that, in turn, reduce EU living standards, particularly in its smaller member states.

The European Union's (EU) concept of strategic autonomy encompasses a wide range of policy proposals and initiatives. If implemented, they are likely to impose costs on international trade between the EU and its partners. These costs, in turn, would have a negative effect on EU living standards. Depending on the stringency of the measures involved, and whether partners retaliate when faced with the EU's trade measures, real gross national income (GNI) would fall on an annual basis by between $12 billion (0.08%) in a low-stringency scenario, $20 billion (0.14%) in a high stringency scenario and $22 billion (0.15%) in the high scenario with retaliation by certain partners. These results, in absolute value terms, are consistent with those reported in the comparable empirical literature on the effects of certain free trade agreements (FTAs) such as the North American Free Trade Agreement (NAFTA).

These results are derived from a class of general equilibrium models, described as new quantitative trade models (NQTMs), which estimate impacts on economic activity with and without the interventions currently envisioned under the umbrella of strategic autonomy. The changes in trade costs associated with these interventions are calculated via a structural gravity model of trade. The economic impacts arise at one particular point in time, typically the year for which the model is estimated. In principle, they would accrue year after year absent any other shocks or policy interventions.

An alternative way of estimating the economic impacts of trade policy is to draw on estimates in the empirical literature regarding the long-run responsiveness of income to changes in trade, and to use the trade effects computed through our modelling to infer changes to EU national income per capita. This approach takes account of dynamic effects of trade on productivity growth and innovation. It suggests that EU national income per capita could fall by 0.25% to 0.38% for the low scenario, 0.45% to 0.68% for the high scenario and 0.5% to 0.75% for the high scenario with retaliation. We might consider these to be the upper bound of income effects.

Focusing on the results of the NQTM modelling, we observe that there is substantial variation across EU member states, with GNI effects ranging from -0.05% and -0.38% at the lower end to -0.08% and -0.76% at the higher end. On balance, smaller countries (such as Ireland) fare worse compared to larger countries (such as France or Germany), because of their greater openness to and reliance on trade with non-EU countries.

Strategic autonomy is a tax on the EU's external trade …

The negative effects reflect the fact that the EU's own measures depress its trade – both imports and exports – with partners. Annual losses in total exports range between around $30 billion and $65 billion (0.5 and 1%). The interventions generate trade diversion: there is increased trade within the EU, but this is insufficient to compensate for lost external trade. In essence, the policy measures envisioned under strategic autonomy collectively act as a tax on the EU's trade with the world. This tax raises prices for goods and services in the EU by between 0.2% and 0.8%. There are also likely to be longer-term economic costs, notably lost productivity, associated with the sub-optimal allocation of resources that results from trade diversion

How could the pursuit of strategic autonomy affect bilateral trade with partners? The effects on EU exports of goods are broadly similar in relative terms (i.e. percentage change relative to existing exports) across partner countries. Under the high stringency scenario with retaliation, exports to China and the USA would be more heavily impacted given assumed retaliation by these partners. Effects on EU services exports are more varied: in percentage terms, they are higher for exports to the UK, the USA, China, Russia and India. This partly reflects the fact that effects are driven by increased regulatory fragmentation, which could be particularly significant under the more stringent scenarios envisioned.

… and impacts negatively on partners

Third country trading partners also lose in terms of access to the EU market. In percentage terms, goods exports from China (especially, with falls of around 12%), the USA, the UK, Japan, Korea and India (all around 10%) are more heavily impacted This is because of their particular exposure to measures taken by the EU as part of strategic industrial policy and/ or in response to the perceived trade practices of these partners. China and the US also bear the costs of the retaliatory measures they are assumed to take. For services, the bigger impacts, in percentage terms, are experienced by India, the UK and the USA (around 2%). This reflects the impact of increased regulatory fragmentation with the EU. In absolute terms, the UK and the USA face the biggest decline.

Strategic trade and industrial policy measures, and measures that unilaterally take action against partner policies are particularly costly

What are the mechanisms through which strategic autonomy generates these effects? It is, first of all, important to recognise that the concept serves as an umbrella for a wide range of policy and regulatory proposals. We identified four broad categories: (i) measures aimed at strategic trade and industrial policy objectives; (ii) measures aimed at correcting market failures in relation to specific markets and products primarily within the EU; (iii) measures aimed primarily at correcting market failures relating to production and processing methods,

with extra-territorial reach: and (iv) contingent measures responding to trade measures or behaviour by partners. The categories are not watertight; they serve primarily as a heuristic device that helps us to understand what specific policy instruments have been implemented or are envisioned under the umbrella of strategic autonomy, and how these relate to trade and non-trade objectives.

Once we have identified specific policy instruments in each broad category, we are able to model their trade costs in terms of ad valorem equivalents using gravity modelling techniques. The primary measures envisioned under category 1 are producer subsidies and preferential procurement measures. Category 1 measures account for around two-thirds of trade costs across all four categories. This is unsurprising given the potential range of goods covered and the types of measures envisioned. These measures reflect many of the aspects of "murky protectionism" – such as subsidies, and preferential procurement/ "buy local" initiatives- that have proliferated in recent years.

Category 4 measures account, after category 1, for the bulk of trade costs. This is unsurprising because they involve the use of measures – tariffs and duties for the most part – that would penalise partners for perceived misdemeanours, and directly impose trade costs. Their effect is limited because of the relatively conservative assumptions (based on observed episodes of retaliation) that we make about the range and value of goods subjected to these measures.

Fragmentation in digital regulation also imposes trade costs

Category 2 measures primarily relate to digital markets. We capture their effects through the degree of regulatory fragmentation they generate between the EU and partners. This is in line with broader concerns about the fragmentation of global digital governance into rival blocs and its effects on trade. Moreover, existing measures of regulatory heterogeneity provide the most suitable means of exploiting data on bilateral variations in trade costs between partners, reflecting fragmentation in data governance.

The impacts of these measures are more limited than in category 1. This result is relatively intuitive: compared to category 1, these measures do not explicitly aim to confer an advantage to EU industries but largely seek to remedy broader market failures. Indeed, remedying such market failures could have positive impacts on trade. However, to the extent that there is divergence between EU and partner approaches, trade costs will rise. There may be further costs, related for example to innovation, but these lie outside the scope of our modelling, which focuses on bilateral trade costs between the EU and partners. The effect of category 3 measures is limited for similar reasons and because of their relatively narrow scope.

The trade costs point to the value of quantifying the benefits of non-trade objectives pursued under the umbrella of strategic autonomy …

What do these results tell us about the merits of strategic autonomy as a concept? First, strategic autonomy imposes welfare costs through trade diversion effects. It taxes the EU's external trade and therefore distorts resource allocation within the EU. We recognise that there are a range of objectives pursued under the umbrella of strategic autonomy. Hence the welfare effects stemming from impacts on trade provide a reference point for how large the welfare effects of achieving non-trade objectives need to be in order to offset the trade-related losses. Specifically, the lost income estimated through the general equilibrium model is a guide to the short-run gains needed from the pursuit of non-trade objectives. Whereas the lost income measured through the longer-term relationships between income and trade suggests that the long-run benefits associated with non-trade objectives would need to be significant.

…and point to ways in which the concerns behind strategic autonomy can be pursued in a less trade-distorting way

Second, our analysis helps to shine a light on those areas where adjustments could reduce the risks associated with the pursuit of strategic autonomy, while helping to secure legitimate policy objectives. These are: (i) reducing recourse to market distorting subsidies and discriminatory procurement measures, and focusing on ones (such as interventions correcting for specific market failures in innovation) that are more likely to be welfare enhancing; (ii) enhancing mechanisms for regulatory cooperation and recognising equivalence in outcomes, particularly in digital markets; and (iii) eschewing unilateralism in dealing with the allegedly distortive behaviour of partners. This last point also serves to highlight the relatively conservative nature of our approach, in that we assumed relatively restrained responses by partners. There is a non-negligible risk that the EU and its trade partners engage in cycles of policy measures that lead to much deeper levels of regulatory fragmentation and fragmentation in trade. Partners may, for example, seize on the contradiction between the intentions of category 4 measures through which the EU seeks to respond to interventionist policies in partners, on one hand; and on the other hand, category 1 measures that would permit similar policies within the EU.

Overall, our analysis supports the case for a more nuanced approach to strategic autonomy on the part of the EU. In particular, the approach currently contemplated would reduce welfare in the EU by making it more inward-orientated. The results suggest that the EU's size is not sufficient to offset the costs of such inward orientation. On the other hand, the results, along with a more differentiated view of the elements that make up the concept of strategic autonomy, suggest how legitimate public objectives can be pursued without precipitating an inward-orientation to EU trade policy, or greater fragmentation in international economic governance. Recognising that the EU sees itself as an exporter of norms and good practices

in economic governance, its ability to play this role will be enhanced to the extent that its approach is more closely tethered to core concepts underpinning the governance of trade and international relations, notably non-discrimination, coherence and proportionality.

1 Introduction

The purpose of this research is to measure the economic impacts of the EU's concept of strategic autonomy. As explained below, the concept encompasses a wide range of proposed policies and regulations and high level initiatives. These, in turn, reflect a range of motivations. Some reflect a more activist industrial policy stance. Others are potential responses to actions taken by partners that are deemed to hurt EU commercial interests. And finally there are measures that are considered necessary to meet public policy objectives within the EU but that also have effects on international trade.

The economic impacts of these could play out in a number of different ways. The primary interest of this research lies in how far the pursuit of strategic autonomy creates restrictions on international trade or raises the costs of international trade, and what the economic implications of this are for the EU. This does not imply that the measures envisioned under the concept of strategic autonomy should be rejected solely on the grounds that they might adversely affect trade. Indeed, it is entirely plausible that the welfare effects of such costs are deemed acceptable from a social point of view. However, for this to be the case, the incidence of these costs needs to be established, and that is what this report sets out to do.

Finally, as explained in the following section, the EU would like to position itself as a "producer" of norms relating to economic governance, especially in relation to the interaction between trade and the digital economy, and trade and sustainability. Its capacity to do so will be enhanced to the extent that its approach encourages policy convergence rather than fragmentation in norms and governance, which, in turn, would contribute to ensuring that costs are proportionate to benefits.

In order to address these questions, this report is structured as follows:

- In section 2, we explain in more detail the concept of strategic autonomy and present the policies/regulations/initiatives that come under this heading, including a description of their objectives (both trade related and "non-trade"). We develop a classification that helps us to better characterise the concept of strategic autonomy, and the specific measures and instruments that might be implemented.
- In section 3, we draw on the analysis in section 2 to estimate a gravity model of trade that helps us to measure the trade costs generated by these policy measures on bilateral trade in goods and services between the EU and partners.
- In section 4, we model the trade and macroeconomic impacts of strategic autonomy, drawing on the trade costs estimated in section 3.

2 Understanding the concept of strategic autonomy

2.1 Background and context

The European Commission (EC) defines strategic autonomy as "the EU's ability to make its own choices and shape the world around it through leadership and engagement, reflecting its strategic interests and values".[1] The motivation for this orientation given to the European Union's (EU) approach to trade policy and international cooperation reflects the confluence of a number of concerns: achieving sustainable growth in the EU and globally in line with climate objectives; making the EU more resilient to shocks, notably through control of value chains; enhancing the ability of the EU to shape global rules; dealing with geopolitical rivalry; and dealing with perceived "unfair competition", notably from China.

The idea of strategic autonomy was given a boost by the experience of the pandemic (notably concerns about control over critical supply chains) and latterly by Russia's invasion of Ukraine, but its antecedents stretch back further. They include the proposals by the then German and French economic ministers (respectively, Peter Altmaier and Bruno Le Maire) that the EU should adopt a more activist industrial policy, including support for the emergence of national champions that are able to compete with Chinese businesses in manufacturing and US businesses in technology.

Strategic autonomy is not necessarily protectionist – the EC in fact refers to "*open* strategic autonomy", based on an "engagement" with international trade rules. Indeed, part of the EC's concerns relate to what it perceives as distortions to international trade and investment by state-led models of investment and economic activity, particularly in China. At the same time, whereas the EU's approach has historically been to deal with such matters within the framework of multilateral rules, notably under the auspices of the World Trade Organization (WTO), some of the measures contemplated under the guise of strategic autonomy (as discussed subsequently in this paper) reflect a preference for a more unilateral approach. That, in turn, reflects a view that gaps in current multilateral rules make them unfit for purpose, particularly in dealing with interventionistic policies by China and other partners, and that recent actions, notably by the USA, weaken the enforcement of existing rules.[2]

Nor are the policy motivations that underpin the idea of strategic autonomy by any means unique to the EU. For example, The America Competes Act, passed in February 2022 by the United States House of Representatives, contains provisions that, if enacted, would introduce screening to outbound investments to avoid the offshoring of technologies and capabilities

[1] European Commission (2021e: 8).

[2] We refer, notably, to the blocking by the USA of appointments to the WTO Appellate Body, which in effect renders the WTO's dispute settlement mechanism non-binding as appeals against adverse panel rulings would not be heard.

that are deemed critical to domestic manufacturing capabilities. The Build America, Buy America Act, passed in 2021, establishes a domestic content procurement preference for federal assistance to infrastructure projects. The Biden administration's 100-day review on building resilient supply chains underscored the need to invest in greater domestic manufacturing capacity to reduce risks associated with unforeseen events and actions by rivals. For its part, China has targeted an increase in its productive capabilities of critical technologies, such as high-end semi-conductors, in order to reduce reliance on global value chains. Its "dual circulation" strategy aims more generally at preserving export opportunities while increasing domestic investment and consumption as drivers of growth.

Notwithstanding these points, there are, however, concerns that the EU's pursuit of strategic autonomy could reflect protectionist pressures and could undermine trade rules at a time when the international trading system is showing signs of fragmentation, or worse. These concerns relate to: (i) selectivity – both in terms of trade partners and of local industries deemed to be strategic and singled out for priority support; (ii) reduced exposure to trade and increased self-reliance; (iii) the greater role accorded to non-trade factors in shaping the design and conduct of trade policy, and to non/economic factors in the design of policy more generally; and (iv) a willingness to move away from multilateral processes, notably WTO negotiations and dispute settlement functions, in favour of more unilateral measures.

Strategic autonomy may also reflect an intention to ensure that approaches and rules followed at a global level reflect the EU's specific approach to regulatory and policy approaches to dealing with market failures and preferences relating to risk.[3] This dovetails with a willingness to be a rule setter in the expectation that the EU's size will mean that others will follow the EU's lead. This, in turn, is intended to secure both a competitive advantage to EU businesses and to ensure that global rule making aligns with domestic preferences over risk. As the EC itself puts it, "[open strategic autonomy] implies supporting domestic policies to strengthen the EU's economy and to help position it as a global leader in pursuit of a reformed rules-based system of global trade governance".[4]

However, even policies and regulations that are non-discriminatory may impose trade costs on the EU and partners that are disproportionate to the benefits sought. In the language of international trade, the measures envisioned could be more trade restrictive than necessary to achieve the objectives sought. This, in turn, could be a result of unilateral rules not being aligned or based on international standards. Such fragmentation imposes costs on trade.

[3] By market failure, we mean the technical economic sense of the word, i.e. cases where the self-interested behaviour of businesses, organisations and individuals does not fully promote the wider social good. Causes of market failure include market power, externalities and public goods, incomplete information and bounded rationality. We can distinguish from more political definitions of the term, for example concerns that competition undermines the emergence of national champions that help to secure perceived geostrategic interests.

[4] European Commission (2021e: 8).

Moreover, even if the EU's rule-setting capability prompts convergence in rules, there is no guarantee a priori about the optimality of rules around which such convergence takes place. This range of costs is sometimes considered and addressed, but there are concerns that this tends to be as a result of piecemeal, and sometimes incomplete, assessments of individual policies. This can mean that it can be difficult to judge the degree to which the policies are proportionate to the EU's goals.

2.2 A classification of measures to assess strategic autonomy and its impacts

The EU is considering a raft of policies, initiatives or regulations that contain several or all of the elements discussed in the previous section as raising concerns about their impacts. While these policies, initiatives or regulations can be categorised in a number of ways, we propose the following classification:

1 Policies, initiatives or regulations that seek strategic industrial and trade policy objectives through direct interventions in favour of EU industries and businesses. These include geo-strategic objectives, notably reducing reliance on partners that could be viewed as political rivals, and ones linked to industrial transformation, notably in the context of "green growth" objectives and digitalisation. Interventions in this cluster are directly geared to conferring an advantage to EU industries and businesses over rivals in order to enhance their competitiveness (as measured, for example, by shares of industry, sector output or value added).

2 Regulations and policies aimed at correcting market failures, primarily in the EU, associated with trade, investment and production. Market failures include market power and dominance; collective action problems related to externalities and public goods (e.g. environmental impacts,); ethical and distributional concerns (e.g. related to privacy and fundamental rights); and bounded rationality and informational problems.

3 Regulations and policies primarily to correct market failures related to production and processing methods, and regarding which extra-territorial reach (e.g. to ensure that value chains supplying the EU comply with Environmental, Social and Governance (ESG) standards) is a primary focus.

4 Contingent measures responding to trade measures or behaviour by partners. These involve responding to perceived trade-restrictive or distortive policies or actions by partners, and often seek to remedy what the EU perceives to be lacunae

in the multilateral toolkit. They reflect concerns expressed by the EC regarding the perceived lack of a "level playing field", which it attributes to extensive state intervention in partner countries.

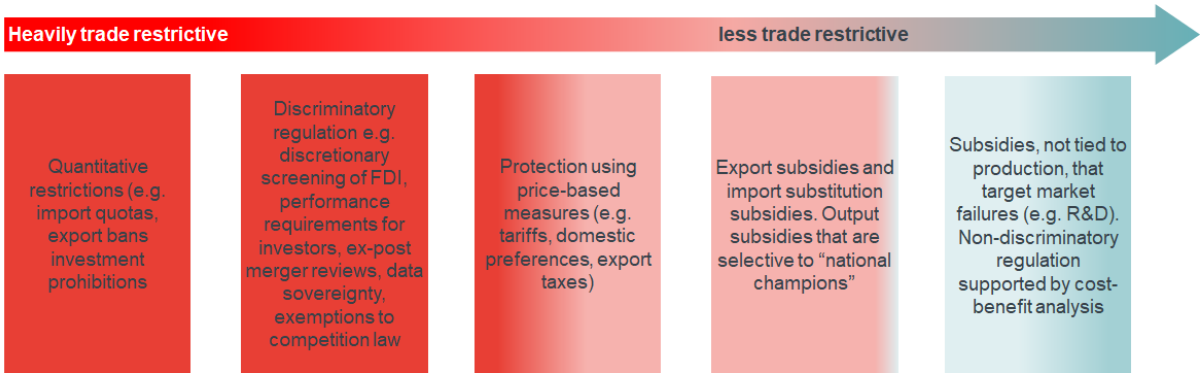
The categories are obviously not watertight. Industrial policy measures falling under category 1 include those that are intended to correct market failures related to R&D and innovation. Measures under category 2 can also be seen as ways to enhance the competitive position of EU industries to the extent that regulations written by the EU become a global norm and advantage EU businesses. Category 2 measures can also have extra-territorial reach, as category 3 measures do. This is most obviously the case with proposals relating to data that carry over the concept of "adequacy" of partner country data governance frameworks, which is currently found in the General Data Protection Regulation (GDPR). Finally, a Carbon Border Adjustment Mechanism is a measure that is intended to remedy lacunae in global rules (incomplete and asymmetric pricing of emissions on a global basis) and is contingent on the practices of partners, but it also has a clear extra-territorial component that targets Processes and Production Methods (PPMs) in specific sectors in partner countries and could thus equally fall into categories 3 or 4.

The issue is ultimately one of the primary effects of the policy. For example, while category 1 measures may target market failures associated with innovation, the measures are explicitly subsumed within frameworks geared to providing EU-established businesses with an advantage over rivals. Similarly, whereas category 2 measures may have extra-territorial reach, their primary objective is to regulate perceived market failures within the EU, whereas, in category 3, extra-territorial issues linked to PPM (e.g. deforestation in Brazil) are the primary focus.

In addition to considering the proposed policies, initiatives and regulations in light of their objectives and functions, it is useful to examine what specific measures and instruments (e.g. subsidies, tariffs) are being contemplated under these proposals. That is a necessary first step in modelling the impact of the proposals, since these impacts will depend on the nature and incidence of these measures.

But before we embark on a detailed modelling exercise, it is useful to undertake a qualitative evaluation of the proposed measures. Such a qualitative description can draw on established principles of trade policy that allow us to make some a priori judgements about the restrictiveness of proposed measures. These principles are depicted in Figure 1 below.

Figure 1 Typology of trade measures and their restrictiveness



To summarise the figure:

- Quantitative restrictions (quotas, prohibitions, local content requirements) are more trade distortive than price-based measures such as tariffs or taxes.
- Subsidies for domestic producers are preferable to tariffs on imports because they do not have an adverse price effect on consumption. Within subsidies, those that directly target market failures, such as those associated with research and development (R&D), are better than output subsidies.
- Regulation should not discriminate solely on the basis of country. It should not be more trade restrictive than necessary to achieve a specific policy outcome. Good practice approaches to regulation, supported by cost-benefit analysis, will usually minimise the extent of trade restrictiveness.

The typology is consistent with the philosophy underpinning the WTO agreements, which is to proscribe quantitative restrictions and discriminatory measures; transform quantitative restrictions into tariffs which are then reduced unilaterally or through negotiations; and to provide relatively greater flexibility for the implementation of non-discriminatory regulatory measures and subsidies while attempting to control their cross-border spillovers. While measures at the "red" end of the spectrum are a priori more trade restrictive than those at the "green" end, the actual economic impact of any particular measures will depend on their stringency and frequency, and their scope in terms of product/sectoral coverage. The issue of coverage includes flow-on effects through sectoral linkages. The twin issues of stringency and scope motivate the use of our gravity modelling general equilibrium approach, which we discuss in section 4.

Table 1 draws on both our fourfold classification and the typology set out in Figure 1 to provide summary descriptions of the policies, initiatives and regulations as well as initial observations on the restrictiveness. The purpose of this initial exercise is to provide both a qualitative overview of proposals that come under the umbrella of strategic autonomy, including their broader policy context, and a basis for the decisions taken on modelling approaches in the subsequent sections of the study.

Table 1 Classification summarising proposed strategic autonomy interventions by major category

Name of policy/regulation/initiative and objectives	Observations on trade-restrictive elements	Priority based on likely materiality of impact, and options for modelling
1. Strategic industrial and trade policy objectives (including geo-strategic objectives)		
New Industrial Strategy for Europe. A high level strategy built on 5 pillars ensuring level playing fields internationally in relation to industrial subsidies and state intervention; a set of key industrial transformations; and supporting strategic autonomy. The strategy **was initially launched in 2020 and then updated in 2021**, drawing on the experience of the Covid-19 pandemic, which prompted a more detailed focus on reducing "strategic dependencies" and on increasing resilience.	The strategy itself is a basis for sector- or issue-specific policies and actions. These are discussed in the remaining sections of this table. In its own right, the strategy suggests a substantial focus on policy instruments that can accelerate industrial transformations, build resilience and reduce "strategic dependencies", notably via state financial support (subsidies and procurement related). The role of financial support was enhanced through crisis recovery measures, including the Multiannual Financial Framework and the Next Generation EU recovery instrument.	The strategy provides an overall framework that can guide policy interventions. While it does not prescribe specific measures in detail, its general orientation favours the use of behind-the-border interventions in support of industrial strategy. Based on recent experience, this suggests that a particular focus on subsidies and procurement measures across a broad range of activities is appropriate. Sources of information on this include, notably, the Global Trade Alert (GTA) database, particularly in light of recent research.[5]

[5] See, for example, Evenett and Fritz (2021).

Name of policy/regulation/initiative and objectives	Observations on trade-restrictive elements	Priority based on likely materiality of impact, and options for modelling
		The GTA inventory of measures suggests the following could be conserved: - Financial grant, in-kind grant; interest payment subsidy; loan guarantee; production subsidy; state aid; state aid, unspecified; state loan. - Government procurement: public procurement access; public procurement preference margin; public procurement localisation.
Foreign investment screening mechanism. Sets out minimum requirements that EU member states should have in any screening laws. To date, 24 member states have such laws. Main focus is on sensitive/strategic sectors (e.g. in health, energy, transport,	It is up to the member states to establish processes, including lists of sensitive sectors and allowable measures, which could include prior notification, imposition of conditions or exclusions. Retrospective reviews are also possible. Actual effects could vary depending on the willingness of member states to be restrictive.	**Moderate to high**. Likely to target selected partners (China) and selected sectors. Recent years have seen a proliferation. Can be modelled using **OECD Foreign Direct Investment Restrictiveness Index (FDIRI) and Services Trade Restrictiveness Index (STRI)** data, which allows the choice of

Name of policy/regulation/initiative and objectives	Observations on trade-restrictive elements	Priority based on likely materiality of impact, and options for modelling
media, defence, financial infrastructure sectors).	Likely to be targeted at countries with which EU does not have a Free Trade Agreement (FTA) and which are considered rivals. Can increase uncertainty surrounding decisions.	measures. (e.g. screening thresholds, cap on foreign equity, performance requirements). GTA: FDI entry and ownership rule; foreign direct investment (FDI) treatment and operations
Chips Act. Three pillars: (i) investment in R&D; (ii) subsidies to attract investment in foundries and expand production with target of 20% global output; (iii) monitoring of value chains with possibility of implementing range of measures to secure supply.	The subsidies are specific and actionable under WTO rules. R&D subsidies for basic research can be defended on standard market failure grounds. Specific production subsidies are more distortive and can lead to an escalation of industrial rivalry. Though it does not mandate such instruments, the third pillar opens the scope for discriminatory procurement measures and export restrictions in the event of a crisis, potentially adding a highly restrictive element to policy, and inducing tit-for-tat responses by partners in a context where restraint would be required (see for example the case of	**Likely high impact** given the centrality of semi-conductors in a digitalised economy, and their role in "green" industrial transformation e.g. electrical vehicles, renewable grids, remote working technologies. A range of measures. Within the GTA, these could include: - FDI: Financial incentive - Subsidies - Procurement measures

Name of policy/regulation/initiative and objectives	Observations on trade-restrictive elements	Priority based on likely materiality of impact, and options for modelling
	export controls during Covid pandemic and their adverse effects).	- Export restrictions: export ban; export quota; export tariff quota; export licensing requirement - Export tax.
Council regulation on emergency framework regarding medical countermeasures. Aimed at increasing EU capacity to respond to health crises. Develop "reserve" or "surge" capacity for manufacturing vaccines and medicines in times of crisis; reduce reliance on foreign sources.	Focus is on entire medicines value chain: production facilities, raw materials, consumables, devices, equipment and infrastructure. Restrictive elements include powers to undertake advance purchase agreements favouring local manufacturers; powers to suspend Intellectual Property Rights (IPRs); payments/subsidies for capacity.	**Moderate.** The scope is specific but reinforces the notion of reducing "critical dependencies" and therefore the prevalence of measures such as preferential procurement. Modelling using **GTA** data, including: - Public procurement preference margin - Public procurement localisation - Production subsidy - State aid.
Dual Use Regulation. Regulates export from, transit through and brokering by EU of products deemed "sensitive" because of their potential dual military and civilian	Increase in trade costs due to compliance costs and potential complexities of "intended use" provisions in a context of fragmented value chains.	**Moderate impact**, likely to be more material in times of international tension and could prompt retaliatory measures. The impact of the policy is likely to increase the more the EU

Name of policy/regulation/initiative and objectives	Observations on trade-restrictive elements	Priority based on likely materiality of impact, and options for modelling
use. Some goods (e.g. types of electronic, computer and telecommunications equipment) require compulsory authorisation prior to export to non "white-listed" countries. Others require authorisation if exporter is aware that intended use is unauthorised.	The provisions comply with the General Agreement on Tariffs and Trade (GATT) article X. Potential escalation of export restrictions in a time of heightened international tension. The trade restrictiveness would vary depending on whether authorisation regimes or outright bans are chosen. Under the former, the effect on trade would work through increased frictions associated with compliance (a negative trade facilitation effect).	expands its own production of dual use products and technologies (e.g. under the Chips Act). Adds weight to modelling a crisis/tension scenario using export restrictions (see also comments in relation to the Chips Act). Modelling using GTA data: - Export licensing requirement, export ban.
Hydrogen strategy for a climate neutral Europe. Aims to facilitate the deployment of large scale clean hydrogen production by 2030. Creation of a clean hydrogen alliance that would promote knowledge sharing and receive public funding primarily directed at innovation.	Restrictive elements are primarily that eligibility for funding is contingent on establishment within the EU Subsidies are specific in the WTO sense, and therefore potentially actionable, though from an economic perspective their focus on innovation	Low to moderate. Very specific. It provides further support for modelling the impact of subsidies. - Modelling using GTA data: various state aid and subsidy instruments.

