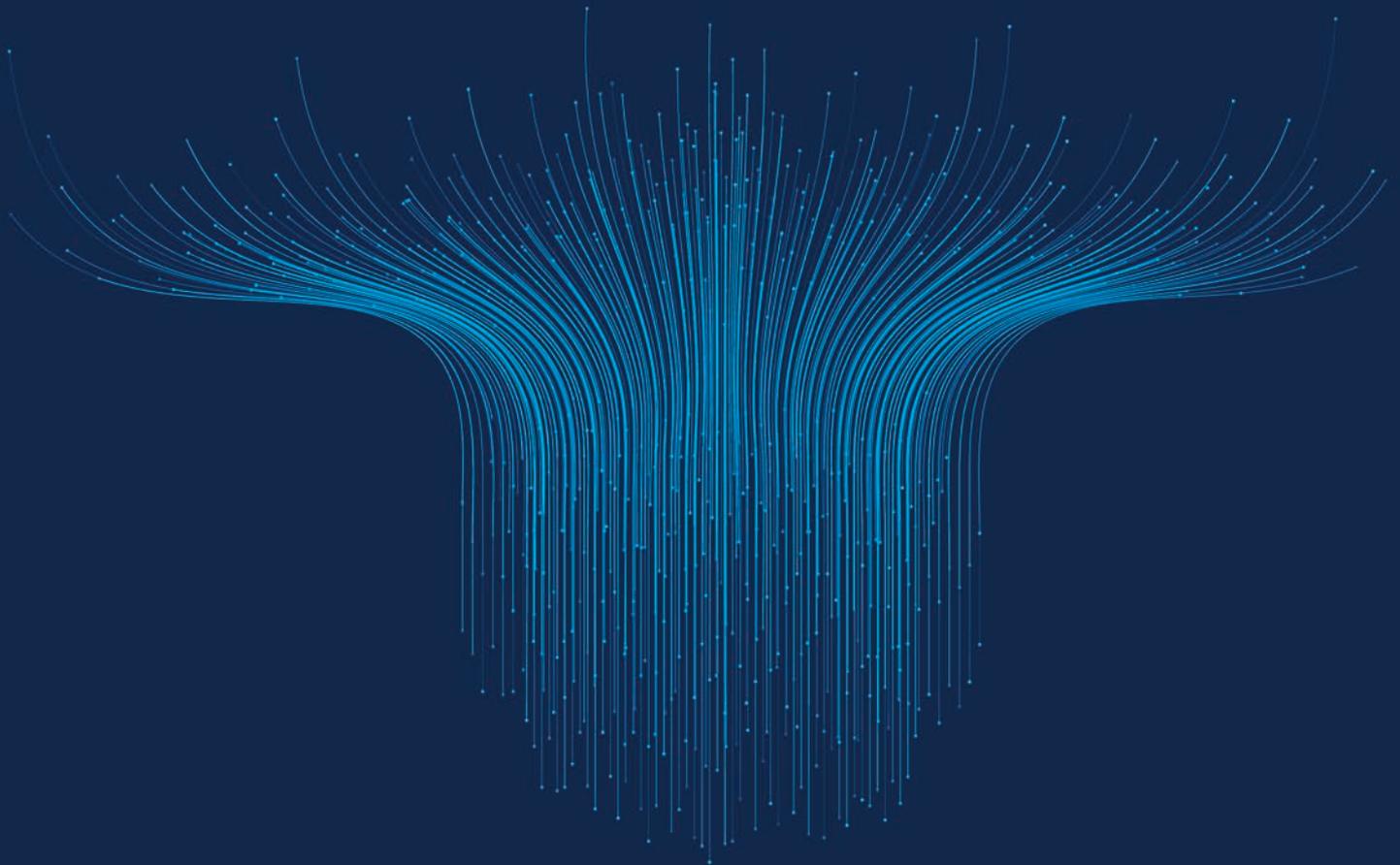




Economic Implications of Data Regulation

BALANCING OPENNESS AND TRUST



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Foreword

Today, our social and economic activities are underpinned by the movement of data across international borders. They help us connect with family and friends; they support research addressing global challenges; they enable the co-ordination of production along supply chains; and allow firms, notably smaller ones, and people to access global markets. In sum, cross-border data flows have become the lifeblood of modern day social and economic activities.

However, as more and more data crosses international borders, concerns across a range of policy areas have amplified. For instance, for privacy and data protection, there are concerns that, when data is transferred abroad, it might not receive the same, or the desired and expected, degree of protection. Cross-border data flows also raise issues in the context of national security, intellectual property protection, digital industrial policy and regulatory reach. These concerns have led to a growing adoption of regulation which conditions (or prohibits) the transfer of data across borders, and/or data localisation measures which mandate that data be stored or processed domestically.

To make the most out of the evolving digital environment, policy makers increasingly need to balance the trade costs of regulating data policies with the trust benefits of data safeguards. This has come to be known as *data free flows with trust*. This joint OECD-WTO report provides empirical evidence on these issues with a view to helping policy makers weigh the potential opportunity costs and benefits involved in their regulatory choices.

This report does not aim to offer a precise measurement of the economic impact of the current regulatory landscape. Nor does it aim to pit approaches against each other. Rather it is an effort to identify how different data-related measures might affect economic activity and to provide a baseline for assessing the relative magnitude of potential effects through a set of hypothetical scenarios.

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Executive Summary

Data flows are the lifeblood of our modern social and economic interactions. However, concerns related to privacy and data protection, national security, cybersecurity, digital protectionism and regulatory reach, among others, have led to a surge in regulation conditioning (or prohibiting) its flow or mandating that data be stored or processed domestically.

The implications of these measures are not well understood, especially where it relates to finding a balance between enabling flows while also ensuring that data receives the desired safeguards when transferred abroad, a concept that has also been referred to as data free flows with trust (DFFT).

This report aims to identify the potential economic implications and opportunity costs associated with different data flow and data localisation regulations. It draws on information from a business questionnaire, econometric analysis and mathematical modelling exercises to provide an empirical grounding to enable policy makers to weigh the opportunity costs and benefits involved in their regulatory choices. It is novel in that it incorporates both the potential costs that might be associated with data flow regulation, but also the potential benefits that arise from growing trust in economic transactions afforded by data protection frameworks. While subject to some limitations and caveats, the results provide insights into the main channels of impacts from data regulations.

For regulations affecting the *movement of data*, the results suggest that:

- Cross-border data flows are a key element of the global economy. Data autarky, or what might otherwise be considered as *'full fragmentation'*, where all economies fully restrict their data flows, would lead to global GDP losses of 4.5% and reductions in exports of 8.5%.
- The absence of data flow regulation is also associated with negative economic outcomes. Indeed, if all economies removed their data flow regulation trade costs would fall, but so too would trust. Overall, global GDP would fall by nearly 1% and global exports by just over 2%. The impacts would be largest for high-income economies which could see their GDP fall by over 2%.
- Open regimes that include safeguards balance the trade costs associated with data regulation with the trust benefits of data safeguards. Indeed, if such approaches were adopted by all economies, global exports would grow by 3.6% and global GDP by 1.77%. Benefits would be highest for low and lower-middle income economies which could see their GDP rise by over 4%.
- The economic costs of geoeconomic fragmentation of data flow regimes are potentially sizeable (more than 1% real global GDP loss), but much smaller than those associated with *full fragmentation* reflecting an already fragmented regulatory landscape.
- Overall, more global solutions that balance free-flows with trust are likely to deliver better economic outcomes for countries at all levels of development.

For *data localisation measures* (those explicitly mandating local storage or processing), the findings suggest that:

- Removing existing data localisation measures would deliver small but positive impacts. Exports would rise by 0.26% and GDP by 0.18%. Gains are, however, potentially large for low-income economies which could see their GDP rise by over 1%.
- Data storage requirements without flow prohibitions lead to relatively small economic costs. If such requirements were adopted by all economies, global GDP would fall by less than 0.1%. That said, low-income economies are projected to see strong increases in GDP from moving to less restrictive forms of data localisation.
- When storage conditions are combined with flow prohibitions, even if only for a limited set of sectors (financial, telecommunications, and ICT services), impacts can rise quickly. If all economies adopt these, GDP would fall by 0.5% and exports by nearly 1%. Losses would be highest for high-income economies.
- At the extreme, a strict data localisation measure is the same as a complete prohibition on transferring data (see numbers associated with full fragmentation). Storage conditions combined with flow prohibitions, when applied across all sectors of the economy, would deliver impacts that are nearly nine times larger than under more targeted sectoral prohibitions.
- Overall, the impact of data localisation depends strongly on the type of measure implemented. Developing countries will benefit most from removing data localisation measures.

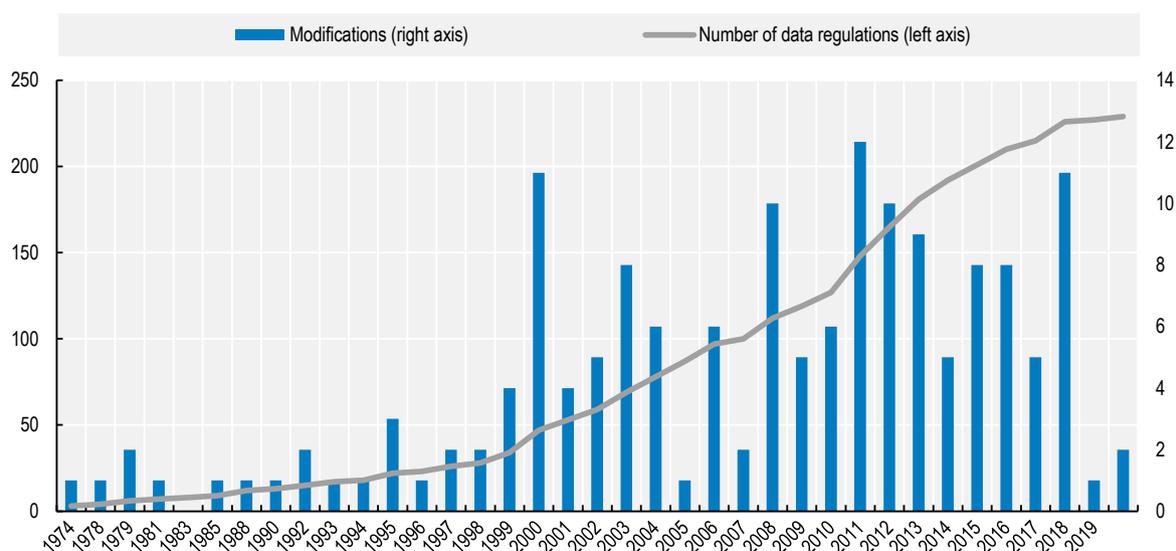
The empirical evidence presented suggests that getting data regulation right matters for economies at all levels of development. It underscores the need to find more global or convergent solutions to issues related to data regulation.

1 Introduction

Cross-border data flows underpin today's economic and social interactions. They help people connect with family and friends located in different geographical locations; they support research addressing global challenges (as was the case during the COVID-19 pandemic); they enable the co-ordination of production along global supply chains; and they allow firms, notably smaller ones, and people to access global markets. In sum, cross-border data flows have become the lifeblood of modern day social and economic activities.

As more and more data crosses international borders, concerns across a range of policy areas have amplified. For instance, for privacy and data protection, there are concerns that, when data is transferred abroad, it might not receive the same, or the desired and expected, degree of protection. Cross-border data flows also raise issues in the context of national security, intellectual property protection, digital industrial policy and regulatory reach. These concerns have led to a growing adoption of regulation which conditions (or prohibits) the transfer of data across borders, and/or data localisation measures which mandate that data be stored or processed domestically (Flaig et al., 2016^[1]; World Bank, 2016^[2]; Cory, 2017^[3]; Cory and Dascoli, 2021^[4]; Casalini and López González, 2019^[5]; López González, Casalini and Porras, 2022^[6]; WEF, 2020^[7]) (Figure 1.1).

Figure 1.1. Measures that affect the location or movement of data are on the rise



Note: "Data regulation" includes different types of regulation relating to data transfers and local storage requirements. Numbers are affected by the way in which regulations are structured, as this varies by economy; some economies may have a single regulation covering a wide range of measures; others will have several different regulations covering, for example, restrictions on data flows for different types of data, and local storage requirements. Evidence suggests that the number of measures have continued to increase up to 2024, including through important rises in data localisation measures (Del Giovane, López González and Ferencz, 2023^[8]).

Source: Casalini and López González (2019^[9]).

Although the Internet is global and to some extent borderless, regulations are not. There have been mounting worries that the emerging regulatory landscape is becoming increasingly complex and fragmented [see Evenett and Fritz (2022_[10])]. The economic implications of this growing digital fragmentation and of rising data-flow regulation are, however, not well understood.

Against this backdrop, the aim of this report is to begin filling some of the existing evidence gaps with a view to identifying some of the potential economic implications and opportunity costs associated with different approaches to data flow regulation. This work builds on a small literature that uses computable general equilibrium (CGE) models for the analysis of data flow regulation (Bauer et al., 2014_[11]; Flaig et al., 2016_[11]). It is novel in that it extends the analysis to incorporate both the potential costs that might be associated with data flow regulation and the potential benefits that might arise from growing *trust* between countries. In this sense, it also provides a better understanding of the implications of what has come to be known as *data free flows with trust*.

The work does not aim to provide a precise measurement of the economic impact of the current regulatory landscape. Nor does it aim to pit approaches against each other. Rather it is an effort to identify how the impact of data-related measures might be transmitted through the economy and to provide a baseline for assessing the relative magnitude of potential effects through a set of hypothetical scenarios. While subject to some limitations and caveats, it is hoped that this illustrative and hypothetical modelling exercise can provide policy makers with needed empirical grounding to enable them to weigh the opportunity costs and benefits involved in their regulatory choices.

To this end, this report is structured as follows. The following section provides an overview of the evolving policy landscape, identifying the why, what and how of emerging data flow regulation. Section 3 discusses results from a business questionnaire which motivates the methodological choices behind the modelling exercise, described in Section 4. Section 5 provides an analysis of the main results and concludes with some policy observations.

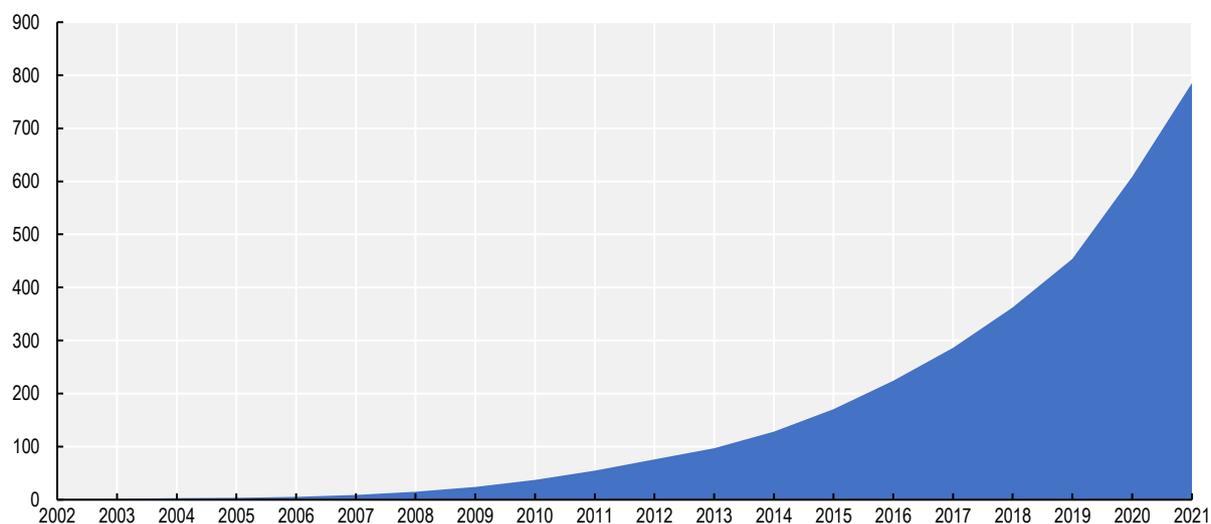
2 Data flows and the evolving regulatory environment

Global traffic from data centres is estimated to have increased fourfold since 2015 – from 5 zettabytes in 2015 to around 20 in 2021.¹ To put that into perspective, a zettabyte is 1 000 000 000 000 000 000 bytes (21 zeros), that is, a thousand exabytes, a billion terabytes, or a trillion gigabytes. There are 20 times more bytes of traffic from data centres than there are stars in the expanding universe.² The pace of change shows no signs of slowing; quite the opposite: global IP traffic is expected to continue growing at an accelerating pace (CISCO, 2020_[12]), including after faster growth in bandwidth demand during the first wave of the COVID-19 pandemic (OECD, 2020_[13]).³

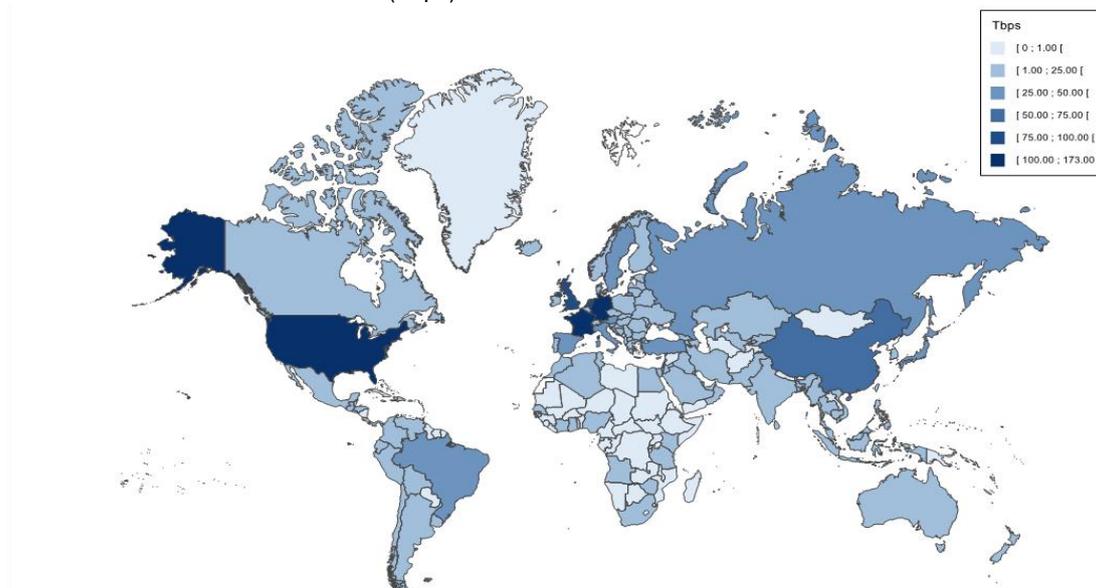
In terms of the cross-border elements of this traffic, data from Telegeography show a near 800-fold increase in international internet bandwidth capacity (a measure of international information-carrying capacity) in the period 2002-2021 (Figure 2.1). International internet bandwidth is especially high across OECD countries, but it is also important in emerging economies like the People’s Republic of China (hereafter “China”), India, the Russian Federation (hereafter “Russia”), and Brazil (Figure 2.1), which are important exchange points in the global internet architecture. As data becomes increasingly critical to economic activity and trade, understanding what it is, how it flows and how value can be derived from its use becomes ever more pressing.

Figure 2.1. International Internet bandwidth is growing

A. International Internet bandwidth (Tbps)



B. International Internet bandwidth (Tbps)



Note: Top panel shows cumulative international bandwidth in terrabytes per second. Bottom panel shows distribution across the globe. Darker shades identify greater international bandwidth.

Source: Own calculations based on Telegeography data.

2.1. What is different about data?

The economic activity that growing data traffic supports is not easy to identify and measure. How bits and bytes translate into dollars and cents is hard to establish. This is because, from an economics perspective, *data is different* (Aaronson, 2018^[14]). It is unlike other resources, factors of production, or inputs.

- *Data is valued at use, not at volume.* For instance, a spreadsheet with 100 personal shopping entries may occupy the same memory space as one with 100 personal health records but its underlying value will be different. A retailer will value the shopping entries more than a health service provider (which will value the personal health records more).
- *The value of data can increase when merged with other data to become greater than the sum of its parts.* For instance, the shopping entries linked to the health records can help target advertisements towards the health-conscious shopper.
- *Data has both inherent and potential value.* Data not used today can become valuable tomorrow with changing business dynamics or when combined with other data yet to become available.⁴ Information in the health records may become more useful over time to analyse new conditions.
- *Data can be used by different actors simultaneously (data is non-rivalrous) and can be copied and shared at virtually no cost.* This means that its use can serve many different purposes at once.⁵ The 100 personal health records may be used both by one health service provider to research cures for cancer and by another to provide remote health services without being depleted.

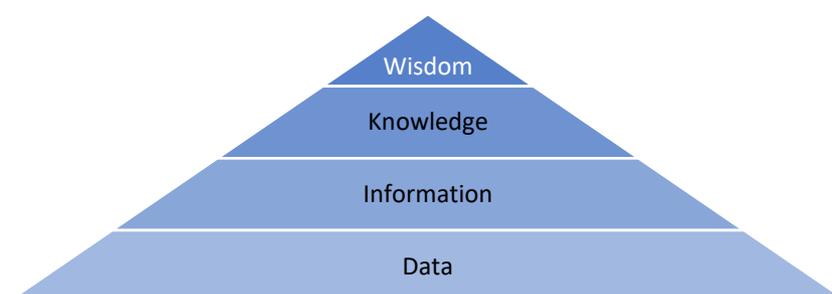
These characteristics imply that although data remains excludable (that is, it can be reserved for only certain users or uses), there are significant economic and societal benefits from sharing and re-using data (OECD, 2019^[15]; 2021^[16]), including across borders.

