Modelling data localisation measures[1]

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Abstract:

Data localisation measures introduce digital 'border controls' through a combination of restrictions on cross-border data flows and/or local storage requirements. The implications of these are not well understood and raise new policy challenges related to balancing consumer protection in a way that preserves the significant economic and trade benefits flowing from data-enabled business. Using an adapted computable general equilibrium model (METRO), this paper aims to identify the transmission mechanisms associated with the opportunity costs of data localisation measures. To this end, it models a hypothetical scenario with a uniform policy shock across selected regions (selected for demonstrative purposes only). The results suggest that the opportunity costs of data localisation measures would be highest in countries most integrated into global value chains or with higher trade exposure. They also highlight the possibility for large spill-over effects. Countries which have strong trading ties with measure-implementing regions would witness equivalent or even larger negative effects on their economic activity, even when these have not put any data localisation measure in place.

Keywords: Data localisation, Non-tariff measures, CGE,

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[1] This paper is based on a forthcoming study entitled "Localising Data in a Globalised World" (Lopez-Gonzalez et al., forthcoming). It discusses the methodology used in the estimation of the impact of current data localisation measures. The views expressed in this paper are those of the authors and do not necessarily represent the views of the OECD or its members.

1 Introduction

New technologies are driving novel business models in this new era of globalisation. The Internet and information and communication technology (ICT) have not only reduced the cost of coordinating internationally fragmented modes of production but also that of sharing knowledge. This new era of globalisation is underpinned by the movement of data across international borders. But the ubiquitous exchange of data has raised concerns related to the privacy and security of consumers and led to the emergence of regulations seeking to provide greater protection to their privacy.

Current data localisation measures introduce digital 'border controls' through a combination of *restrictions on cross-border data flows* and/or *local storage requirements*. The implications of these are not well understood and raise new policy challenges related to balancing consumer protection in a way that preserves the significant economic and trade benefits flowing from data-enabled business. The role of economic analysis in this debate is to provide information to weigh the existing trade-offs. In this context, the aim of this paper is to identify the transmission channels for the opportunity costs related to data localisation measures and not to quantify the effect of actual policies in place.

The quantification of the impact of these measures is challenging. There is no clear understanding of how firms use data, how much data flows between countries or how data regulations might affect them. It is therefore difficult for policy analysis to assess how restrictive data regulations are likely to be. In this context, estimations have to rely, at least partly, on estimates and analogies. The dearth of statistics and detailed time-series information, added to the importance of inter-linkage effects arising from the pervasive use of data across the economy, favours the use of computable general equilibrium (CGE) models over ex-post econometric approaches to assess the potential effect of data localisation regulations.

A static multi-country CGE model (METRO) is used wherein a 'data' sector is split from the GTAP database by applying weights informed from the TiVA database. Data localisation measures are subsumed into two categories: measures which restrict the transfer of data across borders, and measures which impose restrictions on the location of data. The former is modelled as a non-tariff barrier which creates a wedge between the domestic and the foreign price. The latter is depicted as a modified local content requirement (see Stone et al., 2015) combined with a technology shift, where the forced localisation causes an increase in the cost of storage which has to be satisfied by the domestic sector.

The transmission mechanisms associated with data localisation measures are evaluated using a hypothetical scenario which models a uniform policy shock across selected regions (which are selected to demonstrate the channels of transmission). The modelling exercise distinguishes between cross-border transfer restrictions and local storage requirements.

The hypothetical exercise shows that cross-border data transfer measures would increase the costs of exports and therefore result in a decrease in export flows from the implementing country. The impact, although spread across all sectors, is especially strong in manufacturing given its high engagement in international trade. Production decreases in most sectors, driven by three mutually reinforcing effects: first, a direct effect from falling export demand; second a decrease in domestic demand arising from decreasing income; and third, growing production costs which further dampen demand.

Data storage requirements would increase data service demand leading to a sizeable increase in production. However, most other sectors in the economy would experience increasing production costs lowering their competitiveness. The positive production effect in the data management sector would be outweighed by the negative competitiveness effects in other sectors resulting in a negative aggregate effect on the economy.

The size of the opportunity costs of both types of measures seems to depend on exporting patterns and the degree of integration of the economy into global value chains, making the respective regions more or less sensitive to changes in production prices. But maybe the most important result from this modelling exercise is that data localisation measures do not only impact the implementing region. They also affect trade partners at a scale that, according to our assumptions, can even be larger than the effect on the implementing region in particular for important importing neighbours.

The next section provides some context related to data localisation regulations, the objectives of these policies and the range of economic effects they could generate. Section 3 reviews the nature and incidence of identified measures. Section 4 provides the methodological basis for the analysis. Section 5 discusses simulation results and section 6 concludes with a discussion on the implications of the findings.

2 State of play: cross-border data flows

Today, the world is globalised and digitalised. Firms can effectively segment tasks or processes of production and have them performed almost anywhere in the world drawing on expertise in multiple locations. The pervasiveness of online access and ICT technologies has been credited as the driving force of this new era of globalisation (Baldwin, 2012). Trade and production are now heavily dependent on moving and using digital information (data) across international borders. This development has fundamentally changed how, what and with whom companies trade and produce goods and services.

At the same time, governments and citizens have increasingly become concerned with some of the negative side effects of so much information being collected and used, often without the knowledge of those individuals generating the data. Concerns related to privacy and security, amongst others, have led to growing calls for deeper and more widespread regulations of the Internet and its underlying data flows. However, given the complexity of the issue, governments face the ongoing challenge of ensuring adequate privacy and security for data flows while also ensuring that users can enjoy the benefits of a free and open Internet.

2.1 The role of cross-border data flows in business operations

The digitalisation and the movement of data necessary for digital solutions to function can create trade opportunities and deliver benefits for a large share of the business population. Modern business models rely on data being collected, stored, processed and transferred within companies as well as to and from customers and business partners often located abroad.[2]

The benefits of using cross-border data for business can arise through various channels:

i. As an enabler and facilitator of new international production methods[3];

ii. As an engine for greater operational and production efficiency (i.e. through access to new, more sophisticated or more competitively priced digitalised service inputs[4]); and

iii. As a conduit for new opportunities for reaching new customers or integrating into new segments of global production.

2. Detailed description of how companies in different fields rely on data, see National Board of Trade (2014) and Castro and McQuinn (2015).

3 Efficient supply-chain management requires the smooth flow not just of goods, services and capital, but also of ideas and managerial know-how. Cross-border data flows are also key to managing actual production processes such as, for example, controlling robotics. They also play an important role in the post-sales phase.

4. Including services embedded in goods.

These gains could be particularly welcome for SMEs and firms in developing countries which face bigger internationalisation constraints than larger firms in developed countries.[5]

Data-use is also not limited to technology or ICT firms. Firms in all economic sectors use electronic payment systems for international transactions, Internet-based advertising and retailing to reach global customers, and cloud computing in their day-to-day operations. Production of goods and services include moving information in every step of the process. Data is used both as input into production and delivery of goods and services as well as output when, for example, embodied in digital products or services (van der Marel, 2015). Increasing customer demands for traceability in agricultural value chains and business needs to better identify points of fault along these also rely on the free flow of process related data across international borders.