Name of policy/regulation/initiative and objectives	Observations on trade-restrictive elements	Priority based on likely materiality of impact, and options for modelling
	and market failures related to them reduces their distortive potential.	
Pharmaceutical strategy for Europe. Aims to ensure, inter alia, affordable access, competitiveness and innovativeness of EU production and supply chain resilience in response to crises, including by reducing vulnerabilities	The strategy is at an early stage of development, so details are not clear. However, the ambitions of increasing competitiveness and reducing dependency and references to public–private partnerships (PPPs) suggest role for subsidies No detailed explanation of mechanisms for crisis response, but the ambitions for the strategy could open the door to the use of procurement measures and export restrictions.	Focused on pharmaceuticals. By itself, moderate to low priority, but this does reinforce the importance of capturing subsidies as part of modelling future trade scenarios and potentially reinforces the logic of considering the role of procurement and export restrictions in such scenarios. Modelling using **GTA data**: - Government procurement measures and export restrictions.
Revised Renewable Energy Directive. Sets out targets for renewable energy	The directive and associated initiatives involve specific subsidies for the development and	Moderate. The directive is still a work in progress. The focus on subsidies for specific

Name of policy/regulation/initiative and objectives	Observations on trade-restrictive elements	Priority based on likely materiality of impact, and options for modelling
production to meet emission reduction goals and cooperation mechanisms to achieve these targets. These mechanisms include joint project and joint support schemes involving EU member states. Along with RePowerEU programme, these will direct substantial amounts of funding to support the deployment of various renewable energy technologies.	commercialisation of renewable technologies within the EU. They may be distortive depending on whether the definition of renewable technologies is biased towards EU-produced technologies. Focusing the subsidies on market failures related to innovation could make them more likely to be welfare enhancing.	technologies underscores the need to model the effects of such subsidies. **GTA data** sources include: - FDI: financial incentive - Subsidies and state aid.
EU Space Package. Seeks to develop a secure space connectivity system through a PPP. Space traffic management system to safeguard sustainable use of space. The initiative is intended to ensure cybersecurity and reduce dependencies	Though not explicitly restrictive, the initiative seeks to reduce critical dependencies, defined as reliance on key infrastructure and inputs. This may reduce the scope for non-EU members to take part in the initiative, though access to the PPP elements appears to be open to countries that	Low to moderate. Model using **GTA data**: - FDI: financial incentive - Subsidies and state aid.

Name of policy/regulation/initiative and objectives	Observations on trade-restrictive elements	Priority based on likely materiality of impact, and options for modelling
and hence vulnerabilities in a digitalised age.	have an agreement (trade or other relevant collaborative arrangements with the EU).	
Amendment to EU standardisation regulation. Gives EC the right to request one or several EU standardisation organisations to draft a standard, and require that decisions are taken only by representatives of national standardisation bodies	The proposal reflects concerns by the EU that non-EU entities may have an undue influence in European standards-setting organisations (ESOs) and thus may act contrary to EU priorities. The aim is to ensure a greater alignment with strategic objectives. Amendments agreed by the Council and European Parliament potentially give a more restrictive orientation by calling for the exclusive participation of national standardisation bodies in the decision-making process To the extent that ESOs follow the requirements of the WTO Agreement on Technical Barriers to Trade regarding the use of international regulations and standards, the increase in restrictiveness may be limited.	Unclear at this stage. Potential for fragmentation in international standardisation process if the proposal leads to a decoupling of EU processes from international ones.

Name of policy/regulation/initiative and objectives	Observations on trade-restrictive elements	Priority based on likely materiality of impact, and options for modelling
State aid and IPCEI (Important Projects for Common European Interest) exemptions. Adaptation of exemptions to grant more flexibility for types of projects counting as IPCEI, including relaxing stipulation that elements must be necessary to attain an EU priority objective and rather state that they will make a significant contribution. Environmental and sustainability requirements are more stringent.	Widens the scope for subsidies to be granted within state aid/ IPCEI framework. The revisions reflect other cross-cutting priorities (e.g. the Green Industrial Strategy) and sector-specific initiatives on batteries and electronics. Political pressure, notably by France, Germany and like-minded countries, on the need to adapt state aid rules to support European competitiveness suggest this could be used as a conduit for a more active use of subsidies, including those falling under the scope of WTO rules.	Moderate to high priority – underscores the importance of modelling state intervention via financial instruments. Model using GTA data: - Subsidies and state aid measures.
2. Regulations and policies aimed at correcting market failures in the EU associated with products and activities		
Proposal for an Artificial Intelligence Act. Seeks to regulate artificial intelligent (AI) horizontally by setting requirements	Main effects on trade are via trade costs relating to compliance requirements, including product adaptations. The materiality of these trade costs	Medium to high priority. The breadth of its sectoral coverage increases materiality as, against this, the incremental impact will be

Name of policy/regulation/initiative and objectives	Observations on trade-restrictive elements	Priority based on likely materiality of impact, and options for modelling
that ESOs that develop product standards need to meet. Stringency of requirements depends on risk classification. Products that embody "high risk" AI must demonstrate compliance prior to being placed on the market. Regulation has extra-territorial reach since it applies to any producer or developer that places product on the EU single market.	effect depends on: (i) the extent to which these requirements are not embedded in existing product standards or regulation; (ii) the extent to which ESOs use international standards (as required by the WTO TBT agreement) and the extent of divergence from other jurisdiction; (iii) the nature of the business and whether it chooses to make bespoke product adaptations.	more a question of international **fragmentation in product regulation** and between approaches taken by ESOs and other jurisdictions. Potentially restrictive impacts on innovation and thus on productivity and growth. Modelling challenges include the need for detailed data on compliance costs. Measures of regulatory heterogeneity (e.g. the OECD's STRI_H index offer a possibility).
Digital levy. Response to market power of certain platform and related digital businesses. Supplementing current OECD/G20 work with options including tax on specific digital activities or transactions and corporate income tax top up. Austria, France and Spain are EU	Treats data as analogous to a resource and seeks to tax super-normal profits earned. Also aims to deal with profit shifting and international arbitrage on different tax rates In principle, taxing pure rent should not affect investment and production decisions. But difficulties in doing so mean that taxes are applied to turnover. That, in turn, can cause cost pass-	Moderate. In principle, this should not affect commercial decisions; in practice, the extent of impacts on cross-border transactions costs will depend on the manner of implementation. Data: tracked by GTA Digital policy alert, but modelling may prove challenging given limited

Name of policy/regulation/initiative and objectives	Observations on trade-restrictive elements	Priority based on likely materiality of impact, and options for modelling
member states to have adopted a digital services tax.	through effects that affect the costs of transactions. Further distortions could be caused by the application of the tax to some activities – leading to cost shifting. Moreover, tax registration requirements may de facto constrain market access through mode 1. The USA formed the view that the taxes were de facto discriminatory because their incidence primarily fell on US businesses. If the tax invites retaliatory trade action, this could impose further costs on trade. The risks of trade war would be mitigated to the extent that OECD negotiations progress and actions on top of this are not deemed unduly restrictive.	data and limited number of countries implementing the measure. Alternative is to use commercial presence requirement as a proxy given the registration requirements.
EU Cloud Scheme. Aims to harmonise cybersecurity standards across EU cloud services. Scheme is voluntary and cross-cutting across sectors. Three levels of	The digital sovereignty requirement would require providers to demonstrate that data are stored in the EU and ensure the data they hold are immune	Moderate. The scheme is not compulsory (yet). However the coupling of digital trust with a localisation requirement is potentially

Name of policy/regulation/initiative and objectives	Observations on trade-restrictive elements	Priority based on likely materiality of impact, and options for modelling
certification are provided: basic, substantial and high. The high level is expected to include a digital sovereignty requirement.	from the reach of non-EU laws allowing foreign governments access. The scheme is voluntary but some expect it to become mandatory over time.	restrictive and underscores the case for modelling the effects of data localisation. Model using OECD STRI or STRI_H. The data components of the STRI allow for the consideration of "hard" localisation measures and other softer/conditional forms of localisation.
Green bond standard. Intended to facilitate investments in bonds that meet ESG standards and thus help business and governments to raise finance for sustainable projects. Issuers will have a robust tool to demonstrate that they are funding legitimate green projects aligned with the EU taxonomy	Scheme is voluntary. Standard would have transparency and verification mechanisms so that bonds are genuinely green. It is intended to remedy a market failure based on information asymmetry, so not restrictive per se. Potential sources of restrictiveness arise if the envisioned taxonomy does not recognise in an equivalent manner all measures that have equivalent levels of "green-ness"	Low priority.

Name of policy/regulation/initiative and objectives	Observations on trade-restrictive elements	Priority based on likely materiality of impact, and options for modelling
Proposal for a Data Governance Act (DGA). Primarily intended to facilitate sharing, joint processing and re-use of data within the EU and support data intermediation services. Will adopt a wide definition of data including individual and company data. Transfers to non-EU jurisdictions are contingent and depend on demonstration of adequacy of frameworks for data protection. Non-EU providers of data intermediation services may be required to establish a presence in the EU.	The proposal seeks to liberalise data flows within the EU, in part to remedy market failures, reflecting economies of scale and scope that may lead to concentration and the potential positive externalities relating to wider access to data. Restrictive elements include its conditional liberalisation/restrictions on data flows to non-EU jurisdictions, but these are not necessarily specific to the DGA (see also, for example, provisions of the GDPR). Local presence requirements applicable to data intermediaries may be trade restrictive.	Medium to high. Wide scope of regulation increases materiality. Aspects of conditional localisation (e.g. adequacy) can be captured by OECD STRI. OECD STRI can capture local presence requirements.
Proposal for a Data Act. Aimed at facilitating access to and use of data by businesses and consumers. Includes provisions for data "portability", interoperability and contractual clauses	Primarily aimed at creating market failures related to data ownership and market concentration.	Medium to low. Scope is wide. No explicit data localisation or local presence requirements. Modelling difficult in the absence of compliance costs data.

Name of policy/regulation/initiative and objectives	Observations on trade-restrictive elements	Priority based on likely materiality of impact, and options for modelling
that protect businesses from "unfair" behaviour by businesses that are more dominant because they hold the data.	Potential trade costs through bespoke adaptations of process to comply with requirements.	
Digital Services Act. Applies to online intermediaries (which includes providers of cloud services and platforms). Obligations include countering illegal content online (incl. products and services), increasing transparency of user experience (e.g. by making terms and conditions more explicit, not using so-called "dark patterns"), stopping targeted ads to minors and stopping using data on protected characteristics for targeted ads, and having a crisis response mechanism. Specific rules apply to platforms reaching more than 10% of 450 million consumers	The provisions would apply to all businesses, EU and non-EU. As a matter of practice, the burden of regulation could fall more on non-EU businesses. But this is unlikely to count as de facto discrimination as the case for saying this differential burden is the indirect effect of a legitimate regulatory distinction (regarding size) appears strong. Increased trade costs for businesses that need to adapt to EU specific regulations (e.g. "know your business customer") and that may otherwise not have implemented these measures.	Medium priority. Effects on trade costs difficult to model explicitly.

Name of policy/regulation/initiative and objectives	Observations on trade-restrictive elements	Priority based on likely materiality of impact, and options for modelling
in Europe. They will have additional risk management obligations.		
Digital Markets Act. Applies to "gatekeepers", which are very large platforms controlling core platform services in at least three member states. Aim is to prevent these from abusing their dominant position, inter alia, by ensuring users can unsubscribe from core platform services under similar conditions to subscription; giving sellers access to their marketing or advertising performance data on the platform; informing the European Commission of their acquisitions and mergers; stopping self-preferencing behaviour; and not using private data collected during a service for the development of another service.	As above, not explicitly discriminatory, though burden likely to fall on non-EU businesses as a matter of practice. Likely reflects a legitimate regulatory distinction – "gatekeeper" position reflects economies of scale and scope, and network effects. Some of the proposals are conceptually similar to third-party access regime requirements. The effects on trade costs are ambiguous. To the extent the act facilitates access, it can promote competition in downstream markets, including cross-border transactions. At the same time, this needs to be weighed against efficiency losses related to the loss of scale effects and compliance requirements imposed on gatekeepers. Dynamic effects could include reduced incentives for	Moderate. There are no de jure protectionist elements, but the focus of the act on digital gatekeepers, nearly all of whom are non-EU ones, could have de facto protectionist impacts. The application of the act could have unintended consequences if its cost-raising impact outweighs any competition benefits. The effects on trade costs are uncertain. They depend on the balance between effects of the act on downstream competition, and efficiency effects (loss of scale efficiency and dynamic efficiency).

Name of policy/regulation/initiative and objectives	Observations on trade-restrictive elements	Priority based on likely materiality of impact, and options for modelling
	investment and expansion – e.g. it may discourage acquisition of extra customers if growth tips a platform into the gatekeeper category. There may also be disincentives in investment resulting from data sharing and algorithmic sharing requirements. The net benefits to users, including businesses engaged in e-trade, depend on whether gains in competition outweigh increase in costs borne by gatekeepers.	
GAIA-X. An initiative to create an ecosystem of EU cloud providers, by providing a common set of standards for data exchange and interoperability of systems for data exchange. Board members of GAIA-X need to be from organisations headquartered in the EU. Aims to develop a labelling system which	Potential increases in transaction costs if this creates multiple standards. The labelling requirement is not in and of itself protectionist but it dovetails with a wider trend towards encouraging data localisation.	Moderate. The labelling requirements reinforce the appropriateness of considering restrictions on data flows (e.g. localisation requirements) in the modelling.

Name of policy/regulation/initiative and objectives	Observations on trade-restrictive elements	Priority based on likely materiality of impact, and options for modelling
would indicate that customers' data are stored and processed in Europe and so they are protected from the reach of non-European laws.		
3. Measures primarily to correct market failures related to production and processing methods, with extra-territorial reach		
Corporate sustainability due diligence. Requires businesses to identify and, where necessary, prevent, end or mitigate adverse impacts of their activities on human rights, such as child labour and exploitation of workers, and on the environment, for example pollution and biodiversity loss.	The measure is not explicitly discriminatory. The law itself does not target specific production or processing methods in particular sectors (see also below for batteries or forestry) but by opening the possibility of fines and legal redress it would impose on businesses the requirement to enhance surveillance of PPMs through value chains. The compliance costs in international value chains are likely to be significant.	Low to moderate. More a framework with specific legislation left to national authorities. It does highlight the importance of capturing the impacts of a proliferation of Non-Tariff Measures (NTMs) Modelling could draw on GTA data relating to technical barriers to trade.
Deforestation Free Products Regulation. Prohibition to sell products in	Introduces PPM-based restrictions on specified commodities and products, conditioning market	Moderate. The regulation applies to a specific set of commodities. However, it is likely to be

Name of policy/regulation/initiative and objectives	Observations on trade-restrictive elements	Priority based on likely materiality of impact, and options for modelling
the EU unless they are: (i) deforestation free (i.e. produced on land that has not been subject to deforestation after December 31, 2020); (ii) in line with relevant legislation in the country of production; and (iii) covered by due diligence statement. Applicable to selected commodities and products derived from them.	access to the EU on addressing a problem in the exporting jurisdiction. Trade restrictive elements (and potential scope for legal challenge) reflects: (i) link between commodities selected and deforestation in particular jurisdictions; (ii) treatment of exporters based on the actual impact of their production and processing mechanisms; and (iii) how far the measure discriminates between "like" regions.	controversial and could invite challenge/ retaliation. Moreover, it underscores the value of evaluating the impacts of NTMs, particularly those related to PPMs. Modelling could draw on GTA data relating to technical barriers to trade.
Sustainable batteries. Imposes due diligence requirements relating to ESG; calculation of carbon footprints; recycling requirements.	As with the proposed regulation on deforestation free products, the sustainable batteries regulation introduces a series of non-tariff measures, including labelling. As with the deforestation regulation, these measures have extra-territorial reach and regulate PPMs. Given the fragmented nature of battery value chains, the requirements for, say, ESG compliance or carbon footprint compliance are	Moderate to high. Imposes PPM-related NTMs in a key sector. Underscores the need to measure the effects of these NTMs. Modelling could draw on GTA data relating to technical barriers to trade.

Name of policy/regulation/initiative and objectives	Observations on trade-restrictive elements	Priority based on likely materiality of impact, and options for modelling
	likely to be onerous. If the EU is seen to be rejecting approaches to demonstrating compliance that may nevertheless be valid or imposing default values (e.g. for emissions) in the absence or in lieu of values provided by the supplier, this could be considered a disguised restriction on trade.	
4. Contingent measures responding to trade measures or behaviour by partners		
Anti-coercion instrument (ACI). To allow scope for the EU to retaliate against coercive measures taken by third parties, or to deter third parties from taking coercive action. The definition of "coercion" is broad and leaves significant discretion to the EC as to what constitutes coercion or not.	In principle, any country deemed to be acting coercively could be targeted. Any sector or combination of sectors could be targeted. The analogy here is with retaliatory measures in trade disputes, in which countries typically target a range of products, usually those that are price sensitive (so foreign producers bear the costs) and have some degree of political symbolism.	Moderate to high. The ACI has the potential to introduce significant trade restrictions, particularly in the context of fragmented international relations. Moreover, the scope for discretion in determining coercion and its impacts can introduce significant uncertainty into trade.

Name of policy/regulation/initiative and objectives	Observations on trade-restrictive elements	Priority based on likely materiality of impact, and options for modelling
	The EC determines what is the extent of adverse effects of action taken by third parties. As the proposal prescribes no particular methodology, this also leaves significant discretion. There is also discretion in the choice of measure.	GTA data; tariff rates through WTO/ World Integrated Trade Solution (WITS).
Carbon Border Tax Adjustment Mechanism (CBAM). Deals with issues of competitiveness and carbon leakage. Intended to replace shielding via permit allocations. Importers would be levied charge reflective of the EU Emission Trading Scheme's price and embodied emissions of goods. The immediate scope of the CBAM is on five sectors of iron and steel, cement, fertiliser, aluminium and electricity generation, though the overall economic impact will	Not inherently trade distortive. However, there are considerable implementation challenges, reflecting the fact that border adjustments were designed for consumption taxes and not taxes on production. In particular, measuring embodied emissions will be challenging, with likely differences of views between non-EU suppliers and EU authorities. If the latter choose to use alternative values to those reported, the former may well claim that they face an unjustified tax that in essence discriminates against them. The challenge of measuring embodied emissions increases when production is fragmented across	Moderate to high. The range of sectors is relatively limited, but there may be appetite for expansion. From a WTO point of view, it is highly likely that the implementation of the CBAM will be challenged for the reasons set out in the preceding column. Past case law in relation to environmental standards (e.g. on gasoline) or in trade remedies that have involved instances of authorities using benchmark values or alternative values to those supplied by exporters highlights how contentious the administration of the CBAM could be.

Name of policy/regulation/initiative and objectives	Observations on trade-restrictive elements	Priority based on likely materiality of impact, and options for modelling
reflect the inter-sectoral linkages associated with these sectors.	countries with different emissions intensities of production and different emissions policies.	Can be modelled by simulating charge as a tariff on specific products. The rate would be the ad valorem equivalent (AVE) of the carbon price levied per tonne of emission, with the rate depending on the carbon content of the product. Various estimates of AVEs of different prices and goods exist. GTA data on import tariffs; WITS data.
Revision to blocking statute. The statute prohibits compliance with laws passed by another country that have extra-territorial impacts. It was first enacted to counter US sanctions on businesses engaged in activities in countries such as Cuba or Iran.	Not trade restrictive per se – incentivises businesses to pursue normal course of activities with countries targeted by third-party measure.	Low priority.
Foreign subsidy instrument. Aims to remedy adverse effects of foreign	Process for determining existence of and actioning subsidy similar to WTO Agreement on	Medium to high. It is not targeted to specific sectors, though in practice the adverse effects

Name of policy/regulation/initiative and objectives	Observations on trade-restrictive elements	Priority based on likely materiality of impact, and options for modelling
subsidies affecting Mergers and Acquisitions, and procurement within the EU. Reflects concerns about distortions to competition and foreign ownership or involvement in strategic sectors/assets	Subsidies and Countervailing Measures. Scope is broader as proposed instrument covers both goods and services, and it includes both public entities and private entities whose actions are attributable to the third party (non-EU state). The process for determining adverse effects appears to take account of the scope for the subsidy to confer benefits to users of the imported products. The instrument potentially increases uncertainty for foreign investors given the wide definition of subsidies and the need for investors to take account of the range of subsidies they receive, including those for bona fide market failure reasons in the host economy. This will possibly add to regulatory compliance costs and may also have adverse efficiency effects to the extent this deters market-improving subsidies. Likely to concern a handful of major trade partners and	test means action may be directed to sectors that are sensitive/strategic. There is a manifest tension between this and other aspects of EU policy e.g. semi-conductors, which could in turn invite retaliatory measures by partners. GTA data: import tariff, D2 countervailing measure implemented pursuant to domestic trade remedies legislation.

Name of policy/regulation/initiative and objectives	Observations on trade-restrictive elements	Priority based on likely materiality of impact, and options for modelling
	likely to capture sectors connected to "green industrial policy".	
International Procurement Instrument. Allows EU to restrict access to EU procurement by firms from countries that restrict access of EU firms. The threshold value for tenders at which this instrument would kick in is Euros 5 million for goods and services, and Euros 15 million for works and concessions. Its scope is restricted to those procurements which are not covered by an agreement the EU has entered into, either via the WTO or via an FTA.	The instrument is not per se restrictive since its main intent is to open foreign procurement markets. The approach is reminiscent of section 301 actions by US administrations in the 1980s, and more recently under the Trump administration. Nevertheless, like all import restrictions, unilaterally restricting access imposes costs on the party imposing the costs. As such, it reflects a willingness to work outside more conventional arrangements for negotiating market access, based on reciprocity, and, in particular, multilateral arrangements.	Moderate. Scope relatively restricted, but again highlights importance of considering procurement related interventions. GTA data: Government Procurement Market Access Restrictions. Because the use of the instrument is necessarily contingent on restrictions elsewhere, the modelling scenario would involve the use of restrictions in multiple jurisdictions.

Name of policy/regulation/initiative and objectives	Observations on trade-restrictive elements	Priority based on likely materiality of impact, and options for modelling
Revised enforcement regulation. The regulation would allow the EU to enforce WTO panel rulings, in the event that a partner: (i) is found to be in violation of rules/commitments by a WTO panel; (ii) appeals the finding to the now inoperant Appellate Body or does not have recourse to alternative arbitration arrangements. Cross-retaliation, e.g. suspension of services commitments in response to breaches affecting goods, is allowed.	The measure is intended to enforce compliance with trade rules, albeit with the same paradoxical characteristic of WTO enforcement (i.e. to respond to restrictions with the threat of further restrictions). The restrictiveness of the proposal is increased by: (i) the possibility that panel ruling may have been reversed in part or in whole, in which case imposition of enforcement measures would be unwarranted; (ii) the decision to authorise retaliation, and the extent allowable will be decided by the EC (normally it would be the WTO's Dispute Settlement Body), which may bias the extent of retaliation upwards; and (iii) the possibility of cross-retaliation increasing the scope for damages.	Medium to high. Around 75% of panel rulings have been appealed since 1995. While the proposed regulation may reduce that number, this proportion also suggests there may be substantial scope for the use of this instrument WITS: import tariff. In practice, a range of instruments could be used as the regulation allows for cross-retaliation, but tariff measures are by far the most frequent.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economics

3 Modelling the impacts of strategic autonomy on trade costs

3.1 Implications of the classification for approaches to modelling

The previous section presented a fourfold classification of proposals contemplated under the heading of strategic autonomy. As discussed, the classification is not intended to provide a comprehensive analysis of the various initiatives, policies and regulations considered, if only because most have yet to be implemented. Nevertheless, it helps us to identify objectives and potential channels of wider impacts.

There are many possible channels of impact. These include direct impacts on capital investment and on innovation and productivity, which, in turn, could have growth impacts. Our approach is to focus on the effects of the proposals on international trade. This is motivated by the fact that the notion of strategic autonomy necessarily implies a (re)positioning of the EU vis-à-vis the rest of the world on matters of international commerce. Moreover, trade policy changes have a range of welfare and growth impacts through static effects (such as resource reallocation and price effects) and dynamic effects (such as the effects of trade on productivity via the diffusion of knowledge and technology).

The focus on trade explains why the analysis presented in Table 1 focuses on measures that are liable to generate trade costs. We are interested in examining the extent to which the proposals considered under the umbrella of strategic autonomy impose costs on trade between the EU and its partners. One of the advantages of developing a classification of measures as presented in **Table 1** is that it allows us to identify which types of measures occur most frequently by category of interventions. For example, we note the prevalence under category 1 of forms of state financial support (subsidies and state aid) as well as procurement measures and export restrictions, whereas category 4 is dominated by duties on imports.

Mapping proposals to specific measures helps us to model the effects of the proposals. It is difficult to model, for example, the Chips Act per se. What can be done more readily is to measure the impacts of the measures envisioned in it (subsidies, state aid). Furthermore, the classification in **Table 1** opens the possibility of modelling the effects of interventions by broad category. This makes more sense than attempting to model specific interventions such as the Chips Act or the emergency framework for medical countermeasures. Rather, what the classification demonstrates is the likely prevalence of certain types of measures (e.g. export subsidies) which, in turn, motivates their inclusion in a modelling effort.

The remainder of this section is organised as follows:

- We present a structural gravity model of trade which estimates the responsiveness of trade to policy measures of the sort envisioned in the classification developed in Table 1.
- We present ad valorem equivalent (AVE) trade costs which reflect assumptions about how policy measures will be implemented, i.e. in terms of their scope of application, and their stringency.

3.2 Gravity modelling – baseline estimates

To model the effects of proposals on trade costs, we use a structural gravity model of international trade. By this we mean a model that represents trade between any pair of partners as a positive function of size and a negative function of bilateral trade costs. The latter include distance and other cost factors (tariffs, non-tariff measures) that can be presented in ad valorem terms. Structural gravity models are based on representations of the supply- and demand-side economies and are general equilibrium in nature.[6] Further details explaining our approach can be found in Annexes A and B.