Data can be thought of as a factor of production, an intangible asset, an intermediate input into production and even capital with increasing returns. This versatility makes data *sui generis* and is why characterisations of data as the “new oil” (The Economist, 2017^[17]) can be misleading (Mandel, 2017^[18]).

Although, like oil, data is an essential input into the economy, data is not scarce, is neither consumed nor depleted when used, and can be copied and transferred at virtually no cost.⁶

Ultimately, data are vast and unordered or unprocessed records that carry little meaning; they become information when analysed to identify relationships between data points.⁷ Knowledge is generated by analysts who recognise the importance of the information, and wisdom is generated by the decisions that make the most of the streams of analysed data. In this data-information-knowledge-wisdom (DIKW) hierarchy (Figure 2.2), each stage is dependent on those that come before it. There is no wisdom without knowledge, no knowledge without information, and no information without data.⁸

Figure 2.2. There is no wisdom without knowledge, no knowledge without information, and no information without data



Source: Adapted from Rowley (2007^[19]).

Advances in AI, including the rise of generative AI models which now permeate all sectors of the economy, are leading to important changes for international trade (Ferencz, López-González and Oliván-García, 2022^[20]; WTO, 2024^[21]) and also raising new challenges for data governance (OECD, 2024^[22]). In the age of GenAI, data availability, access and variance, coupled with processing power, are posed to deliver new opportunities and challenges (Agrawal, Gans and Goldfarb, 2019^[23]).

Box 2.1. How does data flow through the Internet?

The way data travels through the Internet is not straightforward. When a file is sent from a computer in Economy A to a recipient in Economy B it is first broken down into different “packets”. These are like little parcels of information marked with the IP address of the sender, that of the recipient, and a code identifying the sequence in which the packets are to be reassembled at destination. Once the packets leave the origin computer, they cross different networks and take different routes to their destination. Routers, the traffic wardens of the Internet, guide the packets across the networks, ensuring that at each step they take the shortest or least congested route. Once the packets arrive at their destination, the computer reassembles them according to their pre-specified sequence. If a packet is missing, a signal is sent for that packet to be re-sent.

How data flows globally is therefore strongly linked to the existing global internet architecture, which includes submarine and terrestrial cables. For example, the packets of a file sent from Brazil to Japan may travel through the trans-Atlantic cable that connects the United States to Europe before reaching Japan, or they could be sent through one of the submarine cables connecting the United States to Japan through the Pacific Islands. Different packets may take different routes, often crossing several third countries.

The ultimate origin and destination of data flows will be related to technical decisions. Firms use mirror sites or content delivery networks, which replicate webpages or store data in different countries in closer proximity to final demand. This helps speed up data access. Data flows also rely on cloud computing solutions which store different and sometimes multiple copies of files in different locations. This means that what might seem to be a data transfer between two countries, might in fact involve many more. In some instances, what might seem to be a domestic transfer of data actually involves a cross-border flow (Casalini and López González, 2019^[9]).

2.2. Why and how is data flow regulation emerging?

The growing and pervasive use and exchange of data, including across borders, has fuelled concerns about the use and, especially the misuse, of data, including in the context of power relations among firms and between firms and consumers, and in particular with respect to privacy and personal data protection. These concerns are compounded when data moves beyond the reach of domestic regulatory bodies or is subject to differing regulations depending on where it is located and the type of information that it contains. While data and digital activity are inherently borderless, regulatory frameworks are not. Ensuring privacy and digital security, protecting intellectual property, enabling economic development, and maintaining the reach and oversight of regulatory and audit bodies can all become more complex when data crosses jurisdictions.

Why are countries enacting data-flow regulation?

The reasons countries are regulating data are manifold but can be broadly grouped into five categories (OECD, 2020^[24]).

- Much of the debate about data flows revolves around the movement of personally identifiable information, raising concerns about privacy and *privacy and data protection*. For some, the challenge is to ensure that when data is transferred outside a specific jurisdiction, they continue to receive the same protection received in the domestic jurisdiction. However, views on privacy and data protection can vary significantly across cultures, which is why regulation also differs.
- Some measures that condition data flows or mandate local storage aim to secure access to information for *regulatory control or audit purposes*. In this sense, requirements for data to be stored locally can be seen as the online equivalent of a longstanding practice in the offline world of ensuring that information is readily accessible to regulators. Such measures can be sector-specific, reflecting particular regulatory requirements and targeting specific data such as business accounts, telecoms or banking data.
- Measures related to *national security* often mandate that data be stored and processed locally for the purpose of protecting information deemed to be sensitive, or securing the ability of national security services to access and review data. The latter, in particular, can be very broad in nature, providing wide scope of access to any form of data.
- Governments also promote local storage and processing with a view to ensuring *digital security*. Implementing countries argue that data security can best be guaranteed when storage and processing is domestic.
- Finally, conditioning the flow of data or mandating that it be stored locally can be motivated by the desire to use a pool of data to encourage or help develop domestic capacity in digitally intensive sectors, a kind of *digital industrial policy*, including in the context of economic development. This can reflect a view that data is a resource that must be made available first and foremost to national producers or suppliers. These approaches can be sector-specific or apply to a range of data types.

Different motivations can lead to different measures, whether conditions on how data can flow or local storage requirements (data localisation). However, in discussing these measures it is important to consider the underlying policy objective for which they are applied.⁹ This can help think through how effective the measures are in achieving their stated aims, the associated costs and trade-offs of such measures, and whether there are alternatives offering a better balance among different aims to maximise overall benefits for the population and across countries. From a trade policy perspective, these elements are relevant to identify how a policy objective can be fulfilled in a way that is least trade restrictive.

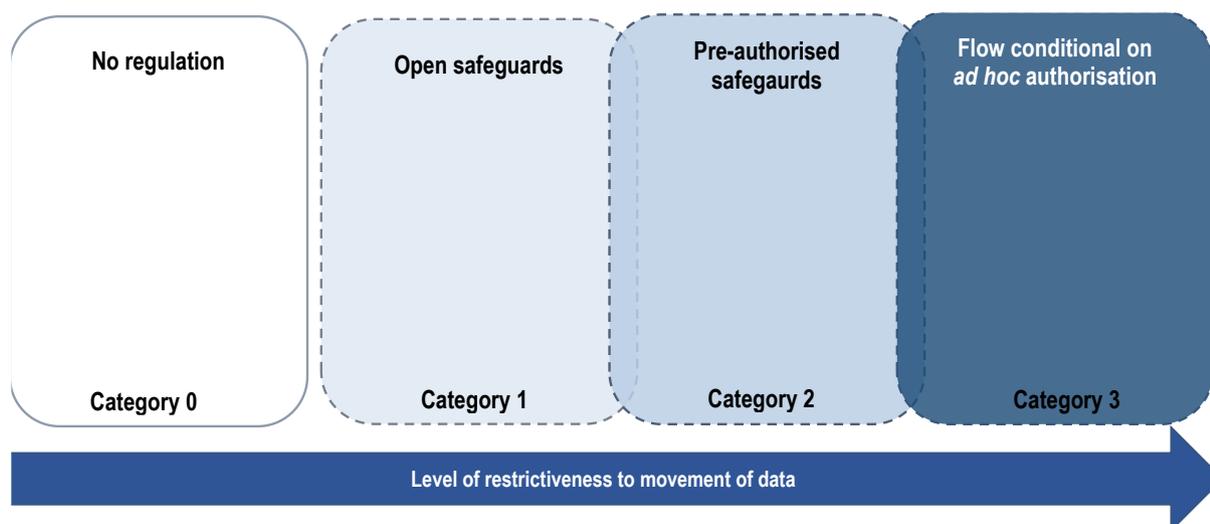
How are economies regulating cross border data flows?

Domestic approaches to cross-border data flow regulation vary widely, reflecting different cultural preferences and policy objectives. Four ‘types’ of approaches to data flow regulation have emerged (Figure 2.3). These are not mutually exclusive: different approaches can apply to different types of data even within the same jurisdiction. For example, health data might be subject to more stringent approaches than data related to product maintenance.

- At one extreme, in some jurisdictions (often Least Developed Countries – LDCs), there is *no cross-border data flow regulation (Category 0)*, usually because there is no privacy and data protection legislation at all. While this implies no restrictions on the movement of data, the absence of regulation can affect the willingness of firms in other countries to send data to these locations.
- The second type of broad approach relates to *open safeguards (Category 1)*. These refer to transfer mechanisms that tend to leave more discretion to the private sector as to how to safeguard transfers (often in the context of existing principles or guidance provided in domestic regulation). These include *ex post* accountability principles (where sending entity is liable for how the data is treated at its destination), contracts governing the conditions for data flows or private sector-led adequacy decisions.¹⁰
- A third broad approach, *pre-authorized safeguards (Category 2)*, includes approaches relying on pre-determined and transparent public sector approval before transfers can be made. In the context of privacy and personal data protection, these relate to determinations of adequacy or equivalence of protection by a public authority. Where an adequacy determination has not yet been made, firms can generally move data under model or approved contractual clauses or using binding corporate rules, or among other mechanisms.¹¹
- The last broad type of approach, *flow conditional on ad hoc authorisation (Category 3)*, relates to systems that only allow data to be transferred on a case-by-case basis subject to review and approval by relevant authorities. This approach relates to personal data for privacy reasons, but also to a more sweeping category of “important data”, including in the context of national security.

Across these different types of approaches, a number of exceptions are also envisaged to permit the transfer of data. These include transfers in relation to “legitimate interest”, or for the “public interest”, or in relation to legal claims (among others). Data-subject consent is also a frequently used exception for permitting otherwise precluded data transfers, but its use remains the subject of debate (Innovation, Science and Economic Development Canada, 2019_[25]).

Figure 2.3. Broad approaches to cross-border data flow regulation



Source: Adapted from Casalini and López González (2019^[9]) and Casalini, López González and Nemoto (2021^[26]).

How are countries approaching data localisation policies?

Data localisation measures constitute another type of emerging data regulation. While there is no single, and widely accepted definition of data localisation, there is agreement that it results in more local storage or processing than would have otherwise taken place. Some consider more implicit measures, such as restrictions on cross-border data flows, to be a form of data localisation since they can lead to more data being stored or processed locally [see Cory and Dascoli (2021^[4]) and Svantesson (2020^[27])]. However, others focus on more explicit measures which directly legislate to require the location or processing of data within a particular territory, defining data localisation as: “an explicit requirement that data be stored and/or processed within the domestic territory [see Del Giovane, López González and Ferencz (2023^[8])]. This narrower definition avoids subjective discussions about what other measures might or might not lead to more local storage or processing.¹²

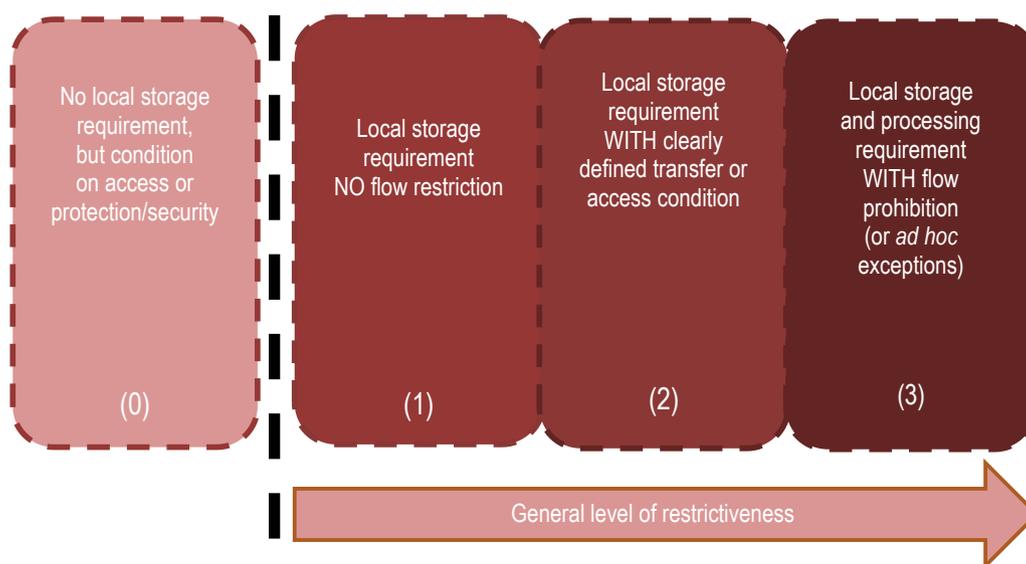
Although data localisation is distinct from conditions on cross-border data flows, a complete prohibition on the transfer of data amounts to a *de facto* requirement for local storage and processing. Similarly, a local storage requirement that is applied horizontally and combined with a local processing requirement is tantamount to a complete ban on the transfer of data abroad, as the relevant data would not be able to be stored anywhere else (Del Giovane, López González and Ferencz, 2023^[8]). One key difference between measures conditioning data flows and data localisation measures is that data localisation measures tend to be more sector specific, with most measures arising in financial, banking or payments sector; the public sector; telecommunications or cloud computing (Del Giovane, López González and Ferencz, 2023^[8]). By contrast, data flow restrictions often apply to all sectors of the economy, largely in the context of privacy and data protection (Casalini, López González and Nemoto, 2021^[26]).

Data localisation measures in place today vary widely, often in relation to their underlying policy objectives; the sectors or types of data targeted; and the wider legal and policy environment (López González, Casalini and Porras, 2022^[6]; Del Giovane, López González and Ferencz, 2023^[8]). Even within a particular economy, or regions within economies, different types of data localisation measures can apply to different types of data (e.g. personal data, health data, telecommunication data, banking or payment processing data; insurance data; or satellite and mapping data). There are also cases where data localisation requirements are aimed at less well-defined data categories such as “important data”, “core data” or “critical data”.

Overall, data localisation measures can be grouped into three broad categories (Figure 2.4).

- The first refers to **local storage requirements without flow restrictions (DL Category 1)**. These are measures that require a copy of the relevant data to be kept within the economy’s territory, but without prohibiting storage or processing in other countries. These measures are often applied in the context of ensuring that regulators do not encounter issues related to jurisdictional reach. Approaches falling under this category often target business data (accounts) or telecommunication metadata, including in the context of data retention policies. For example, Sweden’s Accounting Act¹³ stipulates that accounting information is to be retained and stored for seven years in Sweden.¹⁴
- The second refers to **local storage and processing requirements with clearly defined transfer or access conditions (DL Category 2)**. These require a copy of the data to be kept within the economy but allows the data to be transmitted abroad on the basis of clearly defined transfer or access conditions. For example, the Electronic Health Records Act in Australia requires that health record information be stored in Australia but provides for access overseas in cases where access is needed by users (the data subjects) or by registered healthcare providers overseas.
- The third refers to **local storage and processing requirements with prohibitions on transfer (or ad hoc exceptions) (DL Category 3)**. These are measures that mandate local storage of data while also prohibiting transfers to other countries (or allowing transfer only on the basis of *ad hoc* authorisations). These more sweeping restrictions can apply to a range of data, including banking, telecommunications or payment data, as well as to broader categories of information. For instance, in Indonesia, Regulation 71 (2019) concerning the implementation of electronic systems and transactions foresees that all data is to be managed, processed and stored in Indonesia.¹⁵ Exceptions to this rule arise in the event that relevant storage technology are not available domestically, with the criteria for is the exception determined by a government authority. Another example is China’s Cybersecurity Law, where Article 37 requires “critical information infrastructure operators” to store “important data” in China.¹⁶

Figure 2.4. A typology of data localisation measures and requirements for data flow



Note: Figure is schematic; elements do not singularly identify any given economy’s approach to data localisation. Different approaches tend to apply to different types of data, even within a same jurisdiction.

Source: López González, Casalini and Porras (2022^[6]).

Moreover, outside this typology, a new category of approaches is emerging (DL Category 0). These are measures that do not require data to be stored locally but require firms to guarantee access to data irrespective of where it is stored. For instance, New Zealand’s data retention regulation for business records allows for data to be stored outside of New Zealand provided it meets certain data integrity and access criteria.¹⁷ Within the European Union, legislation on the movement of nonpersonal data forbids data localisation within the European Union but requires that data be made accessible to the relevant national authorities.¹⁸

Cross-border data flow and data localisation measures often co-exist within jurisdictions but they tend to be used to attain different policy objectives.¹⁹ While data flow regulation arises in the context of privacy and data protection and tends to apply across all economic activities (Casalini and López González, 2019^[5]), only 14% of data localisation measures are directly targeted to personal data, these also tend to target particular sectors like payments, telecommunications or cloud computing (Del Giovane, López González and Ferencz, 2023^[8]). Measures might therefore not be substitutes insofar as they might not help attain the same policy objectives.

2.3. What issues does data regulation raise?

While there are legitimate reasons for regulating data flows, and indeed for the diversity in this regulation, the multiplicity of applicable regimes is leading to an increasingly complex and fragmented regulatory landscape [see also OECD (2022^[28]) and Evenett and Fritz (2022^[10])]. Digital fragmentation can take different forms. It can relate to the diversity and number of regulations that affect digital trade (see Ferencz (2019^[29])) or it can relate to fragmented approaches to particular issues that matter for digital trade, such as approaches to data flow regulation [see also OECD (2023^[30])].

Diversity in data flow regulation can make it difficult to effectively enforce public policy goals such as privacy and data protection, national security and regulatory reach when data crosses jurisdictions (OECD, 2022^[31]). At the same time, it can also make it more difficult for firms to operate across markets, affecting their ability to internationalise and benefit from operating on a global scale. Indeed, a recent paper by Sun and Trefler (2023^[32]) shows that AI adoption raises the number of foreign users ten-fold, but the impact is halved if foreign users are in a country with strong restrictions on cross-border data flows (measured using the *OECD Digital Services Trade Restrictiveness Index*).²⁰ The challenge for governments is therefore to promote regulatory approaches that enable the movement of data while, at the same time, ensuring that, when data crosses a border, it receives the desired protection, safeguard or oversight.

The notion of *trust* is at the centre of this debate. The benefits of digitalisation for trade are likely to depend on the degree of “trust” in the digital environment that underpins economic and social transactions. Individuals are unlikely to engage with, or send their data to, businesses they do not trust, and businesses are likely to struggle to reap the benefits of scale unless they can operate with trust globally. The concept of “data free flow with trust” (DFFT), championed by Japan under the G20 “Osaka Track” in 2019, is aimed at encapsulating the policy impetus to find a balanced solution to these challenges. Discussions on DFFT have also taken place under the G7, including under Trade and Digital Ministers’ discussions during the United Kingdom, German, and the Japanese presidencies in 2021, 2022, and 2023, respectively.

Having a clear understanding of the evolving regulatory environment is a first step to enabling greater trust in data flows. Another important factor is to provide policy makers with a clearer picture of the potential economic implications –and the transmission mechanisms for those implications –of different regulatory approaches (OECD, 2023^[30]).

3

Identifying the potential economic impact of different broad approaches to data regulation

Modelling the economic impacts of data regulation can help support the policy debate by presenting stakeholders with information on the potential and relative opportunity costs associated with different types of data-related measures. This information can help policy makers think about different regulations that can successfully meet public policy objectives, including privacy and data protection, in a way that imposes the least possible burden on, or trade-offs in terms of, economic activity.

However, accurate data on the restrictiveness of data flow regulation is not currently available. Moreover, data on how businesses use data and how this data supports economic activity is also difficult to find. This means that economic analysis in this area has to be approached with caution; that is, rather than focusing on the specific quantitative result for any given impact, attention can more usefully be focused on understanding the possible transmission mechanisms for those impacts.