Finally, it is not just companies that receive benefits from the possibilities that digitalisation brings. Digitalisation is also increasingly empowering consumers by giving them access to global information and products from all over the world. They benefit from better preference matching, lower prices, more variety, and greater convenience (USITC, 2013).

2.2 The emergence of barriers to cross-border data flows and data localisation requirements

Data flow regulation is not new, it dates back to the time when international computer networks began to be widely used (Kuner, 2015). Since their initial adoption in 1980, the OECD Privacy Guidelines have included provisions covering "Free flow and Legitimate Restrictions" that identify key principles for addressing the governance of privacy and trans-border data flows. Nevertheless, the number of data localisation measures has increased rapidly in recent years (see Section 3). These new measures predominantly restrict the transfer of personal data or require their localisation in servers in the domestic economy.

When examining data localisation measures it is important to look at the context of where and why they are implemented. While data localisation measures can impede trade and give advantages to national companies this should not automatically be equated to protectionism. Restrictions on movement of data reflect countries' core values, preferences and cultural and political contexts. In discussing the pros and cons of data localisation, the underlying policy goal should be born in mind. At the same time, at least from a trade policy perspective, one should assess if there is a less trade disruptive way to ensure that the same policy goal is reached.[6] The OECD Privacy Guidelines recommend that: "Any restrictions to transborder data flows of personal data should be proportionate to the risks presented, taking into account the sensitivity of the data, and the purpose and context of the processing" (OECD, 2013a; para. 18).

The most common objective of cross-border data transfer measures is to protect the privacy of data subjects.[7] Closely related, and often based on similar arguments, are concerns relating to security. Here data localisation, through local storage requirements, is aimed at addressing concerns about

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5 Access to free or competitively priced online business service inputs can help develop SME or developing country firm competitiveness and therefore face the high costs of engaging in export markets. For example, cloud computing can enable SMEs or firms in developing countries to access IT services with little upfront investment and therefore quickly scale up their IT use in response to changes in demand.

6. USITC (2013) exemplifies how prudential concerns can be handled through a risk-based approach in one jurisdiction and through a location-based approach in another.

7 Kuner (2011) argues that governments have introduced data flow regulation relating to privacy in order to tackle concerns relating to i) prevention of circumvention of national data protection laws, ii) safeguarding against data processing risks in other countries, iii) difficulties in asserting data protection abroad, and iv) enhancing consumer/individuals trust and confidence.

foreign surveillance by keeping data out of reach. However, the localisation of data can also be sought for reasons related to legal jurisdiction, such as tackling tax evasion, identifying fraudulent activity and regulating, or auditing, firms operating within the domestic territory (for example financial, insurance or accounting services). But governments might also have several, sometimes contradictory, reasons for introducing data-related regulation. For example, while officially introducing data storage demands on the grounds of privacy protection for citizens, it may also be aimed at facilitating access to citizens' data by the security services of the government in question (Hon et al., 2015).

2.3 The expected effects of barriers to cross-border data flows and data localisation requirements

The economic impacts of data localisation on business activity can be framed in the context of well-known concepts in the economic literature. For example, data localisation measures closely resemble standards which can be mandatory or, in some instances, voluntary and can either facilitate or impede trade (Swann, 2010). They can be trade facilitating when they bridge informational asymmetries, enhance predictability or reduce compliance burdens, but trade impeding when they do not coincide with commercial realities, the compliance costs are onerous or when they favour local over foreign entities. Multiple standards can also be a source of uncertainty for business; if they are conflicting across different countries they can add to compliance costs due to a need to design systems to meet different standards in different markets.

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Data-related measures can have a positive economic effect through enhanced trust in digital products. Mandating companies to keep data locally could increase the willingness of companies and individuals to use Internet solutions thereby increasing the demand for such services. This can arise from, for example, the reduction of informational asymmetries between consumers and companies and the consequent reduction in adverse selection (Akerlof, 1970).[8] Stakeholder input and literature suggests that localisation demands may indeed lead to increased on-line demand and usage of on-line solutions (European Parliament, 2012). However, it is unclear how much of this is a result of sound data regulation and private solutions as opposed to source-switching towards domestic services as a result of the restrictions themselves. Moreover, while consumers might trust local providers more than foreign ones, it may not always be that case that local providers have the most security/privacy features, from a technical standpoint.

On the other hand, localisation requirements can divert trade and production to national suppliers of intermediate goods and services (Stone et al., 2015). These legal requirements can run counter to the GVC trend which has seen an increasing use of foreign service inputs (OECD, 2013b) by imposing domestic sourcing where foreign sourcing may be more efficient (National Board of Trade, 2015, and Bauer et al., 2015). Evidence also suggests that the localisation demands leading to the construction of new servers in the country, which often use mainly foreign inputs, comes with modest job creation

8. Akerlof noted that asymmetric information can have market efficiency reducing effects (market failures). If the quality of a product is not readily observable by the consumer, then the seller can defraud the buyer by selling a lower quality good at the high quality price. In repetitive transactions, consumers will realise that they are being scammed and either reduce the price they are willing to offer for the product or reduce their demand for the product. If government intervention can help signal consumers that their privacy is being appropriately handled by the firms then the demand for high privacy content services can rise.

and reduces transfers of technology and knowhow (Chander and Lê, 2014). Such protectionist goals could therefore end up being counterproductive in the longer term.

Localisation measures create direct costs of compliance. Resources from the legal or IT departments will need to be used to understand the new measures, meet the conditions attached to transfer data, to strip personal information out of current data and store this new information. More indirect costs arise from companies using potentially less efficient and pricier local suppliers, rather than accessing global digital services or international outsourcing solutions.

Firms might have to relocate and replicate certain functions such as after-sales services or data management facilities, to particular countries in response to the measures. This will disrupt centralised business solutions which could lead to inefficiencies arising from the loss of access to scale opportunities. It could also decrease the use and efficiency of data trends like big data (Kuner, 2011; USITC, 2014; Kaplan and Rowshankish, 2015; Hon et al, 2015; Chander and Lê, 2014; National Board of Trade, 2014).

These measures are likely to impact firm decisions related to production, investment, and trade. Smaller countries or those where the current economic activity or population cannot justify the costs of setting up new servers or implementing processes to deal with the emerging measures would be most vulnerable. This could deprive developing countries of access to productivity enhancing digital solutions. The measures could place disproportionate burden on SMEs compared to large firms. Smaller firms are likely to have a lower capacity than larger firms to face the increased compliance costs that sustaining economic activity or entering markets with data localisation requirements entails. Likewise, SMEs may have a harder time shifting to local suppliers and facing the higher costs associated with this, leading to a relatively greater impact on their competitiveness.

3 The nature and incidence of data localisation measures

Data-related measures have received growing attention from policy-makers, academics and the international press (see Forbes, 2015). However our understanding of the nature and evolution of the existing measures is limited. To fill in the informational gaps, Lopez-Gonzalez et al. (*forthcoming*) compiles a database of existing measures applied by governments. It provides greater clarity about the nature of the measures and therefore their possible economic impact.

3.1 Nature and incidence

The measures identified in Lopez-Gonzalez et al. (*forthcoming*) are pieces of legislation, regulation, or policies that have been implemented by governments and are currently in-force. They fall under two categories, measures that restrict the flow of data and measures that require local storage (with a third category being a combination of the two).