The focus of this section is on the estimation of the baseline gravity model. That is, we seek to compute the elasticities that show how bilateral trade flows respond to changes in trade costs that are driven by the types of policy instruments described above. The elasticity terms measure the partial response of trade flows with respect to these policy shocks. They should be interpreted as annual changes to trade. There will be further general equilibrium effects resulting from changes in relative prices, third-country effects and input-output linkages. These general equilibrium effects are captured in the model presented in section 4.

The results of the counterfactual modelling, i.e. measuring the effects of various policy scenarios, are presented in section 3.3. It should be noted that the counterfactual approach does not specify any timeline over which impacts would be observed, but merely states how different trade flows would be in a world in which the alternative policies are in place.

3.2.1 Overview

The impact of policy measures on trade is analysed using a "structural gravity modelling" approach. This approach is used because it aligns fully with a suite of underlying theoretical models of consumer demand and trade, giving robust theory-consistent results that can be then used in a simulation model, all within the same unified theoretical framework. A key

[6] For a recent detailed explanation of the use of gravity models in trade policy analysis, see Yotov et al. (2016). Other important contributions informing our approach include Anderson and van Wincoop (2003) and Santos Silva and Tenreyro (2006).

feature of structural gravity models is the inclusion of importer and exporter fixed effects which fully capture each country's relative prices and thus propensity to trade.

Owing to differences in how different types of policy are measured and in order to apply the most robust form of structural gravity model, goods and services are modelled separately.

Choice of datasets

Trade flow data are drawn from the OECD Trade in Value Added (TiVA) database, 2021 edition. The reason for using TiVA is that it gives a complete and symmetric "square" dataset which includes domestic consumption, aligns fully with the data requirements for performing simulation modelling (see following section) and improves the performance of econometric models.

Policy measures in services are analysed using the OECD Services Trade Restrictiveness Index (STRI), which seeks to capture in broad terms the full range of restrictions that may affect services trade.[7] The STRI uses a scorecard approach in which each jurisdiction is assessed on a number of policy measures, such as barriers to commercial presence, movement of persons and various regulatory barriers. Each measure carries a weight and, if in place, this is added to the score. A score of 0 means a completely liberalised trade environment and a score of 1 means completely closed. The STRI heterogeneity score is derived by comparing the scorecards for each pair of countries and adding up the absolute differences between scores.[8] A key motivation for using the STRI heterogeneity index is that it has a rich amount of bilateral variation, which means that it is possible to include it alongside country-year fixed effects, thus preserving the integrity of a structural gravity approach.[9]

Goods trade analysis uses the Global Trade Alert data (GTA). An important advantage of the dataset is that it has time-varying bilateral variation in trade policy, which enables more demanding country-pair fixed effects to be used, further controlling for possible simultaneity bias whereby external factors may drive both heightened trade and liberalisation between countries without there necessarily being a causal link. However, the GTA presents some difficulties reflecting the great variety of measures. Moreover, the GTA reports the count rather than the actual intensity of measures.[10] Taken together, these factors suggest that it is appropriate to consider the effects of broad groupings of interventions. This is most straightforward in the context of an aggregate analysis across goods sectors.

[7] The OECD also publishes the Digital Services Trade Restrictiveness Index (DSTRI), which uses the same overall approach but in relation to digital services trade specifically. Categories of restriction are: infrastructure, electronic transactions, payment system, intellectual property rights and other barriers. In the context of this study, the STRI is more suitable than the DSTRI, as the former allows the broader set of restrictions to be controlled for, with the data flows component assigned its relative weight in line with expert judgement.

[8] There are two versions of the STRI heterogeneity index. This is because two jurisdictions may score the same on a measure but for different reasons, with an "answer-based" and "score-based" index. To illustrate, a ban on majority foreign equity in a sector will trigger scores on other dependent measures such as ban on foreign directors. The answer-based index would treat these cases as different answers, whereas the score-based index would treat them as the same score, capturing the fact that the dependent measure is redundant in this case. Here we use the score-based index, although results are very similar to when using the answer-based index.

3.2.2 Approach and results: services

The services model estimates the effect of the STRI heterogeneity index[11] on services trade, while also controlling for bilateral variables such as cross-border trade, distance between countries, common language, etc. Fixed effects by country (importer-year and exporter-year) control for unobservable heterogeneity and remove potential sources of confounding bias. For example, if countries that trade more are also more liberalised without there being a direct causal effect, a cross-sectional regression would still detect such a relationship. The country fixed effects reduce the likelihood of this.

The model is estimated on a sector-by-sector basis using Poisson Pseudo Maximum Likelihood (PPML) and covers the years 2014 to 2018. The regression equation is written:

$$exports_{ijt} = b_0 + b_1 Border_{ij} + b_2 STRI\_heterogeneity_{ijt^*} Border_{ij}$$

$$+ b_3 \boldsymbol{X}_{ij} + \boldsymbol{fixed\_effect}_{it} + \boldsymbol{fixed\_effect}_{jt} + e_{ijt}$$

for sector s (subscript omitted), importer i, exporter j and time t.

In addition to estimating the model for each sector in turn, we include an aggregated model in which all services are combined (weighted by production shares) as well as intermediate models covering transport/distributive services and business services separately.[12]

The results are shown in Table 2 below. The rows show models estimated for different sectors in turn. The first column shows the "beta" coefficient on STRI_H, which approximately gives the percentage change in trade per unit change in the STRI_H. For example, a 1 percentage point increase in the STRI_H would reduce construction services trade by 5.4%. In each case, the beta is negative, showing that regulatory heterogeneity has a negative effect on trade for each of the sectors or groupings analysed. The stars show statistical significance, with variable significant in all but one case (water transport). The rightmost column shows standard errors in parentheses.

[9] An alternative approach to gaining bilateral variation is to interact the STRI with a border dummy. For more detail on this approach, please refer to Heid et al. (2021). This approach yields similar results in terms of magnitude, although the heterogeneity index has the advantage of having greater bilateral variation. In terms of interpretation, the heterogeneity index places equal weight on importer or exporter diverging.

[10] While, ideally, we would work with AVEs, which capture intensity, count data are nevertheless intuitive to interpret, as they tangibly relate to policies being introduced. While UNCTAD TRAINS has the advantage of offering exact ad valorem measures, it lacks a time dimension needed for pair effects to be used.

[11] The STRI heterogeneity index is interacted with a border dummy, i.e. set to zero for cases of intra-national trade as, by definition, there should be no regulatory heterogeneity in these cases.

[12] Codes D41-53 and D58-75 respectively.

The next column shows the standard errors, which measure the degree of precision with which beta has been estimated. The ratio of the two is the t-statistic, which gives a measure of the statistical significance of the effect. A t-statistic larger than 1.96 in absolute terms means there is 95% confidence that the true value of the beta is different to zero. In all but one case (water transport) the STRI_H variable has a statistically significant effect. In other words, we are confident that regulatory heterogeneity has a negative effect on services trade.

Table 2 Services trade – effect of STRI regulatory heterogeneity index on services trade

SECTOR	BETA	STD.E
Construction	-5.44***	(0.47)
Wholesale and retail	-1.15***	(0.23)
Land transport	-2.03***	(0.28)
Water transport	-0.23	(0.45)
Air transport	-2.15***	(0.35)
Postal and courier	-4.32***	(0.46)
Publishing and AV	-1.18***	(0.38)
Telecommunications	-2.05***	(0.31)
IT and information services	-1.68***	(0.53)
Financial and insurance	-4.78***	(0.62)
Professional, technical	-1.74***	(0.46)
Aggregate – all services	-1.90***	(0.30)
Aggregate – transport/distributive	-1.47***	(0.33)
Aggregate – business services	-3.27***	(0.43)

Source: Frontier analysis of TiVA and OECD STRI data
*Note: Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

In terms of interpretation, the index essentially measures the degree of difference between two jurisdictions in terms of which regulations are in force. Suppose, for example, that a data flow restriction is enacted, e.g. "cross-border transfer is subject to approval on a case-by-case basis", this change would be consistent with our interpretation of several of the initiatives we considered in **Table 1**, notably the EU Cloud Act, the Data Governance Act and the Data Act. With many partners, this will give rise to regulatory divergence and the STRI_H will increase

by 0.011 points in the case of professional and technical services. The first-order effect of this is to reduce trade by -2.1%.[13] Some of the other sectors show more responsiveness than this.

An important limitation of this approach is that it focuses on the general effects of the STRI_H index, even though the measures of policy interest relate specifically to data flows. The approach therefore assumes that the responsiveness of trade to data policy is in line with the weight attached to it in line with expert consensus when defining the index. Ideally, one would be able to test the individual components of the STRI directly; however, there is unlikely to be sufficient variation in the data for this to be feasible, given the challenge of measures being correlated with each other.[14]

Note that, in this model, the results are agnostic as to whether effects are driven by the importer or by the exporter policies, so the results apply equally to imports and exports. In other words, a divergence in data flow policy would impact EU imports and exports by the same amount. Ideally, we would incorporate both importer and exporter STRIs to identify which country's actions drive the results. However, this is not possible with current data in a theory-consistent gravity model, due to the limited variation in the STRI, which gives rise to collinearity such that one of the STRI terms drops out.

Further results are provided in Annex A exploring different fixed-effect structures and specifications.

3.2.3 Approach and results: goods

Policies affecting goods trade are analysed using the Global Trade Alert (GTA), a database that tracks the introduction of trade policies.[15] This is done on a bilateral basis as GTA identifies the particular trading partners affected by each policy measure. As the data are gathered from November 2008 up to the present, they capture policies introduced during the period rather than the overall stock. The bilateral nature of GTA enables models with country pair-level fixed effects to be estimated, thus further controlling for unobservable heterogeneity. That in turn reduces the risk of finding spurious relationships between trade flows and policy liberalisation.
.

An important caveat of GTA is that the measures are not quantified in terms of their severity (for example the size of a subsidy), so it is necessary to work with the count of measures adopted as a proxy for stringency. And, while GTA defines products affected at a detailed 6-

[13] This is calculated using the marginal effects formula exp($\beta\Delta$-1 = exp(-1.74 * .012)-1 = -2.1%.

[14] For a recent example using the STRI broken down into sub-components, refer to Khachaturian and Oliver (2021). In many cases the STRI components take large, insignificant or wrong-signed values, indicating difficulty distinguishing the relative effects of the different sub-components. In any event, note that sub-components of the heterogeneity index are not available.

[15] https://www.globaltradealert.org/

digit HS code level, the TiVA trade flow data to which GTA restrictions are applied are much more aggregated. We therefore aggregate up the GTA data to the level of TiVA sectors, using a "prevalence score" approach measuring the average number of measures applied to a product.[16] A prevalence score of 1 means that a product in a sector has, on average, one measure applied to it. This makes interpretation of model coefficients straightforward, as they have the interpretation of there being one additional measure applied.

The GTA classifies measures in great detail. In total, 86 different types of measure are considered for export subsidies, technical standards or anti-dumping measures. Furthermore, measures are classified as red/amber/green in terms of whether they are considered to be trade-restricting ("red"), trade-liberalising ("green") or ambiguous ("amber"). This produces an unwieldy combination of measures that cannot easily be distinguished in a multivariate analysis. We therefore employed some simple conceptual steps to group measures and consider inclusion in the model:

- "Red" and "green" measures are hypothesised to have opposite impacts, so should be distinguished.
- As only around 2% of policies are classified as "amber", for simplicity, these can be excluded.
- The majority of measures affect how a country treats foreign imports, so in these cases we hypothesise that only the policy stance of the importing country is of direct relevance. In the other cases, policies affect exports, so it is the policy of the exporter that is relevant.
- Further multivariate analysis using principal components and factor analysis did not find strong groupings of importer policies, and these did not perform as well as a general importer prevalence score from across the breadth of measures.
- As the exporter variables do not perform well enough to justify inclusion in the model, we are left with a parsimonious specification that includes the prevalence of "red" importer measures and the prevalence of "green" importer measures.

This results in a parsimonious specification in which prevalence of importer reds and greens are included, together with participation in FTAs/RTAs, which have some variation over time. Fixed effects are included for country pair, exporter-year and importer-year. The model can be written:

$$Exports_{ijt} = b_0 + b_1 importer\_red_{ijt} + b_2 policy\_importer\_green_{ijt} + b_3 rta_{ijt} + b_4 fta_{ijt} + \boldsymbol{dummy}_{it} + \boldsymbol{dummy}_{jt} + \boldsymbol{dummy}_{ij}$$

for importer i, exporter j and year t

[16] An advantage of using the simple average number of measures applying to a product is that the measure is additive and divisible and thus insensitive to how interventions or products are grouped. By contrast, a coverage ratio or median approach is sensitive to grouping. The aggregation from HS to TiVA sector uses total trade volumes from the BACI dataset.

The model is estimated over aggregated sector groups.[17] The results are shown in Table 3 below.

Table 3 Goods trade – main results

	IMPORTER REDS		IMPORTER GREENS	
	BETA	STD.E	BETA	STD.E
All goods (D1-33)	-0.052***	(0.015)	0.068***	(0.022)
Manufacturing (D10-33)	-0.041***	(0.013)	0.057***	(0.016)
High-tech (D26-33)	-0.035***	(0.008)	0.016	(0.013)
Basic manufacturing (D10-25)	-0.010	(0.020)	0.017	(0.042)
Raw materials (D1-8)	-0.133	(0.096)	0.171***	(0.049)

Source: Frontier analysis of TiVA and OECD STRI data

*Note: Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

The sign and significance of the results are largely intuitive, with negative effects on importer reds and positive effects on importer greens. In most cases, these are statistically significant. To illustrate the impact, consider the upper-left cell. This shows the impact of there being an additional importer red measure. The first-order impact is exp(-.052) = -5.1% reduction in imports. Over the whole set of goods products, the prevalence score is around 10%, suggesting, on average, that the "importer red" measures introduced during the GTA timeframe result in EU goods trade being around 0.5% lower overall than absent these measures. "Importer green" measures have the opposite effect of roughly the same magnitude.[18]

3.3 Counterfactual modelling

The counterfactual modelling develops scenarios which represent sets of measures that are enacted in combination. These are combined with results from the gravity modelling to develop ad valorem equivalents (AVEs), which measure the level of tariffs that would generate the same trade reduction as the measures under consideration. The AVEs are then used as inputs in a new quantitative trade model (NQTM), which takes account of full equilibrium effects such as changes in wages and relative prices, input-output relationships between sectors, as well as changes due to tariff revenue (see section 4). This gives changes in trade flows, production and welfare once the economy as a whole has adjusted to the changes in trade costs resulting from the policies. Note that simulation models a counterfactual in the sense of capturing how

[17] Results for individual sectors are provided in the Annex B. Overall, these perform well for the high-tech grouping but less well for other groupings, suggesting the aggregate approach works better overall.

[18] As the goods trade model incorporates pair, importer-year and exporter-year fixed effects, the GTA coefficients measure the average difference in trade flows pre and post introduction of the policy. However, the dynamics of when any impacts emerge is not modelled.

different outcomes would be relative to the baseline as a result of these policies being enacted. It does not model the dynamics of adjustment, nor does it provide a forecast or projection.

3.3.1 Scenarios

We consider three scenarios. In each case the scenario is operationalised as changes in a policy measure of interest, which could be the STRI heterogeneity score, the GTA importer red prevalence score or a tariff level. These are specified in relation to specific products/sectors and trading partners.

To identify the policy measures of interest, we drew on the classification we developed. In particular, we observed that in each of the four categories defined in the classification, certain types of measures were frequently envisioned.

In category 1, the main measures were subsidies and, to a lesser extent, procurement measures. These are therefore the main focus of our counterfactual modelling. Specifically drawing on GTA data, we model an increase in the prevalence of these instruments. Under the low scenario, we assume an increase in subsidies, while under the high scenario, we assume an increase in interventions via both subsidies and procurement. The scope of application is expansive in the sense that coverage is extended to all goods and affects trade with all partners.

This assumption reflects several considerations. First, documented trends point to the proliferation of such instruments. One report suggested that over 85% of extra-EU imports were in products in which local rivals were awarded subsidies.[19] This is consistent with longer-standing concerns about the use these instruments as means of "murky protectionism" since the advent of the Global Financial Crisis.[20] Second, as observed in section 2.2 and **Table 1**, the formulation of the new industrial strategy is quite open ended, and its emphasis on industrial transformation and the reduction of dependencies suggests a further reliance on the sorts of mechanisms that have been extensively drawn on in the past.

Our modelling of category 1 is nevertheless conservative in the sense that we did not consider the possible responses by partners to the extension of subsidies and procurement measures. Moreover, we did not consider scenarios in which instruments such as subsidies, which are relatively weakly disciplined under trade law, are combined with more hard-core forms of protection such as local content requirements (as, for example, envisioned under proposed subsidy arrangements for electric vehicles in the USA).

[19] See Evenett and Fritz (2021: 6).

[20] See, for example, Baldwin and Evenett (2009) and IMF, OECD, World Bank, WTO (2022).

Category 2 focuses on digital markets. Recall that we are specifically interested in the effects of proposals on trade costs. As observed in section 2.2 and **Table 1**, in many cases the trade cost effects of the proposals are ambiguous. The primary type of impact is likely to arise through effects on the regulation of cross-border data flows. At a conceptual level, the international fragmentation of frameworks for data regulation is likely to impose costs on cross-border trade. This, in turn, dovetails with our approach to econometric modelling described in section 3.2.2, which highlighted the value of drawing on the OECD's work on measuring regulatory heterogeneity in relation to data. In our scenario modelling, we therefore capture the effects of category 2 as driving a moderate increase in the degree of regulatory fragmentation relating to data and apply this to all services, given their digitalised nature. The increase is the same under the low and high scenarios. We believe this is consistent with the current direction of EU policy to manage issues raised by divergent approaches to data governance on data transfers.[21]

Note that this does not mean that the effects are limited to services: by virtue of the integration of services into goods trade, category 2 measures will also affect goods. These indirect effects, via services-goods linkages, are captured through the modelling we present in section 4.

Category 3 focuses more on technical regulation and associated non-tariff measures. They are likely to be particularly visible in specific sectors, notably automotive sectors and those related to forestry activities.

Finally, category 4 includes measures that are generally contingent on (perceived) behaviour by partners. The measures contemplated under category 4 include tariffs and duties and, to a lesser extent, restrictions applied to procurement and to services. The choice of measure depends on the nature of the policy instrument. We impose limits to the scope of the application of these measures in terms of the overall value of goods. Specifically, each tariff element other than the Carbon Border Tax Adjustment Mechanism (CBAM) (i.e. Anti-Coercion, Foreign Subsidies Instrument, Revised Enforcement Regulation) is scaled so that tariffs, when applied, cover $5 billion of trade. Partner retaliation is also similarly scaled. We motivate this "cap" on the grounds that these tariffs are contingent on the EU's assessment of behaviour by partners. They are analogous to contingent trade remedies or retaliatory action authorised (suspension of concessions) under WTO dispute settlement proceedings in the event of non-compliance with WTO Dispute Settlement Body rulings. The value of $5 billion is an upper bound and reflects the value of trade affected by recent bilateral disputes such as EU-Airbus, except that in the case of our modelling the measures are not applied to one partner only. In the case of the Revised Enforcement Regulation, we also include a

[21] See, for example, recent developments to the EU-US data privacy framework. It is of course possible that heterogeneity increases because of the actions taken by partners. We do not consider the effects of these actions since the aim here is to measure the effects of EU policy decisions (just as we excluded from the scope of the analysis subsidy and procurement intervention measures taken by partners under category 1).

services component given that the regulation explicitly allows for cross-retaliation. The CBAM is not capped in this way, as the measures would apply to the full range of products in scope. The tariff ranges for CBAM are based on the tariff equivalents reported by the EU's internal impact assessment.[22]

To illustrate the coverage of the different types of measures, category 1 covers $1,195 billion of imports, category 2 covers $891 billion, category 3 covers $94 billion and category 4 covers $646 billion in the low scenario and $1,215 billion in the high scenario. We consider two policy scenarios for the EU, a low and a high scenario, representing different levels of vigour with which the EU pursues the concept of strategic autonomy. The scenarios differ in terms of the range of measures enacted and the stringency with which they are enacted.

In addition to the EU's own actions, we model the effects of responses by partners. We apply this in response to EU measures under the high scenario. This reflects a situation in which a more vigorous pursuit of strategic autonomy prompts a greater level of fragmentation in trade. We model retaliation through the imposition of 30% tariffs by the USA and China on EU manufacturing.

The low and high scenarios, as well as the retaliation by partners, are described in Table 4 below.

[22] European Commission (2021b: 114), Impact Assessment Report, accompanying the document Proposal for a regulation of the European Parliament and of the Council establishing a Carbon Border Adjustment Mechanism

Table 4 Scenario settings

Measure	Scope	Low scenario	High scenario
Category 1	All goods	+1 line GTA from all partners (subsidies)	+2 lines GTA from all partners (subsidies + procurement)
Category 2	Services[23]	+1 line STRI_H data restriction with all partners	+1 line STRI_H data restriction with all partners
Category 3	Automotive + deforestation-related	+1 line GTA from all partners (technical)	+1 line GTA from all partners (technical)
Category 4 Anti-Coercion	Manufactured goods ($5bn in scope)	+10% tariffs facing China, Russia	+50% tariffs facing China, Russia
Category 4 Carbon Border Adjustment Mechanism	Fertilizer, aluminium, iron and steel, cement and lime	+2% tariff from all partners	+5% tariff from all partners
Category 4 Foreign Subsidy Instrument	Tech manufacturing (D26-28)	+10% tariff facing China, Vietnam	+30% tariff facing China, Vietnam, Japan, Korea, India, USA, UK
Category 4 International Procurement Instrument	Manufactured goods	n/a	+0.2 st. devs. GTA procurement measures facing China, India, UK, USA
Category 4 Revised Enforcement Regulation	Services	n/a	+ 1 line STRI_H facing China, Russia, India, USA and UK
Category 4 Revised Enforcement Regulation (tariff component)	Manufactured goods ($5 billion in scope)	+10% tariffs facing China, Russia, India, USA and UK	+50% tariffs facing China, Russia, India, USA and UK
Retaliation by partners	Manufactured goods ($5 billion in scope for each of USA and China)	n/a	+30% tariffs by China and, USA on EU exports

[23] The services sectors modelled are those for which corresponding sector-level STRI data are available, thus covering codes D41-D75

3.3.2 Magnitude of trade cost impacts

Having estimated the baseline model and having specified the counterfactual scenarios, the next step is to translate all the measures considered into "ad valorem equivalent" (AVE) trade cost terms.[24] This is the tariff equivalent of the measure that would bring about the same reduction in trade, thus providing an even basis on which to compare the impacts of measures. This allows the various measures to be compared side by side in terms of overall magnitude. The AVEs will also be key inputs into the modelling described in section 4.

Overall, the changes in trade costs across all categories of measures are 0.82% in the low scenario and 1.70% in the high scenario for importing into the EU.[25] Note that the trade costs are expressed as an average over all sectors, some of which will be more affected than others. For example, category 2 impacts relate only to services but are divided through by a numerator reflecting all sectors. Thus the total economy impact will be smaller than the impact for a particularly affected sector. As shown in the subsequent modelling, there is variation in sectoral exposure, with some experiencing larger and some experiencing smaller shocks.

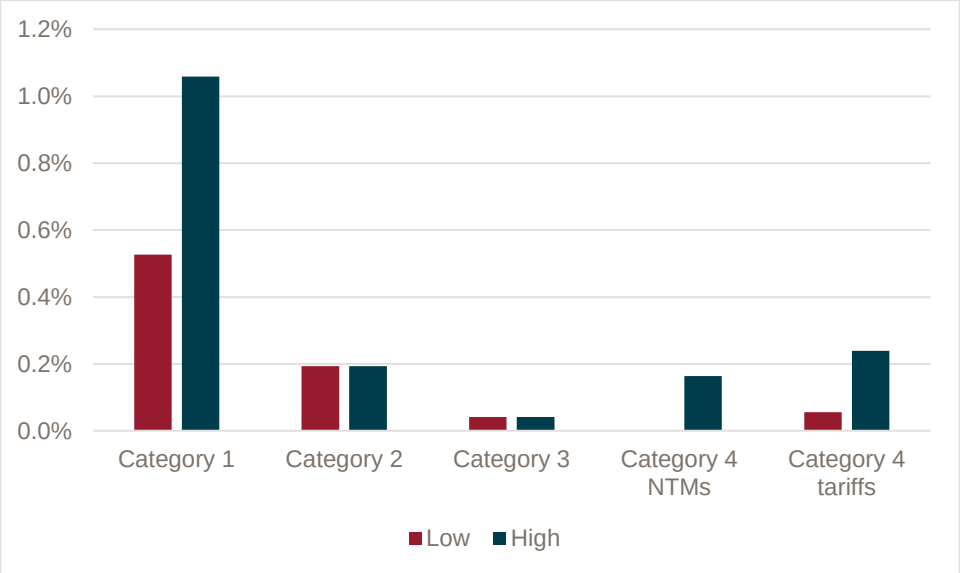
The respective contributions of the different categories are shown in Figure 2 below. Here we see that the category 1 restrictions are driving the bulk of the impact, nearly two-thirds. This reflects the prevalence and scope of these measures under the two scenarios, which is explained by the reasons provided in section 3.3.1. By contrast, the duty measures contemplated under category 4, while severe for affected products, would only be applied to a limited subset of products, so have less impact overall.

The effects of category 2 measures on trade costs under the scenarios are more limited. This is in line with our modelling approach, which focused on the extent of regulatory fragmentations (as measured by the OECD's STRI heterogeneity index). Under the scenarios, we postulated a relatively moderate increase in heterogeneity, which remained constant across both high and low scenarios.

[24] The conversion into AVEs uses the formula exp(beta*NTM/epsilon) where epsilon is a trade elasticity calculated for that sector. The various NTM components are multiplicative in the sense that if c = a+b, 1+AVE_c = (1+AVE_a) * (!+AVE_B).

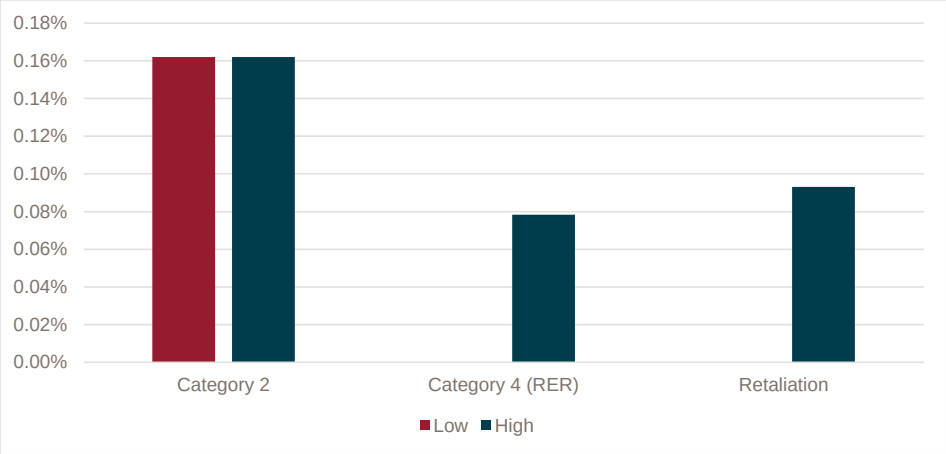
[25] Thus if the factory gate price was 100, inclusive of NTMs it becomes 101.7 in the high scenario.