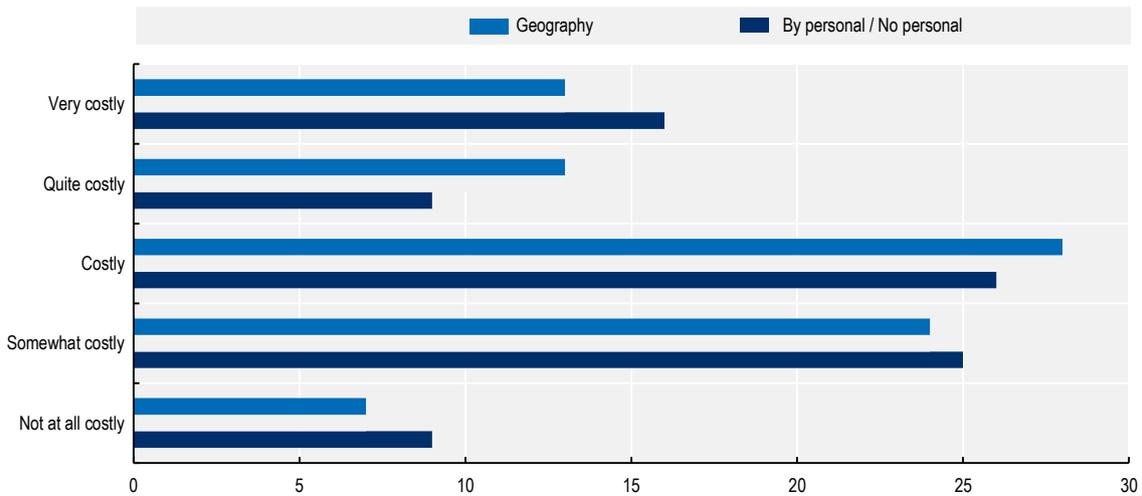
3.1. Insights from a business questionnaire

Preliminary information on the costs and benefits of data policies can be obtained by asking businesses about their data-related decisions and the perceptions of the emerging regulatory landscape.²¹ This can help gather new evidence about how business might react to changes in regulation, in turn helping to inform the modelling analysis.²² The OECD-WTO Business Questionnaire, administered online during the period 9 May – 14 June 2022, aimed to do just that. It garnered over 400 views, with 85 full responses across 32 economies covering most sectors of economic activity.²³

Data flow regulation

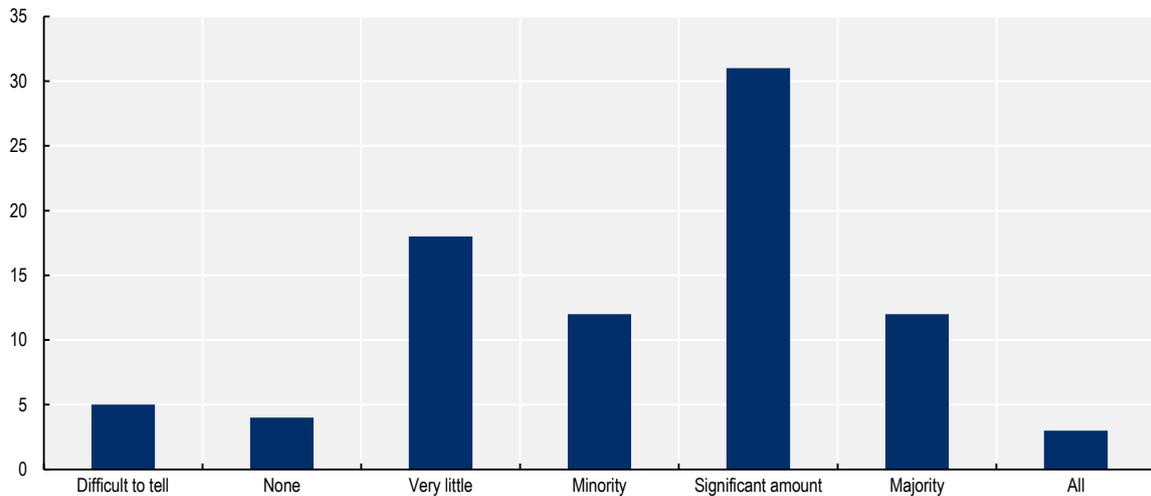
A large share of respondents to the Business Questionnaire, 70%, claimed that separating data, either by type or by geographical origin, would be costly (Figure 3.1). Respondents also suggested that most of the data they use or collect can be considered personal or personally identifiable data (Figure 3.2).²⁴ Emerging data regulation, which largely applies to personal information, might, however, have spill-overs on non-personal data, given the difficulties in separating data by type.

Figure 3.1. How hard would it be for your business to identify/separate your data by type and geographical origin?



Note: Figure shows responses to the business questionnaire.
Source: Own calculations based on OECD-WTO Business Questionnaire.

Figure 3.2. How much of the volume of data that your business sends or receives across international jurisdictions is likely to be personal data?



Note: Figure shows responses to the business questionnaire.
Source: Own calculations based on OECD-WTO Business Questionnaire.

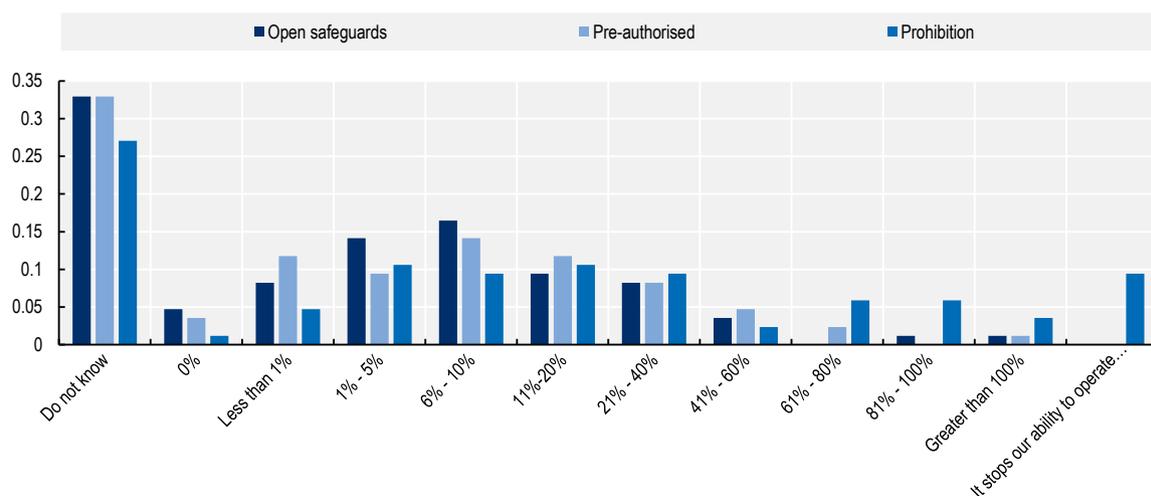
In terms of the impact of the emerging conditions for the transfer of data across borders, businesses recognise that there are a range of uncertainties, costs, and benefits (Figure 3.3). Around 33% of respondents said they did not know what costs or benefits there were in terms of the different data-flow regulations, highlighting a degree of uncertainty surrounding these regulatory frameworks. In terms of costs, open safeguards were perceived as less costly (on average these are seen to increase data management costs by 9.5%), followed by pre-authorized safeguards (increasing data management costs by nearly 11%), with prohibitions perceived as incurring the highest costs (increasing data management costs by 19.5%), including in the context of stopping business activity altogether.²⁵ That said, around 55% of respondents said that there could be increased sales as a result of higher trust from the use of

safeguards.²⁶ They perceived benefits to be higher, albeit marginally, in the case of open safeguards (increasing sales by 13.5%) relative to pre-approved safeguards (12.5% increase in sales). That said, again around one-third of respondents said they did not know.

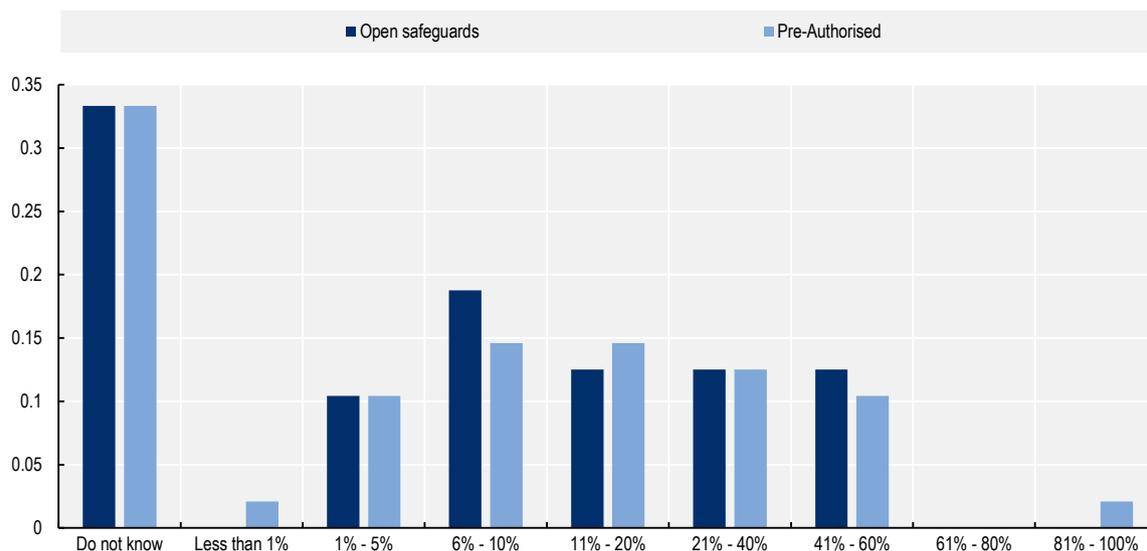
Other important insights can be gleaned from the business questionnaire, including on the share of data management costs in total costs; the type of actions businesses take in response to data regulations; whether the costs of complying with data regulations are of variable or fixed costs; and the nature of the costs of complying with regulations (Annex A). Some of these results are used to inform the modelling exercise.

Figure 3.3. Perceived impact of conditions for cross-border data transfers

A. Costs: By how much do you think that regulation can increase your data management costs?



B. Benefits: By how much do you think regulations can increase sales through greater trust?

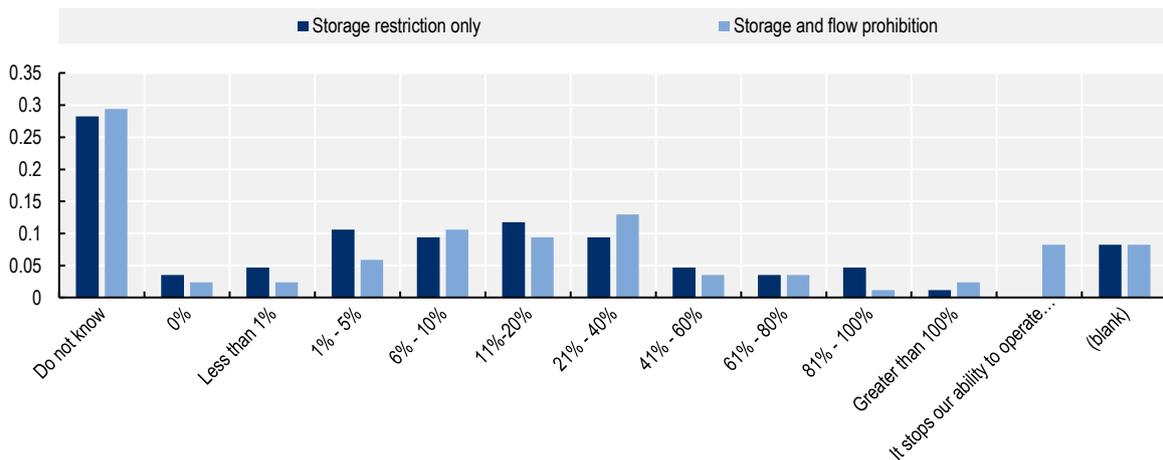


Note: Figure shows share of responses to the business questionnaire.
 Source: Own calculations based on OECD-WTO Business Questionnaire.

Data localisation

When businesses were asked about the costs of data localisation measures (Figure 3.4), there was also a high degree of uncertainty, with around 30% of firms not knowing how big these might be. On average, storage restrictions were seen to add 16% to total data management costs. When local storage is combined with flow restrictions, the reported impacts can be considerably higher, at around 55% (Figure 3.4).²⁷ Importantly, 8% of respondents suggested that storage and flow prohibitions would prevent them from being able to operate in some markets. Where benefits of these measures are concerned, only 15% of firms reported that there might be benefits with these estimated to be around 3% increases in sales. When asked about whether data localisation measures helped deliver other legitimate public policy objectives such as domestic innovation, privacy protection or data security, most businesses (around 70% of respondents) did not think, or were uncertain about, data localisation being linked with these outcomes (Figure 3.5). This implies that trust benefits might operate in complex ways that are beyond the scope of the analysis.

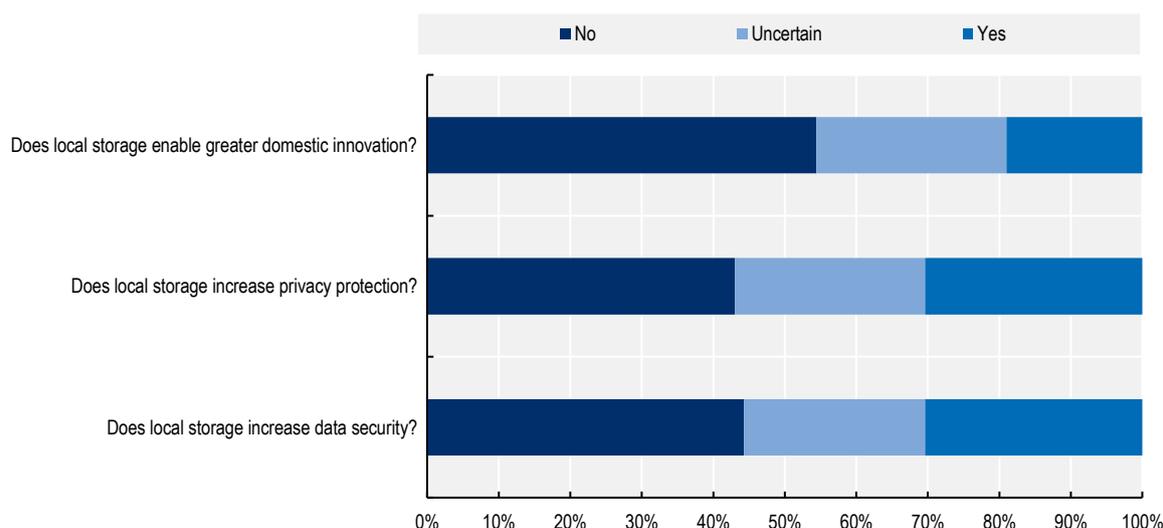
Figure 3.4. Perceived impact of data localisation measures: By how much do you think regulation can increase your data management costs?



Note: Figure shows share of responses to the business questionnaire. Respondents were asked “Regulations that require that a copy of data (such as financial information, or personal information) be located domestically, but that do not prohibit its transfer or processing abroad, could increase your total Data Management costs (including ICT equipment and legal costs) by approximately”. They were then asked, “By how much more would total Data Management costs increase if the above local storage requirement were to be combined with a prohibition to transfer data for storage or processing abroad?”

Source: Own calculations based on OECD-WTO Business Questionnaire.

Figure 3.5. Data localisation and public policy objective



Note: Figure shows share of responses to the business questionnaire.
Source: Own calculations based on OECD-WTO Business Questionnaire.

3.2. Modelling the economic implications of data regulation

To explore the economic impact of potential changes in data policies, the outcomes of the Business Questionnaire, combined with the results of econometric estimation (structural gravity model) are fed into the WTO Global Trade Model (GTM). The GTM is a computable general equilibrium (CGE) model describing the economic relations between countries in multiple sectors incorporating intermediate linkages. In the version of the GTM employed, output is produced by firms with heterogeneous productivity (see Aguiar et al. (2019)^[33] for a description of the model). The presence of fixed and variable trade costs implies that only the most productive firms can profitably export (Bekkers and Francois, 2018)^[34]. The GTAP Data Base, Version 11 (2017) is used to calibrate the model. It is extended to split out a data management (or ICT) sector which is not part of the original GTAP Data Base. This split is done using standard techniques and information from OECD Trade in Value Added (TiVA) database.

Nature of shocks

In the economic model data policies affect economic activity through three channels.

- *Trade costs.* Policies on the movement of data affect both variable and fixed trade costs. More stringent data flow policies make it more costly for firms to export, implying that they need to spend more variable (in proportion to the amount produced) and fixed resources.
- *Trust/willingness to pay (WTP).* Data flow policies with safeguards generate more trust among consumers, thus leading to a higher demand or willingness to pay for products.²⁸
- *Data management costs.* Data localisation policies imply that firms need to spend more resources in the domestic data management sector.

To capture the nature of some of the measures being implemented, these shocks are combined. For example, to capture data localisation measures which combine storage conditions with flow restrictions, data management costs and trade costs are implemented jointly.

Stylised scenarios

Two sets of stylised scenarios, one for data flows and one for data localisation are used, to help identify differences and similarities across data regulation measures. All scenarios explicitly take into account that data flow and data localisation policies interact with each other. Four stylised scenarios are proposed to evaluate the economic impact of *data flow restrictions* – holding existing data localisation measures constant (Table 3.1).

- *Scenario 1: No data flow regulation:* All regions remove their data flow regulation but maintain existing data localisation policies.²⁹ This scenario helps explore the impact of not having data flow regulation, taking into considerations interactions between different data policies.
- *Scenario 2: Moving to the middle:* Regions without data flow regulation (Category 0) move to open or to pre-authorized safeguards (Categories 1 and 2). On the other side of the spectrum, regions with stringent *ad hoc* transfer mechanisms (Category 3) move to open or pre-authorized safeguards (Categories 1 and 2). This scenario explores the value of moving towards data flow regulations that seek to balance flows with safeguards.
- *Scenario 3: Geoeconomic fragmentation:* Regions in different geopolitical blocs impose more stringent data flow regulations – i.e. *ad hoc* authorisation policies (Category 3) – on regions in different geopolitical blocs while maintaining existing policies for intra-bloc data flows.³⁰ This enables exploration of the repercussions of geo-economic fragmentation in terms of data flows.
- *Scenario 4: Data flows doomsday:* data flows are restricted globally with all regions introducing *ad hoc* authorisation policies (Category 3) for all trading partners. This scenario helps underscore the importance of data flows for economic activity.

Each scenario involves different changes in trade costs and willingness to pay (Table 3.1, top panel). For example, for Scenario 2 – moving to the middle, a shift from Category 0 to 1 in the data transfer regime entails an increase in trade costs and trust/willingness to pay while a shift from Category 3 to 2 in the data transfer regime entails both decreases in variable and fixed trade cost and increases in trust/WTP.³¹ That said, these decreases only take place if the economy in question does not have a strict data localisation measures in place (DL Category 3) as this would imply that they could not transfer data abroad.

Table 3.1. Breakdown of CGE policy shocks related to data flow regulation (maintaining data localisation policies)

Scenario	Before	After	Trade costs	Trust / willingness to pay
Scenario 1 – No data flow regulation	Category 0	Category 0	-	-
	Category 1	Category 0	-	Decrease
	Category 2	Category 0	Decrease	Decrease
	Category 3	Category 0	Decrease	-
Scenario 2 – Moving to the middle	Category 0	Category 1	Increase	Increase
	Category 1	Category 1	-	-
	Category 2	Category 2	-	-
	Category 3	Category 2	Decrease	Increase
Scenario 3 – Geoeconomic fragmentation*	Category 0	Category 3	Increase	-
	Category 1	Category 3	Increase	Decrease
	Category 2	Category 3	Increase	Decrease
	Category 3	Category 3	-	-
Scenario 4 – Data flow doomsday	Category 0	Category 3	Increase	-
	Category 1	Category 3	Increase	Decrease
	Category 2	Category 3	Increase	Decrease
	Category 3	Category 3	-	-

* Policy shocks in Scenario 3 are only applied to regions in the opposite geopolitical bloc.

Source: Authors' elaboration.

For *data localisation measures* four scenarios are explored, holding existing data flow regulation constant:

- **Scenario A: No data localisation.** All regions that currently apply data localisation measures remove them (while keeping existing data flow policies). This implies reductions in data management costs in regions only applying storage conditions and added reductions in trade costs implied by the elimination of data localisation policies. However, this only happens for regions that do not have *ad hoc* data flow authorisation policies in place. This scenario allows us to explore the existing opportunity costs associated with data localisation policies.
- **Scenario B: Horizontal local storage conditions.** All regions apply horizontal local storage restrictions. That is, for those that do not have these already, data management costs increase throughout the economy. This scenario allows us to get a sense of the overall potential magnitude of the effects of the least restrictive form of data localisation.
- **Scenario C: Sectoral local storage and flow prohibition.** All regions apply sector specific local storage requirements (data management costs) and flow restrictions (trade costs) in financial services, ICT services, and telecommunications services. This scenario allows us to explore the overall impact of targeted data localisation measures.
- **Scenario D: Horizontal local storage and flow prohibition.** All regions apply local storage combined with flow restrictions across all sectors of the economy. This scenario illustrates the potential impact of full localisation of data. It is, by construction, very similar to Scenario 4 in the data flow exercise because a full horizontal data localisation measure is similar in impact to a full data flow restriction. In terms of modelling, the only difference is that in Scenario D there is also a cost increase related to the increased use of domestic data management services.

Since data flow and data localisation policies interact with each other, the elimination of data localisation requirements only reduces data management costs if there is no *ad hoc* authorisation data flow policy in place.³² Table 3.2 shows the potential changes in trade costs and WTP/trust in the data localisation scenarios. Whether trade costs and trust/WTP change depends on whether such a move leads to less restrictions on data flows, which depends on the existing data flow policies. In regions without *ad hoc* data flow authorisation policies trade costs and WTP/trust can change.

Table 3.2. Breakdown of CGE policy shocks related to data localisation (maintaining data flow policies)

Scenario	Before	After	Data management cost	Trade costs	Trust / willingness to pay
Scenario A – No data localisation	DL Category 3	DL Category 0	Decrease	Potential decrease	Potential increase
	DL Category 1	DL Category 0	Decrease	-	-
	DL Category 0	DL Category 0	-	-	-
Scenario B – Horizontal storage conditions	DL Category 3	DL Category 1		Potential decrease	Potential increase
	DL Category 1	DL Category 1	-	-	-
	DL Category 0	DL Category 1	Increase	-	-
Scenario C – Sectoral storage and flow prohibition*	DL Category 3	DL Category 3	-	-	-
	DL Category 1	DL Category 3	-	Potential increase	Potential decrease
	DL Category 0	DL Category 3	Increase	Potential increase	Potential decrease
Scenario D – Horizontal storage and flow prohibition*	DL Category 3	DL Category 3	-	-	-
	DL Category 1	DL Category 3	-	Potential increase	Potential decrease
	DL Category 0	DL Category 3	Increase	Potential increase	Potential decrease

* The increase in trade cost and decrease in willingness-to-pay policy shocks in Scenario C and D is the same as in 'Scenario 4 – Data flow doomsday' as shown in Table 3.1. In other words, the magnitude of the policy shocks would depend on a region's current category of data transfer policy.