Cross border transfer measures tend to allow cross-border data transfers to take place provided certain requirements are met (i.e. obtaining explicit consent of the data subject, the recognition of adequate government data protection settings in the receiving country, or individual contracts between national companies that receive data transfers setting out the latter's data protection obligations).[9] In

9. The full list of conditions include: adequate or equivalent data protections standards; model contract clauses between the recipient and the data controlling authority in the sending country; binding corporate rules; explicit consent of the data subject; consent of a government official; the transfer is necessary to complete a contract for the data subject; the transfer is necessary for medical treatment of the data subject; the transfer serves in the public interest; where the information is already in the public domain; the transfer is required by statute; falls within international judicial cooperation; as part of international intelligence cooperation regarding crime, terrorism or drug trafficking; where the recipient organisation is controlled by the organisation that manages the data; where the sender takes reasonable steps to ensure

general, associated costs are likely to be shouldered by the private sector that may need to adapt business processes to adhere. Failure to meet the protection standards or a decline of consent would prohibit any data transfer.

Local storage requirements demand that a company store data on servers located within the implementing country/region. To meet these measures, firms must incur costs associated with this storage. There are many different business models for storage, ranging from a firm installing and maintaining data servers themselves, to outsourcing the service to international or local firms.

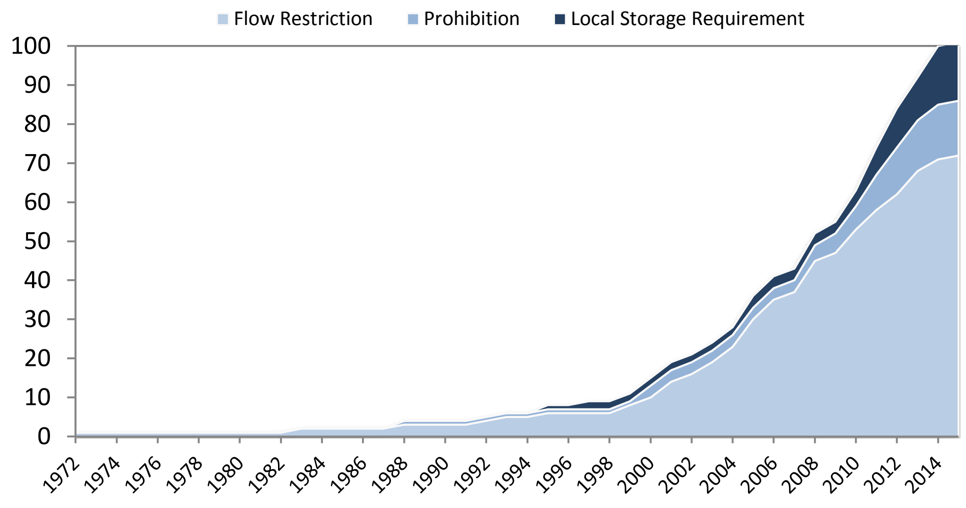
While the most stringent forms of regulation are likely to be those that combine local storage and prohibit cross-border transfers, the evidence in Lopez-Gonzalez et al. (*forthcoming*) suggests that these are sector specific and therefore their aggregate impact is likely to be small. Nevertheless, for particular sectors, measures of this nature imply not only the installation and maintenance of additional data servers, but also the use of local data processing services.

The number of data-related measures has been growing over time and there are signs suggesting that measures are becoming more restrictive in nature (Figure 1). In particular, the combination of cross-border data transfer prohibition and local storage conditions is a relatively new phenomenon.

Most of the cross-border measures identified target personal data across the entire economy (Figure 2 a); while the data localisation measures focus on how data is to be handled in a range of specific sectors of activity, such as financial, telecommunications, health, business, or the public sector (Figure 2 b).[10] This suggests that the data transfer measures potentially have economy-wide effects, resulting in all sectors of the economy having to adapt their data solutions. By contrast, storage measures are more targeted and therefore are likely to have smaller aggregate impacts.

Figure 1. Evolution of stock of data measures

By class of measures



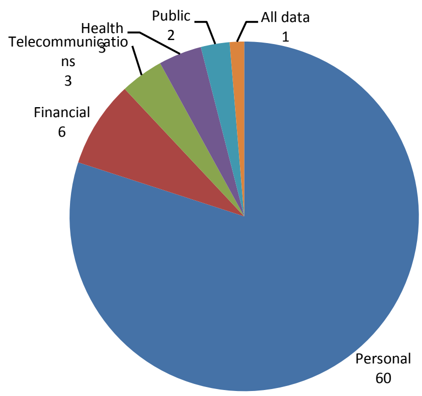
Source: adapted from Lopez-Gonzalez, et al. (*forthcoming*)

that adequate data protection exists; or where the recipient self-certifies to adequate data protection standards

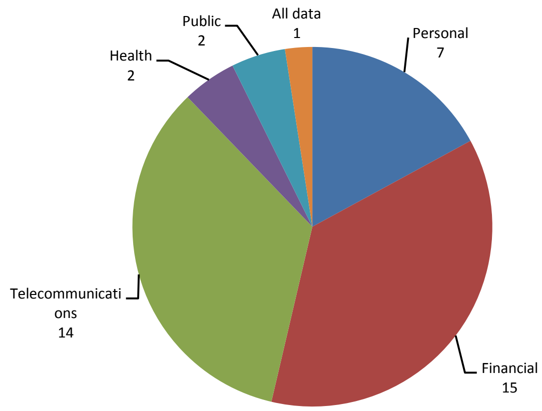
10. Though all of these types data will also be (or at least include) personal data.

Figure 2. Stock of data measures identified, by type of affected data

(a) data transfer measures



(b) data localisation measures



Source: Lopez-Gonzalez, et al. (*forthcoming*)

3.2 Data localisation as an NTM

In principle, the approach to quantify the impact of data localisation policies on business activity and trade is likely to be similar to assessments of the impact of other non-tariff measures (NTMs) or regulations on trade. Regulatory measures affecting trade in goods and services, such as for example SPS standards, bear strong similarities with those affecting the movement of data. The task of quantifying these, which is already a complex one in the case of goods and services (Fugazza and Maur, 2008), is compounded by the lack of information on i) data flows and on how firms use data for their business activity; and ii) the restrictiveness of the new data localisation measures.[11]

There are different approaches to incorporate and analyse non-tariff measures using CGE models (Fugazza and Maur, 2008). Border effects of NTMs are generally measured in terms of ad-valorem equivalents (AVEs) which are derived from estimates of the differences between world and domestic prices. One approach to modelling changes in NTM-policies is to represent these as border taxes expressed as AVEs that rise or fall as a result of policy reform. One challenge in this approach, however, lies in the difficulty of calculating these AVEs. Another is that, unlike tariffs, NTMs generally do not generate any revenue for the government (the rent is kept by the domestic company), so that the revenue impacts of NTM-reform in CGE analysis has to be interpreted carefully (Andriamananjara et al., 2003).

11. Moreover, many data localisation measures have been introduced over recent years, so that there is little time series information available to empirically assess their impact through econometric methods.

Another modelling approach rests on the assumption that NTMs, in the form of divergent technical standards, lead to lower economic efficiency. Policy reform through harmonization of standards or the conclusion of mutual recognition agreements would then be captured in the CGE context as improvements in economic efficiency that make it possible to reduce domestic producer prices by the amount of the NTM's ad valorem equivalent (Hertel et al., 2001). This approach has similarly been used to assess the benefits from trade facilitation reforms (OECD, 2003; Francois et al., 2005), and to capture some of the impacts of services trade reform (Christen et al., 2012).