Figure 2 Additional trade costs on EU imports by category of measure and scenario



The approach is repeated for EU exports, which are affected less than imports. Trade costs are 0.16% in the low scenario, 0.24% in the high scenario and 0.33% if partner retaliation is included. The contributions to trade costs are shown in Figure 3 below. The measures that increase trade costs for EU exports are those that decrease regulatory alignment in the approach to data flows in delivering services. Trade restrictions imposed by a country could be expected to have an impact on its own exports (by making sales on the domestic market more attractive than sales on world markets), but effects on own exports are not found to be statistically significant in our models. That does not rule out general equilibrium effects, a point that we consider subsequently. Moreover, measures imposed by the EU that contribute to fragmentation in services regulation do affect the EU's own exports. Effects on trade costs affecting EU exports arise from the "retaliation" scenario, where the USA and China impose tariffs on certain EU goods. However, the scope of products affected by the tariffs is limited, so the overall impact is relatively limited.

Figure 3 Additional trade costs on EU exports by category of measure and scenario



3.3.3 Policy discussion

The modelling of trade costs provides a preliminary guide to the impact of measures enacted under the guise of strategic autonomy. An important insight is the relative contribution of different categories. Category 1 measures have a broader scope, mainly because they are connected to broad strategic objectives, such as industrial and technological transformation, that are, in turn, motivated by a range of higher policy priorities (such as decarbonisation or resilience). This, in turn, drives their greater relative contribution to trade costs. The policy measures captured by this category (subsidies and procurement) are ones that have historically been weakly disciplined under trade rules and, indeed, have become the instruments of choice in government intervention. As observed in section 2.2, subsidies are generally preferred to tariffs, because they are considered to be more transparent and because their distortive effect is smaller. However, the results show that their proliferation generates costs, and perhaps to a greater level than more obviously visible trade measures such as tariffs.

Category 2 measures, which reflect the costs of regulatory fragmentation on services trade, are also significant in terms of their contribution to relative trade costs. This underscores the point that, while it is well recognised that policies under this category seek to promote a range of policy objectives (notably the remedying of market failures associated with digital activities), the pursuit of these objectives in a manner that engenders fragmentation imposes costs including, significantly, on the EU's own exports.

In relation to category 4, the assumed limits to the scope of their application (and to partner retaliation) have a moderating influence on their impacts on trade costs. To the extent that these assumed limits do not hold in a potentially highly fragmented international context, the contribution to costs would be higher. The inclusion of services measures, modelled as measures that increase fragmentation, explains why category 4 measures imposed by the EU impose costs on its own exports.

4 Modelling economic impacts

4.1 Summary of key findings

- Increases in trade costs associated with the EU's strategic autonomy measures lead to losses in economic welfare for the EU, even without retaliation by trading partners. The measures that contribute most to this outcome are those with the largest ad valorem equivalents (AVEs) in the previous section, i.e. category 1 measures in the low scenario, and category 1 and 4 measures in the high scenario.
- For the EU-27 as a whole, real gross national income (GNI) falls by $12 billion (0.08%) in the low scenario, $20 billion (0.14%) in the high scenario and $22 billion (0.15%) in the high scenario with retaliation. At a country level, impacts range between -0.05% and -0.38% for the low scenario, -0.06% and -0.65% for the high scenario, and -0.08% and -0.76% for the high scenario with retaliation by partners. The impacts are in a similar order of magnitude to those reported for modelling exercises of FTAs. They are annual and accrue after the economy has had time to adjust to all relevant changes.
- The driving force behind these outcomes is increases in prices: improved terms of trade are insufficient to offset the distortionary effect of the policies, so all countries experience price increases, which, in turn, decreases the volume of trade. The range of price rises across EU countries is from 0.2% to 0.4% under the low scenario, 0.5% to 0.8% under the high scenario and 0.4% to 0.8% under the high scenario with retaliation.
- Increased intra-EU trade is insufficient to compensate for decreased trade with third-country partners. Total EU exports and imports therefore fall. On the import side, the region as a whole sees a decline in imports of $32 billion in the low scenario (0.5%), $56 billion (0.9%) in the high scenario, and $65 billion (1.0%) in the high scenario with retaliation. Changes are approximately the same on the export side, given that the model assumes an exogenous trade deficit.
- While the model does not take account of changes in productivity, technology, investment, competition in markets or innovation, an estimate from the literature makes it possible to account for these factors in a simple way by relating the model's trade changes to changes in per capita incomes. This approach suggests that EU gross domestic product (GDP) per capita could fall by 0.25% to 0.38% for the low scenario, 0.45% to 0.68% for the high scenario and 0.5% to 0.75% for the high scenario with retaliation.
- Third-country trading partners also lose in terms of access to the EU market. Proportional changes are relatively similar at a country level for the low and high scenarios because the policy changes are not directed at individual countries. But in the high scenario with retaliation, the USA and China see particularly large relative losses.

4.2 Overview of approach

We model the economic impacts of measures enacted under the scenarios described in the preceding section by using a model from the class of general equilibrium models known as new quantitative trade models (NQTMs). They improve on traditional computable general equilibrium (CGE) models by exhibiting "a tighter connection between theory and data thanks to more appealing micro-theoretical foundations and careful estimation of the structural parameters necessary for counterfactual analysis".[26] For these reasons, academic economists now typically use NQTMs for the analysis of trade policy changes ranging from entry into a trade agreement[27] to joining the WTO.[28] The model used here is based on articles published in leading academic journals and has previously been applied in peer-reviewed research, for instance to analyse the economic impacts of improvements in trade facilitation.[29]

Like all economic models, NQTMs have a complex structure embodied in a large set of equations linked to a dataset. However, the basic logic is straightforward and is based on a widely shared understanding of how policy changes affect trade flows and prices, and how they, in turn, affect economic welfare. Figure 4 summarises the NQTM approach to turning inputs (changes in policies, expressed as AVEs of policies – see above) into outputs (changes in real GNI as a measure of economic welfare, as well as intermediate variables like prices and trade values). In essence, the policy change leads to a change in relative prices, which feeds directly through to consumer prices and indirectly through its effect on production costs. These price changes then influence each country's terms of trade – the price of its exports in terms of its imports – and the composition of its trade, meaning exports and imports in particular sectors and with individual country partners. The net outcome of these different effects, which are complex at a micro level, is measured by changes in real GNI. A key feature of all general equilibrium trade models, including this one, is that expansions in import-competing sectors due to an increase in their relative price must necessarily draw resources from exporting sectors; trade economists therefore universally acknowledge that "a tax on imports is a tax on exports".

The net outcome of any policy change fed into the model is ambiguous due to the large number of effects at play. In particular, terms of trade effects and volume of trade effects can act in opposite directions, or they can act in different ways for different countries. So the model solves for an equilibrium of the world economy in which a set of macroeconomic constraints

[26] Ottaviano (2015).

[27] Caliendo and Parro (2015).

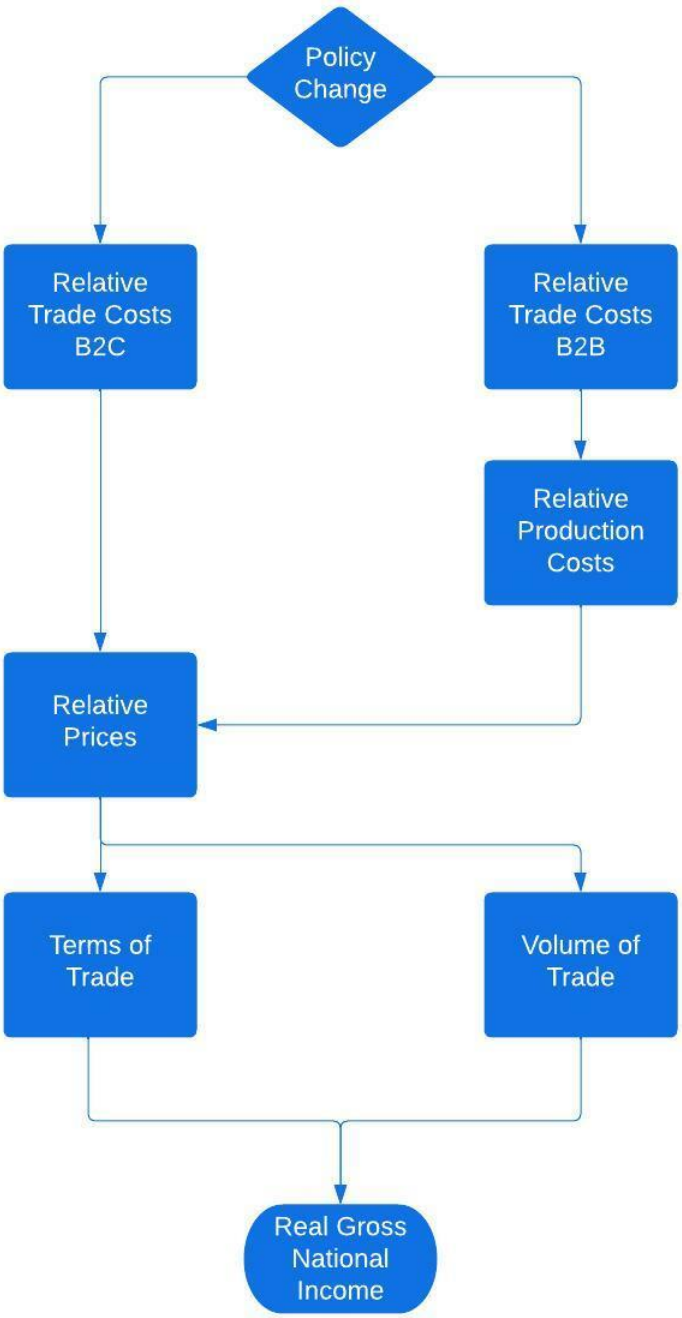
[28] Aichele and Heiland (2018).

[29] Shepherd (2022).

hold, and reported results are based on this equilibrium. Annex B describes the model in full mathematical detail and sets out the relevant limitations.

Unlike a macroeconomic model, the NQTM does not have a time dimension. It compares two equilibrium states of the world economy: one observed (the baseline) and one with the policy changes discussed above (the counterfactual). Estimated differences to the two are for a single year, but in principle would recur for all future years for which the model was run. However, moving from one equilibrium to another can take time during which economic actors adjust. The NQTM does not model that dynamic adjustment process.

Figure 4 Simplified flowchart of the NQTM



In the version of the model used here, there are 30 sectors and 38 countries. This arrangement is based on an aggregation of the OECD-WTO Trade in Value Added Database (TiVA), which is based on a global input-output table of the type needed by the NQTM. Country coverage is based on individual treatment of the EU-27 member states and major trading partners, with other countries summed into an aggregate "rest of the world" (ROW) region.[30] Sectoral coverage is based on individual treatment of sectors that are subject to policy changes under the scenarios discussed above; the remaining sectors are summed into aggregates. The model therefore works with a large database and produces both macro-level results such as changes in real GNI and micro-level findings such as changes in the exports of a particular sector between two countries.

Like any economic model, however, the NQTM used here has important limitations. Its most appropriate use comes from comparing scenario outcomes in relative terms: they summarise the relative extent of changes in economic variables for a constant model structure, and therefore give a useful indication of the relative magnitudes of changes. Interpretation in absolute terms is less helpful, as model structure clearly plays a role in determining results.

We supplement our results based on the NQTM by drawing on the findings from another strand of empirical research into the relationship between trade and economic performance. This research seeks to estimate the responsiveness of national income or GDP to changes in trade. Work by Frankel and Romer (1999) on this relationship sparked further critical research (see notably Rodriguez and Rodrik (2001)) and refinements (see notably Wacziarg (2001) and Feyrer (2019)). The body of work finds a positive relationship between trade and income, driven primarily by the positive impacts that trade has on productivity. Those productivity effects could operate through a variety of channels, including dynamic gains from specialisation, the diffusion of knowledge and innovation, and efficiencies driven by increased competition. The exact magnitude of the effect of trade on national income is a matter of debate. We therefore draw on estimates used in recent work and combine these with the estimated effects on trade from our own modelling to derive estimates of effects on income per capita to supplement those estimated via the NQTM.

4.3 Modelling results

4.3.1 Overall welfare effects

To interpret the results, the presentation starts with the end of the results chain, namely real GNI (Figure 5). Focusing on the EU-27 countries, the figure shows that outcomes are uniformly negative. For the region as a whole, real GNI falls by $12 billion (0.08%) in the low scenario,

[30] For technical reasons, very small economies are also aggregated. The model therefore uses "BLX" to indicate an aggregate of Belgium, the Netherlands, and Luxembourg, and "OEU" to indicate Malta and Cyprus.

$20 billion (0.14%) in the high scenario, and $22 billion (0.15%) in the high scenario with retaliation. At a country level, impacts range between -0.05% and -0.38% for the low scenario, -0.06% and -0.65% for the high scenario and -0.08% and -0.76% for the high scenario with retaliation.

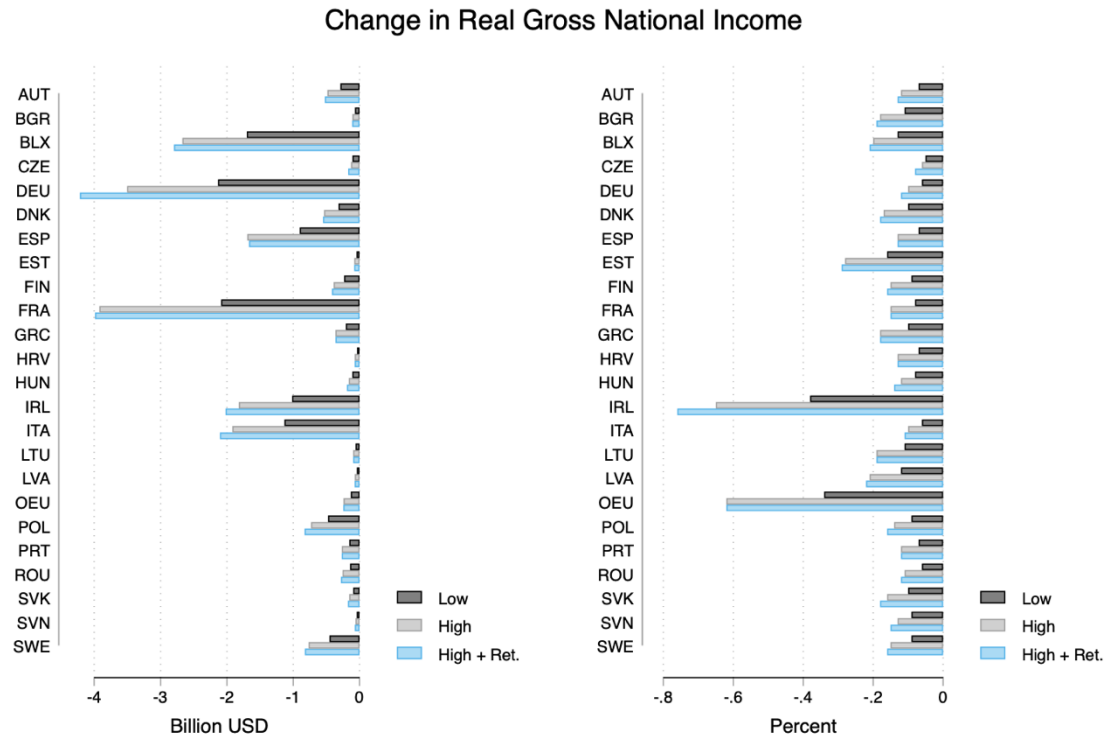
These outcomes are non-negligeable in aggregate terms and are commensurate with the magnitude of changes reported following the modelling of significant trade policy changes. For instance, the model on which the NQTM used here is based was used to quantify the effects of the North American Free Trade Agreement (NAFTA), and it showed that signing that large scale regional agreement increased real GNI by 0.08% in the USA, -0.06% in Canada and 1.31% in Mexico (Caliendo and Parro, 2015). So relative to that baseline, the policy changes here would involve significant disruptions to the EU trading economy. Even under the low scenario, EU countries could see negative impacts of similar scale to the positive impacts seen on the USA as a result of entering its largest trade agreement.

In terms of economic mechanisms, the simplest statement of the reason for this result is that the terms of trade gain to the EU-27 from pushing prices down using trade policy does not offset the loss in trade volumes with external partners (see Figure 6 below). The net result, therefore, is that consumer prices rise: the range of rises across EU countries is from 0.2% to 0.4% under the low scenario, 0.5% to 0.8% under the high scenario and 0.4% to 0.8% under the high scenario with retaliation.

A key finding from the model is that the magnitude of the loss is significantly greater under the high scenario than under the low scenario, but there is relatively little difference between the high scenario and the retaliation scenario. The reason for this is that retaliating countries are limited in geographical scope – which means that sourcing locations can switch following price changes – and the amount of retaliation is similarly limited by assumption. A more generalised "trade war" would likely have far greater impacts, though the importance of intra-regional trade for the EU-27 is a factor that provides some degree of cushion in these kinds of scenarios. In terms of the contribution of individual measures, the model treats them all together, but the greatest impact is from those measures with the highest AVEs, as discussed above.

A second important finding is the extent of variation across countries in terms of relative impacts (i.e. percentage terms). There is some indication that impacts are larger in relative terms for smaller and more open economies – Ireland stands out, for example. This makes intuitive sense: smaller economies are more open to trade and, because of their size, their implementation of policy changes is unlikely to have significant effects on terms of trade. The sectoral mix of in a country will also determine exposure to shocks and may muddy the relationship between size and impacts.

Figure 5 Change in real GNI, EU countries



Source: *Authors*

Note: *Calculated as changes in counterfactuals relative to the 2018 observed baseline.*

As discussed above, the model is a schematic representation of the global economy and so does not take account of all possible changes that could be associated with the EU's strategic autonomy policies. An approach to accounting for a wider range of changes – in areas such as productivity, technology, innovation, competition in markets and investment – is to use an aggregate estimate of the relationship between trade and GDP per capita from the literature. The model's changes in trade can be plugged into this relationship to give an idea of the types of welfare changes that might be seen if a broader range of factors were included in the model. This is the approach taken, for example, by a team of leading economists at the London School of Economics and Political Science (LSE) in their analysis of the UK's exit from the EU.[31] Using their preferred source for the relationship between trade and per capita income, and the estimates of trade changes discussed in the next section, suggests that the EU as a whole could see GDP per capita decline by 0.25% to 0.38% for the low scenario, 0.45% to 0.68% for the high scenario and 0.5% to 0.75% for the high scenario with retaliation. In other words,

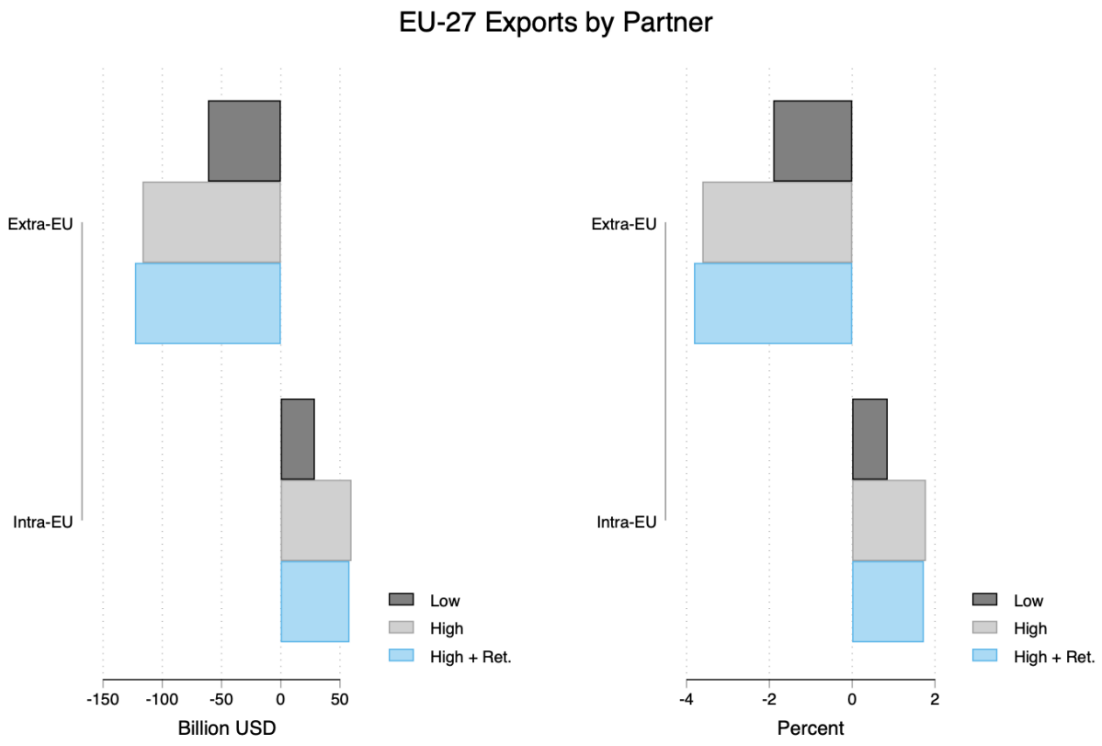
[31] Dhingra et al. (2017).

broader factors outside the strict scope of the model could result in impacts at least three times as large as those quoted above as direct outputs from the model. These impacts can be considered to be long-term impacts, as they are based on the observed relationship between trade and per capita income growth over time.

4.3.2 Trade effects – EU

Figure 6 summarises the model's logic following the defined policy changes. Price rises due to higher trade costs for third countries translate into more intra-EU trade, but it is insufficient to compensate for the loss in trade with third countries with the result that trade overall falls in all three scenarios and, as discussed above, real GNI falls as well.

Figure 6 Change in total imports of goods and services, EU countries

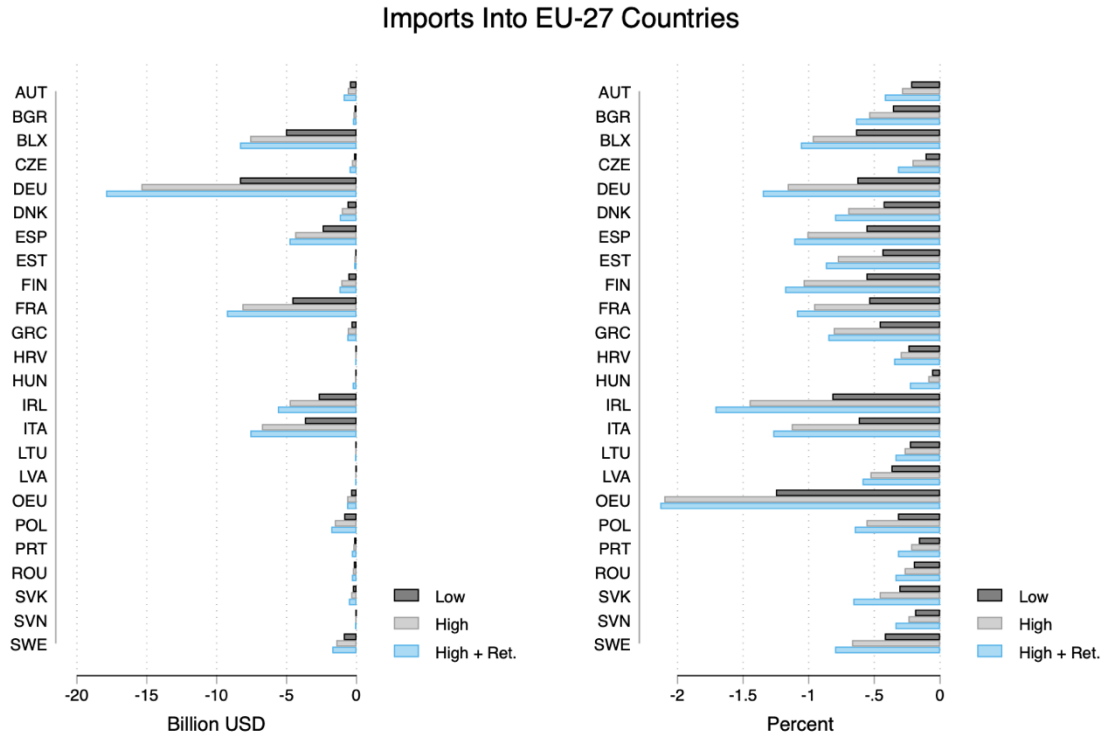


Source: *Authors*
Note: *Calculated as changes in counterfactuals relative to the 2018 observed baseline.*

Figure 7 shows that the price rises associated with more restrictive policies in the EU lead to a fall in total imports in all EU-27 countries. For the region as a whole, the fall amounts of $32 billion in the low scenario (0.5%), $56 billion (0.9%) in the high scenario, and $65 billion (1.0%) in the high scenario with retaliation. Again, there is some indication that effects are

largest in a proportional sense in smaller and more open economies. But there are also significant reductions in larger countries such as Germany and France, which have also been among the more vocal supporters of a number of the initiatives considered under the banner of strategic autonomy. The high scenario results in significantly larger losses than the low scenario, while retaliation has a relatively small impact.

Figure 7 Change in total imports of goods and services, EU countries



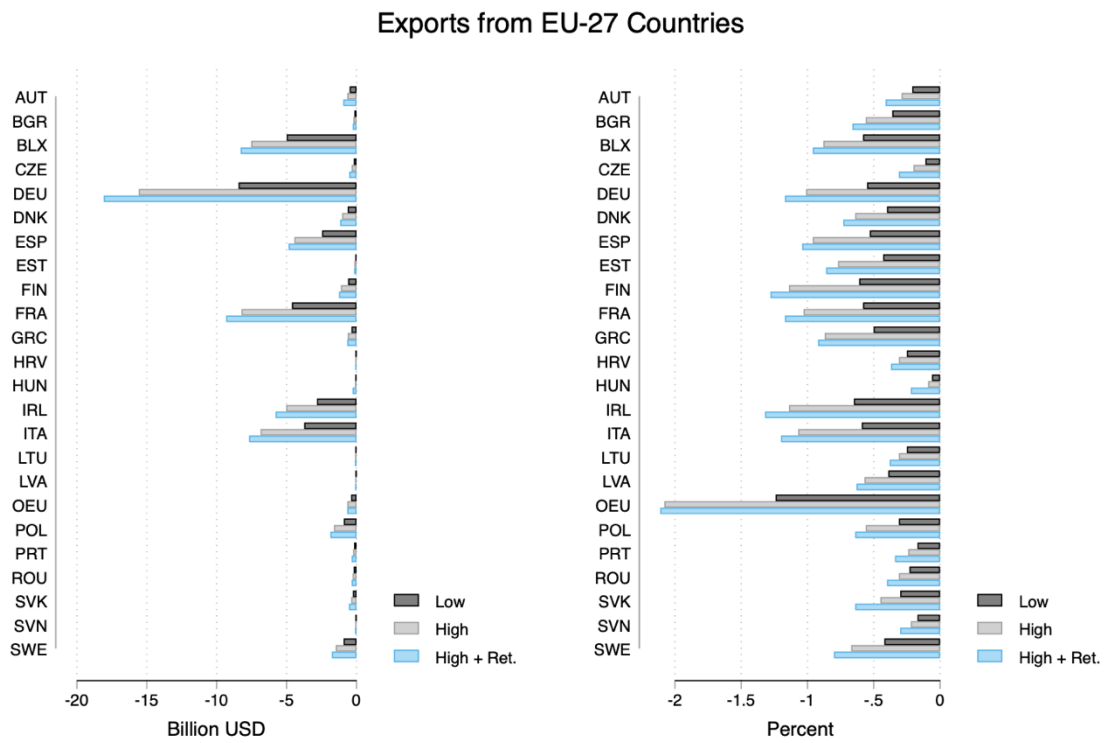
Source: *Authors*

Note: *Calculated as changes in counterfactuals relative to the 2018 observed baseline.*

In light of this result and the structure of the model, it is not surprising that Figure 8 shows falls in EU-27 exports of a similar magnitude. In the low scenario, the total effect amounts to $33 billion (-0.5%), compared with $57 billion (-0.9%) in the high scenario and $65 billion (-1.0%) in the high scenario with retaliation. There are three mechanisms at play. The first is the argument discussed above that, in general equilibrium, a tax on imports is a tax on exports. Second, introducing policy restrictions that make it more expensive to access foreign intermediates means that production costs go up and EU-27 exports become less competitive. And third, the focus on heterogeneity in measuring changes in services policies means that effects are symmetric: an increase in heterogeneity directly impacts both imports and exports.