Source: Authors' elaboration.

3.3. Identifying the size of the associated costs and benefits

To identify the size of (i) the trade costs associated with data flow policies, (ii) the trust or willingness to pay effects of data flow policies, and (iii) the costs of data localisation policies, a combination of information from econometric estimations and the business questionnaire is employed.

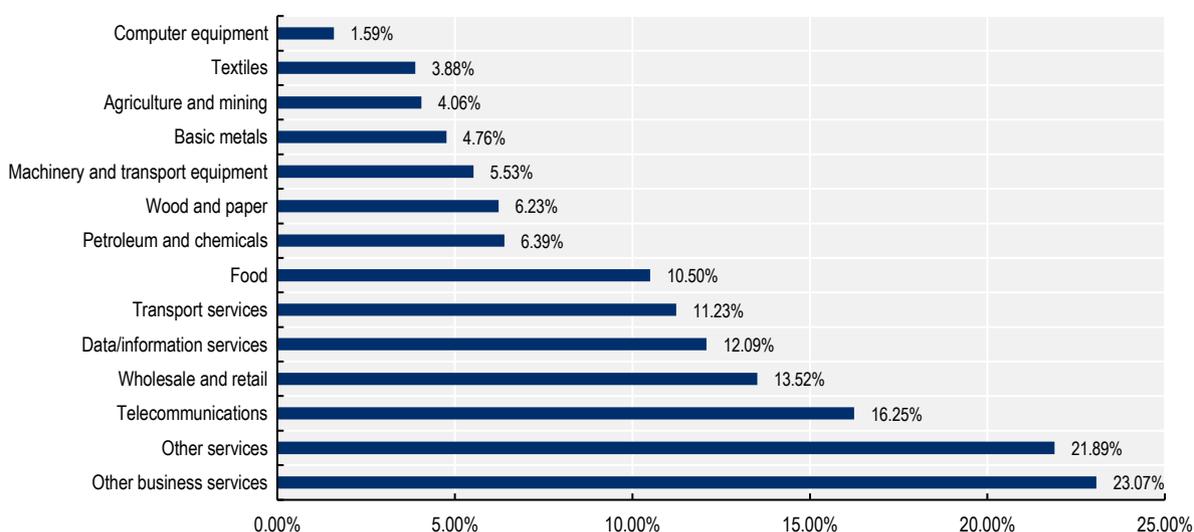
Trade costs

Projected changes in trade costs associated with changes in data flow policies are calculated in three steps.

- First, the trade costs of data flow policies are estimated using a structural gravity model (consistent with the Melitz version of the GTM – see Annex B). The value of exports is regressed against the OECD Digital Services Trade Restrictiveness Index (DSTRI) interacted with a border dummy and a set of control variables and fixed effects.³³ The coefficient on the interacted DSTRI variable captures how trade flows react to changes in the DSTRI (López González, Sorescu and Kaynak, 2023^[35]). This can be used to calculate the *ad valorem* equivalent associated with the DSTRI (Figure 3.6).³⁴
- Second, to determine the specific *ad valorem* equivalents (AVEs) of changes in data flow policies, the gravity estimates are combined with projected changes in the DSTRI associated with changes in data flow policies. For example, a change from a Category 3 data flow policy to a Category 1 or 2 policy corresponds with a fall in the DSTRI score by 0.04 based on the weight of data flow policies in the DSTRI. Using standard formulas for AVEs, this change can be mapped into projected trade cost changes.³⁵
- Third, the split between changes in variable and fixed trade costs are based on answers in the questionnaire reported in Annex A (Figure A3.b). These suggest that about half of the costs to comply with cross-border data transfers are variable in nature and half are fixed in nature.

Figure 3.6. Trade cost increase arising from an increase in the DSTRI

Trade cost increase for selected sectors as a result of a 0.04 point increase in DSTRI



Note: The figure shows by how much export costs increase as a result of a 0.04-point increase in the Digital STRI.

Source: Calculation based on the estimated coefficients reported in Annex B and adapted from López González, Sorescu and Kaynak (2023^[35]).

Trust / willingness to pay

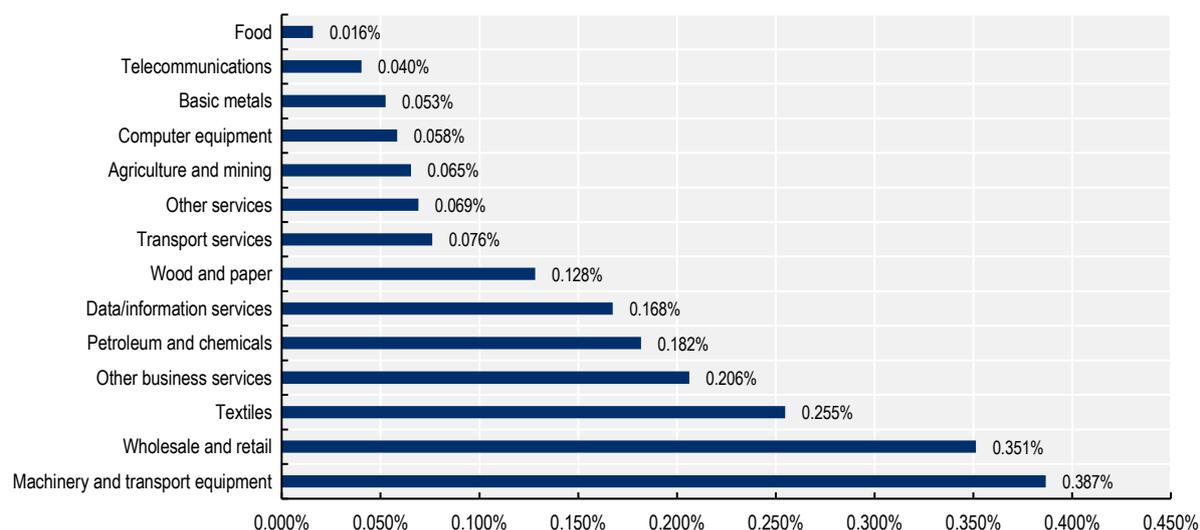
Changes in trust/WTP are calculated by combining the gravity estimates of projected cost changes with outcomes from the Business Questionnaire on the impact of data flow policies (Figure 3.3). The results of the business questionnaire in Figure 3.3 show the expected impact of data flow policies on trade costs and sales. The ratio of the change in sales and trade costs (averaged over all firms across all sectors given the small sample size) are employed to turn the gravity-based projections for trade cost changes into projections for trust/WTP changes. The projected trade cost changes under the different scenarios are multiplied by the ratio of changes in sales to trade costs to obtain the projected change in sales. These projected sales changes are subsequently converted into changes in a trust/WTP parameter in the model (employing the expression for import demand in which sales are a function of trust/WTP).

Data management costs

Changes in data management costs are based entirely on answers from the business questionnaire (Figure 3.7).³⁶ This requires a two-step procedure. First, the projected change in operating costs from the questionnaire shown in Figure 3.7 and Figure 3.4 broken down by sector is transformed into cost increases for the intermediate use of data management services (Figure 3.7). To do so, the sectoral change in operating costs is divided by the share of data management services costs in total costs in each of the sectors using such services. Second, the projected cost increases are mapped into productivity shocks of domestic and imported intermediate use of data management services (to capture the efficiency loss from data localisation). To determine which regions face changes in costs under the different scenarios, the mapping of data localisation measures in Del Giovane, Ferencz and López-González (2023^[8]) is used.

Figure 3.7. Cost increase arising from a change in data management costs

Data management cost increase for selected sectors as a result of local storage requirements



Note: The figure shows the total cost increase of a change in data management costs per sector because of the requirement to use additional domestic data management services.

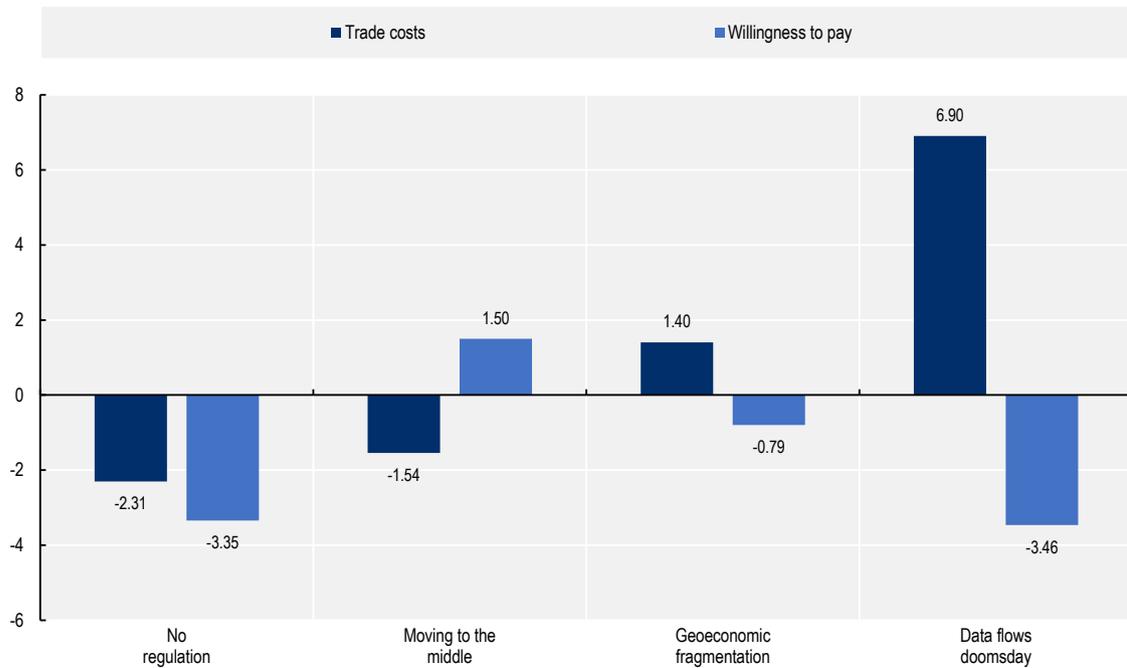
Source: Calculations based on the estimated cost increases reported in Figure 3.4 implied by the OECD-WTO Business Questionnaire.

Overall changes in costs across different scenarios

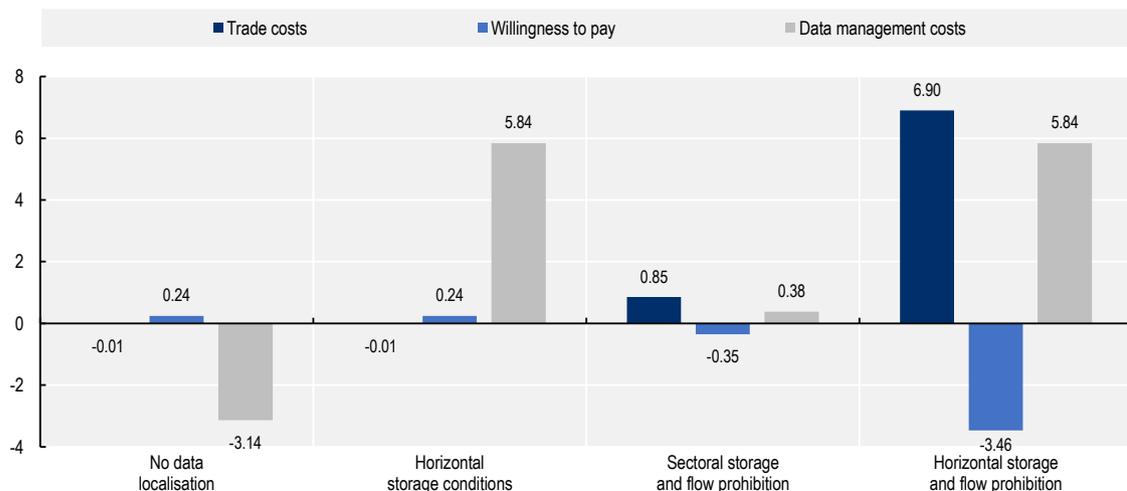
Overall, the projected change in global AVE trade costs and WTP (using trade values as weights) across the different data flow regulation and data localisation scenarios are presented in Figure 3.8.

Figure 3.8. Projected changes in *ad valorem* trade costs, trust and data management costs under different scenarios

A. Data flow regulation



B. Data localisation



Note: The top figure displays the projected change in percentage of *ad valorem* trade costs and the willingness to pay parameter under four data flow scenarios: (1) no regulation; (2) moving to the middle; (3) geoeconomic fragmentation; (4) data flows doomsday. The *ad valorem* trade costs are calculated mapping the combination of fixed trade costs and iceberg trade costs into *ad valorem* trade costs. The bottom figure displays the projected change in percentage of *ad valorem* trade costs and the data management costs under four data localisation scenarios: (A) no data localisation; (B) horizontal storage conditions; (C) sectoral storage and flow prohibition; (D) horizontal storage and flow prohibition.

Source: Own calculations based on the OECD-WTO Business Questionnaire and gravity estimations with the DSTRI.

In the case of *data flow regulation* (Figure 3.8a), when moving towards *no regulation* (Scenario 1), the shocks to the trust/WTP parameter have the same sign as the trade cost parameter. This reflects the fact that *no regulation* implies reductions in trade costs, but also losses in trust. As expected, Scenario 2 shocks are smaller in magnitude (relative to Scenario 1 shocks) reflecting the fact that existing data localisation measures (which are assumed to be unchanged in this scenario) limit the impact of removing data flow regulation (i.e. of moving from Category 3 to Category 1 and 2). Under all other scenarios, the shocks are of opposite sign. That is, reductions in trade costs are overturned by increases in trust when moving to the middle (Scenario 2). Geoeconomic fragmentation (Scenario 3) and Data flow doomsday (Scenario 4) all lead to increases in costs and reduced trust/WTP.

For data localisation regulation (Figure 3.8b), the move towards *no data localisation* leads to a significant reduction in data management costs as regions are able to source data storage solutions globally at lower prices.³⁷ *Horizontal local storage restrictions* (Scenario B) lead to increases in data management costs for all sectors. Scenarios C (sectoral storage and flow prohibition) and D (horizontal storage and flow prohibition) also imply changes to trade costs and trust/WTP on top of data management, but the differences between these scenarios highlights how targeted measures, limited to three sectors only, are likely to have a less negative impact.

4 Outcomes of the simulations

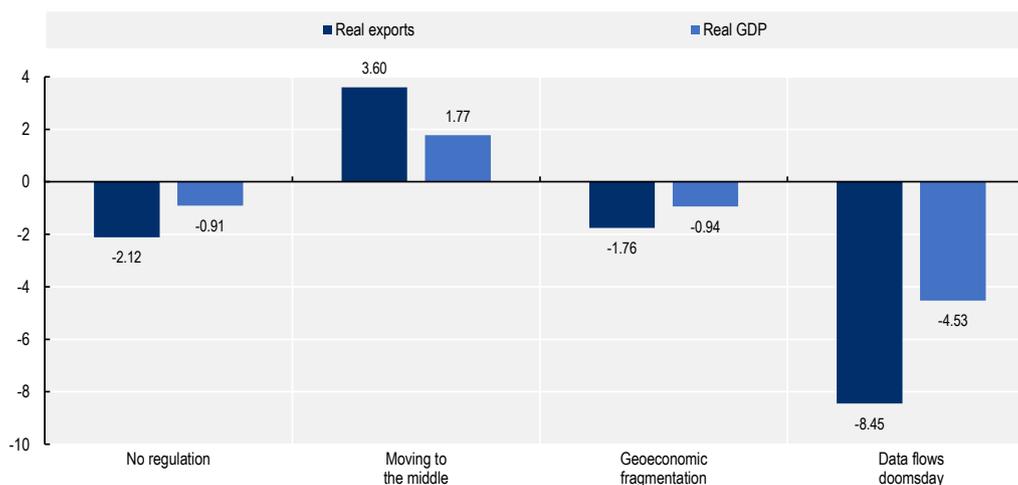
4.1 Changes in data-flow regulation can have sizeable impacts

Overall impact

Four main takeaways emerge from the simulations on data flow regulation (Figure 4.1). (A discussion of the channels of transmission can be found in Annex C.1).

- The *no regulation scenario* (Scenario 1) underscores the economic importance of data flow policies to build trust in economic transactions. Moving to *no regulation* leads to overall reductions in exports and GDP because the losses from a reduction in trust outweigh the gains from lower trade costs as a result of less regulation.
- The scenario where all regions *move to the middle* (Scenario 2) shows the benefits of convergence towards balanced data flow regulations in the form of regimes with either open or pre-authorized safeguards. Here benefits are sizeable, with a projected increase in global exports of 3.6% and in global GDP of 1.77%.
- The *geoeconomic fragmentation scenario* (Scenario 3) highlights that the economic costs of fragmentation of data flow regimes are sizeable, with global exports projected to fall by about 1.76% and global real GDP to fall by 0.94%.³⁸
- The *data doomsday scenario* (Scenario 4) shows the overall importance of data flows in underpinning economic activity. A move to “data autarky” would see real global exports fall by 8.45% and real global GDP by 4.53%.

Figure 4.1. Projected change in global exports and GDP as a result of different data flow regulation scenarios



Note: This figure displays the projected change in percentage of real exports of goods and services and real GDP at the global level under the four scenarios. Source: Simulations with the WTO Global Trade Model (version with Melitz market structure as described in Bekkers and Francois (2018^[34])).

Impact by level of development

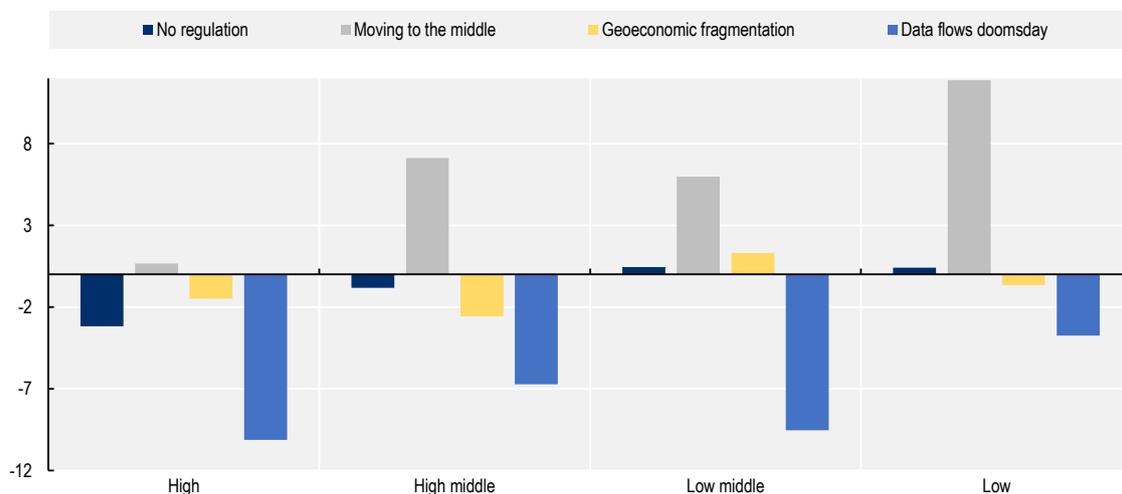
The projected changes in these scenarios do not fall equally across economies across different income groups:³⁹

- High income economies would lose most from the *no regulation* scenario (GDP losses around 1.5%). This reflects losses in trust benefits from existing regulation. By contrast, low- and lower-income economies would see small benefits arising from reductions in trade costs as regulations are eased (just below 0.5% of GDP).
- The main beneficiaries of *moving to the middle* would be low- and middle-income economies. These would see trade costs fall and trust increase leading to increases in GDP of 5 and 4.3% respectively. High-income economies also benefit, but to a much lesser extent (increases in GDP of 0.5%), and largely as a result of positive spillover effects from changes in low- and middle-income countries.
- Losses arising from *geoeconomic fragmentation* would be concentrated in high and upper middle-income economies (losses of 0.9% and 1.2% in GDP). Low-income economies would experience losses of about 0.5% of GDP, while lower middle-income economies would gain (+0.2% of GDP), given that many lower-middle income economies are not part of a bloc (and would therefore not restrict their flows vis a vis others).
- Under the *data flows doomsday* scenario, the largest losses would be experienced by high-income economies who would face both higher trade costs and less trust leading to losses of around 5.3% in GDP. Low-income economies would generally experience smaller losses (around 2.5%), reflecting the fact that many of these economies already have either no policies (thus experiencing less trust) or restrictive policies (which already incur trade costs) however, low-middle income economies would experience sizeable shocks (close to 4 % reductions in GDP).