There have been few prior attempts at using CGE-modelling to evaluate the impacts of data regulations. ECIPE (2013) used the GTAP model to assess the impacts of the EU's prospective General Data Privacy Regulation on GDP, services sector output and trade. The authors model the effect of introducing new data regulations as friction-generating impediments to international trade that cause efficiency losses. They calibrate their model with data from an impact assessment undertaken on behalf of the UK government (United Kingdom Ministry of Justice, 2012) and relative labour costs inside and outside the EU. They find that the negative impact on the EU's GDP could reach -0.8% to -1.3%, and that EU services exports to the United States could drop by -6.7% due to loss of competitiveness.

In another study, Bauer et al. (2014) assess the impact of data privacy and security laws, including data localisation requirements, in seven jurisdictions, namely Brazil, China, the European Union, India, Indonesia, South Korea and Vietnam. They construct an index of administrative barriers by applying weights for each regulatory measure and type of restriction based on available impact assessments, so as to take into account the relative importance of each policy measure in the economy (van der Marel et al., 2014). This index is then used to econometrically estimate the loss in total factor productivity, which in turn is used to derive the magnitude of the efficiency-shock in the GTAP-CGE model. Bauer et al. (2014) also make adjustments in GTAP to the return on investments in order to capture costly market limitations that discourage capital spending. In terms of simulation results, the authors report that the impact of proposed or enacted data legislation on GDP is substantial in all seven countries, to the extent that the data regulations can undo the productivity increases from major trade agreements.

These first attempts at measuring the impact of data regulation on economic activity are laudable and are based on the assumption that data regulation reduces productivity. While this is not an unreasonable assumption, the way that the data localisation measures were integrated into the CGE model may be contentious. The previous studies enacted economy wide changes in both productivity and savings, which might be seen as an upper bound to the impact of the measures. In so doing, they did not capture the mechanisms that will be outlined in subsequent sections.

4 Model and database

The modelling strategy differs in several respects from earlier studies in the field (ECIPE, 2013 and Bauer et al., 2014). In particular, we distinguish a data management sector which makes it possible to capture and represent the characteristics of data localisation measures more precisely. Disentangling the data management sector from other aspects of telecommunications or information technology allows for a modelling approach capturing regulations directly affecting data storage and transfers but not other aspects of telecommunications or information technology. In addition, the proposed method distinguishes between different types of measures, allowing them to be modelled individually

4.1 The database and the data management sector

The OECD SAM database derives from the GTAP V9 database (see Narayanan et al., 2015) and disaggregates imports based on *use categories* derived from OECD sources[12], as opposed to the widely applied proportionality assumption. The database consists of all 57 GTAP sectors and 60 regions plus rest of the world. For the purpose of this study it is aggregated as displayed in Table 1.

Table 1 Data aggregation: Regions, sectors and factors

Region		
European Union	Japan	ASEAN (BRN,KHM,IDN,MYS,PHL,SGP,THA,VNM)
China	Canada	Russia
Oceania (AUS, NZL)	India	Latin America (MEX, ARG, BRA, CHL, COL, CRI)
USA	Africa (TUN, ZAF)	Other Asia (HKG, TWN)
Other Europe (CHE, NOR)	Other OECD (KOR, ISR, TUR)	Rest of the World
Commodity/Sector[13]		
Agriculture	Coal oil gas mining	Food
Textiles, wearing apparel and leather	Lumber and paper products	Heavy manufacturing
Motor vehicles, transport equipment	Electronic equipment	Other machinery and equipment
Other manufacturing	Utilities	Construction
Trade	Transport air water and other	Communications
Other financial services	Insurance	ICT services
Other business services	Recreation and other services	Other government services
Dwellings		
Factors		
Technical a. Assistant Professionals	Office managers and Professionals	Service and shop assistants
Clerks	Agricultural, other low skilled	Land
Capital	Natural Resources	

Services sectors are rather aggregated in the GTAP sector classification, with all business activities being represented by one sector. Thus, none of the 57 sectors represents data management activities as such and therefore a new sector on data management is split from the standard sectoral aggregation.

The definition of the data management sector is taken from OECD (2007) which defined the ICT sector as follows[14]:

> *"The production (goods and services) of a candidate industry must primarily be intended to fulfil or enable the function of information processing and communication by electronic means, including transmission and display"* (OECD 2007, p. 15)

This includes the following sub-categories:

- ICT manufacturing
- ICT trade
- ICT repair
- ICT services
    - Telecommunication
    - Computer programming, consultancy and related activities (ISIC Rev 4: 62)
    - Data processing, hosting and related activities; web portals (ISIC Rev 4: 631)

12. Shares for manufacturing and agricultural sectors derive from comtrade applying the BECs classification. Data on services derive from the OECD Inter-Country Input-Output Model (May 2013)

13 For this study the database contains an additional ICT services sector.

14 sector definitions based on ISIC 4

The new data management sector is defined as a subsector of ICT services, excluding telecommunications. Subsequently, the term ICT services (ICTS) is used for this subsector which concords to sector 72 in ISIC Rev 3[15]

In the GTAP sector classification, the data management sector is part of GTAP ‘other business services (OBS)’ which includes ISIC Rev 3 sectors 70 to 74. A part of sector ISIC3: 70, computed rents, is represented in GTAP by an additional sector ‘dwellings (DWE)’. This is taken into account when calculating the splitting weights.

The database is split using the splitcom programme developed by Horridge (2008). The OECD ICIO database is chosen as source for the splitting as it details sector ISIC Rev3 72 for 61 countries. Table 2 lists assumptions employed in the splitting process. The average scaling in the rebalancing process is moderate. Relatively larger adjustments were necessary especially in the domestic part and are limited to small economies.

Table 2 splicom assumptions

	GTAP and ICIO sectors match to 23 aggregate sectors The ICIO contains data for 61 countries and the Rest of the world. The GTAP database contains 140 regions including all of the ICIO countries except Island. Island is therefore dropped from the list of countries in METRO. Additional GTAP regions are split applying splitters of an average region.
Row weight (RWGT)	Dimensions supplied to splitcom are NEWCOM*SRC*ORGUSER*REG: differentiating source (domestic and foreign) and assuming same share for base and tax (TYP). Splitters are based on data sourcing from ICIO and GTAP matrices: the split values are derived from coefficient times value of ICTS. Where the coefficients are derived from the OECD ICIO and the share of ICTS in OBS is calculated, taking into account that sector dwellings is part of OECD_ICIO sector 70. The ROW weights are rebalanced to fit to the GTAP database in three rounds: reallocation first takes place inside a sector aggregate and then inside wider groups, e.g. imported intermediates, and finally in some instances values are reallocated between groups.
Column weight (COLA)	Dimensions supplied to splitcom are ORGCOST*SRC*NEWIND*REG: differentiating domestic and foreign products (SRC) Splitters are derived as before from OECD ICIO coefficient times value of ICTS. Rebalancing similar to row weights.
Trade weights (TFOB)	Dimensions supplied to splitcom are NEWCOM*REG*REG No differentiation intermediates-final demand in trade matrix because this will be done later (in the METRO database construction process) The OECD ICIO share matrix is applied to the GTAP trade matrix. Total imports from import demand are used to scale the shares in order to meet import demand

After the GTAP database is split, the database is run through the standard METRO database construction process. Real labour demand is split assuming uniform wages for ICTS and the remaining other business sector. Use weights, for the new commodities, are derived from the ICIO.