Together, these three mechanisms mean that the largest proportion of the total trade losses facing the EU-27 in the three scenarios come from their own policies, not the reactions of trading partners in the ways those have been characterised in the retaliation scenario.

Figure 8 Change in total exports of goods and services, EU countries

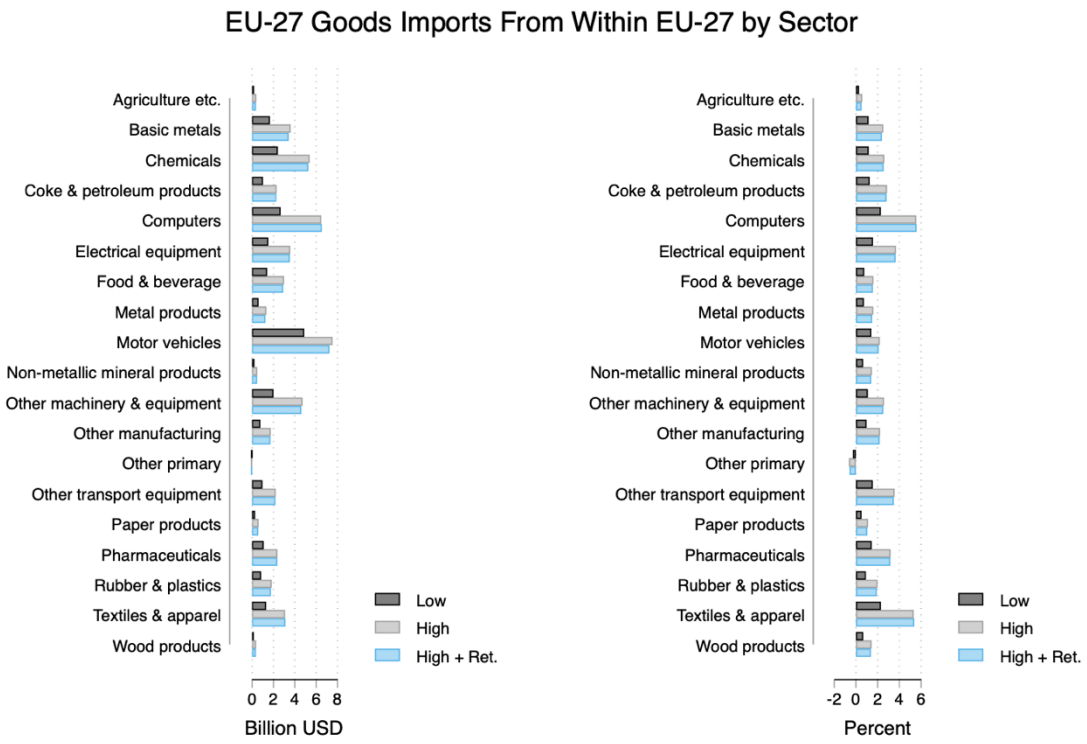


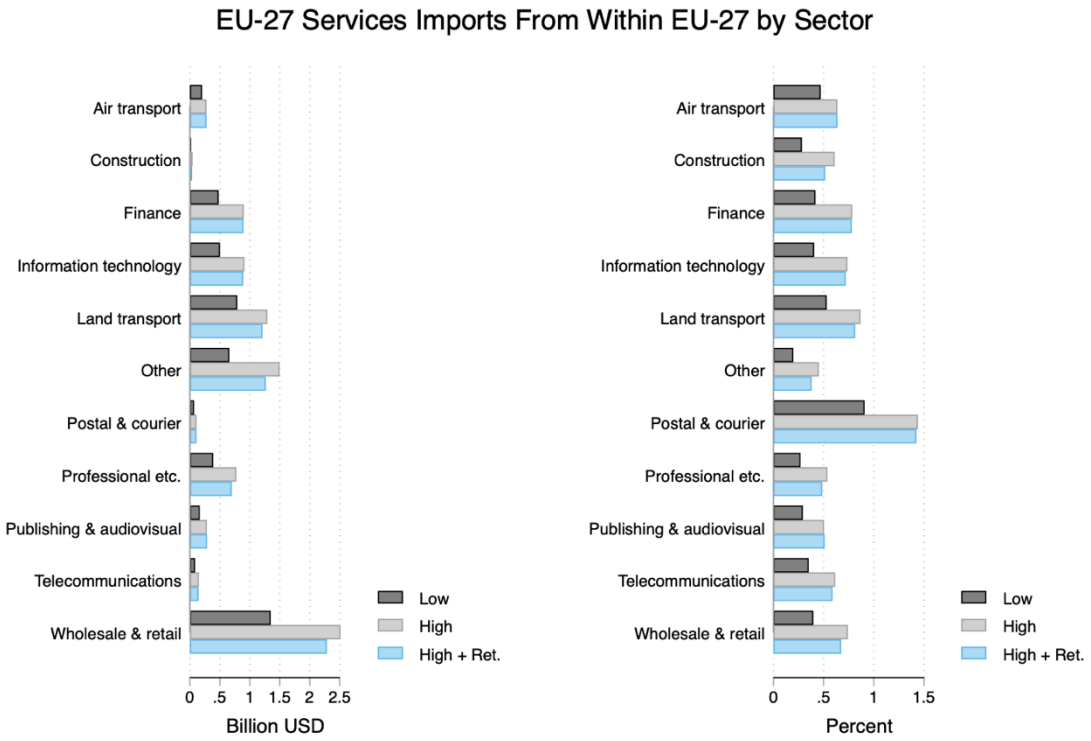
Source: *Authors*
Note: *Calculated as changes in counterfactuals relative to the 2018 observed baseline.*

While the above figures are useful in understanding the overall net results from the model, it is important to look at more disaggregated outcomes as well. An important first distinction is between intra- and extra-EU trade: when trade costs increase vis-à-vis third countries but stay constant for internal trade, the expectation would be that external trade falls but internal trade rises. Figure 9 bears out the first part of this intuition: intra-bloc trade increases in almost every sector. Moreover, the extent of that increase depends on the degree of restrictiveness of the policies imposed on third countries, so intra-regional trade rises most under the high and high with retaliation scenarios. While the percentages are not particularly high, the baseline of intra-EU trade is very large, so the numbers translate into significant amounts of additional intra-regional trade in dollar terms. Impacts are noticeably stronger in goods sectors relative to

services, with computers, electrical equipment, textiles and apparel, and transport equipment standing out.

Figure 9 Change in intra-regional exports of goods (upper panel) and services (lower panel) by sector, EU countries

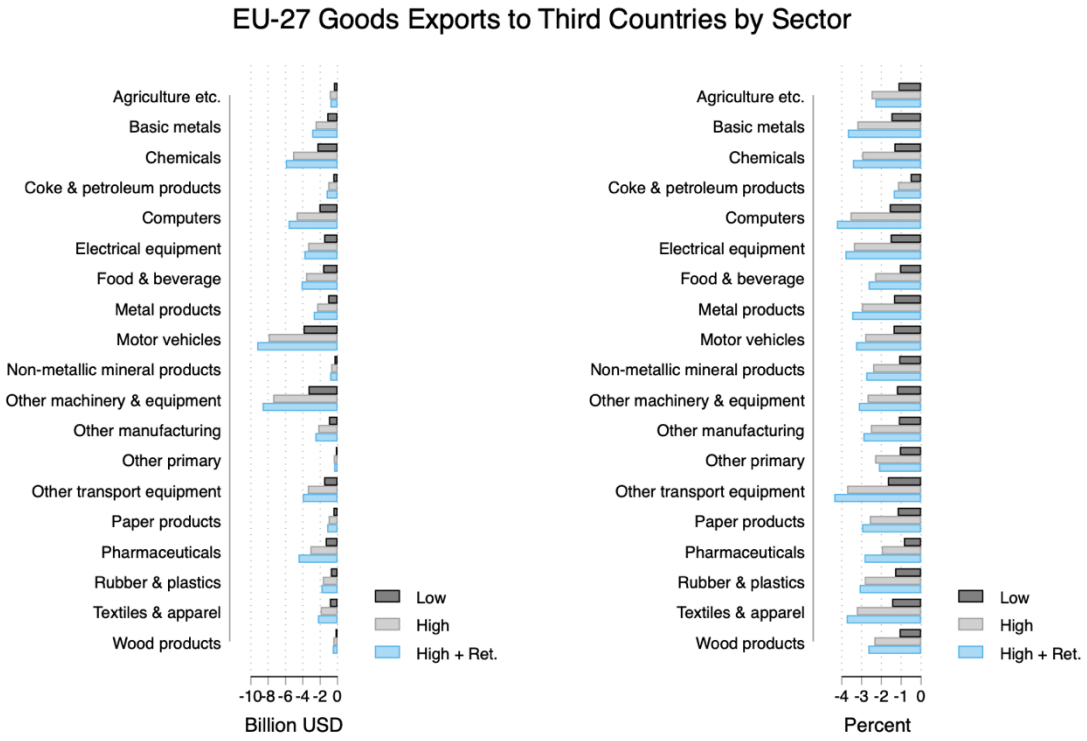


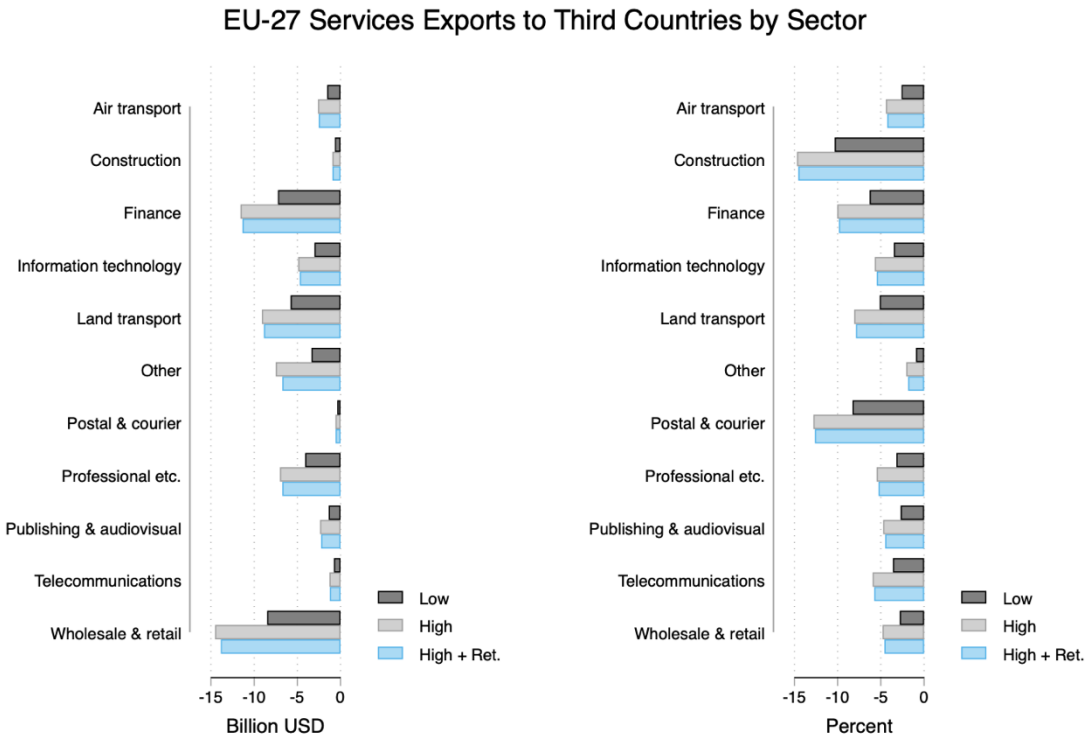


Source: *Authors*
Note: *Calculated as changes in counterfactuals relative to the 2018 observed baseline.*

Figure 10 shows that the model is also supportive of the second part of the intuition above: exports of goods and services to third countries fall across sectors. In dollar terms, the changes are largest in goods sectors, but proportional changes in services exports can be large. In a mirror image of the case for intra-regional trade, falls in exports to third countries are largest in the scenarios with a higher level of policy restrictiveness, namely the high scenario and the high with retaliation scenario. The reductions in extra-EU trade dominate increases in intra-EU trade. In terms of standout sectors in goods, the list is exactly the same as the sectors where intra-regional trade grew the most above. For services, proportional impacts – admittedly from small baselines – are largest in construction, postal and courier, finance and some transport sub-sectors.

Figure 10 Change in extra-regional exports of goods (upper panel) and services (lower panel) by sector, EU countries



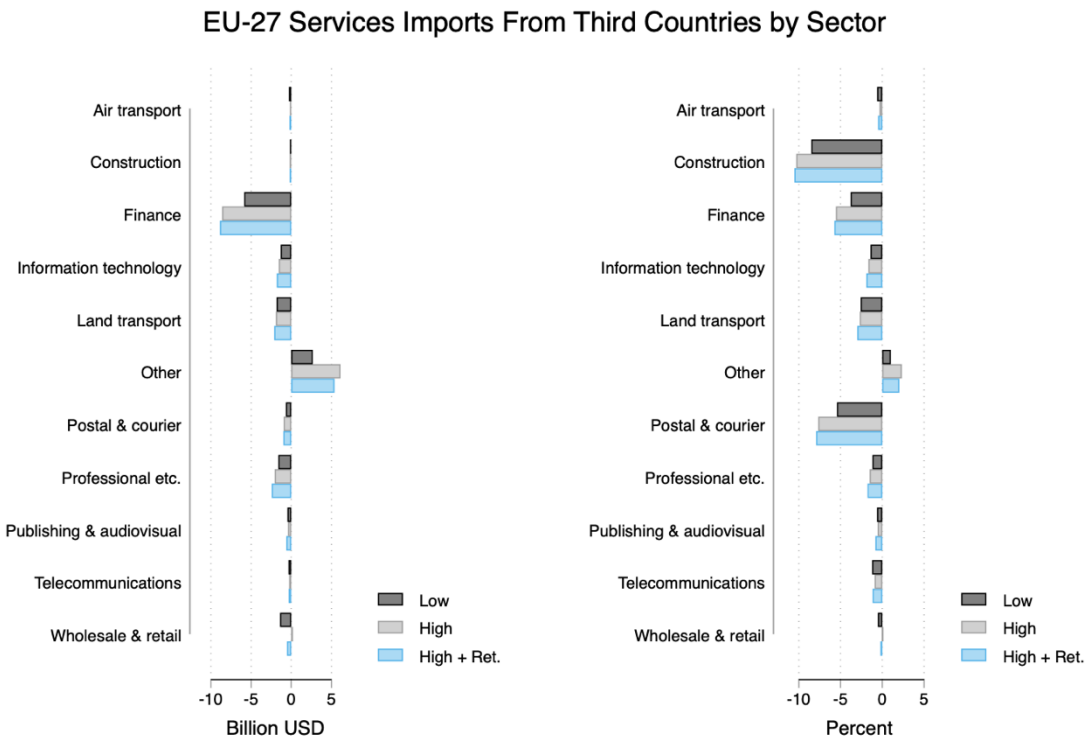


Source: *Authors*

Note: *Calculated as changes in counterfactuals relative to the 2018 observed baseline.*

Figure 11 examines the situation for imports. For goods, the analysis is straightforward: imports fall in nearly all sectors, with proportional impacts that vary relatively little from one sector to another. The same is generally true of services. However, it is worth explaining the positive result on imports in the "other" aggregate. This sector is not subject to any policy changes so, relative to other sectors, its price falls and hence trade volumes tend to increase. The list of sectors that are most affected in both goods and services is similar to the ones given above, though again, in the case of services, it is relevant that there are sometimes large proportional changes from a relatively small baseline.

Figure 11 Change in extra-regional imports of goods (upper panel) and services (lower panel) by sector, EU countries



Source: *Authors*
Note: *Calculated as changes in counterfactuals relative to the 2018 observed baseline.*

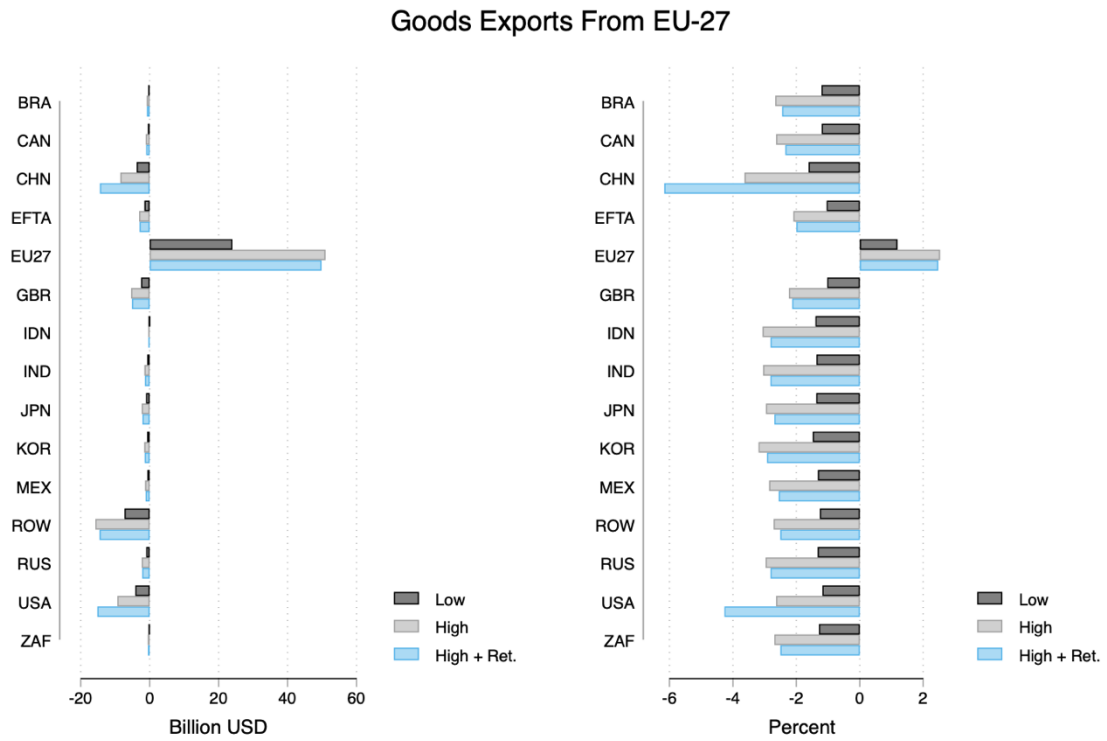
The above analysis clearly shows that trade effects in each scenario are very different for intra- and extra-EU trade. In general, intra-EU trade gets a boost because trade costs do not change. But extra-EU trade falls because trade costs on those routes increase. So there is some reallocation of activity from extra-EU partners to intra-EU partners. As the analysis of total trade effects above makes clear, the net effect, however, is negative for all countries and for the EU as a whole. That is, the increase in intra-regional trade is insufficient to offset the reduction in extra-regional trade. The resulting net loss of trade, as shown above, is 0.5% to 1.0% of baseline, depending on the scenario.

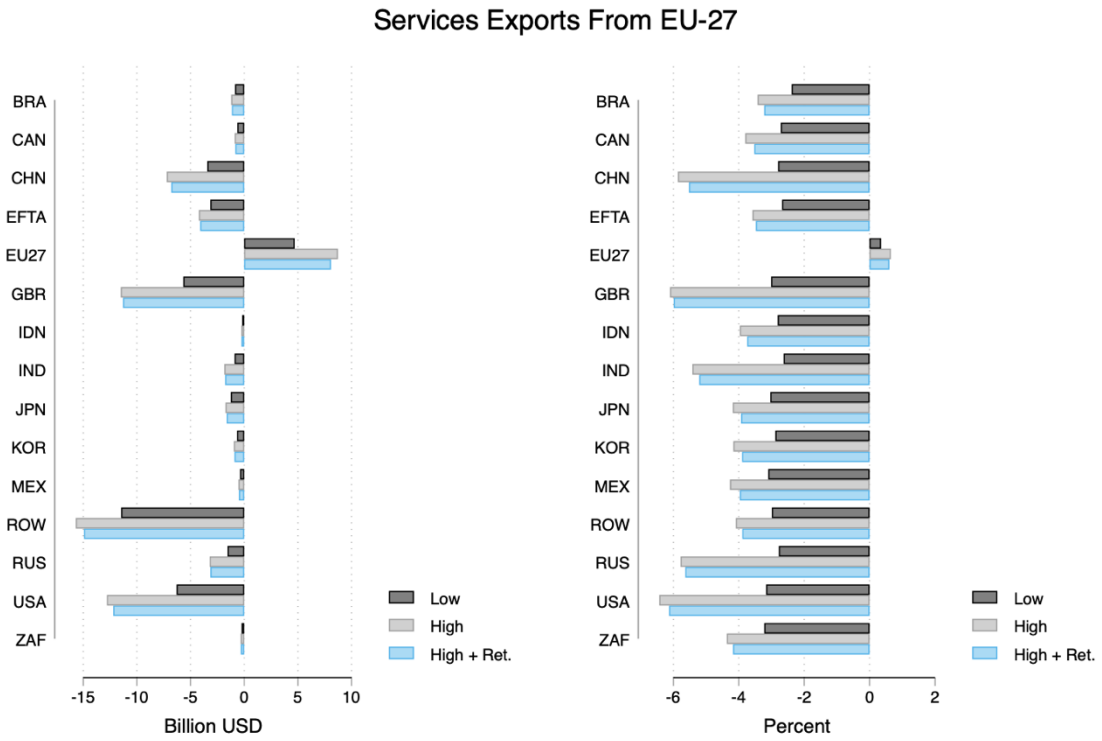
4.3.3 Trade effects by partner

It is also possible to break the model results out by trading partner. Figure 12 shows that EU countries uniformly see lower exports to third countries as a result of the policy changes. The three reasons noted above are key: (i) a tax on imports is a tax on exports in general equilibrium; (ii) increases in the cost of imported intermediates; and (iii) the reallocation of spending towards the internal market due to relative price changes. The degree of the loss is linked to the degree of restrictiveness of the policy regime and is substantially higher under the high and high with retaliation scenarios. Intra-EU trade, aggregated over all sectors,

displays the mirror image pattern. However, as the macroeconomic results above made clear, the increase in intra-regional trade, even combined with improved terms of trade, is insufficient to compensate in a national income sense for reduced trade volumes with other countries.

Figure 12 Change in extra-regional exports of goods (upper panel) and services (lower panel) by partner, EU countries

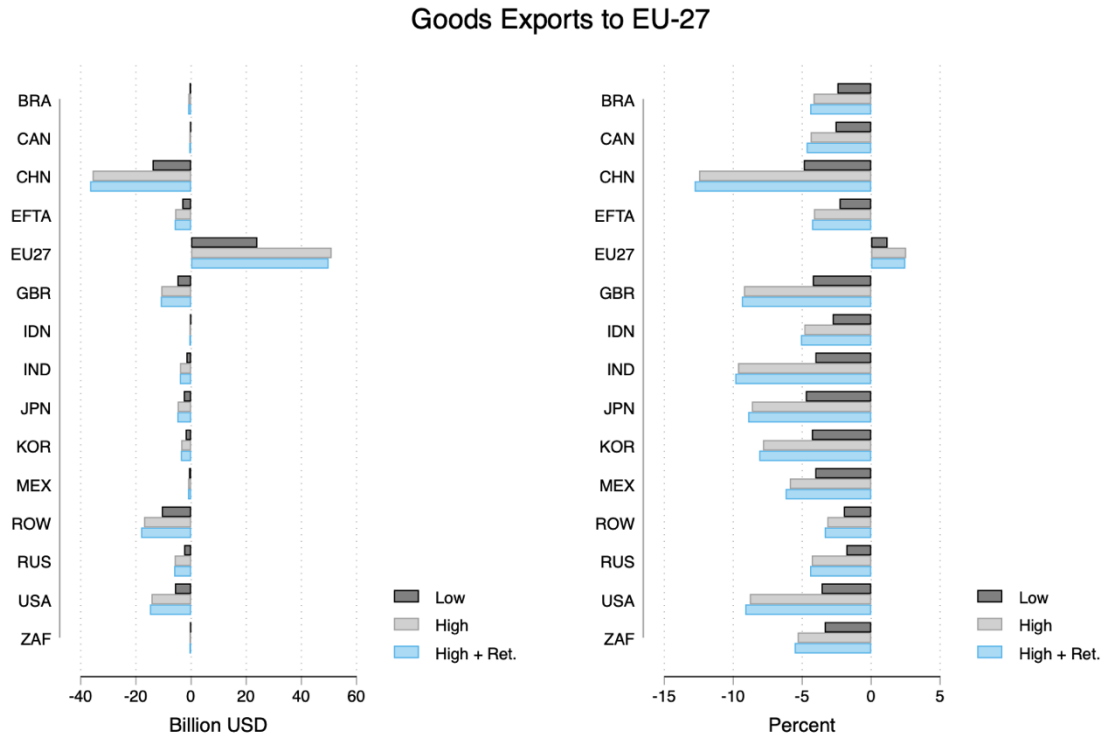


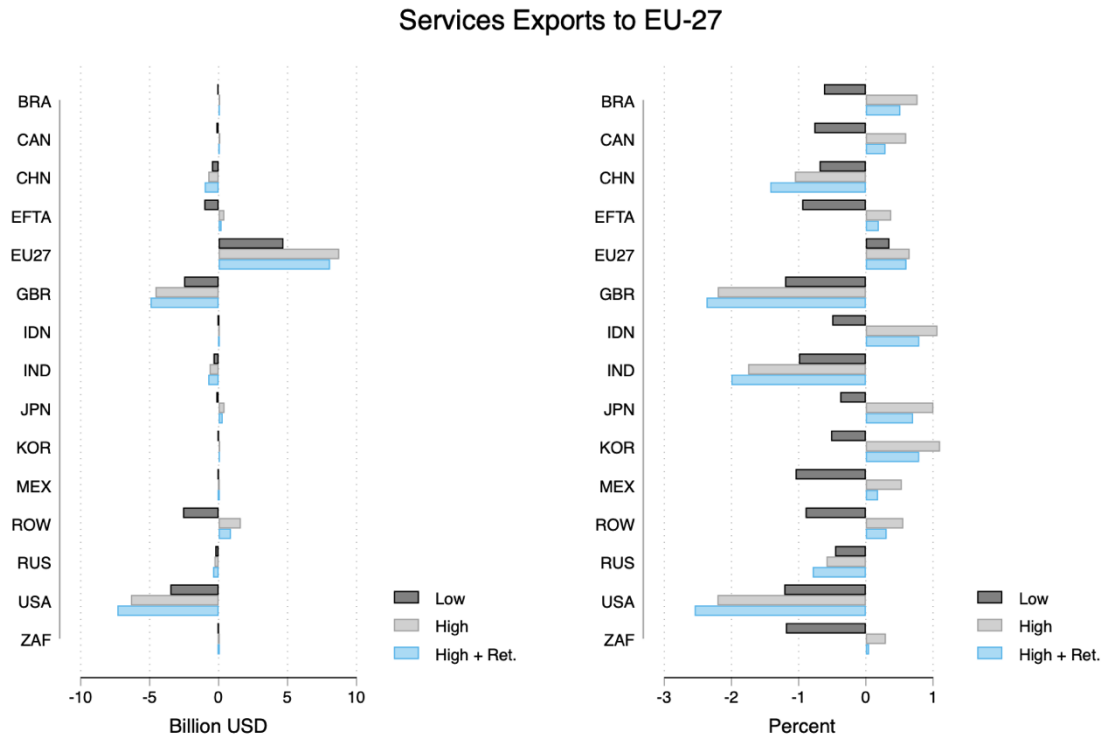


Source: *Authors*
Note: *Calculated as changes in counterfactuals relative to the 2018 observed baseline.*

Figure 13 makes the same points from the inverse perspective, namely imports into the EU from third countries. For goods, the situation is clear: restrictive policies in the EU lower imports from third countries but boost intra-regional trade. The reason for this is that the restrictive EU policies directly increase the cost of foreign goods relative to intra-bloc goods, thereby shifting business and consumer spending towards the internal market. However, the situation is more complex for services. Under some scenarios, some countries see increases in their services exports to the EU, which seems paradoxical. However, it is important to keep these results in perspective. In dollar terms, the changes involved are very small, as the left-hand panel makes clear. But the reason for this unexpected result is linked to the composition of these countries' trade. They typically see, either directly or indirectly, significant proportions of the "other" aggregate in their total services exports. As noted above, there is no policy change that directly affects that sector, so its relative price falls and trade increases. Therefore the baseline composition of services trade matters in terms of determining these sometimes very small absolute changes in country-level exports.