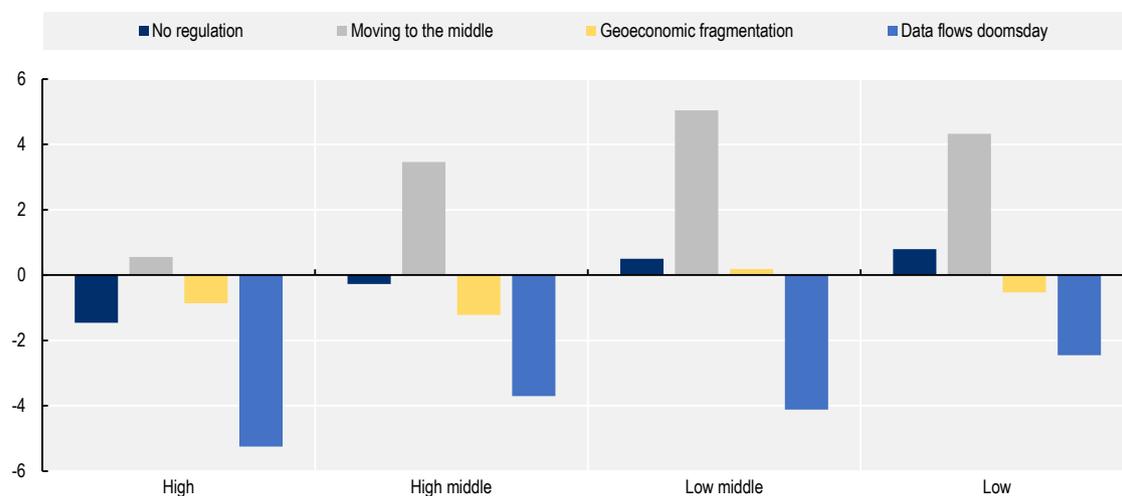
To an extent, this analysis suggests that policies in low and middle-income economies that restrict data flows for digital industrial policy purposes might be counterproductive. This is because they tend to increase trade costs, but without having an offsetting positive impact on trust. For these countries, significant losses are associated with just imposing restrictions on data flows, but gains are largest from measures that allow for data to flow with conditions that help generate trust. That said, some caveats apply: the economic model employed here does not account for other channels which some argue might make restrictive digital industrial policy effective, i.e. the presence of scale economies and network externalities. The potential benefits of restrictions stemming from these characteristics would have to be assessed against the costs that such measures impose. Models of international trade with such features are not available (see Ciuriak (2017_[36]) for a discussion).

Figure 4.2 Projected change in real exports and real GDP by income group from changes in data flow regulation

A. Changes in real exports



B. Changes in real GDP



Note: The figure displays the projected change in percentage of real exports of goods and services and real GDP at the global level under four scenarios: (1) no regulation; (2) moving to the middle; (3) geoeconomic fragmentation; (4) data flows doomsday for four income groups: low-income economies (less than USD1 006), lower-middle income economies (between USD1 006 and USD 3 955), higher middle-income economies (between USD 3 956 and USD 12 235), and high-income economies (more than USD12 235) employing the World Bank definition with cutoffs for 2017, the baseline year of the simulation data.

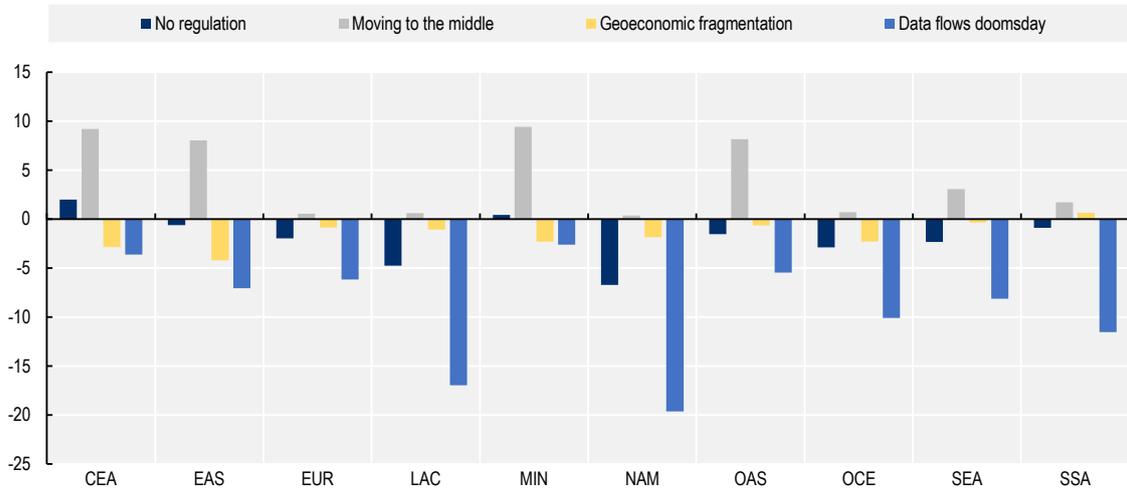
Source: Simulations with the WTO Global Trade Model (version with Melitz market structure as described in Bekkers and Francois (2018^[34])).

Impact by region

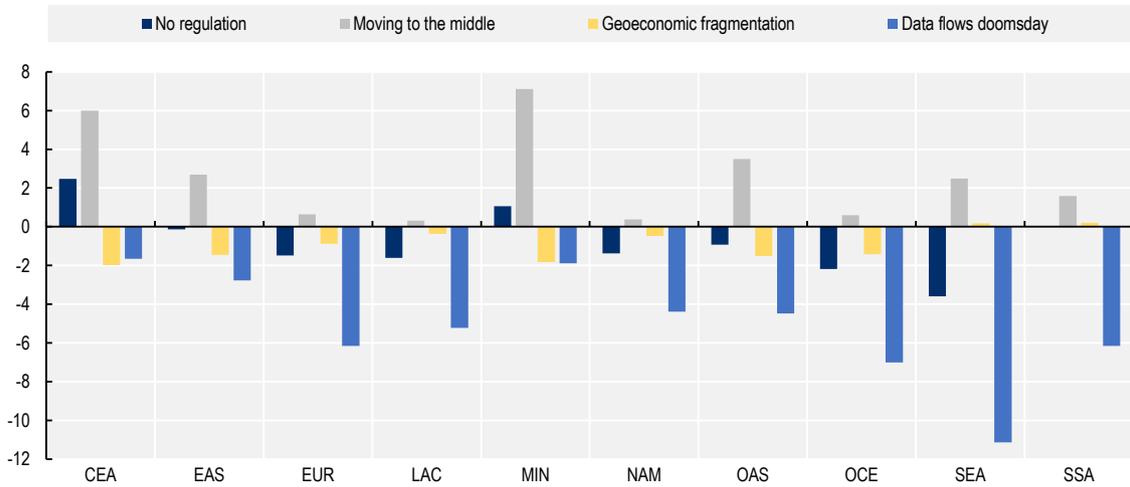
There is a strong degree of heterogeneity across regions, largely depending on the current regulatory stance (Figure 4.3). In the first scenario, *no regulation*, as foreshadowed, regions which would see both trade costs fall and willingness to pay decrease (Categories 1 and 2) would face important reductions in both exports and GDP. This would include Europe (EUR) and North America (NAM). By contrast, under this scenario, exports and GDP for Central Asia (CEA), which comprises a number of economies with Category 3 measures, are projected to rise, reflecting reductions in trade costs with no associated changes in trust.

Figure 4.3. Projected change in real exports and real GDP by aggregate region from changes in data flow regulation

A. Changes in real exports



B. Changes in real GDP



Note: The figure displays the projected change in percentage of real exports of goods and services and real GDP at the global level under four scenarios: (1) no regulation; (2) moving to the middle; (3) geoeconomic fragmentation; (4) data flows doomsday for ten aggregate regions: Central Asia (CEA); East Asia (EAS); Europe (EUR); Latin America and the Caribbean (LAC); Middle East and Northern Africa (MIN); North America (NAM); Other Asia (OAS); Oceania (OCE); Southeast Asia (SEA); Sub-Saharan Africa (SSA).

Source: Simulations with the WTO Global Trade Model (version with Melitz market structure as described in Bekkers and Francois (2018)^[34]).

The Asian regions (CEA, EAS, OAS and SEA), which comprise economies in categories 0 and 3, are projected to benefit in the second scenario, *moving to the middle*, seeing reductions in trade costs but also associated increases in trust (willingness to pay). Furthermore, under this scenario Sub-Saharan Africa (SSA), which comprises a number of economies in Categories 0 and 3, is projected to gain because the effect of increased trust/WTP as a result of the introduction of data flow regulation dominates the increase in trade costs. For the other regions, there are no changes in trade costs, so the trade and GDP effects are second order (i.e. arise through changes in what others are doing).

In the third scenario, *geoeconomic fragmentation*, the projected trade and GDP effects are negative for almost all regions. The effects are largest for Central Asia (CEA), East Asia (EAS) and the Middle East and Northern Africa (MIN). These regions contain most countries in the Eastern Bloc and would thus be more adversely affected than regions in the Western Bloc such as Europe (EUR) and Northern America (NAM). The latter regions tend to trade most within the Western Bloc and are thus less affected by geoeconomic fragmentation. In this scenario, the effects for regions that are in neither bloc, such as OAS (Other Asia) and Sub-Saharan Africa (SSA), are smaller, which is expected because these regions do not face cost increases *vis-à-vis* the other blocs (by assumption).

Finally, in the fourth scenario, *data flows doomsday*, the projected losses for all regions are large, with GDP losses ranging between about 6% for Europe (EUR) to 11% for Southeast Asia (SEA). For the European Union, the more modest effects reflect the fact that intra-EU trade is not subject to increases in trade costs. This is not the case, however, for trade within SEA, where trade costs are projected to rise.⁴⁰

Impact on trade patterns

Regional changes are, in part, driven by changes in trade patterns (Annex C2). Four key messages emerge from the trade pattern analysis.

- Trade shifting plays an important role in the projected changes. For example, in the *no regulation* scenario (Scenario 1), exports from regions which previously had open or pre-authorised safeguards are projected to fall, because demand shifts to regions which previously had *ad hoc* authorisation (due to lower trade costs in these regions and to lower trust in regions which had pre-existing open or pre-authorised safeguards).
- Intermediate linkages are an important explanation for the projected changes in trade patterns. For example, in the *no regulation* scenario (Scenario 1), exports from regions without regulation to regions which formerly had *ad hoc* authorisation are projected to rise, because of increased production in the latter regions leading to more demand for intermediate imports.
- Bilateral trade changes in the geopolitical scenario (Scenario 3) reflect changes in trade costs. Hence, trade between the Eastern and Western Blocs falls, whereas trade within blocs and between regions outside these and the Eastern and Western Blocs rises.
- The *data flows doomsday* scenario (Scenario 4) sees the largest reductions in exports. This is the case for all regions. However, impacts are smallest, and sometimes even positive, for those regions that already have the most restrictive policies (Category 3). Indeed, exports of Category 3 regions to other Category 3 regions increase, largely as a result of the strong reduction in exports of all other regions as a result of growing trade costs.

4.2. Impacts of data localisation tend to be smaller, but depend strongly on the measure applied

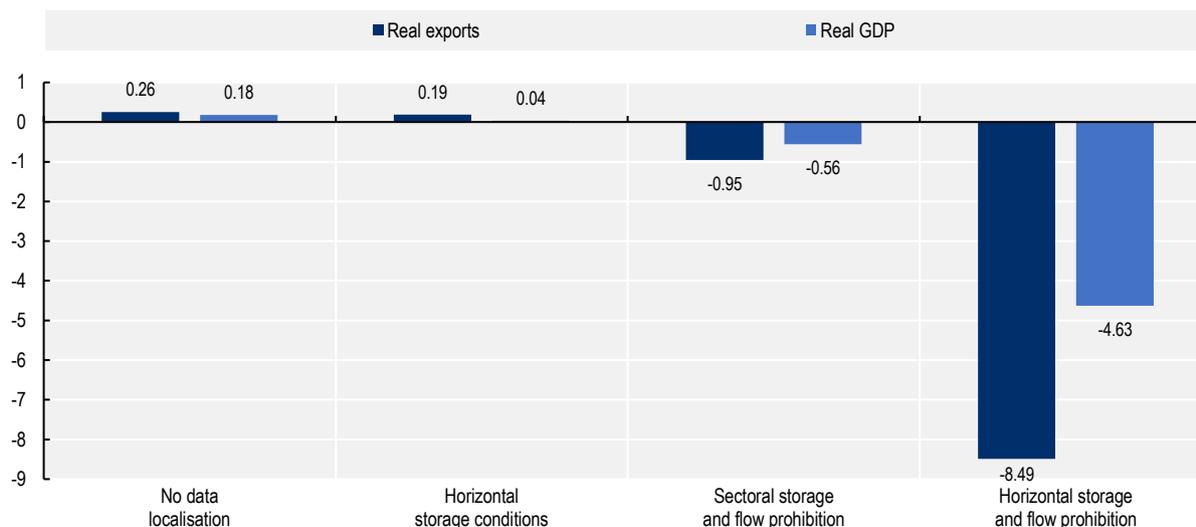
Overall impact

When looking at the projected global exports and GDP changes in the different scenarios for data localisation measures (Figure 4.4), the following messages emerge.

- *No Data Localisation scenario* (Scenario A) reveals that, while global GDP is projected to increase, the impacts of removing data localisation measures are, in relative terms, smaller than those of removing data flow regulation. This is because data localisation policies generate small cost increases (according to the business questionnaire) through the suboptimal use of data management inputs which represent a small share of total costs. Minor changes in trade costs and trust arise because there are economies that have very restrictive data localisation policies with less restrictive data flow policies. Once data localisation measures are removed, these economies would see a reduction in both trade costs and an increase in trust to the level of the data flow regime. Overall, moving to no data localisation would increase exports by 0.26% and GDP by 0.18%.
- In *Horizontal Storage Conditions scenario* (Scenario B), global exports and GDP are projected to increase very slightly. This is because the positive impact of economies moving from restrictive data regulation to less restrictive horizontal storage conditions outweighs the negative impact of economies moving from no regulation to horizontal storage conditions (e.g. increase in data management costs). Overall, moving to horizontal storage conditions in regions would raise global exports and global GDP by respectively 0.19% and 0.04%.
- In the *Sectoral Storage and Flow Prohibition scenario* (Scenario C), real GDP and export losses are seen to be much larger than in previous scenarios, even if they are only implemented in a small number of sectors. This suggests that the economic costs of localisation conditions depend strongly on both the type of measure and the sectors in which these are implemented. Overall, the moving to sectoral storage and flow prohibitions is projected to decrease exports by 0.95% and GDP by 0.56%.
- The *Horizontal Storage and Flow Prohibition scenario* (Scenario D) underscores the difference between applying storage and flow prohibitions across the board or only in a limited number of sectors. Global GDP losses would be 4.63%, nearly nine times larger than under sectoral prohibitions. The costs are marginally larger than in the *data doomsday* scenario because they also incorporate additional data management costs related to local storage (which are relatively small).

Overall, the data localisation scenarios show that changes in storage conditions without complementary flow prohibitions have only a small impact on global exports and global GDP. The reasons are twofold. First, data storage conditions generate costs from the greater use of domestic data management services inputs, but these represent only a small share of total firm costs across many sectors. Second, the costs associated with domestic storage conditions are modest according to the OECD-WTO Business Questionnaire.

Figure 4.4. Projected change in global exports and GDP as a result of data localisation measures



Note: The figure displays the projected change in percentage of real exports of goods and services and real GDP at the global level under four scenarios: (1) No data localisation; (2) Horizontal storage condition; (3) Sectoral storage and flow prohibition; (4) Horizontal storage and flow prohibition.

Source: Simulations with the WTO Global Trade Model (version with Melitz market structure as described in Bekkers and Francois (2018)^[34]).

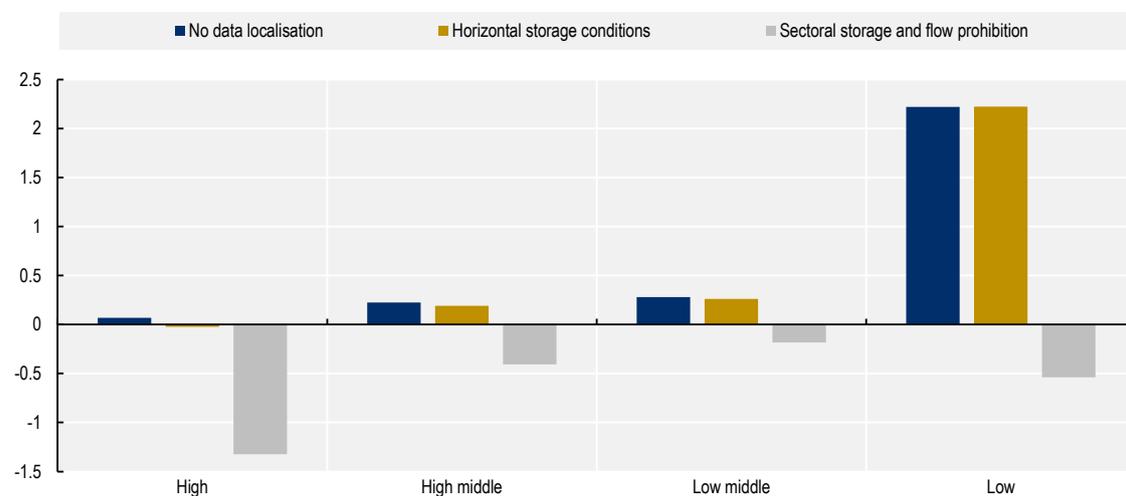
Impact by level of development

The projected changes in real GDP and real exports under the three data localisation scenarios for the different income groups indicate the following (Figure 4.5).

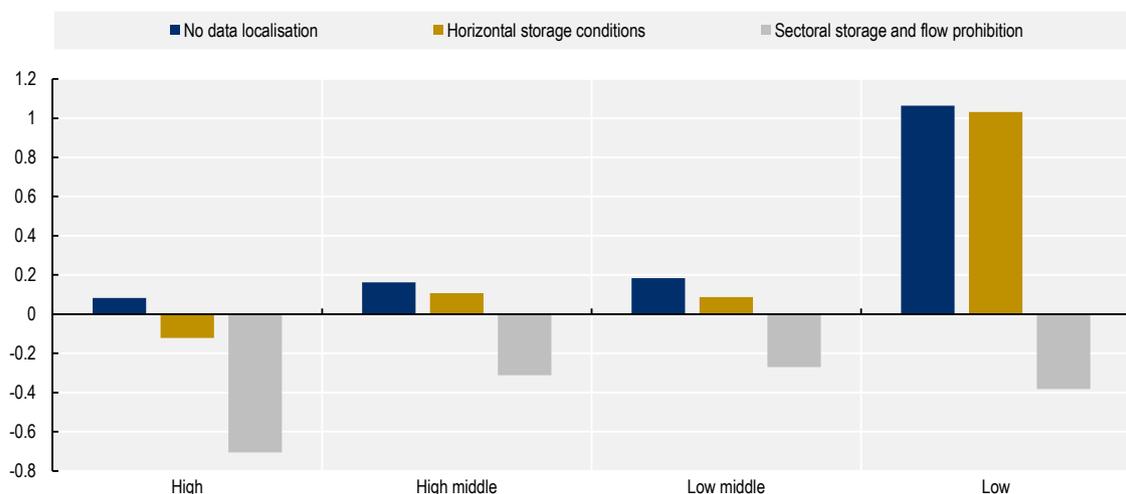
- The gains under the *no data localisation* scenario (Scenario A) are much larger for low-income economies than for other economies given the restrictive nature of existing data localisation policies in place and the lack of data flow regulation. These could see their GDP increase by over 1% as a result of removing existing data localisation policies.
- Under *Horizontal storage conditions* (Scenario B) there would be small losses for high-income economies (-0.1% of GDP) for which this would represent a shift to more restrictive conditions, small gains for middle income economies (+0.1% of GDP), and large gains for low-income economies (+1% of GDP) which, for these countries, reflect the impact of moving to less restrictive data localisation than is currently in place.
- *Sectoral storage and flow prohibitions* (Scenario C) generate the largest losses in high-income economies, because the introduction of these policies would both raise the costs of sourcing intermediate inputs and the costs to export goods and services compared to the current regime.
- The impacts of horizontal restrictions (Scenario D) are the same as reported in Figure 4.2.

Figure 4.5. Projected change in real exports and real GDP by income group from changes in data localisation measures

A. Changes in real exports



B. Changes in real GDP



Notes: This figure displays the projected change in percentage of real exports of goods and services and real GDP under three scenarios: (1) No data localisation; (2) Horizontal storage condition; (3) Sectoral storage and flow prohibition for three income groups: low-income economies (less than USD 1 006), lower middle-income economies (between USD 1 006 and USD 3 955), higher middle-income economies (between USD 3 956 and USD 12 235), and high-income economies (more than USD 12 235) employing the World Bank definition with cutoffs for 2017, the baseline year of the simulation data.

Source: Simulations with the WTO Global Trade Model (version with Melitz market structure as described in Bekkers and Francois (2018)^[34]).