A comparison of original ICIO production coefficients in ICTS with the outcome shows only small changes; relatively large deviations on sector coefficients are limited to small regions, i.e., TWN, MYS, SGP, BRA, CRI, LUX, MLT.

The database is completed with a vector of trade elasticities[16] and production elasticities sourced from the GTAP database. Reflecting the nature of cross border data transfers the ICT services sector is

[15] The METRO database is based on the GTAP database which concords to ISIC Rev 3

treated differently and its trade elasticities (import and export) are set to an inelastic level of 0.4 on the lower and 0.8 on the upper levels.

4.2 The METRO model

The CGE used for the quantitative analysis is the METRO model[17]. It derives from the Social Accounting Matrix (SAM) based CGE model GLOBE developed by Scott McDonald and Karen Thierfelder (2013).[18] The model is a direct descendant of an early US Department of Agriculture model (Robinson et al., 1990 and 1993 and follows trade principles from the 1-2-3 model (de Melo and Robinson, 1989; Devarajan et al., 1990).

The novelty and strength of the OECD METRO Model lies in the detailed trade structure and the differentiation of commodities by use – Commodities, and thus trade flows, are distinguished by use category (u) into commodities designed for either intermediate use, households or government consumption and investment commodities.

Like GLOBE, the underlying approach for the multi-region model is the construction of a series of single country CGE models that are linked through trade relationships. As common in CGE models, the price system is linear homogeneous, which directs the focus on relative rather than absolute price changes. Each region has its own numéraire, typically the Consumer Price Index (CPI), and a nominal exchange rate (an exchange rate index of reference regions serves as model numéraire). Thus, price effects within a country are fed through the model as a change relative to the country's numéraire. Prices between regions change relative to the reference region. Finally, the Model contains a 'dummy' region to allow for inter-regional transactions where full bilateral information is not available, i.e., data on trade and transportation margins.

The model distinguishes activities which produce commodities. Activities maximise profits and produce output combining, through a constant elasticity of substitution (CES), primary inputs (i.e. land, natural resources, labour and capital) and intermediate inputs in fixed shares (combined using Leontief technology). Households are assumed to maximise utility subject to a Stone-Geary utility function, which allows for the inclusion of a subsistence level of consumption. All commodity and activity taxes are expressed as ad valorem tax rates and taxes are the only income source to the government. Government consumption is set as a fixed proportion of its income and government savings are defined as a residual. Closure rules for the government account allow for various fiscal specifications.[19] Total savings consist of savings from households, the internal balance on the government account and the external balance on the trade account. The external balance is defined as the difference between total exports and total imports in domestic currency units. While income to the capital account is defined by several savings sources, expenditures by the capital account are based solely on commodity demand for investment.

Trade relationships of agents within a region are implemented using a standard approach as applied in the GLOBE model. For the modelling of a local content requirement (LCR), such as data storage,

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[16] Assuming that goods face the same substitutability whether being imported or exported.

[17] For a detailed model description refer to the OECD (2015), METRO v1 Model Documentation. TAD/TC/WP(2014)24/FINAL

[18.] The original model and a detailed documentation are available at http://www.cgemod.org.uk/.

[19.] The default assumption for the government account is a fixed internal balance and flexible government expenditures, government income tax is defined by fixed tax rates. Alternatively government expenditure could be fixed and a tax rate variable to clear the government account. Alternatively to the volume of government demand, the government share of final demand or the value of government expenditure could be fixed. Another setting could assume e.g., a flexible internal balance and fixed tax rates.

which are typically targeted on input use of an activity and not on the commodity side, an alternate input structure is developed. The alternate intermediate nesting identifies activity specific imports and domestic supply and shifts the composite of domestic and imported goods directly at the activity level.

4.2.1 Restrictions on cross-border data transfers

Conditional flow restrictions impose a compliance cost on individual firms who wish to export data (for example model contracts require the approval of Privacy Authorities of the country of export and meeting the requirements is likely to incur costs). Once complied with, the firm faces no additional cost and can therefore continue transferring data. If the firm does not comply, then it must either split out the personal data (which is both, costly and reduces value of the good), or not transfer any data internationally.

Restrictions on cross-border data transfers are therefore similar to non-tariff measures (NTM) and can be implemented as an "iceberg" cost (Samuelson, 1954). Such 'iceberg costs' can capture the costs associated with splitting personal and non-personal data or the costs of meeting the grounds of the conditional flow restrictions.

The approach adopted in METRO follows that of the GTAP model (Hertel et al., 2001) which has two effects on trade within the Armington structure. First, the introduction of the iceberg cost, which is introduced on the import rather than export side[20], increases the importer's price causing substitution away from that good and therefore a decrease in quantity demanded. Second, it increases the amount that needs to be imported to satisfy a given level of demand. These two effects work in opposite directions, although, the first effect is typically larger as a result of the trade elasticity being greater than 1. The demand for imports therefore decreases as a result of the NTM, which is implemented on exports from region w into region r (and thus on imports into r). An important feature of the second effect is that the calculated quantity observed by the importer is changed in direct proportion to the size of the NTM and thus maintains the balance in the initial accounting, i.e., the value of imports of good c from country w (exports of country w) still equals price times quantity:

$$Import\ Value_{c,w} = \frac{Import\ quantity_{c,w}}{iceberg\ cost_{c,w}} * \ Import\ price_{c,w} * iceberg\ cost_{c,w} \qquad (1)$$

Following this approach, the iceberg costs are introduced in METRO in the second level CES import nesting that defines bilateral import demand of the partner region, which equals export supply of the imposing region:

$$QMR_{w,c,u,r} = \frac{QML_{c,u,r}}{AMS_{w,c,u,r}} * \left(\frac{PMR_{w,c,u,r} / AMS_{w,c,u,r} * \alpha_{c,u,r}^{\rho}}{PML_{c,u,r} * \delta_{w,c,u,r}} \right)^{-1/\rho+1} \qquad (2)$$

4.2.2 Local data storage requirements

Local storage requirements, when implemented without cross-border restrictions, require a copy of all data generated within a country to be stored domestically, forcing companies to either source data storage services in-house or buy these within the host country.[21] In this way, these regulations can resemble local content requirements (LCRs) in terms of data storage providers (but not in the use of

[20] This is, the iceberg costs of data localisation requirements of country A are levied on imports from A to country B.

[21] These requirements are applied equally to domestic and foreign firms.

data). The producer's choice of data storage providers is restricted and the costs of obtaining the service will be at least as high as, or often higher than, in the case of free international procurement. The added costs relate to physical inputs, such as data servers, as well as opportunity costs from resources diverted from other business functions to domestic data management tasks.[22] Moreover, investment decisions and the geographical location of production facilities will be influenced by the relative stringency of local data storage requirements. Overall, producers will either suffer from lower profit margins in their operations and, thus, lower returns on investment, or pass the higher costs on to consumers in the form of higher prices.