Figure 13 Change in extra-regional imports of goods (upper panel) and services (lower panel) by partner, EU countries





Source: *Authors*
Note: *Calculated as changes in counterfactuals relative to the 2018 observed baseline.*

In a similar way, the results for individual EU countries also require nuanced handling. While the analysis here has focused only on the net outcome in a national income sense at the country level, the results in Annex A go into further detail on trade figures for a selection of EU countries. A key consideration is the importance of intra-EU trade in each country's baseline. Where a country primarily trades intra-bloc, it is possible for the increase in that direction of trade to more than compensate for losses of extra-bloc exports. There is still an overall loss in a national income sense due to price changes and lost efficiency, but in a gross trade flow sense, some countries such as Denmark and Czechia and the aggregate of Belgium, the Netherlands and Luxembourg see overall increases in their exports of goods.

4.4 Policy discussion

The modelling allows us to consider the welfare effects of various policies, strategies and initiatives proposed under the banner of "strategic autonomy". It suggests that the concept of strategic autonomy has the potential to have significant trade effects that lead to losses in welfare. The absolute value of the effects are comparable to those associated with what might be expected from a relatively large FTA. Expanding the set of factors accounted for by the model to include a potentially wider range of factors, such as investment, productivity and

competition, suggests that the modelled estimates are a low bound for what could be expected over the longer term.

The economic intuition behind these effects is that the measures make trade within the EU more attractive than extra-EU trade, but the expansion of the former is not sufficient to compensate for the shrinkage of the latter. The fall in extra-EU trade, observed in both imports and exports, as a result of the proposed measures reflects the established principle that a tax on imports is a tax on exports. This also highlights the paradoxical nature of those interventionist measures that are intended to secure a greater degree of international competitiveness but end up undermining a jurisdiction's trade.

The welfare effects are not evenly distributed. As might be expected, smaller economies within the EU fair worse. Again, this is intuitive given that smaller economies are more trade dependent. Given that the main proponents of the concept of strategic autonomy are larger EU members states such as France and Germany, this could invite some reflection as to how the impacts of the concept across EU member states could be taken into account.

It is important to note that, in the modelling, the bulk of the effects are driven by the EU's own measures. Retaliation accounts for a small proportion of the impacts. This is partly because we make the conservative assumption that retaliation is limited to a few partners and a limited value of trade. In practice, partner responses may be more expansive. Retaliation in response to category 4 actions by the EU could be more intense and could involve a greater subset of partners.

This report developed a classification of policies, strategies and initiatives that have been proposed under the banner of strategic autonomy and identified four main categories. The impacts of each of these categories on trade are in line with the AVEs that we estimated for them.

Category 1 comprised measures aimed at strategic industrial policy objectives, often in tandem with geopolitical ones. Under both the low and high scenarios, these measures are the single largest source of trade costs and therefore account for the bulk of welfare effects. This partly reflects the scope of their coverage, which is consistent with evidence regarding their proliferation over the last decade, and the important role that would be assigned to them under the EU's current thinking with regard to specific sectors and cross-cutting interventions under its new industrial strategy. From a policy perspective, category 1 is dominated by measures such as subsidies and preferential procurement, which tend to be relatively weakly disciplined by international rules. The findings add further evidence to the significant costs associated with "murky" protectionism, which can be difficult to detect.

The modelling only takes account of the effects of the EU's implementation of these measures. It does not make any assumption as to how far partners could implement similar measures as

part of a “policy reaction function” (as seen, for example, in the past use of subsidies for large civil aircrafts).[32] To the extent that the widespread use of subsidies and similar measures by the EU prompts similar responses from partners, the overall costs to the EU and to partners would rise.

Category 2 measures, which focus on proposals to address market failures mainly in digital markets, create trade costs to the extent that they increase divergence between the EU and its partners in regulatory arrangements. The findings reflect the principle that, unlike category 1 measures, category 2 measures do not seek to directly influence conditions of entry and competition. However, they could have this effect by increasing fragmentation in digital regulation. The findings may be seen as a lower bound as they do not directly capture the possible effects of EU proposals related to digital markets on innovation and investment. These effects lie outside the scope of the type of models we used, which focus on trade costs. But even with that caveat in mind, the findings point to the value to the EU of finding mechanisms that mitigate the extent of regulatory divergence created by measures enacted under this category.

The effects of category 3, i.e. measures taken to correct market failures associated with production and processing methods, are relatively small, mainly because of the relatively limited product coverage of these measures. The extra-territorial aspects of their application could invite countermeasures from partners, which could in turn raise the overall costs imposed on EU trade. These are not explicitly modelled.

Finally, category 4 measures constitute an important source of trade costs. These are primarily contingent measures. We were conservative in our assumptions about the scope of their application, which, in turn, limited their welfare effects. We were also conservative about the scope of retaliation, limiting the partners and products involved. Since this category of measures largely reflects a preference for unilateralism over multilateralism, retaliation could be significant, with deeper adverse effects on trade and welfare. Moreover, the motivation for retaliation could be stronger given that the type of partner policies targeted by the EU are often the same, or very similar, to those EU policies that feature in category 1. This inconsistency in the EU’s overall position could create further systemic instability, which exacerbates costs.

What does this modelling tell us about the overall value to the EU of pursuing the concept of strategic autonomy? As already observed, the concept is multi-faceted, hence the classification that we developed in section 2.2. We also recognised that broad public policy objectives, whose legitimacy we did not seek to challenge, were embedded across the different categories, albeit to varying degrees. Moreover, the payoffs from achieving some of these objectives (for example, the social benefits of reduced environmental externalities or the

[32] More recent evidence of such a reaction function can be found in IMF, OECD. World Bank, WTO, (2022).

value of data security) are not ones we sought to quantify. What our estimates point to is how large these potential benefits would need to be to offset any adverse effects on welfare through trade.

The results obtained by combining our trade modelling with long-run estimates of the relationship between GDP and trade suggest that the strategic autonomy policies could have a range of additional effects that could reduce EU welfare further. On the one hand, making it harder to access world markets can negatively impact the incentives for EU firms to upgrade productivity over time. Similarly, reducing world market competition leads to less competitive markets within the EU, which in turn could reduce incentives to innovate. While the modelling does not make it possible to identify precisely which elements of the overall agenda might have such effects, it clearly points to such possibilities in an aggregate sense.

The modelling also points to ways in which some of these policy objectives could be pursued in ways that reduce the risks associated with the costs we quantified, for example through:

- The choice of industrial policy measures – in our terminology, substituting "red" measures with "green" ones, e.g. which correct for market failures in innovation and are not directly aimed at securing market share. From a policy perspective, this involves efforts to ensure that measures that correct market failures do not slide into becoming forms of "murky" protection;
- Measures to minimise the incidence of regulatory fragmentation; and
- A preference for working within established frameworks of rules over the unilateralism associated particularly with category 4 measures

The last point perhaps underscores the biggest risk associated with the concept of strategic autonomy that, by virtue of the EU's size, it creates a systemic unravelling of the norms and practices that have been of benefit to the EU and partners. This risk is reinforced by the observation made above that there are inconstancies between the EU's policy activism under category 1 and its willingness to target such activism under category 4 in partners. A more nuanced approach which tethered the EU's policy stance to core concepts such as non-discrimination, coherence and proportionality could, by contrast, minimise the downside risk of strategic autonomy, and would be more in keeping with the EU's ambition of being an "exporter" of good practices in economic governance.

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Annex A – Services trade – detailed results

The general model is written:

$exports_{ijt} = b_0 + + b_1 \boldsymbol{X_{ij}} + b_2 \boldsymbol{X_{ijt}} + b_3 trade\_cost + fixed\_effects + e_{ijt}$

for sector s (subscript omitted), importer i, exporter j and time t.

The equation is estimated in PPMLHDFE with standard errors clustered by country pair.[33]

- X_{ij} are time-invariant country-pair characteristics such as distance comlang that are retained in absence of pair fixed effects.
- X_{ijt} are time-varying country-pair characteristics, in this case an RTA dummy.
- Fixed-effects structures tested are:
  - fx1 : Importer-year, exporter-year; $u_{it} + u_{jt}$
  - fx2 : Importer, exporter (2018 only) $u_i + u_j$ if t=2018
  - fx3 : Importer-year, exporter-year, pair; $u_{it} + u_{jt} + u_{ij}$
- trade_cost is tested in a number of different combinations, using both STRIs and the heteroegeneity score:
  - tc1 : $stri\_imp_{ijt} + border_{ij}$
  - tc2 : $stri\_imp_{ijt} + border_{ij} + h\_SCORE_{ijt}$
  - tc3 : $border_{ij} + h\_SCORE_{ijt}$

Regarding trade costs, ideally, both importer and exporter STRI terms would be used. Note that with these data in the presence of exporter-year and importer-year fixed effects, the second STRI term drops out due to collinearity, and importer-driven or exporter-driven interpretations cannot be distinguished. In terms of modelling incremental changes, the most easily interpretable result is tc3, where any divergence increases the h_SCORE and reduces trade.

Regarding fixed-effects structure, it should be noted that with T small there is fairly limited temporal variation in the STRI, and results driven by it may be problematic. FX2 removes temporal variation from the data and attributes all the policy impacts to bilateral variation. It gives very similar results to FX1. In FX3, the country-pair dummies mean that all bilateral

[33] The general syntax is written:

```
ppmlhdfe exports lndist lngdp_exp lngdp_imp colony comcol comlang_off rta fta  "`trade_cost_vars'" if sector=="`sector'",
        absorb("`fixed_effects'") cluster(pair)
```

variation is absorbed and all remaining effects are driven by temporal variation. The results obtained under FX3 do not appear informative.

Results

Results from the core set of fixed effects (importer-year and exporter-year, denoted FX1) are shown below. In the vast majority of cases, the STRI, border and heterogeneity scores are negative and statistically significant. Overall, they appear broadly similar in magnitude to equivalent results estimated elsewhere, although there is a reasonable degree of dispersion in terms of sector-level effects. For both the STRI and heterogeneity score variable, marginal effects are given by $\exp(\beta * \Delta X)-1$.

Table 5 STRI and border – model with importer-year and exporter-year fixed effects (Model TC1FX1)

	IMPORTER STRI		BORDER	
	BETA	STD.E	BETA	STD.E
Construction	-9.73***	(1.04)	-6.95***	(0.31)
Wholesale and retail	-3.57***	(0.44)	-3.17***	(0.19)
Land transport	-3.07***	(0.33)	-2.75***	(0.18)
Water transport	0.05	(1.34)	-3.70***	(0.52)
Air transport	0.003	(0.86)	-2.70***	(0.49)
Postal and courier	-6.94***	(0.79)	-3.35***	(0.31)
Publishing and AV	-2.12**	(0.89)	-3.71***	(0.30)
Telecommunications	-3.29***	(0.49)	-4.98***	(0.23)
IT and information services	-0.12	(1.23)	-4.55***	(0.42)
Financial and insurance	-7.95***	(1.09)	-3.95***	(0.43)
Professional, technical	-1.29*	(0.67)	-4.31***	(0.29)
Aggregate – all services	-4.50***	(0.55)	-3.60***	(0.20)
Aggregate – transport/ distributive	-4.52***	(0.51)	-3.31***	(0.19)
Aggregate – business services	-5.25***	(0.85)	-3.98***	(0.31)

Source: Frontier analysis of TiVA and OECD STRI data
*Note: Significance levels: *** p<0.01, ** p<0.05, *, p<0.1.*

Table 6 Border, STRI and H_SCORE – model with importer-year and exporter-year fixed effects (Model TC2FX1)

	BORDER		IMPORTER STRI		H_SCORE	
	BETA	STD.E	BETA	STD.E	BETA	STD.E
Construction	-5.07***	(1.11)	-6.84***	(0.28)	-4.39***	(0.51)
Wholesale and retail	-4.83***	(0.66)	-2.8***	(0.17)	0.76**	(0.33)
Land transport	-2.16***	(0.37)	-2.64***	(0.18)	-0.96***	(0.32)
Water transport	-1.31	(0.96)	-1.63***	(0.30)	0.24	(0.47)
Air transport	0.59	(0.82)	-1.93***	(0.49)	-2.19***	(0.33)
Postal and courier	-5.68***	(0.99)	-2.88***	(0.30)	-1.08*	(0.63)
Publishing and AV	-2.7***	(0.91)	-2.97***	(0.26)	-0.2	(0.43)
Telecommun -ications	-2.86***	(1.09)	-4.47***	(0.24)	-0.37	(0.72)
IT and information services	0.28	(0.98)	-3.59***	(0.34)	-1.72***	(0.53)
Financial and insurance	-5.73***	(1.83)	-3.14***	(0.43)	-2.56**	(1.01)
Professional, technical	-0.78	(0.76)	-3.49***	(0.30)	-1.59***	(0.49)
Aggregate – all services	-3.09***	(0.17)	-4.19***	(0.70)	-0.37	(0.36)
Aggregate – transport/ distributive	-2.99***	(0.17)	-4.83***	(0.67)	0.28	(0.38)
Aggregate – business services	-3.16***	(0.29)	-3.56***	(1.07)	-2.16***	(0.57)

Source: Frontier analysis of TiVA and OECD STRI data

*Note: Significance levels: *** p<0.01, ** p<0.05, *, p<0.1.*

Table 7 Border and H_score – results estimated for 2018 only (Model TC3FX1)

	BORDER		H_SCORE	
	BETA	STD.E	BETA	STD.E
Construction	-7.79***	(0.20)	-5.44***	(0.47)
Wholesale and retail	-3.3***	(0.15)	-1.15***	(0.23)
Land transport	-3.06***	(0.14)	-2.03***	(0.28)
Water transport	-1.88***	(0.22)	-0.23	(0.45)
Air transport	-1.65***	(0.18)	-2.15***	(0.35)
Postal and courier	-3.84***	(0.26)	-4.32***	(0.46)
Publishing and AV	-3.38***	(0.19)	-1.18***	(0.38)
Telecommunications	-4.76***	(0.18)	-2.05***	(0.31)
IT and information services	-3.54***	(0.26)	-1.68***	(0.53)
Financial and insurance	-4.01***	(0.31)	-4.78***	(0.62)
Professional, technical	-3.66***	(0.20)	-1.74***	(0.46)
Aggregate – all services	-3.71***	(0.14)	-2.1***	(0.32)
Aggregate – transport/ distributive	-3.72***	(0.16)	-1.64***	(0.38)
Aggregate – business services	-3.62***	(0.20)	-3.56***	(0.43)

Source: Frontier analysis of TiVA and OECD STRI data
*Note: Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table 8 STRI and border – results estimated for 2018 only (Model TC1FX2)

	IMPORTER STRI		BORDER	
	BETA	STD.E	BETA	STD.E
Construction	-9.73***	(1.04)	-6.95***	(0.31)
Wholesale and retail	-3.57***	(0.44)	-3.17***	(0.19)
Land transport	-3.07***	(0.33)	-2.75***	(0.18)
Water transport	0.05	(1.34)	-3.7***	(0.52)
Air transport	0.003	(0.86)	-2.7***	(0.49)
Postal and courier	-6.94***	(0.79)	-3.35***	(0.31)
Publishing and AV	-2.12**	(0.89)	-3.71***	(0.30)
Telecommunications	-3.29***	(0.49)	-4.98***	(0.23)
IT and information services	-0.12	(1.23)	-4.55***	(0.42)
Financial and insurance	-7.95***	(1.09)	-3.95***	(0.43)

	IMPORTER STRI		BORDER	
	BETA	STD.E	BETA	STD.E
Professional, technical	-1.29*	(0.67)	-4.31***	(0.29)
Aggregate – all services	-4.68***	(0.55)	-3.56***	(0.21)
Aggregate – transport/ distributive	-4.75***	(0.54)	-3.3***	(0.20)
Aggregate – business services	-5.41***	(0.87)	-3.87***	(0.33)

Source: *Frontier analysis of TiVA and OECD STRI data*

Note: *Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table 9 Border, STRI and H_SCORE – results estimated for 2018 only (Model TC2FX2)

	BORDER		IMPORTER STRI		H_SCORE	
	BETA	STD.E	BETA	STD.E	BETA	STD.E
Construction	-5.89***	(1.24)	-6.53***	(0.33)	-4.21***	(0.56)
Wholesale and retail	-5.18***	(0.80)	-2.72***	(0.18)	0.53	(0.39)
Land transport	-2.79***	(0.42)	-2.59***	(0.20)	-0.93***	(0.34)
Water transport	-0.99	(1.10)	-2.29***	(0.41)	-0.24	(0.62)
Air transport	1.59*	(0.93)	-2.31***	(0.57)	-2.54***	(0.38)
Postal and courier	-6.14***	(1.08)	-2.99***	(0.35)	-0.8	(0.69)
Publishing and AV	-2.38***	(0.91)	-2.87***	(0.27)	-0.39	(0.46)
Telecommun -ications	-2.45**	(1.01)	-4.54***	(0.23)	-0.67	(0.65)
IT and information services	1.21	(1.09)	-3.67***	(0.36)	-1.7***	(0.58)
Financial and insurance	-5.91***	(1.91)	-2.87***	(0.49)	-3.05***	(1.03)
Professional, technical	-0.58	(0.75)	-3.38***	(0.29)	-1.79***	(0.47)
Aggregate – all services	-3.05***	(0.18)	-4.1***	(0.74)	-0.6	(0.40)

	BORDER		IMPORTER STRI		H_SCORE	
	BETA	STD.E	BETA	STD.E	BETA	STD.E
Aggregate – transport/ distributive	-2.97***	(0.19)	-4.9***	(0.77)	0.17	(0.47)
Aggregate – business services	-3.02***	(0.31)	-3.32***	(1.11)	-2.51***	(0.57)

Source: Frontier analysis of TiVA and OECD STRI data
*Note: Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table 10 Border and H_score – results estimated for 2018 only (Model TC3FX2)

	BORDER		H_SCORE	
	BETA	STD.E	BETA	STD.E
Construction	-7.65***	(0.23)	-5.52***	(0.51)
Wholesale and retail	-3.27***	(0.16)	-1.51***	(0.27)
Land transport	-3.14***	(0.15)	-2.27***	(0.32)
Water transport	-2.48***	(0.30)	-0.59	(0.51)
Air transport	-1.56***	(0.22)	-2.44***	(0.39)
Postal and courier	-3.91***	(0.29)	-4.44***	(0.48)
Publishing and AV	-3.23***	(0.19)	-1.28***	(0.39)
Telecommunications	-4.78***	(0.17)	-2.13***	(0.31)
IT and information services	-3.45***	(0.27)	-1.47***	(0.57)
Financial and insurance	-3.81***	(0.33)	-5.3***	(0.65)
Professional, technical	-3.52***	(0.19)	-1.9***	(0.45)
Aggregate – all services	-3.71***	(0.14)	-2.1***	(0.32)
Aggregate – transport/ distributive	-3.72***	(0.16)	-1.64***	(0.38)
Aggregate – business services	-3.62***	(0.20)	-3.56***	(0.43)

Source: Frontier analysis of TiVA and OECD STRI data
*Note: Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table 11 STRI (border dropped) – results with importer-year, exporter-year and country-pair fixed effects (Model TC1FX3)

	IMPORTER STRI	
	BETA	STD.E
Construction	2.49**	(1.16)
Wholesale and retail	1.95***	(0.33)
Land transport	-0.26	(0.46)
Water transport	9.7***	(2.37)
Air transport	-0.84***	(0.32)
Postal and courier	0.49*	(0.28)
Publishing and AV	2.28***	(0.54)
Telecommunications	-3.02***	(0.49)
IT and information services	10.48***	(1.13)
Financial and insurance	-1.49	(2.01)
Professional, technical	1.97*	(1.10)
Aggregate – all services	3.07***	(0.61)
Aggregate – transport/distributive	2.65***	(0.48)
Aggregate – business services	2.52**	(1.02)

Source: *Frontier analysis of TiVA and OECD STRI data*
Note: *Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table 12 STRI and H_score (border omitted) – results estimated for 2018 only (Model TC3FX2)

	STRI		H_SCORE	
	BETA	STD.E	BETA	STD.E
Construction	1.41	(1.31)	2.39**	(1.10)
Wholesale and retail	1.67***	(0.44)	0.19	(0.17)
Land transport	-1.82***	(0.55)	1.25***	(0.28)
Water transport	6.47***	(2.04)	4.03***	(0.95)
Air transport	-1.08***	(0.29)	-0.21	(0.20)
Postal and courier	0.66**	(0.30)	-2.82***	(0.93)
Publishing and AV	2.21***	(0.70)	-0.35	(0.34)
Telecommunications	-1.53**	(0.69)	-1.17***	(0.39)
IT and information services	10.2***	(1.15)	-0.5	(0.59)
Financial and insurance	-1.31	(2.20)	-1.59*	(0.95)
Professional, technical	4.97***	(1.34)	-0.22	(0.57)

	STRI		H_SCORE	
	BETA	STD.E	BETA	STD.E
Aggregate – all services	2.49***	(0.52)	0.6*	(0.34)
Aggregate – transport/ distributive	1.77***	(0.45)	0.57**	(0.24)
Aggregate – business services	3.34***	(1.13)	-0.75	(0.50)

Source: Frontier analysis of TiVA and OECD STRI data

*Note: Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table 13 H_score (border dropped) – results with importer-year, exporter-year and country-pair fixed effects (Model TC3FX3)

	H-SCORE	
	BETA	STD.E
Construction	2.5**	(1.05)
Wholesale and retail	0.72***	(0.11)
Land transport	0.69***	(0.20)
Water transport	4.77***	(1.05)
Air transport	-0.02	(0.20)
Postal and courier	-2.67***	(0.95)
Publishing and AV	0.14	(0.26)
Telecommunications	-1.66***	(0.29)
IT and information services	-0.16	(0.76)
Financial and insurance	-1.7*	(0.90)
Professional, technical	0.27	(0.65)
Aggregate – all services	1.18***	(0.34)
Aggregate – transport/distributive	1.07***	(0.21)
Aggregate – business services	-0.48	(0.54)

Source: Frontier analysis of TiVA and OECD STRI data

Note: Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

Annex B – Goods trade – detailed results

GTA can be linked to TiVA by aggregating measures up from 3-digit CPC codes up to the ISIC sector groupings in TiVA. The resulting dataset runs from 2010 to 2018, and full bilateral variation means that country-pair fixed effects can be used alongside importer-year and exporter-year fixed effects. This allows the following general form of model to be estimated:

$$Exports_{ijt} = b_0 + \mathbf{b_1 policy\_importer_{ijt}} + \mathbf{b_2 policy\_exporter_{jit}} + b_3 rta_{ijt} + b_4 fta_{ijt} + \mathbf{dummy}_{it} + \mathbf{dummy}_{jt} + \mathbf{dummy}_{ij} \text{ for sector s}$$

A wide variety of policy variables are included in the dataset. GTA classifies policies in terms of a red/yellow/green system of their expected effect and a detailed hierarchy of policy domain headings. Including even the full range of high level headings, red/yellow/green, and for both partners would give a large set of parameters liable to contain many implausible results. We therefore run a sequence of progressively more elaborate models in terms of the array of trade policy variables:

- Model 1 includes a simple count of reds and greens implemented by the importer. Reds have a negative effect of -0.007 and greens a positive effect of 0.006.
- Model 2 excludes export-related policies from the importer's score but gives very similar results.
- Model 3 adds in export-related policies by the exporter. Exporter reds have a negative insignificant effect and greens a positive significant effect.
- Model 4 splits out the importer's measures in terms of three groups: a) import/ subsidy/dumping; b) export-related; c) procurement/other/local content. The importers' export policies have no effect, but a and c both do, especially c. The exporter's export policies are not modelled.
- Model 5 is as per 4 but adds back the exporter's export policies. Red export policies have a negative significant effect and greens have a positive insignificant effect. The coefficients on importer's policies change very little from in 4.
- Model 6 is as per 5 but drops the importer's export policies with little change to results.
- Model 7 includes the full set of policies for both importer and exporter. Importer results are less clear cut than in 5 but procurement/local content remains strong. Some of the exporter's policies (not just in relation to exports) are also significant, although the rationale is not clear.

The variables of interest are summarised in the table below, with the beta followed by standard error in parentheses, and stars for significance (***=1%, **=5%, *=10%). The preferred specification is model 2 estimated over all goods. As can be seen, model 3 seeks to split out export policies by the exporter, but these effects are not usually significant. With further measure types split out in models 4, 5 and 6, these often do not have statistical significance and, although the sign typically accords with intuition, the magnitude of effects can differ markedly. A parsimonious approach in the absence of consistent evidence to the contrary is that measures have similar magnitudes of effect.

Commenting on sector group splits, we see that "all goods", "all manufacturing" and "tech manufacturing" all show strong evidence of negative impacts of importer reds in models 1, 2 and 3. Basic manufacturing and raw materials show considerably less clear results. One interpretation would be that for these groupings of sectors, particular types of measures or policy shocks may have undue influence so that trade responds differently.