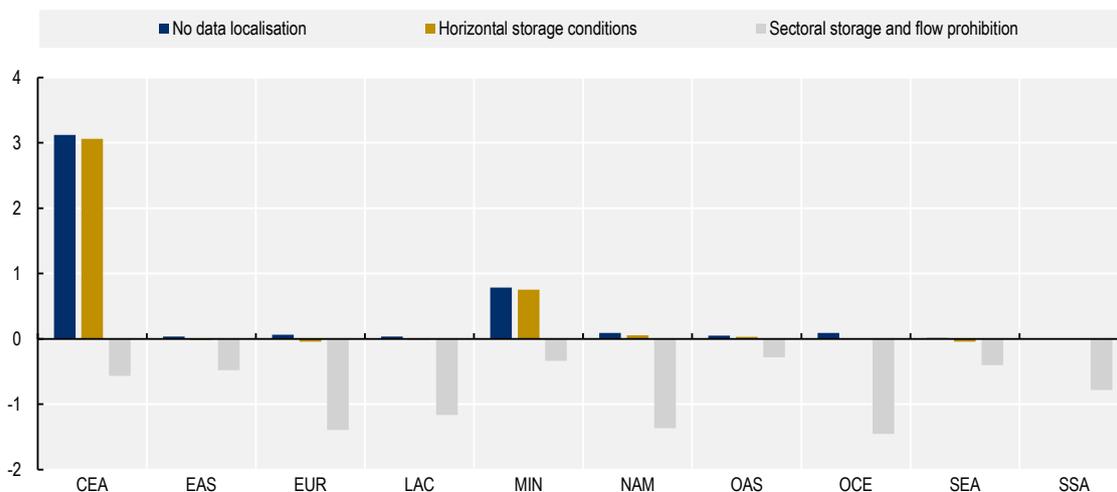
Impact by region

In terms of the regional projections, only the results for Scenarios A-C are reported (Figure 4.6) since the effects of Scenario D are similar to the data flow Scenario 4 and much larger than the effects of the other scenarios. The positive effects of moving to *no regulation* (Scenario A) and *horizontal storage conditions* (Scenario B) is largest in regions with the most restrictive data localisation policies short of *ad hoc* data flow authorisation policies. These regions include Central Asia (CEA), and Middle East and Northern Africa (MIN), where an easing of data localisation policies leads to reductions in trade costs and increased trust/WTP raising exports and GDP.

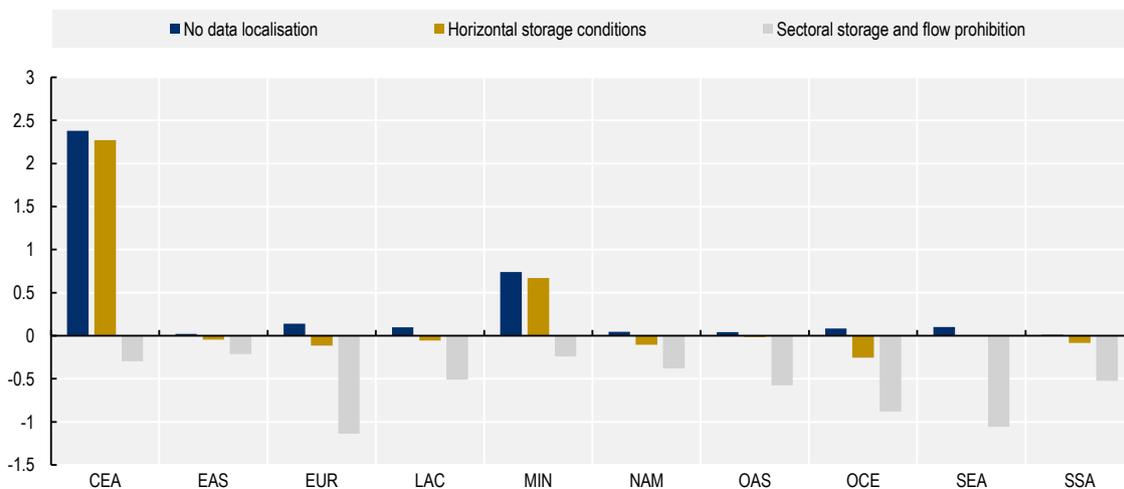
Under Scenario C, *sectoral storage and flow prohibitions*, all regions are projected to lose. Projected changes in GDP are especially large in Europe (EUR), Southeast Asia (SEA) and Oceania (OCE). In these regions, trade costs are projected to increase substantially when the most restrictive data localisation policies are introduced.

Figure 4.6. Projected change in real exports and real GDP by aggregate region from changes in data localisation measures

A. Changes in real exports



B. Changes in real GDP



Notes: This figure displays the projected percentage change of real exports of goods and services and real GDP under three scenarios: (1) No data localisation; (2) Horizontal storage condition; (3) Sectoral storage and flow prohibition for ten aggregate regions: Central Asia (CEA); East Asia (EAS); Europe (EUR); Latin America and the Caribbean (LAC); Middle East and Northern Africa (MIN); North America (NAM); Other Asia (OAS); Oceania (OCE); Southeast Asia (SEA); Sub-Saharan Africa (SSA).

Source: Simulations with the WTO Global Trade Model (version with Melitz market structure as described in Bekkers and Francois (2018)^[34]).

5 Policy implications

There are manifold reasons economies are reviewing their data policy. These include considerations related to privacy and data protection, national security, regulatory control or audit, digital security, and also new forms of digital industrial policy (Casalini, López González and Nemoto, 2021^[26]). While there are legitimate reasons for the diversity in regulations across economies, the regulatory landscape that underpins cross-border data flows and data localisation is becoming increasingly complex.

The emerging patchwork of approaches risks undermining the policy objectives they were intended to serve. The patchwork makes it difficult not only to effectively enforce public policy goals such as privacy and data protection when data crosses international borders, but also for firms to operate across markets, affecting their ability to internationalise and benefit from operating on a global scale. The challenge for governments is thus to promote regulatory approaches that enable the movement of data while, at the same time, ensuring that, when data crosses a border, it receives the desired protection, safeguard or oversight.

In the context of *data flow measures*, the analysis generates four main findings.

- Cross-border data flows are the lifeblood of the global economy. Data autarky, where all economies restrict their data flows (full fragmentation), would lead to global GDP losses of 4.5% and reductions in exports of 8.5%.
- The absence of data flow regulation is also associated with negative economic outcomes. Indeed, if all economies moved towards an absence of regulation for data flows, trade costs would fall, but so too would trust. Overall, global GDP would fall by nearly 1% and global exports by just over 2%. The impacts would be largest for high-income economies which could see their GDP fall by over 2%.
- Regimes that combine open data flows with safeguards (Categories 1 and 2) balance the trade costs associated with data regulation with the trust benefits of data safeguards. Indeed, if such approaches were adopted by all economies, global exports would grow by 3.6% and global GDP by 1.77%. Benefits would be highest for low and lower-middle income economies, which could see their GDP rise by over 4%.
- The economic costs of fragmentation of data flow regimes along geoeconomic blocs would also be sizeable (more than 1% real GDP loss).
- Overall, the analysis suggests that global solutions to data flow issues that combine open regimes with safeguards are likely to deliver better economic outcomes.

For *data localisation measures*, the following messages emerge.

- Removing existing data localisation measures would deliver small but positive impacts. Exports would rise by 0.26% and GDP by 0.18%. Gains are, however, potentially large for low-income economies which could see their GDP rise by over 1%, given more restrictive existing regimes.
- Moving to *data storage requirements without flow prohibition* is associated with relatively small economic costs. The global GDP loss is projected to be smaller than 0.1%. That said, low-income

economies are projected to see strong increases in GDP from moving to this less restrictive form of data localisation.

- *Horizontal storage and flow prohibitions* are nearly nine times more costly than more targeted policies in areas that are typically regulated (financial, telecommunications, and ICT services).
- *When combined with flow prohibitions the costs of data storage requirements* are much larger and similar to restrictive data flow measures.

Data flow and data localisation policies also interact with each other. At the extreme, a requirement that all data be stored domestically is equivalent to a prohibition to transfer data. That said, along the continuum of measures, the impact between these varies markedly. A local storage requirement that does not have a flow prohibition has an effect on data management costs arising from having to keep copies of data using potentially more expensive data storage solutions. By contrast, conditional flow regimes require greater costs associated with ensuring that data remains protected. These include legal costs associated with understanding privacy and data protection frameworks abroad as well as costs associated with drafting and managing contracts, binding corporate rules, or signing up to certification schemes that ensure that privacy and data protection is enforced when data is transferred. This is, however, associated with benefits in the form of greater trust arising from the fact that transferred data is being protected against privacy violations. For the case of data localisation measures, trust benefits are not identified. This is partly because the location of the data does not necessarily have an impact on whether data is or is not safeguarded (see also Del Giovane, López González and Ferencz (2023^[8])).

Overall, this work aims at weighing different considerations in the context of discussions about balancing data flows with safeguards. Overall, the analysis shows that data policies matter for our globalised economy. It underscores the dangers of unnecessarily restrictive policies and suggests that balanced and global approaches to data regulation work best.

As noted in IMF et al. (2023^[37]), an important digital divide between developed and developing countries remains. Future work can investigate the implications of different data governance policies and how these might contribute to or attenuate this digital divide.

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Notes

¹ See <https://newsroom.cisco.com/press-release-content?type=webcontent&articleId=1908858>.

² Based on data from the University of California, Santa Barbara, accessed on 10 November 2020, <http://scienceline.ucsb.edu/getkey.php?key=3775#:~:text=The%20number%20of%20stars%20in,stars%20in%20the%20observable%20universe>.

³ Video is estimated to account for a large share of this traffic. Indeed, CISCO estimated that global video traffic as a share of global consumer IP traffic was 73% in 2017 and forecasted to reach 82% by 2022. Since global consumer IP traffic is estimated to represent 84% of total IP traffic, this suggests that video traffic would represent 70% of total IP traffic. See [Global Device Growth Traffic Profiles \(cisco.com\)](#).

⁴ For example, popular social networking platforms ran strong deficits during their early years of operation while seeking about how to best capitalise on the mass of information gathered.

⁵ In economic terms the non-rivalrous nature of data means that its consumption by one user does not prevent the simultaneous consumption by another.

⁶ That said, as a result of developments in Generative AI, access to data is increasingly being restricted, including through website protocols preventing web crawlers from accessing publicly available, yet legally protected content. GenAI models also require important costs of collecting and processing data requiring more compute and advanced micro-processors.

⁷ Although there is a difference between data and information, these terms are used interchangeably in this report.

⁸ This is a widely-used model within the information and knowledge management literature.

⁹ That said, identifying the ultimate objective of measures is complex. Sometimes these might not be made clear, they might be intentionally ambiguous and might serve several purposes at once (which can be difficult to disentangle).

¹⁰ *Ex post accountability* refers to frameworks that allow cross-border transfers to take place without specific upfront requirements such as additional legal steps. In these cases, “trust” is placed on the data holder on the understanding that if data is mishandled or misused in the foreign economy, the data holder in the regulating economy will be accountable. For example, the US Privacy Act will remain relevant for US citizens if data is misused abroad. Another approach within this category is where transferring entities are encouraged or required to develop their own legal instruments to protect the data when it crosses borders, such as through the use of contracts. Finally, “private sector adequacy” occurs when the data holder is accountable for having taken reasonable steps to ensure the adequacy of protection in the destination of the transfer, often on the basis of principles set out by the public sector in the sending country.

¹¹ *Public adequacy decisions* are a unilateral recognition by a public body certifying that the personal data protection regime of another jurisdiction meets a certain level of privacy requirements and thus permitting the transfer of personal data to that jurisdiction. A designated public body is in charge of determining adequacy or equivalence on the basis that the protection afforded to individuals in the receiving economy is similar to that afforded domestically. This is the case, for example, of the European Commission's (EC) determination that Israel provides an adequate degree of privacy protection or the designation by the Colombian Superintendence of Industry and Commerce (SIC) that the United States provides adequate protection.

¹² This includes debates over whether emerging privacy and data protection regulation could, in some cases, be classified as data localisation measures, or whether prohibitive tariffs that lead to tariff jumping FDI may be considered as data localisation because they might lead to more local storage than would have been the case if companies could access markets duty free from abroad.

¹³ Bokföringslag (1999:1078), accepted 1999-12-02, last amended 2017-06-07, Chapter 7 Section 2, https://www.riksdagen.se/sv/dokument-lagar/dokument/svensk-forfattningssamling/bokforingslag-19991078_sfs1999-1078

¹⁴ Such rules can be thought of as transpositions of analogue rules such as enabling physical access to a firm's financial data for audit purposes, to the digital world.

¹⁵ Government Regulation Number 71 dated 10 October 2019 concerning the Implementation of Electronic Systems and Transactions [JDIH KEMKOMINFO](#).

¹⁶ A number of other draft laws in China mandate local storage with transfer prohibitions. These include the Draft Data Security Law, as well as more sectoral regulation such as Article 6 of the Effective Protection of Personal Financial Information by Banking Institutions and Article 10 of the Administration of Population Health Information.

¹⁷ See <https://www.taxtechnical.ird.govt.nz/-/media/project/ir/tt/pdfs/standard-practice-statements/general/sps-21-02.pdf?modified=20210506215836>.

¹⁸ Regulation (EU) 2018/1807 of the European Parliament and of the Council of 14 November 2018 on a framework for the free flow of non-personal data in the European Union (<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R1807&from=EN>).

¹⁹ See note 10.

²⁰ The OECD Digital STRI identifies, catalogues and quantifies barriers that affect trade in digitally enabled services across over 100 economies. It provides policy makers with an evidence-based tool that helps to identify regulatory bottlenecks, design policies that foster more competitive and diversified markets for digital trade, and analyse the impact of policy reforms (<https://sim.oecd.org/Default.ashx?lang=En&ds=DGSTRI>).

²¹ In emerging fields of study such as this, questionnaires can be useful tools for obtaining background information to help guide research efforts. They are not, however, without caveats. For example, the questionnaire can suffer from biases arising from: i) the channels of distribution; ii) the modes of this distribution; and iii) self-selection. For inference to be made about the larger population of firms an appropriate sampling strategy, ensuring the representativeness of the sample, is needed. Obtaining such

a representative sample, in this instance, would stretch beyond the resources available for this work and therefore the results of the questionnaire are to be seen as initial information on which observations or “rebuttable presumption” for deeper analysis can be made.

²² The aim of the questionnaire was to garner information about how business use data and the economic implications of data regulation. To ensure that data was comparable, it was important to undertake the analysis at the firm level rather than to undertake a separate questionnaire targeted to consumers or to business associations.

²³ The distribution was somewhat skewed towards the OECD economies. Responses were received from business located across 32 economies, of which 18 were OECD economies. Japan was most represented with 25 responses, followed by the United States with 9 responses, Chinese Taipei with 6, Ireland (5), and the United Kingdom (3). In terms of sectors, coverage was more spread out with responses from businesses engaged in agriculture, manufacturing, and services. In terms of size distribution, the sample was heavily biased towards larger firms, which represented 75% of responses.

²⁴ It is important to note that firms that deal with personal data might be more likely to have responded to the questionnaire as they are more likely to be aware of the issues because there is more regulation aimed at privacy/personal data and, as a result, might be more motivated to respond.

²⁵ These are the weighted averages of the response by categories taking the middle of the range as the point of reference. That is, if 30% of respondents claim that costs increase by 6-10% then we assign a weight of 30% to the cost increase of 8% (middle of the distribution). We then take the sum of these multiplications across all categories.

²⁶ The question asked was: “Do you think that regulations that require safeguarded transfers of data across borders can have a positive impact on trust and therefore sales?”

²⁷ To obtain this number, the average cost increase in the given bracket was taken and multiplied by the share of responses that chose that bracket. For cost increases that led business to claim that they would stop their activities costs of 500% are assumed.

²⁸ Trust is a complex phenomenon to capture, including in the context of personal data protection (Acquisti, Taylor and Wagman, 2016^[38]). In this paper, trust is assumed to be demand enhancing. *Ceteris paribus*, a consumer will demand more from a firm that safeguards its information over one that does not.

²⁹ For example, an economy that combines a stringent ad-hoc data transfer mechanisms (Category 3) with a prohibitive data localisation policy would not see a change in the (trade) costs and (trust) benefits of data policies.

³⁰ Geoeconomic blocs are defined based on UN voting patterns and more specifically the difference in voting of economies relative to the United States and China. Following (Métivier et al., 2023^[40]) three groups are defined, a Western group, an Eastern group, and a group of non-aligned economies.

³¹ There are also different categories of localisation requirements with varying degrees of restrictiveness. They are distinct from data transfer policies and an economy can have any combination of them, although economies with restrictive data transfer policies tend to have restrictive localisation requirements as well. The four scenarios discussed above do not include any policy shocks related to data localisation. Instead, the potential economic impacts of localisation are explored with four separate scenarios.

³² In Scenario A, data management costs and trade costs can change for economies with prohibitive data localisation policies, since prohibitive localisation policies are no longer inhibiting data flows. In Scenario 1 only trade costs and WTP change. Data management costs are not projected to change, since there are no economies with *ad hoc* data flow authorisation policies nor an absence of data localisation policies.

³³ These fixed effects help control for multilateral resistance which can lead to unobserved heterogeneity biasing coefficients (Annex B).

³⁴ This can be done by multiplying the DSTRI coefficient in the gravity equation, β , by the change in the DSTRI that would arise from a change in the data regulation, $\Delta DSTRI$, divided by the trade elasticity, θ : $AVE = \exp\left(\frac{\beta \cdot \Delta DSTRI}{\theta}\right)$. See also López González, Sorescu and Kaynak (2023^[35]).

³⁵ DSTRI scores are the same for economies in Category 1 and 2, respectively Open and Pre-authorized Safeguards. The reason is that DSTRI scores do not aim to capture policies into that much detail. Correspondingly, the counterfactual policy scenarios are necessarily stylised.

³⁶ Since these costs reflect increased production costs, gravity estimates, which are related to trade costs specifically, cannot be employed for data localisation policies.

³⁷ The reported costs are the projected additional data management costs, average over all sectors and economies. The values are larger than in Figure 3.7, which reports the increase in total costs in each of the sectors reported emerging from the need to procure more data management services.

³⁸ These are smaller than the costs of geoeconomic fragmentation in the emerging literature (e.g. 5% in Goes and Bekkers (2022^[39]) or 7% in IMF (2023^[41])). The current scenario only considers trade costs associated with data policies, whereas the other work on geoeconomic fragmentation includes generic increases in both tariffs and non-tariff barriers. Furthermore, the degree of existing fragmentation in approaches to data flows is already high.

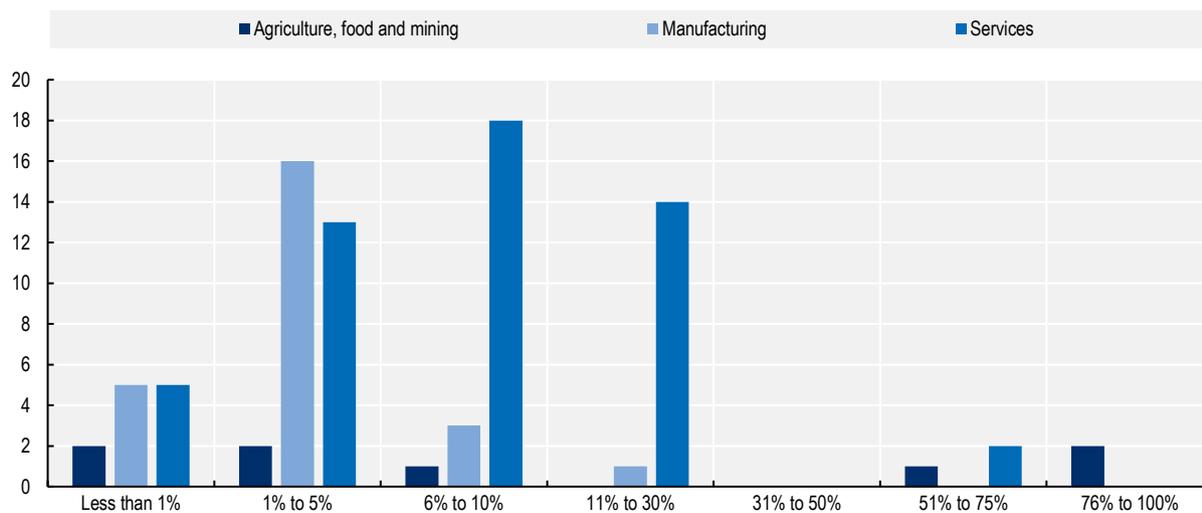
³⁹ Using the World Bank's Classification.

⁴⁰ The analysis assumes that trade costs within the European Union do not change under the different scenarios because EU Members have the same policies and are not assumed to change their policies *vis-à-vis* each other.

Annex A. Further insights from the OECD-WTO Business Questionnaire

The impact of the emerging measures is likely to depend, in part, on the extent to which firms rely on digital solutions to enable their economic activities. When asked about the approximate share of data management costs in total expenses, responding firms highlighted that data management costs were, on average, 11% of total expenses. Differences arise across sectors with services showing a higher share of their costs occupied by data relative to manufacturing and agricultural sectors (Figure A A.1).

Figure A A.1. What is the approximate share of data management cost in your firm's total costs?

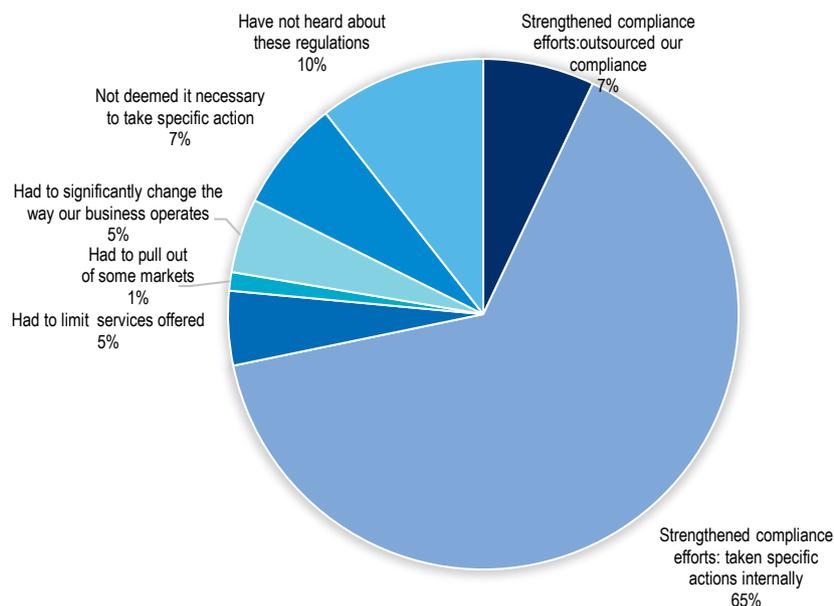


Note: Figure shows responses to the business questionnaire when asked the following question: “What is the approximate share of Data Management Cost (including ICT tasks, equipment and legal compliance costs) in your firm's total costs (total gross expenses)?”