Storage requirement increases ICTS costs for all sectors. Each production sector requires more ICTS per output, which can be interpreted as a technology shift and modelled in two steps:

First, the use of ICTS in total intermediate inputs is increased in the second level production function for aggregate intermediate input ($QINT_{a,r}$), which aggregates intermediate inputs of commodity c in production activity a and region r ($QINTA_{c,a,r}$) using Leontief technology:

$$QINTA_{c,a,r} = newioqint_{c,a,r} * QINT_{a,r} \quad (3)$$

ICTS inputs are shocked by the cost increase, $shock_{c,a,r}$. New coefficients ($newioqint_{c,a,r}$) are calculated so that they continue summing to unity:

For ICTS inputs:

$$newioqint_{c,a,r} = {QINTA^0_{c,a,r} * shock_{c,a,r}} \Big/ \left(QINT^0_{a,r} + QINTA^0_{c,a,r} * (shock_{c,a,r} - 1)\right) \quad (4)$$

For all other inputs:

$$newioqint_{c,a,r} = ioqint_{c,a,r} * \left(\frac{1-newioqint_{icts,a,r}}{1-ioqint_{icts,a,r}}\right) \quad (5)$$

Second, the production of good x requires more intermediate inputs, which increase by the weighted adjustment of ICTS implemented in the first level CES production function:

$$QX_{a,r} = \alpha * \left[\delta x * QVA_{a,r}^{-\rho x} + (1-\delta x) * \left(aqint_{a,r} * QINT_{a,r}\right)^{-\rho x}\right]^{-1/\rho x} \quad (6)$$

And it's first order condition:

$$QVA_{a,r} = \left(aqint_{a,r} * QINT_{a,r}\right) * \left(\frac{PINT_{a,r}}{PVA_{a,r}} * \frac{\delta x}{1-\delta x}\right)^{1/1+\rho x} \quad (7)$$

where $aqint_{a,r}$ is the weighted productivity adjuster for the ICTS cost increase:

$$QINTA_{c,a,r} = QINTA^0_{c,a,r} * shock_{c,a,r} = newioqint_{c,a,r} * QINT_{a,r} \quad (8)$$

22. In case, data producers decide not only to store their data locally, but still send a copy of the data to another location for processing and storage, the costs for data storage would increase.

and thus

$$aqint_{a,r} = \left(\frac{QINTA^0_{icts,a,r} * shock_{icts,a,r}}{newioqint_{icts,a,r} * QINT^0_{a,r}}\right)^{-1} \tag{9}$$

where $QINTA^0_{icts,a,r}$ and $QINT^0_{a,r}$ are the base levels of activity specific and aggregate intermediate inputs.

The additional ICTS must be sourced domestically, leaving the level of imports constant. This is implemented as MCP with the LCR module available in METRO[23]. The quantity that must be supplied domestically, $QLCR_{c,ui,a,r}$, is defined as:

$$QLCR_{c,ui,a,r} = \left(QDA_{c,ui,a,r} + QMA_{c,ui,a,r}\right) * LCR_{c,a,r} \tag{10}$$

With

$$LCR_{c,a,r} = \left(\frac{QDA_{c,ui,a,r}}{QDA_{c,ui,a,r} + QMA^0_{c,ui,a,r}}\right) * fiximp_{c,a,r} + lcr\_sh_{c,a,r} \tag{11}$$

Where $LCR_{c,a,r}$ is the LCR variable which is defined by $fiximp_{c,a,r}$ and is either 0 or 1, and if 1 the import level does not change. $lcr\_sh_{c,a,r}$ is the regular LCR parameter that sets a % LCR and it is 0 in this case. $QDA_{c,ui,a,r}$ and $QMA_{c,ui,a,r}$ are activity specific domestic supply and imports, $QMA^0_{c,ui,a,r}$ the import supply in the base and $QLCR_{c,ui,a,r}$ the quantity that needs to be supplied domestically to fulfil the LCR requirement.

4.3 Simulation setup

In order to analyse the effects of the measures and possible transmission channels of data localisation measures we employ two groups of hypothetical uniform shocks to 4 countries which show different patterns of ICT service use and trade in data. The purpose of this exercise is to identify transmission channels and thus to give an indication to the determinants of opportunity costs related to data localisation restrictions. It is purely hypothetical and *not* aimed towards quantifying the effect of actual policies in place.

The scale of the data flow shock is set as the average costs as perceived by the business community according to a questionnaire conducted by the OECD (see Lopez-Gonzalez et al., *forthcoming*). The value of the data storage shock is informed by the literature (Jensen and Tarr, 2008 and Hufbauer et al., 2013 who use a 20% and 10% cost increase in their studies) and the results from the Lopez-Gonzalez et al. (*forthcoming*) Business Questionnaire.

We run 2 sets of uniform simulations independently for 4 regions, USA, Japan, India and EU:

- Data flow restriction: 3% NTM (iceberg) cost increase for all exported products.
- Data storage: 10% increase of ICT service inputs in all sectors.

The model employs the following macroeconomic assumptions, emulating a steady-state type equilibrium to which the economy converges after a specific policy shock:

[23] Please find a detailed description of the LCR module in the METRO v1 model documentation (OECD 2015).

- Following the standard norm, the current account balance is constant and a floating exchange rate adjusts to balance the current account.[24]
- Investment expenditure is determined by the volume of savings, i.e. savings are a fixed share of final demand, allowing investment volumes to adjust to changing final demand.
- Governments are assumed to have predefined income and tax rates are fixed. With a fixed internal balance government expenditure adjusting to changing income levels.
- In factor markets, capital, land and natural resources are fully employed and mobile across sectors. Labour is assumed to be mobile across sectors and we allow for unemployment.

- There is perfect competition in goods markets.

The sensitivity of results to these underlying assumptions about the behaviour of the economy is tested by re-running the policy simulations and allowing each of the macroeconomic conditions to change at a time and presented in the Annex:

- Assuming a fixed exchange rate and a flexible current account balance.
- Assuming full employment.
- Assuming investment driving savings, where the investment share in final demand is fixed and the saving rate is allowed to vary.
- Assuming that government expenditure is fixed and the income tax varies to balance the budget, thus assuming that governments are transmitting costs or benefits directly to households.

5 Identifying the transmission mechanisms

In what follows the results from the hypothetical shocks are discussed. These are implemented separately to better identify the transmission mechanisms of the different measures.

5.1 Flow restrictions

The first hypothetical simulation aims to identify the transmission mechanisms relating to the effects of data transfer measures on economic activity. In order to isolate these, all sectors are shocked with a hypothetical 3% NTM.[25] While one would expect the size of the shock to differ across sector the exercise is useful because it can alert policy makers as to the sectors and areas of the economy that might be particularly sensitive to data transfer restrictions, i.e., sectors for which measures impose higher opportunity costs. It helps trace the possible transmission channels of the effects on trade partners. The hypothetical simulation (flow) is run 4 times for 4 different regions (USA, Japan, India and the EU) assuming, for each region individually, the introduction of the hypothetical data transfer measure.

[24] Without this assumption, welfare calculations are not meaningful, as a changing balance of trade would mean getting or giving a free lunch to the rest of the world. For instance, in a comparative static model, a country could run a balance of trade deficit indefinitely after a policy shock, without ever having to pay it back.