	All goods D1-33	All manufacturing D10-33	Tech manufacturing D26-33	Basic manufacturing D10-25	Raw materials D1-9
Model 1					
gt_rd_all - All importer reds (inc. FDI, tech, export)	-0.055*** (0.015)	-0.045*** (0.012)	-0.035*** (0.008)	-0.012 (0.02)	-0.137 (0.091)
gt_gn_all - All importer greens (inc. FDI, tech, export)	0.066*** (0.021)	0.06*** (0.015)	0.014 (0.013)	0.019 (0.038)	0.14*** (0.047)
Model 2					
gt_rd - Importer reds (inc. FDI, tech, but not export)	-0.052*** (0.015)	-0.041*** (0.013)	-0.035*** (0.008)	-0.01 (0.02)	-0.133 (0.096)
gt_gn - Importer greens (inc. FDI, tech, but not export)	0.068*** (0.022)	0.057*** (0.016)	0.016 (0.013)	0.017 (0.042)	0.171*** (0.049)
Model 3					
gta_red_mp - Importer's import, dumping and subsidy reds	-0.057*** (0.016)	-0.054*** (0.013)	-0.031*** (0.008)	-0.022 (0.02)	-0.084 (0.101)
gta_red_xp - Importer's export-related reds	0.065*** (0.022)	0.043*** (0.016)	0.019 (0.014)	-0.002 (0.045)	0.179*** (0.05)
grv_red_xp - Exporter's export-related reds	-0.012 (0.279)	-0.065 (0.169)	-0.161 (0.141)	-0.064 (0.332)	-0.408** (0.191)
grv_grn_xp - Exporter's export-related greens	0.087 (0.177)	0.381** (0.176)	-0.07 (0.08)	0.321 (0.23)	-0.182 (0.14)
Model 4					
gta_red_mp - Importer's import, dumping and subsidy reds	-0.095*** (0.019)	-0.087*** (0.015)	-0.041*** (0.009)	-0.043 (0.03)	-0.145 (0.109)

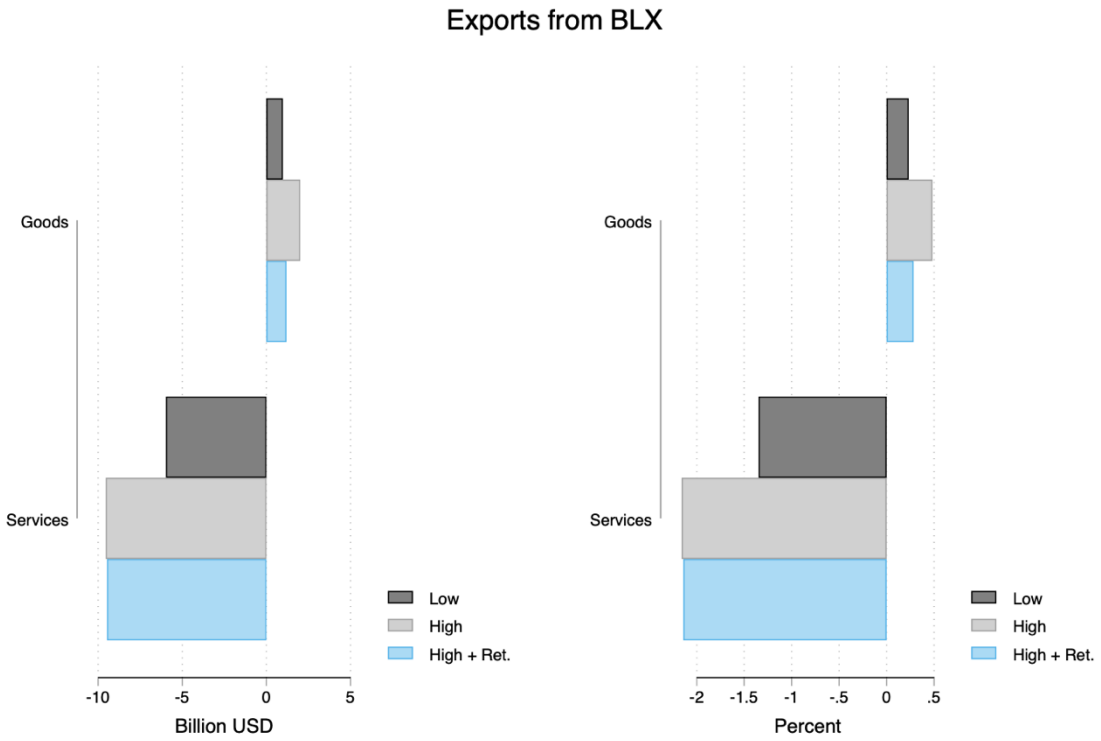
gta_red_xp - Importer's export-related reds	0.05 (0.259)	0.179 (0.173)	-0.082 (0.151)	0.065 (0.325)	-0.203 (0.238)
gta_red_op - Importer's procurement/content/other reds	0.043 (0.048)	-0.042 (0.04)	0.061 (0.054)	-0.068 (0.043)	0.192 (0.299)
gta_grn_mp - Importer's import, dumping and subsidy greens	0.081*** (0.024)	0.042** (0.019)	0.018 (0.013)	-0.009 (0.051)	0.202*** (0.054)
gta_grn_xp - Importer's export-related greens	-0.225 (0.203)	0.202 (0.182)	-0.118* (0.063)	0.145 (0.289)	-0.144 (0.15)
gta_grn_op - Importer's procurement/content/other greens	0.546*** (0.177)	0.521*** (0.163)	0.116* (0.066)	0.928*** (0.332)	-0.366 (0.275)
Model 5					
gta_red_mp - Importer's import, dumping and subsidy reds	- 0.095*** (0.019)	-0.087*** (0.015)	-0.041*** (0.009)	-0.046 (0.031)	-0.126 (0.111)
gta_red_xp - Importer's export-related reds	-0.035 (0.317)	0.142 (0.317)	0.077 (0.264)	-0.021 (0.504)	0.199 (0.278)
gta_red_op - Importer's procurement/content/other reds	0.043 (0.049)	-0.041 (0.038)	0.065 (0.053)	-0.073* (0.042)	0.275 (0.305)
gta_grn_mp - Importer's import, dumping and subsidy greens	0.081*** (0.024)	0.042** (0.018)	0.019 (0.014)	-0.015 (0.05)	0.208*** (0.055)
gta_grn_xp - Importer's export-related greens	-0.214 (0.228)	0.219 (0.268)	-0.068 (0.126)	0.059 (0.31)	-0.031 (0.174)
gta_grn_op - Importer's procurement/content/other greens	0.546*** (0.177)	0.522*** (0.159)	0.119* (0.065)	0.894*** (0.336)	-0.403 (0.275)
grv_red_xp - Exporter's export-related reds	0.125 (0.36)	0.051 (0.333)	-0.22 (0.264)	0.09 (0.559)	-0.473** (0.212)
grv_grn_xp - Exporter's export-related greens	-0.018 (0.193)	-0.027 (0.222)	-0.064 (0.134)	0.201 (0.246)	-0.197 (0.16)
Model 6					
gta_red_mp - Importer's import, dumping and subsidy reds	- 0.099*** (0.019)	-0.084*** (0.015)	-0.041*** (0.009)	-0.045 (0.029)	-0.126 (0.111)
gta_red_op - Importer's procurement/content/other reds	0.024 (0.048)	-0.028 (0.037)	0.067 (0.053)	-0.072* (0.043)	0.261 (0.287)
gta_grn_mp - Importer's import, dumping and subsidy greens	0.074*** (0.023)	0.049*** (0.016)	0.019 (0.014)	-0.012 (0.044)	0.209*** (0.055)
gta_grn_op - Importer's procurement/content/other greens	0.527*** (0.165)	0.544*** (0.16)	0.113* (0.066)	0.903*** (0.34)	-0.397 (0.268)
grv_red_xp - Exporter's export-related reds	0.12 (0.279)	0.142 (0.185)	-0.142 (0.141)	0.079 (0.377)	-0.417** (0.188)

grv_grn_xp - Exporter's export-related greens	-0.125 (0.169)	0.079 (0.142)	-0.121* (0.069)	0.221 (0.226)	-0.203 (0.135)

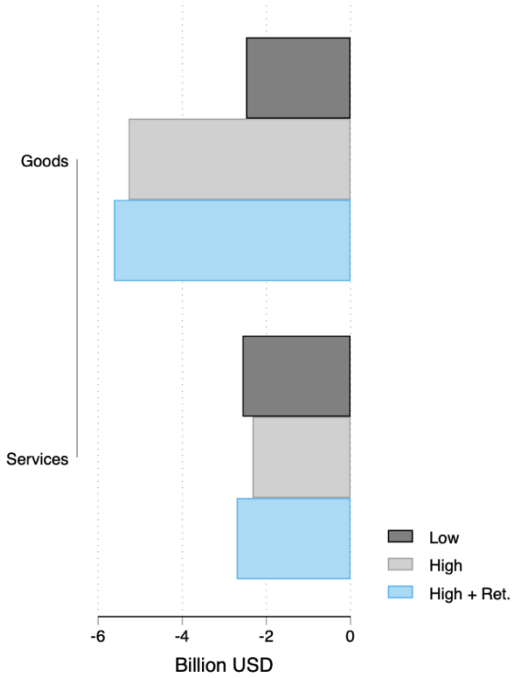
We also report results for model 2 split by each sector in turn. This shows sector-level regressions to work well in relation to technology manufacturing, with negative significant effects of "importer reds" observed in each case. The picture is considerably more mixed in relation to basic manufacturing and raw materials, again suggesting there may be specific factors at play in these sectors. This is therefore a strong justification to focus on a simple set of policy variables applied to highly aggregated sectoral data.

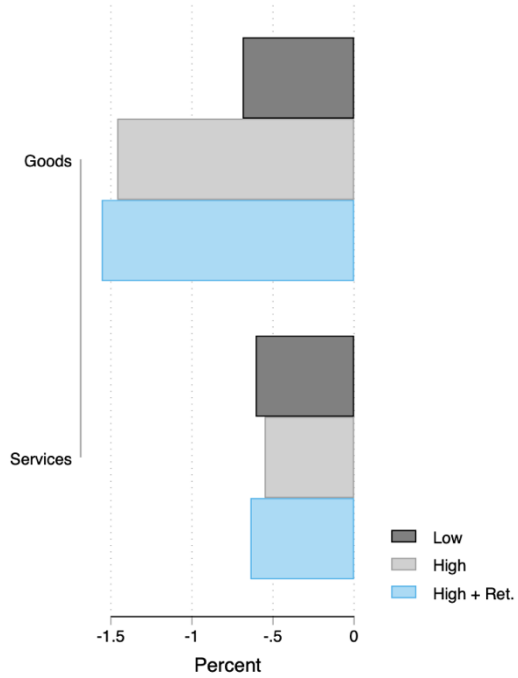
sector	sectorname	Importer reds (inc. FDI, tech, but not export)	Importer greens (inc. FDI, tech, but not export)
D01T02	Agriculture, hunting, forestry	-0.116 (0.077)	-0.06 (0.087)
D03	Fishing and aquaculture	0.144** (0.069)	-0.67** (0.313)
D05T06	Mining and quarrying – energy	0.113* (0.061)	-0.104* (0.055)
D07T08	Mining and quarrying – non-energy	-0.386*** (0.093)	0.218 (0.237)
D10T12	Food products, beverages and tobacco	0.016 (0.051)	0.108** (0.047)
D13T15	Textiles	0.026 (0.027)	0.014 (0.02)
D16	Wood and products of wood and cork	-0.012 (0.089)	0.027 (0.063)
D17T18	Paper products and printing	0.052** (0.024)	-0.041 (0.027)
D19	Coke and refined petroleum products	-0.009 (0.032)	0.111 (0.108)
D20	Chemical and chemical products	0.099*** (0.031)	0.038 (0.043)
D21	Pharmaceuticals	0.027** (0.012)	0.052*** (0.01)
D22	Rubber and plastics products	-0.047*** (0.016)	-0.02 (0.02)
D23	Other non-metallic mineral products	0.041 (0.035)	0.008 (0.032)
D24	Basic metals	0.01 (0.014)	-0.121** (0.051)
D25	Fabricated metal products	0.029*** (0.008)	0.264*** (0.027)
D26	Computer, electronic and optical equipment	-0.065*** (0.015)	0.021 (0.013)
D27	Electrical equipment	-0.032** (0.013)	0.046*** (0.013)
D28	Machinery and equipment, nec	-0.03*** (0.01)	0.016 (0.011)
D29	Motor vehicles, trailers and semi-trailers	-0.011*** (0.004)	-0.003 (0.015)
D31T33	Manufacturing nec	-0.292*** (0.041)	-0.07* (0.037)

Annex C – Selected country results from the NQTM



Exports to BLX





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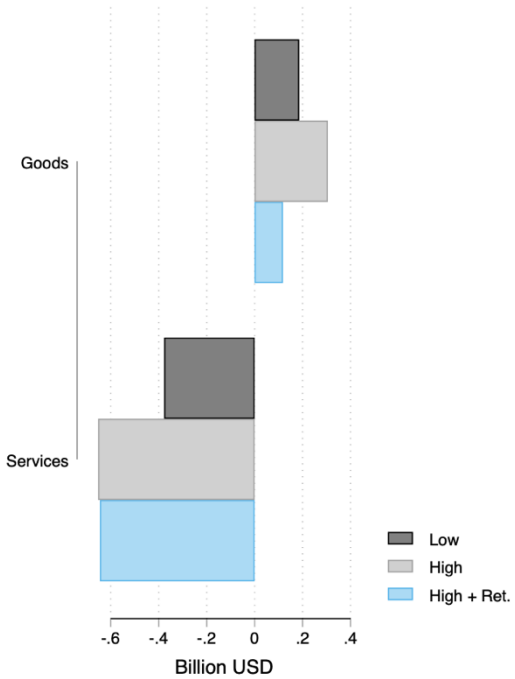
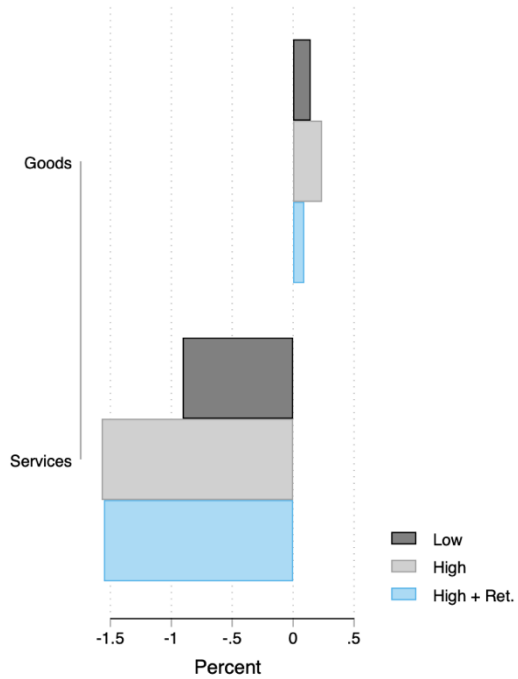
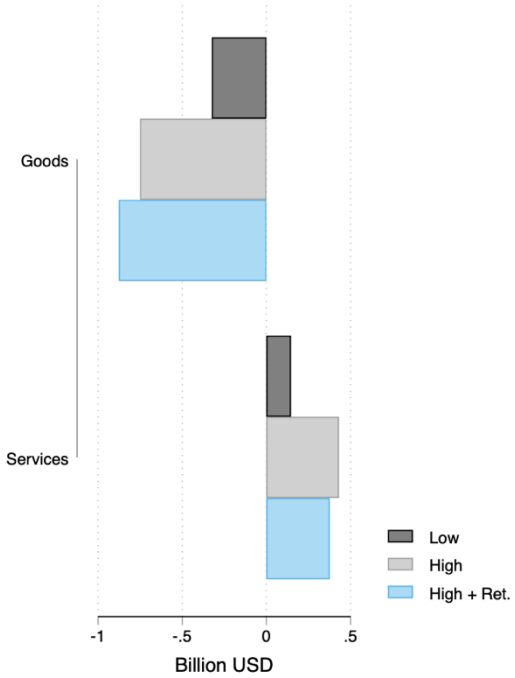
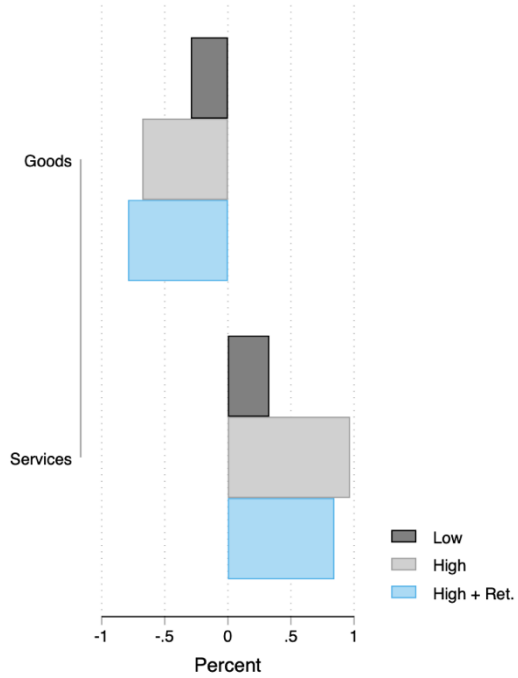


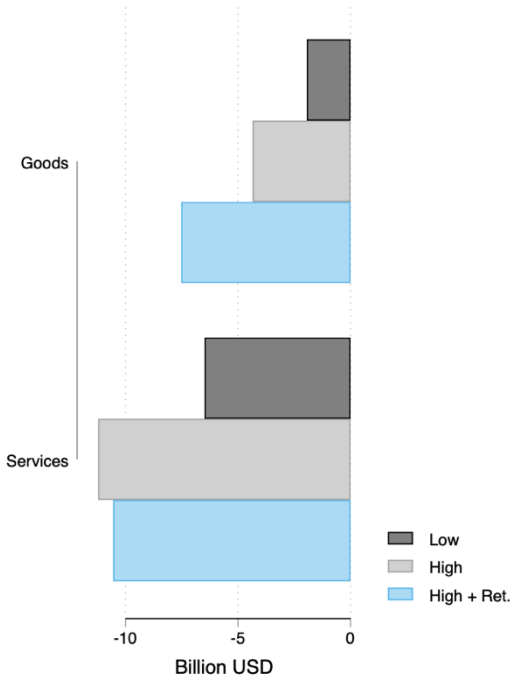


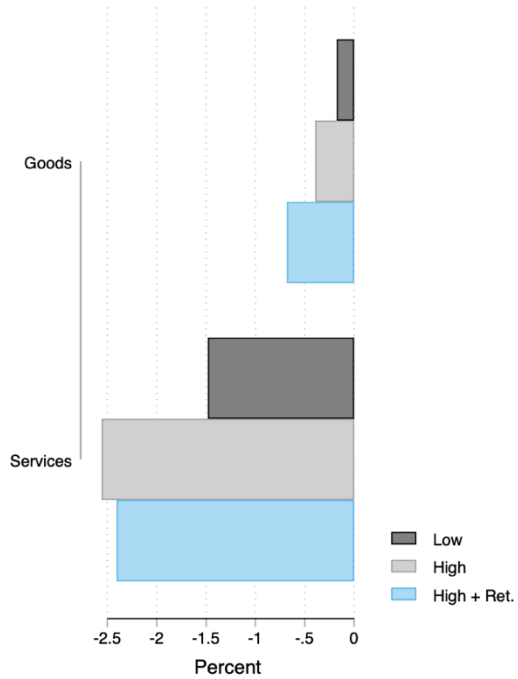
Exports to CZE





Exports from DEU





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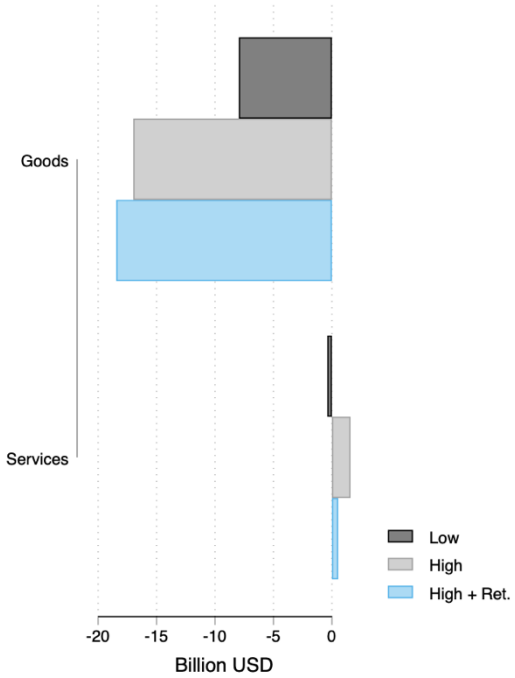

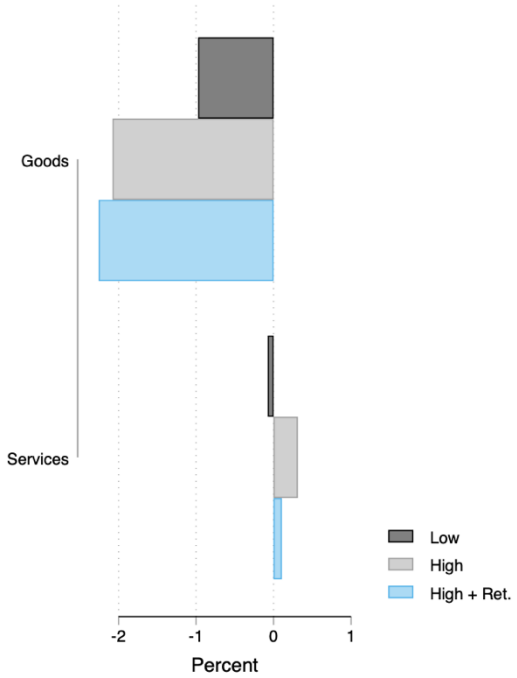

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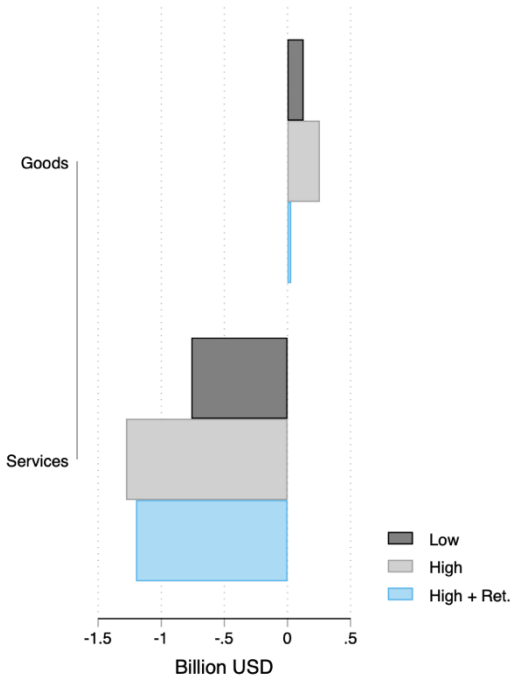
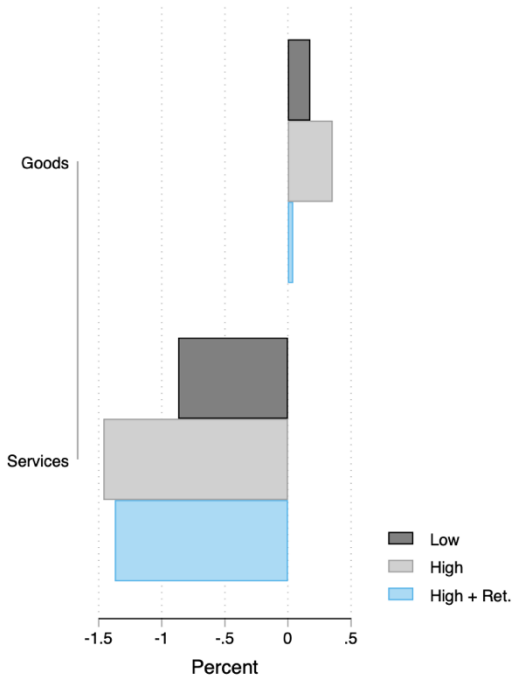
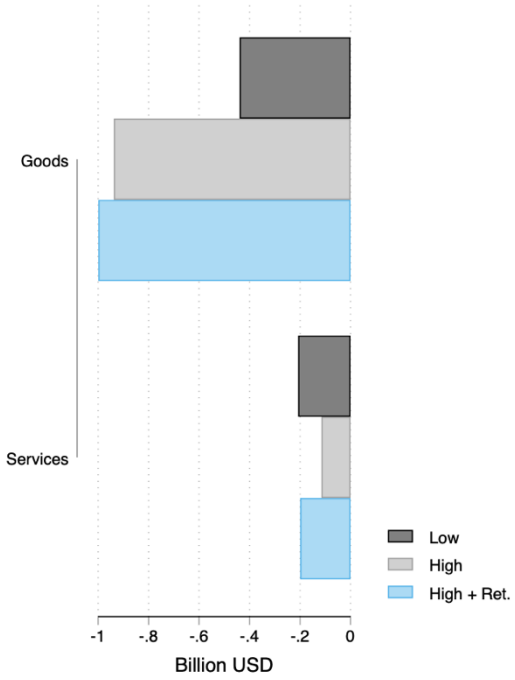
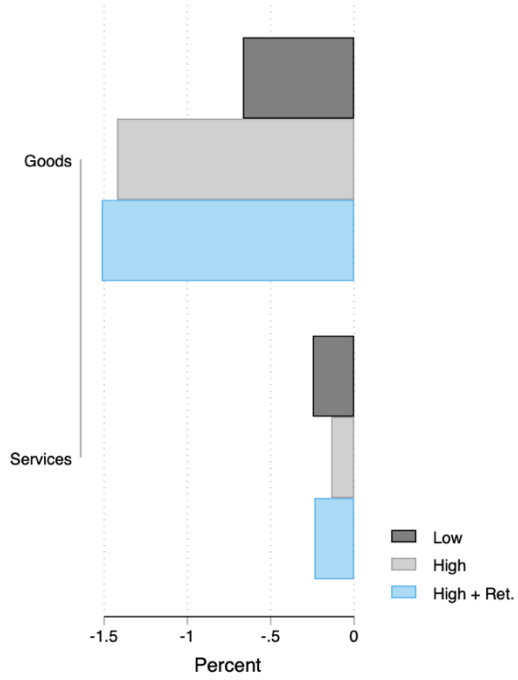