Source: Own calculations based on OECD-WTO Business Questionnaire.

When asked about how their businesses were responding to the emerging regulation (Figure A A.2), most (near 65% of respondents) suggested they had taken internal action, strengthening their own compliance departments. Only 7% claimed to have outsourced compliance. Just over 10% of respondents claimed that they had had to either limit the services they offered, pull out of markets or significantly change their business operations.

Figure A A.2. Amidst the rising number of regulations imposing conditions for cross-border data transfers, have you taken any of the following actions?



Note: Figure shows responses to the business questionnaire.

Source: Own calculations based on OECD-WTO Business Questionnaire.

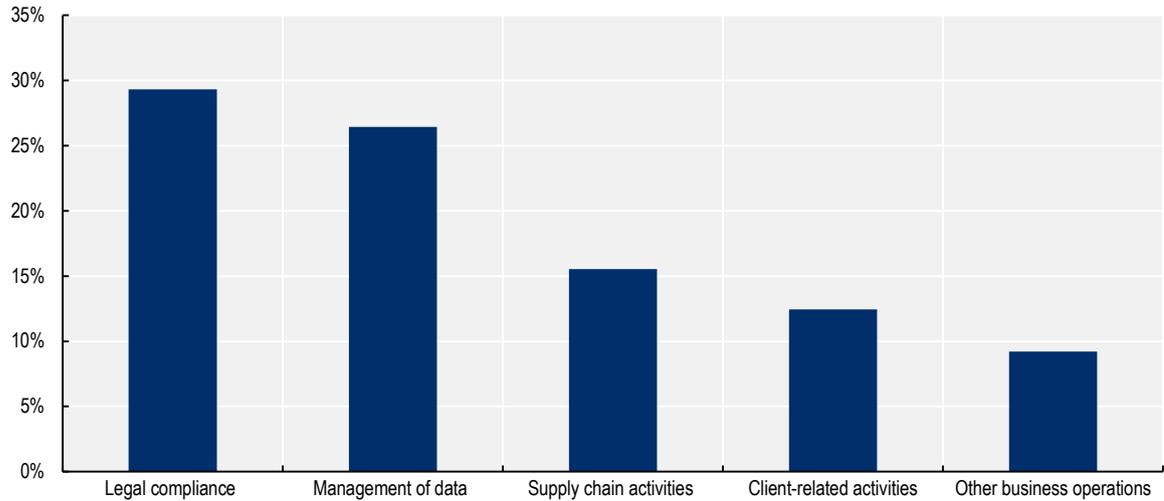
When asked about the incidence of the costs in terms of the activities of the firm, businesses claimed that these were most important for legal compliance, followed by data management and supply chain activities (Figure A A.3). The nature of these costs was perceived to either be variable, in that the costs increased with the number of sales or transfers, or fixed, not varying with transfers (Figure A A.3). This highlights that there could be some heterogeneity as to what these costs mean for different companies in different sectors, as well as across different types of measures (open and pre-defined safeguards might face different costing structures with open safeguards being more of a variable cost with pre-defined safeguards being more of a fixed cost).¹

When the costs associated with different existing transfer mechanisms are ranked, responses highlighted that pre-defined safeguards, such as contractual clauses and binding corporate rules were perceived as the most costly, followed by contractual safeguards defined by the companies themselves, and public adequacy decisions (Figure A A.4). This is in line with the responses received about the size of the costs which suggested pre-defined safeguards as somewhat more costly. The least costly options were identified to be certification schemes and trade agreements.

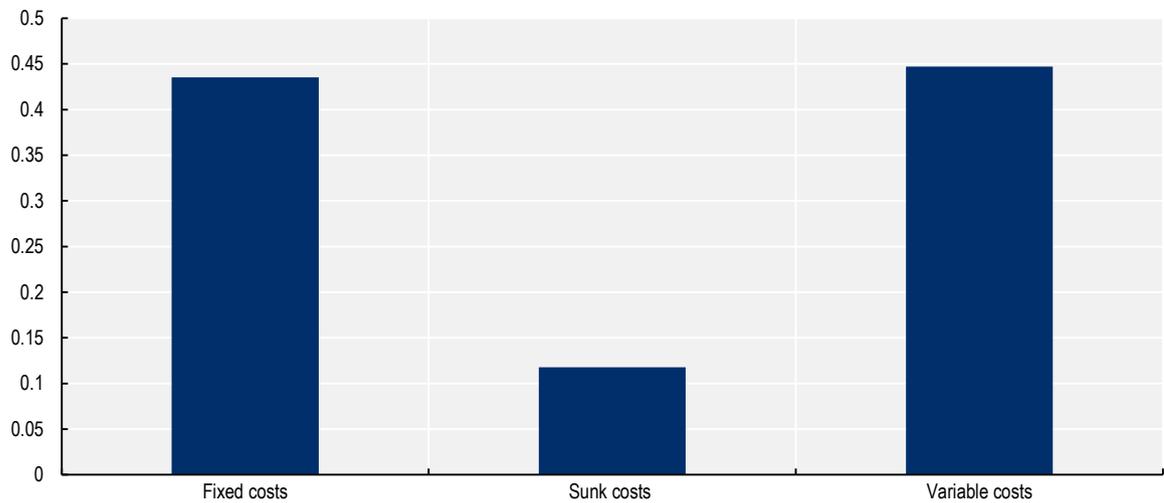
The responses to the business questionnaire also allow us to gauge how the business community feels about some of the other goals that are targeted by data localisation policies. Around 43% of respondents believe that local storage does not lead to increased privacy protection or increase data security and 54% do not believe that it leads to more domestic innovation. Respondents also highlight a range of uncertainties about the degree to which these policies meet other public policy objectives. Only 30% of respondents feel that data localisation can help with privacy, security, or other regulatory objectives with only 19% believing that it can help with domestic innovation.

Figure A A.3. Where are the costs most important and what is the nature of these costs?

A. Where are the costs most important?



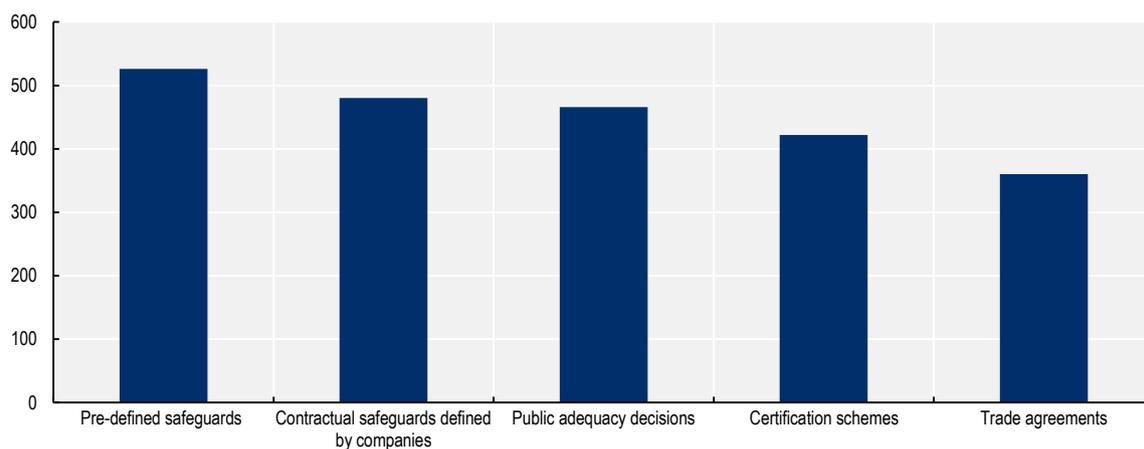
B. What type of cost do these measures generally generate?



Note: Top panel shows a weighted average of ranked responses. Bottom panel shows number of responses. Variable costs are defined as those which vary with the amount of sales or transfers, e.g. having to undertake specific action each time data is transferred. Fixed costs are those which do not vary with sales or transfers, e.g. costs associated with keeping up with regulation in a particular economy. Sunk costs are those incurred only one time, e.g. to set up a system of compliance.

Source: Own calculations based on OECD-WTO Business Questionnaire.

Figure A A.4. Can you rank from most costly to least costly the following transfer mechanisms



Note: Results show weighted average of ranked responses (assigning higher weights to higher rankings). A weight of 10 points is given to the first choice, 8 to the second, 6 to the third, 4 to the fourth, and 2 to the fifth. The axis shows the sum of each category after applying these weights.

Source: Own calculations based on OECD-WTO Business Questionnaire.

Note

¹ It is, *a priori*, difficult to tell whether this is the case as the questionnaire did not ask the firms to identify what type of safeguard they currently faced.

Annex B. Econometric analysis

The gravity model of trade expresses trade flows as a function of the (economic) size of the trading countries and trade costs. A generic sector-specific structural gravity equation can be expressed as:

$$(X_{ij})^k = \frac{Y_i^k E_j^k}{Y^k} \left(\frac{T_{ij}^k}{\Pi_i^k P_j^k} \right)^{-\theta^k} \quad (1)$$

where trade flows from economy i to economy j in sector k , X_{ij}^k , are a function of the supply of sector k -goods from economy i , Y_i^k , and expenditure for sector k -goods in economy j , E_j^k . $T_{ij}^k > 1$ are trade costs when sector k -goods are shipped from exporter-economy i to importer-economy j . θ^k is the sector-specific trade elasticity, and Π_i^k and P_j^k are the price indices representing outward and inward multilateral resistance terms, respectively. The size term is captured by $\frac{Y_i^k E_j^k}{Y^k}$ and shows the hypothetical level of frictionless trade between two countries, which is proportional to their overall share of global economic activity. The trade cost term, $\frac{T_{ij}^k}{\Pi_i^k P_j^k}$, is a scaling factor that takes into account trade frictions.

Trade flows (X_{ijt}^k), taken from the OECD Trade in Value Added database, are regressed against standard gravity variables including:

- The log of bilateral distance ($\ln dist_{ij}$); contiguity ($contig_{ij}$); common official language ($comlang_{ij}$); and colonial history ($colony_{ij}$) – from the CEPII database.
- To capture digital connectivity, the minimum value of the log of the percentage of the population with access to the Internet between economy pairs is used ($min\ln digi_{ijt}$) – from the International Telecommunications Union database.
- A dummy variable capturing the presence of Regional Trade Agreements (RTAs) is also used – from the CEPII database.
- To identify the domestic policy environment for digital trade, the Digital STRI ($DSTR I_{it}$) is included.¹

The specifications include exporter-sector-year and importer-sector-year fixed effects (η_{it}^k and μ_{jt}^k) controlling for all time-varying economy-specific unobservable variables, including multilateral resistance terms. They are estimated using PPML with high dimensional fixed effects. PPML (Poisson Pseudo Maximum Likelihood) allows to account for heteroscedasticity and for zero trade flows (Figure X).

$$X_{ijt}^k = \exp(\ln dist_{ij} + border_{ij} + min\ln digi_{ijt} + border_{ij} * DSTR I_{it} + RTA_{ijt} + RTA_ecomm_chapter_{ijt} + contig_{ij} + comlang_{ij} + colony_{ij} + \eta_{it}^k + \mu_{jt}^k) * \varepsilon_{ijt}^k \quad (2)$$

Table A B.1. Impact of digital connectivity and digital trade policies on trade, 2014-18

	All	Agriculture	Manufacturing	ICT goods	ICT services	DD services	Other services
Log of distance	-1.437*** (-128.08)	-1.452*** (-102.52)	-1.140*** (-162.23)	-0.971*** (-48.36)	-1.416*** (-72.65)	-1.246*** (-90.22)	-1.551*** (-126.40)
Minimum digital connectivity	0.218*** (4.98)	0.432*** (3.57)	0.360*** (8.08)	0.749*** (7.61)	0.337 (1.39)	0.530*** (4.39)	0.275*** (2.95)
Border*digital STRI of reporter	-8.964*** (-40.48)	-10.16*** (-40.70)	-7.784*** (-60.30)	-3.067*** (-11.59)	-9.482*** (-19.47)	-13.28*** (-50.84)	-11.21*** (-39.97)
RTA	-1.012*** (-65.68)	-0.779*** (-22.67)	-0.356*** (-21.17)	-0.186*** (-4.49)	-1.024*** (-21.10)	-1.183*** (-38.28)	-1.445*** (-51.48)
Contiguity	-0.816*** (-19.09)	-0.525*** (-7.47)	-0.138*** (-4.20)	-0.171** (-2.28)	-1.797*** (-10.11)	-1.815*** (-14.53)	-1.003*** (-10.60)
Common language	-0.736*** (-15.34)	-0.914*** (-7.04)	-0.441*** (-8.37)	0.0135 (-0.21)	-0.001 (-0.01)	0.242*** (-3.76)	-0.897*** (-9.50)
Colony	-0.294*** (-9.61)	-0.0779 (-0.84)	-0.183*** (-5.22)	-0.403*** (-4.86)	-0.551*** (-5.83)	-0.493*** (-7.59)	-0.552*** (-10.16)
Constant	20.60*** (-102.65)	20.10*** (-40.23)	17.67*** (-92.58)	14.94*** (-31.88)	19.12*** (-18.38)	18.17*** (-33.32)	21.19*** (-53.23)
N	822 984	55 250	257 984	37 050	37 050	74 100	290 375

Note: Estimated using ppml and reporter-sector-year and partner-sector-year fixed effects. Digital connectivity defined as the minimum, across a dyad of the share of people connected to the Internet.

Source: Own calculations using TiVA 2021 database.

Note

¹ Introducing the DSTRI leads to a shorter period covered in the regressions since availability of data for this indicator begins in 2014.

Annex C. Additional data flow regulation simulations

C.1. Introducing the data flow shocks one by one

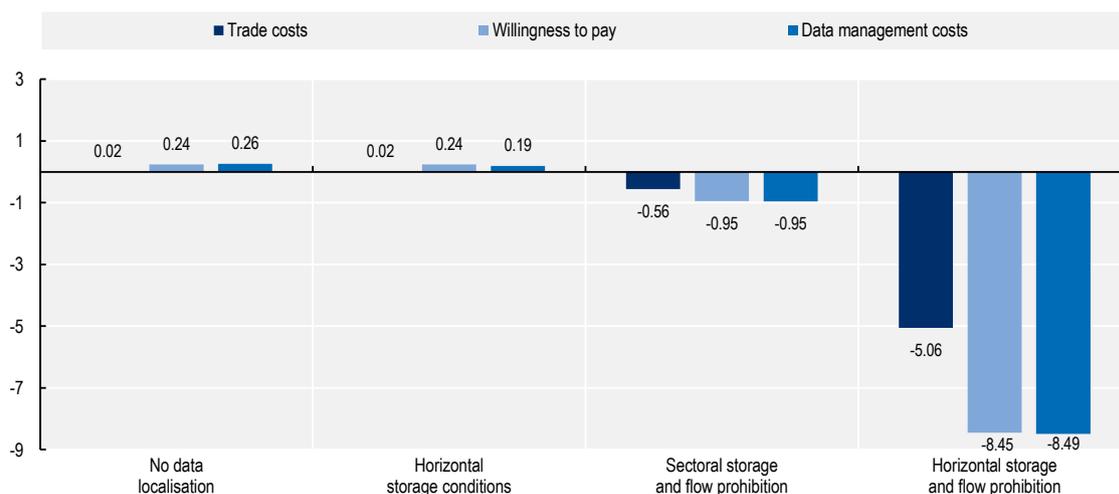
The channels of transmission across the different shocks can be gleaned by introducing the shocks one by one, cumulatively, starting from the change in trade costs, followed by the change in willingness to pay (Figure A C.1).

Under the first scenario of no regulation and given that the shocks are added cumulatively in the figure, the adverse effect of a reduction in trust generating reduced willingness to pay more than compensates for the beneficial fall in trade costs. Although getting rid of data flow policies would reduce costs and thus raise exports (by 1.86%) and GDP (by 1.28%), global exports and GDP are projected to fall when regulations are abolished and the trust effect is taken into account (by respectively 2.12% and 0.91%), because regulations come with enhanced trust among consumers and thus increased sales. As explained above, the size of the trust effect is based on information in the business questionnaire on the size of the cost effect of data flow policies relative to the size of the sales effect.

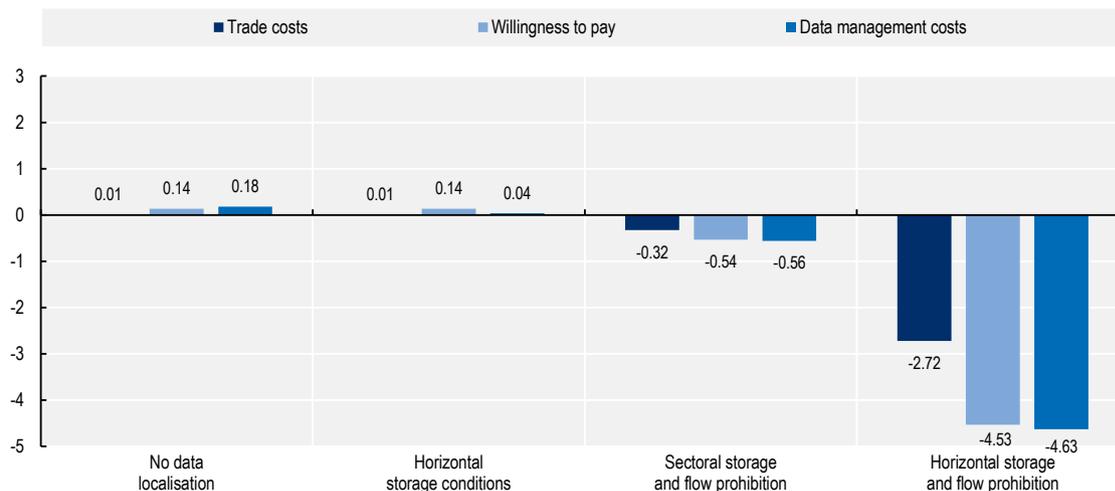
In the other counterfactual scenarios, the willingness to pay shock reinforces the trade cost shocks for regions which currently have *ad hoc* authorisation data flow policies (the fourth approach in Figure 3.6), because both trade costs will fall and willingness to pay rise when moving away from *ad hoc* authorisation towards a safeguards approach. Instead, for regions starting from no regulation changes in trade costs and willingness to pay work in opposite directions. For example, moving to a safeguards approach will raise trade costs which limits trade, whereas it will also raise willingness to pay which will increase trade.

Figure A C.1. Contribution of the different data flow regulation shocks (added cumulatively)

A. Real exports



B. Real GDP



Note: The figure displays the projected percentage change of real exports and real GDP at the global level under four scenarios: (1) no regulation; (2) moving to the middle; (3) geoeconomic fragmentation; (4) data flows doomsday with the four shocks associated with each of these scenarios introduced cumulatively. The four shocks added cumulatively are changes in iceberg trade costs, fixed trade costs, and willingness to pay (related to data flow policies) and changes in the costs of inputs of data management services associated with data localisation policies.

Source: Simulations with the WTO Global Trade Model (version with Melitz market structure as described in Bekkers and Francois (2018^[34])).