[25] This being the average reported increase in total costs as a result of the transfer measures as reported by the firms in a Business Questionnaire conducted by the OECD

Effects on the economy

Data transfer measures are modelled as an increase in the cost of exporting: capturing the added work needed by firms to meet the conditions of the regulation, i.e. separating personal from non-personal data and deploying legal departments to better understand the nature of the measures. This leads to a reduction in exports since these are now more expensive (Table 3). The impact spreads across all sectors but is especially strong in manufacturing (Annex Table 1) given the sector's high engagement in international trade. The impact is similar across exports of intermediates and exports of final products (Table 3).

Table 3 real macroeconomic effects of data flow restriction on imposing region, % change to the base

	flow USA	flow Japan	flow India	flow EU
Imports	-2.55%	-3.31%	-2.81%	-1.42%
Intermediates	-2.56%	-3.04%	-2.63%	-1.44%
Final demand	-2.53%	-4.16%	-3.69%	-1.37%
Exports	-2.80%	-1.81%	-2.42%	-0.96%
Intermediates	-2.92%	-1.75%	-2.35%	-0.93%
Final demand	-2.57%	-1.93%	-2.60%	-1.03%
GDP	-0.96%	-0.77%	-0.62%	-0.87%
Production	-1.03%	-0.90%	-0.90%	-0.88%
Absorption	-1.02%	-1.02%	-0.90%	-1.05%
Household income	-1.22%	-1.08%	-0.89%	-1.11%

Data transfer measures decrease overall production in most sectors (Table 4). The reductions are driven by three different effects that re-inforce each other: First, the direct effect from falling export demand, second a decrease in domestic demand arising from decreasing income and third, growing production costs which further dampen demand.

The decrease in export demand results in a decrease in production which, in turn, lowers domestic demand for intermediate inputs. Unemployment effects also arise which in turn reduce household incomes.[26] As consequence, final demand decreases and imports decrease even more than domestic supply.

Production costs increase in most sectors, and are dominated by increasing prices for intermediate inputs (factor returns fall). This price increase arises from increasing import prices, caused by a depreciation of the exchange rate to balance the current account, and is also stronger in manufacturing which has a higher import share compared to other sectors[27]. In addition, there is a circular effect where the increase in production costs lead to higher prices for domestic inputs. Factor returns

[26] The effect is smaller with full employment but in the same direction.

[27] When assuming a fixed exchange rate import price change is demand driven and decreases for most intermediate import goods, production costs increase accordingly less. On the other hand, the depreciation supported exporting firms who lose this price advantage with the fix exchange rate. In sum, the manufacturing sector is still affected strongest by the flow restrictions as it is strongest engaging in trade.

decrease, assuming rigid wages (unemployment), returns to land and capital decrease because of contracting production.[28]

Table 4 Data flow restriction, effects on production quantities and costs

	Production quantity				Production cost			
	flow USA	flow Japan	flow India	flow EU	flow USA	flow Japan	flow India	flow EU
Agriculture	-0.97%	-0.29%	-0.37%	-0.76%	-0.56%	0.02%	-0.67%	-0.23%
Coal oil gas mining	0.11%	4.86%	1.12%	0.75%	-0.06%	0.22%	0.52%	0.30%
Food	-1.13%	-0.80%	-0.50%	-1.03%	-0.12%	0.08%	-0.20%	-0.09%
Textles wearing apparel and leather	-0.58%	-0.30%	-1.64%	-0.40%	0.25%	0.66%	0.22%	0.12%
Lumber and paper products	-0.76%	-0.48%	-0.52%	-0.87%	0.05%	0.10%	0.21%	-0.05%
Heavy manufacturing	-1.24%	-1.04%	-1.41%	-0.90%	0.25%	0.68%	0.94%	0.23%
Motor vehicles, transport equipment	-1.00%	-1.24%	-1.11%	-0.86%	0.43%	0.38%	0.61%	0.20%
Electronic equipment	-0.38%	-0.52%	-1.07%	0.46%	0.45%	0.42%	0.88%	0.19%
Other machinery and equipment	-0.41%	-0.85%	-0.63%	-0.75%	0.16%	0.31%	0.79%	0.11%
Other manufacturing	-1.15%	-0.63%	-1.89%	-0.86%	0.18%	0.19%	0.34%	0.05%
Utilities	-1.20%	-1.23%	-1.14%	-1.04%	-0.12%	0.38%	0.34%	-0.01%
Construction	0.18%	-0.62%	-0.98%	-0.02%	0.09%	0.18%	0.40%	-0.01%
Trade	-0.99%	-0.92%	-0.87%	-0.96%	-0.03%	-0.11%	-0.25%	-0.09%
Transport air water and other	-1.05%	-0.67%	-1.09%	-0.54%	0.15%	0.07%	0.35%	0.07%
Communications	-1.08%	-0.95%	-1.02%	-0.94%	-0.15%	-0.21%	-0.13%	-0.15%
Other financial services	-1.03%	-0.91%	-0.92%	-0.83%	-0.06%	-0.24%	-0.33%	-0.16%
Insurance	-1.10%	-0.86%	-0.84%	-0.91%	-0.04%	-0.14%	-0.21%	-0.13%
ICT services	-0.87%	-0.57%	-0.64%	-0.73%	0.00%	-0.16%	-0.07%	-0.17%
Other business services	-1.09%	-0.94%	-0.24%	-0.74%	0.00%	-0.07%	0.09%	-0.17%
Recreation and other services	-1.23%	-0.89%	-0.39%	-0.96%	0.00%	-0.17%	-0.01%	-0.16%
Other government services	-1.70%	-1.25%	-0.90%	-1.83%	-0.02%	-0.03%	-0.02%	-0.07%
Dwellings	-0.69%	-0.55%	-0.39%	-0.61%	-0.53%	-0.53%	-0.50%	-0.50%

Services production declines in all 4 regions by around 1% and production of extraction industries increases. The latter are characterised by a small export but high import shares and are therefore less negatively affected by the export drop, owing to import substitution (import prices increase).

In manufacturing the effects differ between the regions. A data flow measure in the EU decreases EU manufacturing production by the same amount as services, just under 1% of production. However, in electronic equipment, production increases 0.5% (benefitting from growing intra EU trade as the price for imports from other regions increase). For India a data flow restriction would decrease services production by just under 1%, agricultural and food production decreases by 0.4-0.5%. Effects on manufacturing production vary between -0.5% and -1.8%. In Japan and the USA manufacturing is affected less than services, with exception of heavy manufacturing and transport vehicles and equipment.

Differences between regions

While the hypothetical simulation implements similar costs of data flow regulation for all 4 regions, the effects differ across these (Table 3). The USA shows the largest decrease in exports, followed by

[28] With full employment also wages for all labour categories decrease (no strong differences between labour categories).

India and Japan. EU exports fall considerably less, about half of the other regions. This is because much of the EU's trade with other EU partners and is therefore not subject to the shock (under the assumption of the free-flow of data in the EU). Similarly, imports decrease considerably less in the EU compared to other regions. Differences in total production are however smaller: production falls most in the US (-1.02%), followed by India and Japan (-0.90%), and then the EU (-0.88%).