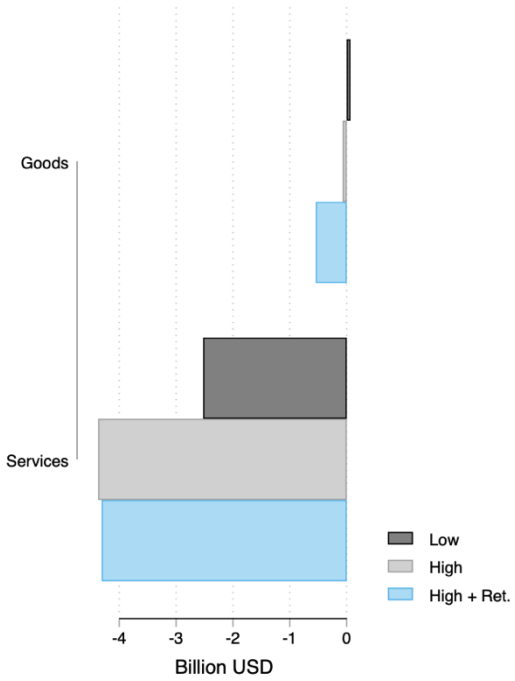


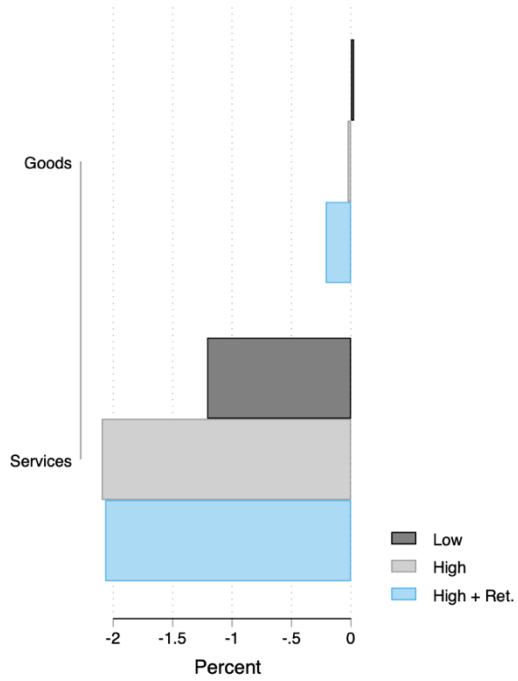
Exports to DNK

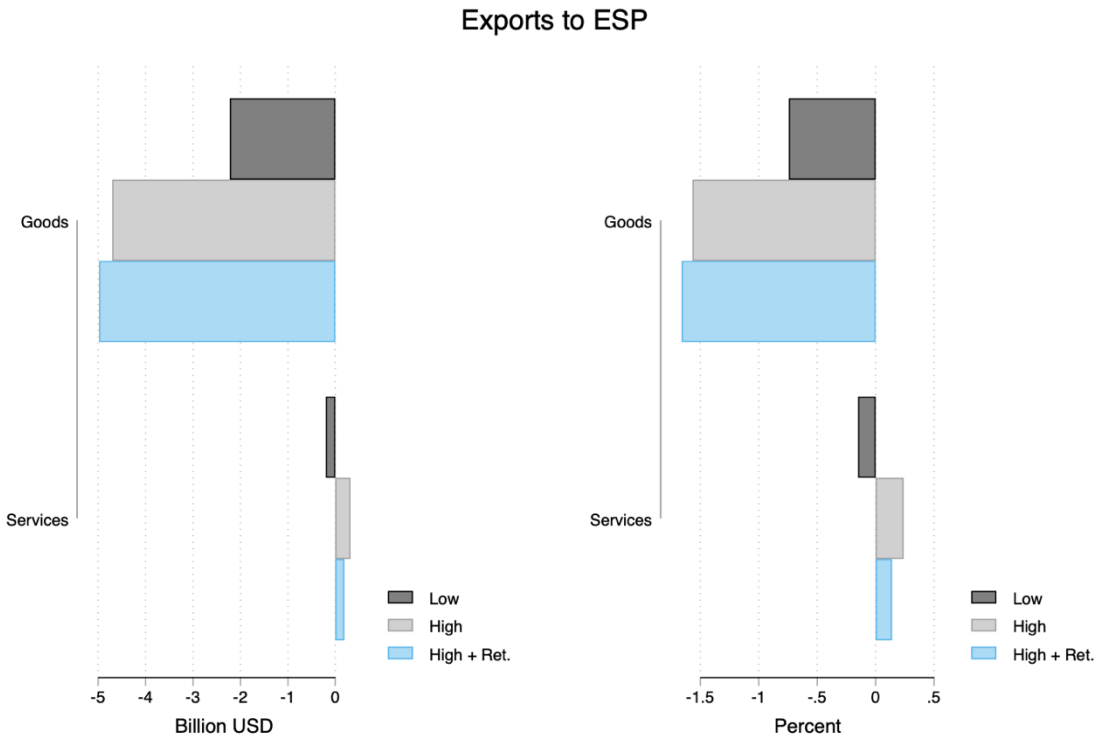


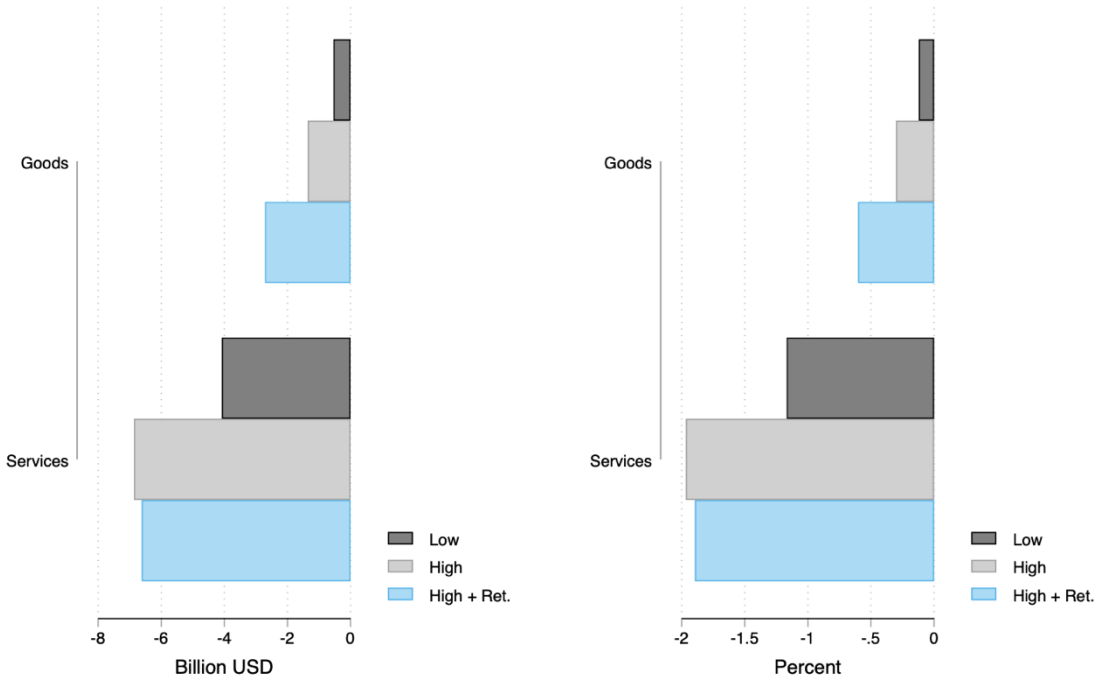


Exports from ESP

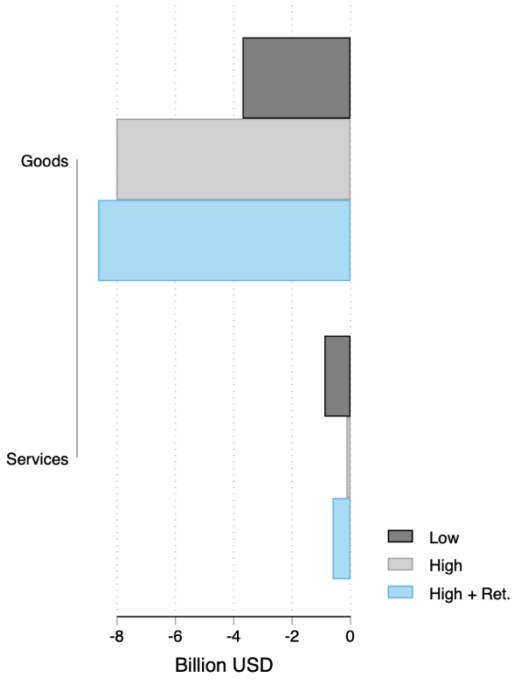


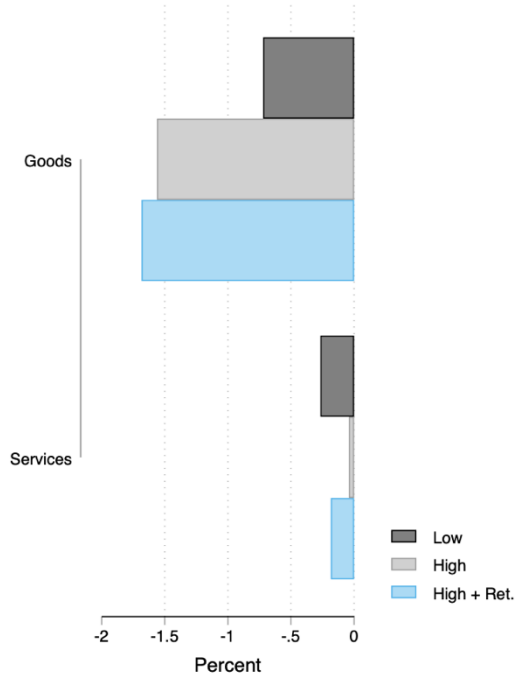



Exports to ESP
Goods
Services
Low
High
High + Ret.
-5
-4
-3
-2
-1
0
Billion USD
Goods
Services
Low
High
High + Ret.
-1.5
-1
-.5
0
.5
Percent

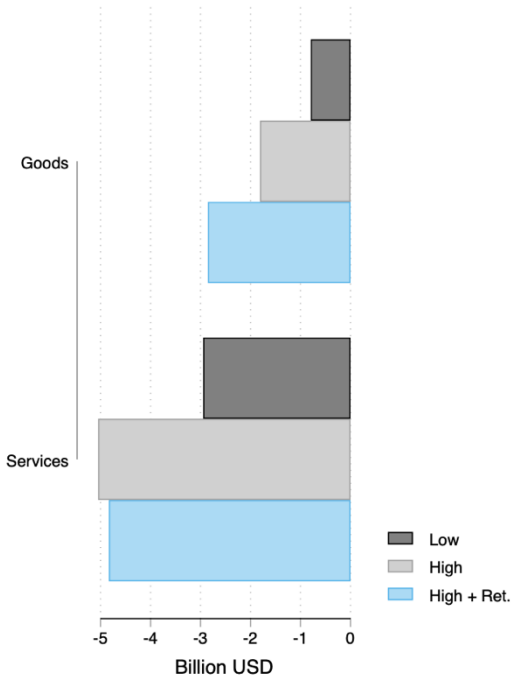

Exports from FRA
Goods
Services
Low
High
High + Ret.
-8
-6
-4
-2
0
Billion USD
Goods
Services
Low
High
High + Ret.
-2
-1.5
-1
-.5
0
Percent

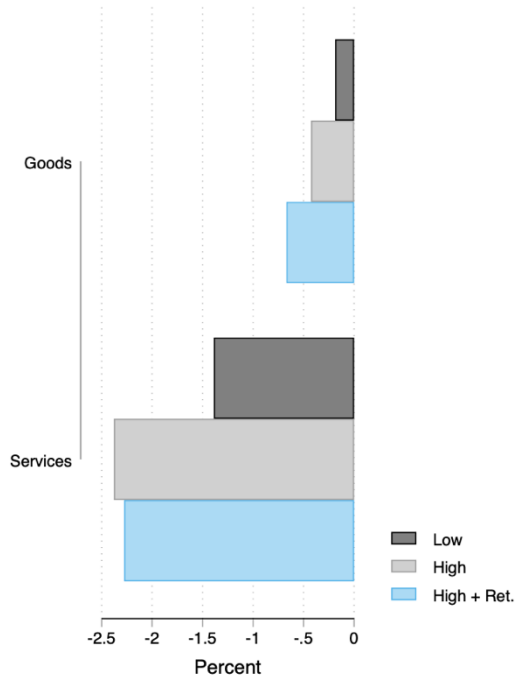
Exports to FRA

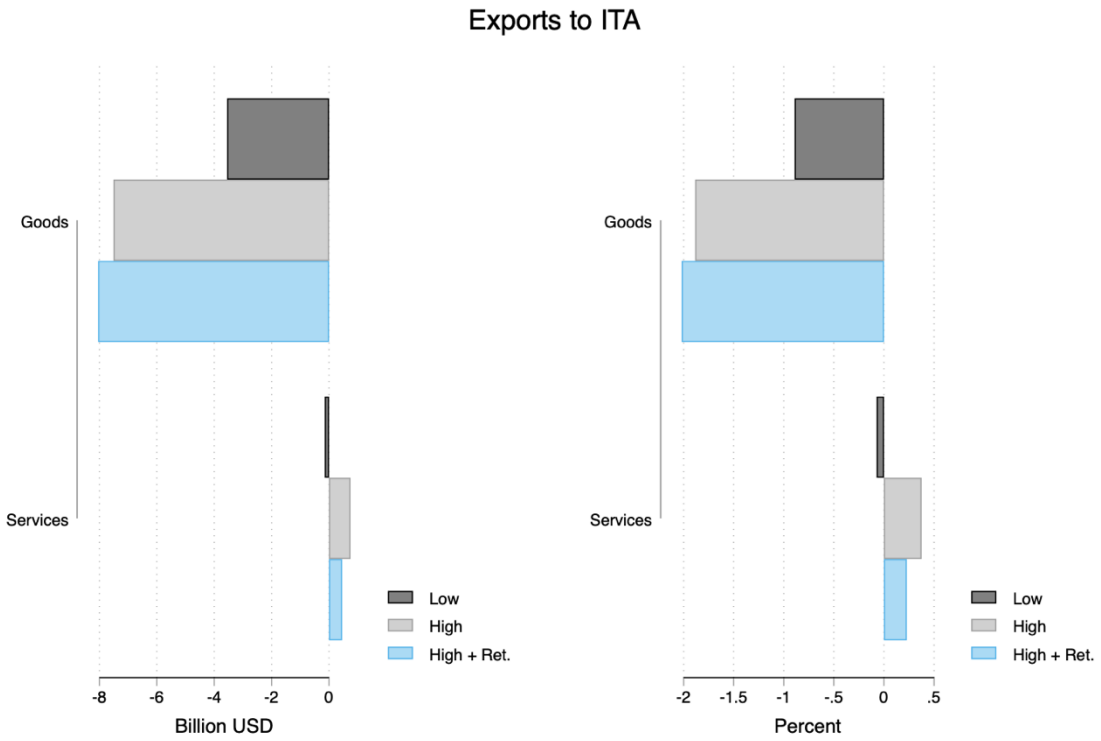




Exports from ITA






Exports to ITA
Goods
Services
-8
-6
-4
-2
0
Billion USD
Low
High
High + Ret.
Goods
Services
-2
-1.5
-1
-.5
0
.5
Percent
Low
High
High + Ret.

Annex D – Detailed description of the NQTM

The general flow of the NQTM was described above. This section presents mathematical details. From a conceptual perspective, key limitations of the model, which are common to many standard trade modelling frameworks, are:

- **Comparative static, all else constant**: The model compares equilibria under the baseline (observed) state of the world economy (2018 in this case) and a counterfactual economy in which trade costs change due to a set of policy changes, but all other factors remain constant. As such, there is no time dimension to the model, and it does not describe the dynamic path by which an economy moves from one equilibrium state to another. Results can therefore be interpreted as answering the question "how different would the 2018 world economy look if policies changed in a defined way, but everything else stayed the same?". Results are an annual change in variables concerned, but they should not be likened to predictions, projections or forecasts.

- **No savings or investment**: Linked to the comparative static structure of the model is the fact that there is no modelling of savings and investment decisions. As such, each country's aggregate trade balance is identical in the baseline and counterfactual equilibria. The absence of savings and investment decisions means that there is no accumulation effect over time, as changes in trade costs affect the decision whether to consume or save/invest.

- **Single factor of production, full employment**: The NQTM has labour as the only factor of production and assumes full employment. As such, it cannot produce results on sectoral or aggregate changes in employment.

- **Variable cost changes only**: Both the procedure adopted above for translating policy changes into cost impacts and the NQTM itself assume that policy changes only affect variable (ad valorem) trade costs. The model does not consider economic effects that the policies could have over and above this. In particular, it does not analyse changes in marketplace competition that could be associated with a broader range of policy effects, such as changes to entry conditions.

Consumption side

The consumption side of the model comes from Caliendo and Parro (2015). A measure Ln of representative households in N countries (subscript) maximise Cobb Douglas utility by

consuming final goods in J sectors (superscript), with consumption shares α_n^j summing to unity.

$$(1)\ u(C_n) = \prod_{j=1}^{J} \left(C_n^j\right)^{\alpha_n^j}$$

Production side

The production side of the model also comes from Caliendo and Parro (2015) via Aichele and Heiland (2018), which can be seen as a multi-sector generalization of Eaton and Kortum (2002). As in Aichele and Heiland (2018), there is provision for different shares in intermediate and final consumption

Each sector produces a continuum of intermediate goods $\omega^j \in [0,1]$. Each intermediate good uses labour and composite intermediate goods from all sectors. Intermediate goods producers have production technology as follows:

$$(2)\ q_n^j(\omega^j) = z_n^j(\omega^j)\left[l_n(\omega^j)\right]^{\beta_n^j} \prod_{k=1}^{J} \left[m_n^{k,j}(\omega^j)\right]^{\gamma_n^{k,j}}$$

Where: $z_n^j(\omega^j)$ is the efficiency of producing intermediate good ω^j in country n; $l_n(\omega^j)$ is labour; $m_n^{k,j}(\omega^j)$ are the composite intermediate goods from sector k used for the production of intermediate good ω^j; and β_n^j is the cost share of labour and $(1-\beta_n^j)\gamma_n^{k,j}$ is the cost share of intermediates from sector k used in the production of intermediate good ω^j, with $\sum_{k=1}^{J} \gamma_n^{k,j} = 1$.

Production of intermediate goods exhibits constant returns to scale with perfect competition, so firms price at marginal cost. The cost of an input bundle can therefore be written as follows:

$$(3)\ c_n^j = \Upsilon_n^j w_n^{\beta_n^j} \left(\prod_{k=1}^{J} \left(P_n^{k_m}\right)^{\gamma_n^{k,j}} \right)^{1-\beta_n^j}$$

Where: $P_n^{k_m}$ is the price of a composite intermediate good from sector k; w is the wage; and Υ_n^j is a constant.

Producers of composite intermediate goods in country n and sector j supply their output at minimum cost by purchasing intermediates from the lowest cost suppliers across countries, similar to the mechanism in the single sector model of Eaton and Kortum (2002).

Composite intermediate goods from sector j are used in the production of intermediate good ω^k in amount $m_n^{j,k}(\omega^k)$ in all sectors k, as well as final goods in consumption C_n^j. The composite intermediate is produced using CES technology:

$$(4)\ Q_n^j = \left[\int r_n^j(\omega^j)^{1-\frac{1}{\sigma^j}} d\omega^j\right]^{\frac{\sigma^j}{\sigma^j-1}}$$

Where: r is demand from the lowest cost supplier, and σ is the elasticity of substitution across intermediate goods within a sector.

Solving the producer's problem gives an expression for demand:

$$(5)\ r_n^j(\omega^j) = \left(\frac{p_n(\omega^j)}{P_n^j}\right)^{-\sigma^j} Q_n^j$$

Where: $p_n(\omega^j)$ is the lowest price of a given intermediate good across countries; and $P_n^j = \left[\int p_n(\omega^j)^{1-\sigma^j} d\omega^j\right]^{\frac{1}{1-\sigma^j}}$ is the CES price index.

Trade costs and equilibrium

Trade costs consist of tariff and NTM components as in Aichele and Heiland (2018), in the standard iceberg formulation for imports by country n from country i, with trade costs potentially differing by end use (intermediate, m, or final, f):

$$(6)\ \kappa_{ni}^{jv} = \left(1 + t_{ni}^{jv}\right) * \tilde{t}_{ni}^{jv}, v \ni (m, f)$$

Where t is the ad valorem tariff, and $\tilde{t}$ is NTM-related trade costs, including potentially policy measures but also geographical and historical factors that drive a wedge between producer prices in the exporting country and consumer prices in the importing country (Anderson and Van Wincoop, 2003). Unlike in Caliendo and Parro (2015), we assume that all sectors are tradable; this assumption accords with the reality in our data, where sectors are sufficiently aggregate that trade always takes place, at least to some degree.

With this definition of trade costs, the price of a given intermediate good in country n is:

$$(7)\ p_n^j(\omega^j) = \min_i \frac{c_i^j \kappa_{ni}^{jm}}{z_i^j(\omega^j)}$$

As in Eaton and Kortum (2002), the efficiency of producing ω^j in country n is the realisation of a Fréchet distribution with location parameter $\lambda_n^j \geq 0$ and shape parameter $\theta^j > \sigma^j - 1$. The intermediate price index can therefore be rewritten as:

$$(8)\ P_n^{jm} = A^j \left[\sum_{i=1}^{N} \lambda_i^j \left(c_i^j \kappa_{ni}^{jm}\right)^{-\theta^j}\right]^{-\frac{1}{\theta^j}}$$

Where A^j is a constant.

Then from the utility function, prices are:

$$(9)\ P_n^f = \prod_{j=1}^{N} \left(\frac{P_n^{jf}}{\alpha_n^j}\right)^{\alpha_n^j}$$

Bringing together these ingredients gives a relationship for bilateral trade at the sector level that follows the general form of structural gravity, but developed in an explicitly multi-sectoral framework and with different relations for intermediate and final consumption:

$$(10)\ \pi_{ni}^{jv} = \frac{X_{ni}^{jv}}{X_n^{jv}} = \frac{\lambda_i^j \left[c_i^j \kappa_{ni}^{jv}\right]^{-\theta^j}}{\sum_{h=1}^{N} \lambda_h^j \left[c_h^j \kappa_{nh}^{jv}\right]^{-\theta^j}}$$

For analytical purposes, a key feature of the gravity model in equation 10 is that the unit costs term depends through equation 3 on trade costs in all sectors and countries. This result is an extension of the multilateral resistance reasoning in Anderson and Van Wincoop (2003) to the case of cross-sectoral linkages.

Goods market equilibrium is defined as follows, where Y is the gross value of production:

$$(11)\ Y_n^j = \sum_{i=1}^{N} \frac{\pi_{in}^{jm}}{1 + t_{in}^{jm}} X_i^{jm} + \sum_{i=1}^{N} \frac{\pi_{in}^{jf}}{1 + t_{in}^{jf}} X_i^{jf}$$

With:

$$(11)\ X_n^{jm} = \sum_{k=1}^{J} \frac{\pi_{in}^{jm}}{1 + t_{in}^{jm}} \gamma_h^{j,k} \left(1 - \beta_h^k\right) Y_h^k$$

$$(12)\ X_n^{jf} = \alpha_n^j I_n$$

National income is the sum of labour income, tariff rebates, and the exogenous trade deficit:

$$(12)\ I_n = w_n L_n + R_n + D_n$$

The model is then closed by setting income equal to expenditure:

$$(13)\ \sum_{j=1}^{J} X_n^{jm} \sum_{i=1}^{N} \frac{\pi_{ni}^{jm}}{1+t_{ni}^{jm}} + \sum_{j=1}^{J} X_n^{jf} \sum_{i=1}^{N} \frac{\pi_{ni}^{jf}}{1+t_{ni}^{jf}} - D_n = \sum_{j=1}^{J} Y_n^j$$

Where: I represents final absorption as the sum of labour income, tariff revenue and the trade deficit; R is tariff revenue, and trade deficits sum to zero globally and to an exogenous constant nationally. So aggregate trade deficits are exogenous, but sectoral deficits are endogenous.

Caliendo and Parro (2015) show that the system defined by equations 3, 8, 10, 11 and 13 can be solved for equilibrium wages and prices, given tariffs and structural parameters.

Counterfactual simulation

Using exact hat algebra (Dekle et al., 2007), it is simpler to solve the model in relative changes than in levels. This process is equivalent to performing a counterfactual simulation in which a baseline variable v is shocked to a counterfactual value v', and the relative change is defined as $\hat{v} = \frac{v'}{v}$. Aichele and Heiland (2018) show that counterfactual changes in input costs are given by:

$$(14)\ \hat{c}_n^j = \hat{w}_n^{\beta_n^j} \left(\prod_{k=1}^{J} \hat{P}_n^{k_m \gamma_n^{k,j}} \right)^{1-\beta_n^j}$$

The change in the price index is:

$$(15)\ \hat{P}_n^{j\upsilon} = \left[\sum_{i=1}^{N} \pi_{ni}^{j\upsilon} \left[\hat{\kappa}_{ni}^{j\upsilon} \hat{c}_i^j \right]^{-\theta^j} \right]^{-\frac{1}{\theta^j}}$$

The change in the bilateral trade share is:

$$(16)\ \hat{\pi}_{ni}^{jv} = \left[\frac{\hat{\kappa}_{ni}^{jv}\hat{c}_i^j}{\hat{P}_n^{jv}}\right]^{-\theta^j}$$

Counterfactual intermediate goods and final goods expenditure are given by:

$$(17)\ X_n^{jm\prime} = \sum_{k=1}^{N}\gamma_n^{j,k}(1-\beta_n^k)\left(\sum_{i=1}^{N}X_i^{km\prime}\frac{\pi_{in}^{km\prime}}{1+t_{in}^{km\prime}} + X_i^{kf\prime}\frac{\pi_{in}^{kf\prime}}{1+t_{in}^{kf\prime}}\right)$$

With:

$$(18)\ X_n^{jf\prime} = \alpha_n^j I_n{}'$$

$$(19)\ I_n' = \hat{w}_n w_n L_n + \sum_{j=1}^{J}X_n^{jm\prime}\left(1-F_n^{jm\prime}\right) + \sum_{j=1}^{J}X_n^{jf\prime}\left(1-F_n^{jf\prime}\right) + D_n$$

The trade deficit condition requires:

$$(20)\ \sum_{j=1}^{J}F_n^{jm\prime}X_n^{jm\prime} + \sum_{j=1}^{J}F_n^{jf\prime}X_n^{jf\prime} - D_n = \sum_{j=1}^{J}\sum_{i=1}^{N}X_i^{jm\prime}\frac{\pi_{in}^{jm\prime}}{1+t_{in}^{jm\prime}} + \sum_{j=1}^{J}\sum_{i=1}^{N}X_i^{jf\prime}\frac{\pi_{in}^{jf\prime}}{1+t_{in}^{jf\prime}}$$

The change in welfare is given by the change in real income:

$$\widehat{W}_n = \frac{\widehat{I_n}}{\prod_{j=1}^{J}\left(\hat{p}_n^{jf}\right)^{\alpha_n^j}}$$

The relative change in trade costs is given by the definition of the counterfactual simulation and in our specification can cover NTMs as well as tariffs. Solving the model using exact hat algebra makes it possible to conduct the counterfactual experiment without data on productivity and, importantly, without trade costs data other than those that are being simulated; due to the multiplicative form of iceberg trade costs, solution in relative changes means that trade cost components, such as geographical and historical factors, which are constant in the baseline and counterfactual simply cancel out. The parameters β_n^j (cost share of labour), $(1-\beta_n^j)\gamma_n^{k,j}$ (cost share of intermediates) and α_n^j (share of each sector in final demand) can be calibrated directly from the baseline data, as can value added ($w_n L_n$). Egger et al. (2018) provide updated estimates of the trade elasticity θ^j at the same level of disaggregation used in our data.

Caliendo and Parro (2015) develop an iterative procedure for solving the model, which we follow here in the modified version developed by Aichele and Heiland (2018).