C.2. Impact on trade patterns from changes in data flow regulation

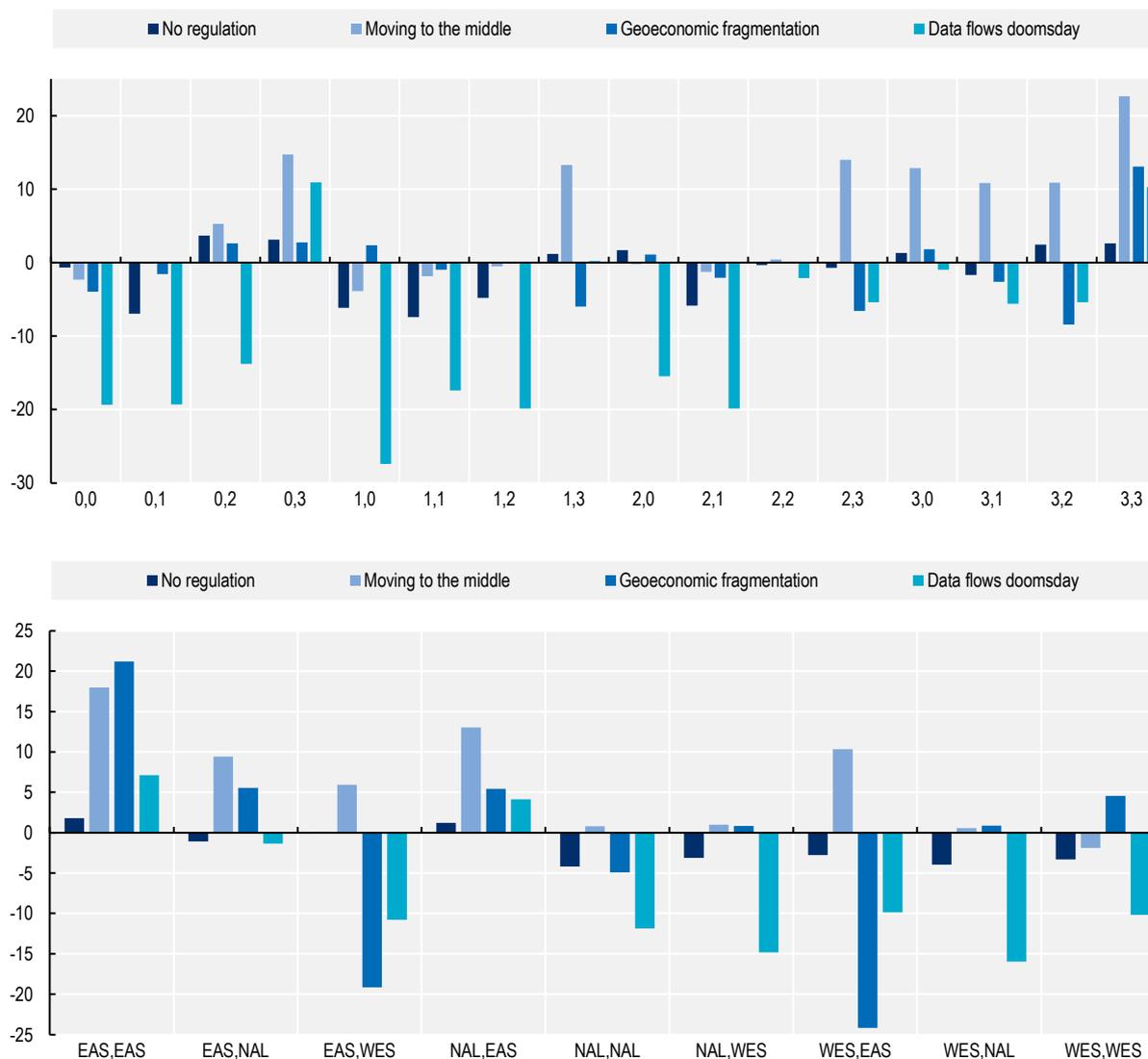
The projected change in exports between regions with different data flow regimes are shown in the upper panel of Figure A C.2. Under the first no regulation scenario the projected increase in trade is very modest for regions with ad hoc authorisation policies, because most of these regions cannot reduce trade costs, because of prohibitive data localisation policies which prevent such regions from transferring data even if data flow policies were abolished.

By contrast, the regions with open or pre-authorized safeguards tend to see their exports fall to all regions except those with *ad hoc* authorisation. The falling exports to regions without regulation can be explained by import demand shifting towards regions with ad hoc authorisation who see their exports increase because of reductions in trade costs. The rising exports from regions without regulations to regions with *ad hoc* authorisation are driven by rising demand in the latter regions for imports because of increased output and thus increased demand for intermediate inputs. For regions, the same mechanism is at play and on top of that there is a reduction in trust for these regions which dominates falling trade costs.

For the second scenario (moving to the middle) both regions without regulations and regions with safeguards see very small changes in their exports to other regions with the same regime. The reason for regions without safeguards is that the impact of increased competition of exports from regions with *ad hoc* authorisation is about as large as increased export opportunities because of increased willingness to pay. For regions with safeguards there are no changes in trade costs and trust and thus no large changes in exports. However, both regions see their exports increase to regions with *ad hoc* authorisation, because of increased demand from these regions which see their exports and income rise.

For the third scenario (geoeconomic fragmentation) the projected changes in exports between regions with different types of data flow regimes for most pairs of regions are negative as expected although the effects are small. For the fourth scenario (data flows doomsday) the projected changes in exports are negative for all pairs except for two (from 0 to 3, from 1 to 3 and from 3 to 3). The reason for these increases is that trade is shifting to pairs for which trade costs are not increasing as much.

Figure A C.2. The projected change in real exports between regions with different data flow regimes (upper panel) and regions with different geopolitical alignment under the four scenarios



Notes: The figure displays the projected change in real exports (in per cent) between regions with different data flow regimes (upper panel) and with different geopolitical alignment (lower panel) under four scenarios: (1) no regulation; (2) moving to the middle; (3) geoeconomic fragmentation; (4) data flows doomsday. The four data flow regimes are (0) No regulation; (1) open safeguards; (2) pre-approved safeguards; (3) *Ad hoc* regulation. The three geopolitical blocs are: (1) Western Bloc; (2) Eastern Bloc; (3) Non-aligned.

Source: Simulations with the WTO Global Trade Model (version with Melitz market structure as described in (Bekkers and Francois, 2018_[34]).

For the lower panel of Figure A C.2 displaying the change in exports between regions by geopolitical affiliation Scenarios 3 and 4 are most interesting, because the first three scenarios are not directly related to geopolitical affiliation. Under Scenario 3, Figure A C.2 shows that trade within geopolitical blocs is projected to rise substantially (EAS,EAS and WES,WES) and fall between blocs as expected. Trade between the non-aligned region and other regions is projected to rise, because of trade shifting away from trade between the Eastern and Western Blocs.

For the fourth scenario (data flows doomsday) trade is projected to fall for almost all combinations as expected because trade costs rise between all regions, except for trade from the Non-Aligned Bloc to the Eastern Bloc. The reason for this increase is that trade is shifting to pairs for which trade costs are not increasing as much and this is only the case for exports from NAL to EAS.

Annex D. Additional data localisation regulation simulations

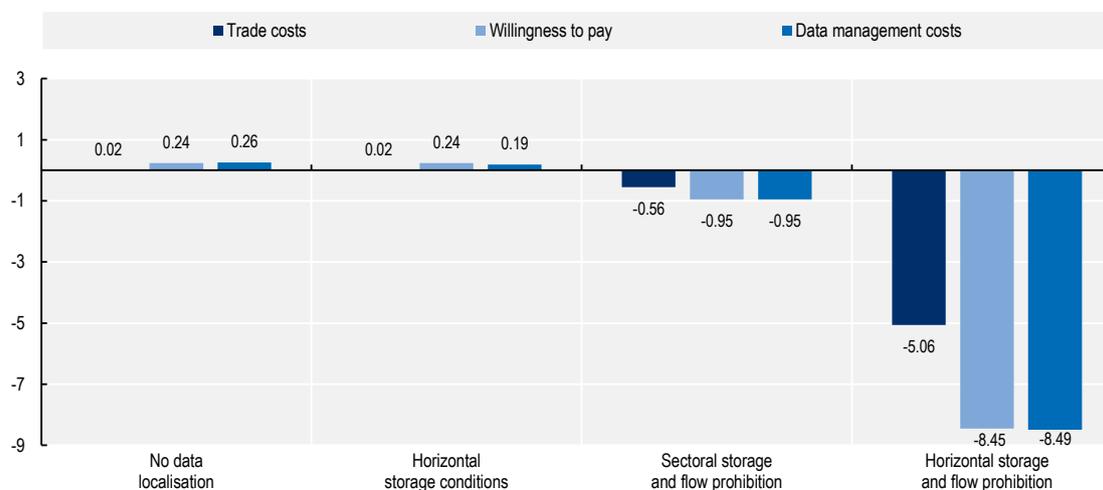
D.1. Introducing the data localisation shocks one by one

Figure A D.1 displays the projected change in real exports and real GDP for the four scenarios with the three types of costs (trade costs, WTP, and data management costs) entered one at a time. In Scenario A No data localisation, there is a small contribution of trade cost reductions, because the interaction of data flow and data localisation policies on trade costs is considered. Lifting data localisation policies would for some regions with less restrictive data flow policies imply a reduction in the costs of transferring data and thus an expansion of trade. At the global level the impact is marginal, because this only happens in isolated cases. The contribution of WTP/trust is larger to the expansion of real GDP and real exports, since the isolated regions would move to a safeguards regime with higher levels of trust when restrictive data localisation policies are lifted.

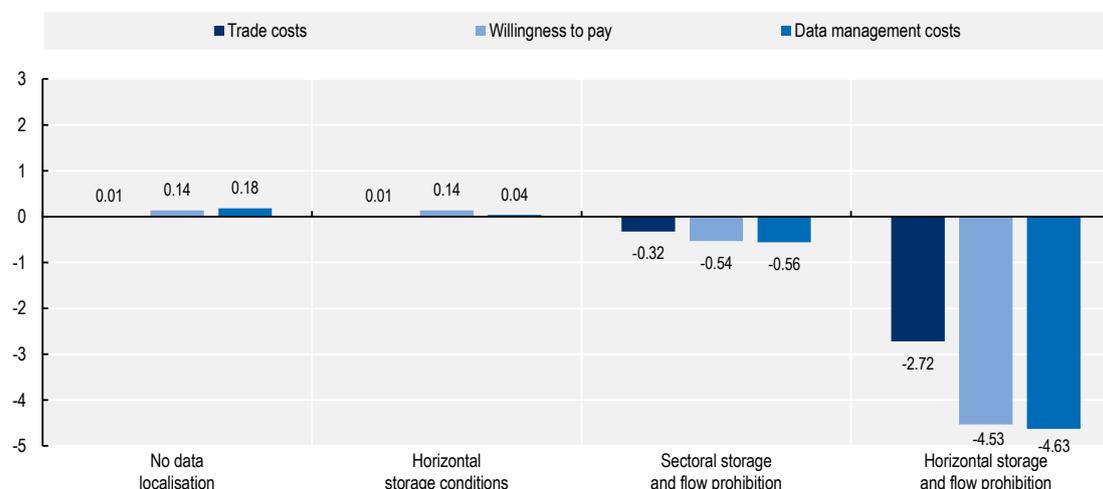
Under Scenario B trade costs also fall and WTP/trust rises for regions and sectors with prohibitive data localisation policies but without *ad hoc* authorisation data flow policies. Hence, real GDP and exports are projected to increase because of changes in trade costs and WTP/trust. However, the impact of reduced data management costs is small for the reasons described in the main text, i.e. the share of data management costs in total costs is small and the projected change in costs according to the BQ is small. Therefore, the overall projected change in GDP and trade is positive. Under Scenario C the largest contribution comes again from changes in trade costs and WTP/trust, because of the interaction of data flow and data localisation policies. The introduction of sectoral storage and flow prohibitions implies that in the concerned sectors data cannot be transferred anymore thus generating higher trade costs and reduced WTP/trust. Although only visible in the figure for real GDP and not for real exports because the impact is too small on the latter variable, there is an increase in data management costs thus generating larger reductions in real GDP and real exports. Finally, under Scenario D the effects are very similar to Scenario 4, because with a complete prohibition data flow and data localisation policies work out almost equivalently. The only difference is that under Scenario D also data localisation policies increase thus generating larger reductions in real exports and real GDP.

Figure A D.1. Contribution of the different data localisation shocks, added cumulatively

A. Real exports



B. Real GDP



D.2. Impact on trade patterns from changes in data localisation policies

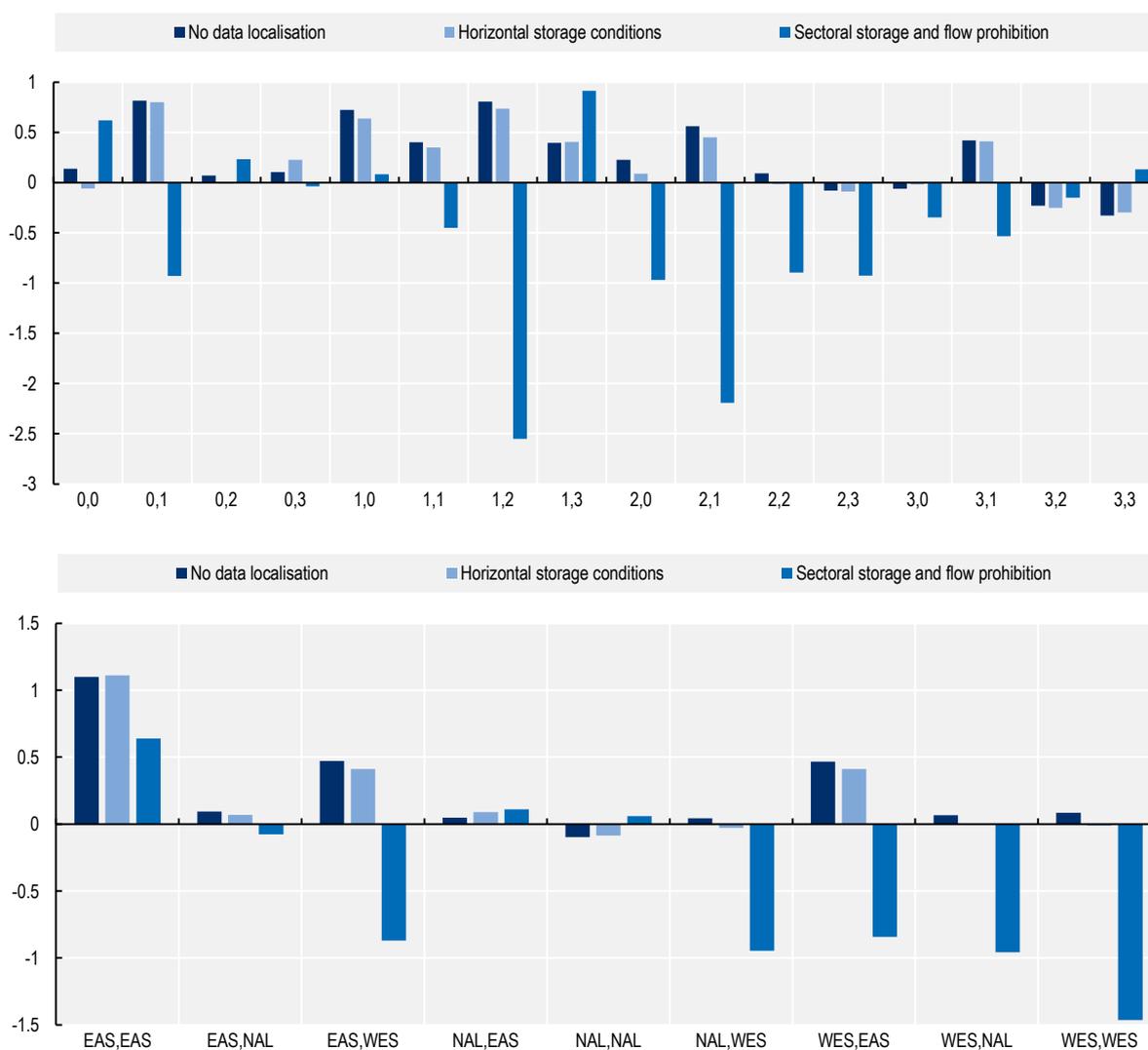
Figure A D.2 displays the projected change in real exports between regions with different data localisation regimes (upper panel) and in different geopolitical blocs (lower panel) for Scenarios A-C since Scenario D is almost identical to Scenario 4 and thus already discussed in Annex C. In Scenario A No data localisation the largest projected increase in exports is projected for trade between regions with regimes 1 and 2 and other regions, for example between 0 and 1 and between 1 and 2. The reason is that data management costs are projected to fall most for these regions. In regions with regime 0 there are no projected changes in costs. This is also the case for most regions with regime 3, because they tend to have both prohibitive data localisation and data flow policies.

The projected change in aggregate real exports under Scenario B Horizontal storage conditions is for most pairs of regions similar to scenario A because the projected changes in trade costs and WTP/trust dominate the impact of changes in data management costs which have only a marginal impact as discussed in the main text. Under Scenario C Sectoral storage and flow prohibitions the largest reduction in real exports is

expected for trade between regions 1 and 2. The reason is that these regions would face both an increase in trade costs and a drop in WTP/trust.

The lower panel shows that projected gains and losses in real exports are concentrated in the Eastern and Western Bloc for the different scenarios. More specifically, exports are projected to increase in Scenarios A and B in the Eastern Bloc, since they would benefit most from the abolishment of data localisation policies (Scenario A) or the relaxation of data localisation policies from a prohibitive regime (Scenario B), whereas the reduction in exports in Scenario C are concentrated in trade with the Western Bloc, because they would face the largest increase in trade costs. Interesting is that in this Scenario C trade within the Eastern Bloc is projected to rise because of trade diversion away from trade with the Western Bloc countries.

Figure A D.2. The projected change in real exports between regions with different data localisation regimes (upper panel) and regions with different geopolitical alignment (lower panel)



Annex E. Sector and region mapping (CGE simulations)

Table A E.1. GTAP mapping of the aggregated sectors in simulations

Sectors in simulation	GTAP sectors
Agriculture and mining	Paddy rice; Wheat; Cereal grains nec; Vegetables, fruit, nuts; Oil seeds; Sugar cane, sugar beet; Plant-based fibers; Crops nec; Bovine cattle, sheep and goats; Animal products nec; Raw milk; Wool, silk-worm cocoons; Forestry; Fishing; Coal; Oil; Gas; Minerals nec
Food	Bovine meat products; Meat products nec; Vegetable oils and fats; Dairy products; Processed rice; Sugar; Food products nec; Beverages and tobacco products
Textiles and wearing apparel	Textiles; Wearing apparel; Leather products
Wood and paper	Wood products; Paper products, publishing
Petrochemicals and chemicals	Petroleum, coal products; Chemical products; Basic pharmaceutical products; Rubber and plastic products; Mineral products nec
Metals	Ferrous metals; Metals nec; Metal products
Computer and electrical eq.	Computer, electronic and optic; Electrical equipment
Machinery and transport eq.	Machinery and equipment nec; Motor vehicles and parts; Transport equipment nec; Manufactures nec
Wholesale and retail	Wholesale and retail trade
Transport services	Transport nec; Water transport; Air transport; Warehousing and support activities
Communication services	Communication
Finance and insurance	Financial services nec; Insurance
Other business services	Real estate activities; Business services nec
Other services	Electricity; Gas manufacture, distribution; Water; Construction; Accommodation, Food and service; Recreational and other service; Public Administration and defence; Education; Human health and social work activities; Dwellings

Table A E.2. GTAP mapping of the aggregated regions in simulations

Regions in simulations	Aggregate region	Income group	Comprising
China	EAS	Upper middle-income	China
Japan		High-income	Japan
Korea		High-income	Korea
Asia LDC	OAS	Low-income	Cambodia; Lao People's Democratic Republic; Rest of Southeast Asia; Bangladesh; Nepal
India		Lower middle-income	India
Other Asian economies		High-income	New Zealand; Rest of Oceania; Hong Kong, China; Mongolia; Chinese Taipei; Rest of East Asia; Pakistan; Sri Lanka; Rest of South Asia
Indonesia	SEA	Lower middle-income	Indonesia
Southeast Asia		Upper middle-income	Brunei Darussalam; Malaysia; Philippines; Singapore; Thailand; Viet Nam
Australia	OCE	High-income	Australia
European Union 27	EUR	High-income	Austria; Belgium; Bulgaria; Croatia; Cyprus; Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; Ireland; Italy; Latvia; Lithuania; Luxembourg; Malta; Netherlands; Poland; Portugal; Romania; Slovakia; Slovenia; Spain; Sweden
EFTA		High-income	Switzerland; Norway; Rest of EFTA
Great Britain		High-income	United Kingdom
Argentina		LAC	High-income
Brazil	Upper middle-income		Brazil
Latin America	Upper middle-income		Rest of North America; Bolivia; Chile; Colombia; Ecuador; Paraguay; Peru; Uruguay; Venezuela; Rest of South America; Costa Rica; Guatemala; Honduras; Nicaragua; Panama; El Salvador; Rest of Central America; Dominican Republic; Jamaica; Puerto Rico; Trinidad and Tobago; Caribbean
Middle East and North Africa	MIN	Upper middle-income	Bahrain; Iran Islamic Republic of; Israel; Jordan; Kuwait; Oman; Qatar; Saudi Arabia; United Arab Emirates; Rest of Western Asia; Egypt; Morocco; Tunisia; Rest of North Africa
Türkiye		Upper middle-income	Türkiye
Canada	NAM	High-income	Canada
Mexico		Upper middle-income	Mexico
United States		High-income	United States of America
Sub-Saharan Africa LDC	SSA	Low-income	Benin; Burkina Faso; Guinea; Togo; Rest of Western Africa; South Central Africa; Ethiopia; Madagascar; Malawi; Mozambique; Rwanda; Tanzania; Uganda; Zambia; Zimbabwe; Rest of Eastern Africa
Sub-Saharan Africa other		Lower middle-income	Cameroon; Cote d'Ivoire; Ghana; Nigeria; Senegal; Central Africa; Kenya; Mauritius; Botswana; Namibia; Rest of South African Customs
South Africa		Upper middle-income	South Africa
Rest of World	CEA	Lower middle-income	Albania; Belarus; Ukraine; Rest of Eastern Europe; Rest of Europe; Kazakhstan; Kyrgyzstan; Tajikistan; Rest of Former Soviet Union; Armenia; Azerbaijan; Georgia; Rest of the World
Russia		Upper middle-income	Russian Federation

Economic Implications of Data Regulation

BALANCING OPENNESS AND TRUST

Cross-border data flows are the lifeblood of today's social and economic interactions, but they also raise a range of new challenges, including for privacy and data protection, national security, cybersecurity, digital protectionism and regulatory reach. This has led to a surge in regulation conditioning (or prohibiting) its flow or mandating that data be stored or processed domestically (data localisation). However, the economic implications of these measures are not well understood. This report provides estimates on what is at stake, highlighting that full fragmentation could reduce global GDP by 4.5%. It also underscores the benefits associated with open regimes with safeguards which could see global GDP increase by 1.7%. In a world where digital fragmentation is growing, global discussions on these issues can help harness the benefits of an open and safeguarded internet.



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