Regarding GDP effects, India seems to be least affected, however, all domestic variables i.e. final demand, household income and total production fall. Moreover, the production decrease is in the same range as EU and Japan. The USA has the highest export share in this group of regions, excluding EU intra-EU trade, and therefore suffers the strongest effects. The size of the opportunity cost of data flow regulation seems to depend on the integration of the economy in global value chains and the specific export patterns of a country. In addition, despite the smaller trade effects the EU shows, the strongest effect in final demand and the second strongest effect in household income are due to slightly stronger unemployment effects than in other regions. This, in turn, implies that labour market adjustment processes are likely to be important determinants of the opportunity costs.

Effects on third party regions

Table 5 effects on total production

	flow USA	flow Japan	flow India	flow EU
European Union	-0.06%	0.01%	0.00%	***-0.88%***
Japan	-0.04%	***-0.90%***	0.01%	-0.01%
ASEAN	-0.06%	-0.08%	-0.01%	-0.14%
China	-0.05%	-0.04%	0.00%	-0.08%
Canada	-1.03%	0.00%	0.01%	-0.23%
Russia	-0.02%	-0.02%	0.00%	-0.24%
Oceania	-0.09%	-0.07%	-0.01%	-0.19%
Latin America	-0.23%	0.01%	0.00%	-0.08%
India	-0.01%	0.02%	***-0.90%***	-0.16%
USA	***-1.03%***	-0.03%	0.00%	-0.30%
Africa	-0.03%	-0.02%	-0.04%	-0.44%
Other Asia	-0.22%	-0.23%	-0.01%	-0.29%
Other Europe	-0.12%	-0.02%	-0.05%	-1.81%
Other OECD	-0.08%	-0.03%	0.00%	-0.26%
Rest of the World	-0.06%	-0.01%	-0.02%	-0.19%

Data flow restrictions do not only reduce production in the region which imposes the measure, but can also negatively affect trade partners (Table 5). The data flow regulation makes imports more expensive resembling an import tariff for the partner regions but without tariff revenue. In addition, contractionary effects in the imposing regions mean that trade partners also loose part of their export markets. The bigger the trade link of the imposing region with neighbouring countries, the higher the spill-overs from the country imposing the measure to its partners (in particular the shorter the physical and trade distance between countries). Thus, the spill-over effects are larger for neighbouring countries which tend to present a higher import share from the region imposing the measures, meaning neighbouring non-EU countries for measures imposed by the EU and Canada for measures in the USA.

5.2 Storage restrictions:

To evaluate the effects of storage restrictions we simulate a hypothetical cost increase of 10% in ICT service inputs across all sectors. The storage restrictions are implemented as a technology shift where the growth in demand in ICT services has to be satisfied domestically. As before, the hypothetical simulation is run for the 4 sample regions USA, Japan, India and the EU.

Effects on the economy

The simulation leads to an increase in ICT service demand and therefore to a sizeable increase in production ranging from 4% to 7% (Table 6). However, most other sectors experience increasing production costs[29] which lower their competitiveness and lead to a reduction in exports and in the domestic market facing substitution towards imports. The overall effects are negative since the positive production effects to the data management sector are dominated by the negative competitiveness effects in the rest of the economy.

Table 6 Storage requirements: effects on production by sector

	Production quantity				Production cost			
	Storage USA	Storage Japan	Storage India	Storage EU	Storage USA	Storage Japan	Storage India	Storage EU
Agriculture	-0.41%	-0.51%	-0.07%	-0.69%	-0.32%	-0.34%	-0.16%	-0.32%
Coal oil gas mining	-0.19%	-0.53%	-0.02%	-0.21%	-0.40%	-0.14%	-0.07%	-0.40%
Food	-0.59%	-0.64%	-0.14%	-0.81%	-0.10%	-0.09%	-0.02%	-0.06%
Textles wearing apparel and leather	-0.77%	-0.80%	-0.60%	-0.99%	-0.05%	0.01%	0.21%	-0.01%
Lumber and paper products	-0.51%	-0.27%	-0.31%	-0.82%	0.05%	0.01%	0.05%	0.13%
Heavy manufacturing	-0.48%	-0.72%	-0.29%	-0.75%	-0.12%	0.01%	0.02%	-0.04%
Motor vehicles, transport equipment	-0.33%	-0.54%	-0.41%	-0.65%	-0.05%	0.03%	0.19%	0.05%
Electronic equipment	-0.52%	-0.80%	-0.72%	-0.88%	-0.01%	0.11%	0.26%	0.10%
Other machinery and equipment	-0.41%	-0.68%	-0.56%	-0.56%	-0.04%	0.09%	0.24%	0.05%
Other manufacturing	-1.02%	-0.67%	-0.50%	-0.90%	0.08%	0.06%	0.13%	0.06%
Utilities	-0.59%	-0.78%	-0.19%	-0.84%	-0.14%	0.11%	-0.02%	-0.04%
Construction	-0.04%	-0.32%	-0.21%	0.04%	-0.02%	0.03%	0.00%	-0.02%
Trade	-0.54%	-0.65%	-0.21%	-0.90%	0.04%	0.07%	-0.01%	0.16%
Transport air water and other	-0.52%	-0.67%	-0.27%	-0.78%	-0.06%	0.05%	0.08%	0.05%
Communications	-0.53%	-0.74%	-0.32%	-0.87%	-0.01%	0.19%	-0.02%	0.19%
Other financial services	-0.65%	-0.78%	-0.24%	-0.97%	0.17%	0.19%	-0.01%	0.26%
Insurance	-0.78%	-0.97%	-0.28%	-1.16%	0.14%	0.34%	-0.03%	0.45%
ICT services	7.26%	5.11%	3.82%	6.15%	0.32%	0.22%	0.60%	0.29%
Other business services	-0.48%	-0.60%	-1.40%	-0.57%	0.18%	0.25%	0.89%	0.20%
Recreation and other services	-0.68%	-0.78%	-1.16%	-0.85%	0.08%	0.11%	1.29%	0.03%
Other government services	-1.01%	-0.96%	-0.19%	-1.45%	0.14%	0.12%	0.00%	0.03%
Dwellings	-0.39%	-0.41%	-0.06%	-0.52%	-0.24%	-0.27%	-0.10%	-0.30%

Although production costs increase most in the service sectors, which rely most on ICT services as inputs, effects on production quantities in manufacturing are in the same order of magnitude. This is because manufacturing is highly exposed to trade making this sector relatively more vulnerable to increasing production costs and shocks in input prices. This suggests that the opportunity cost of the storage measures are also, in part, determined by exposure to international trade and global value

[29] Increasing cost for ICT is partially offset by decreasing costs for value added, and the net effect varies across sectors and regions.

chains. The decreasing production costs of agriculture and mining are caused by decreasing rents from land and natural resources.

As production costs increase, imports of final products become more attractive for domestic consumers and therefore increase in 2 regions or decrease considerably less than total final demand (absorption) in the other regions (Table 7). Contrary to final demand, imports of intermediates decrease considerably (around the same level as total production). Still, imports decrease less than use of domestic intermediates.

Table 7 Storage requirement: macroeconomic effects

	storage USA	storage Japan	storage India	storage EU
Imports	-0.18%	-0.42%	-0.16%	-0.54%
Intermediates	-0.28%	-0.50%	-0.22%	-0.62%
Final demand	0.06%	-0.19%	0.16%	-0.37%
Exports	-0.49%	-0.62%	-0.30%	-0.65%
Intermediates	-0.46%	-0.62%	-0.16%	-0.67%
Final demand	-0.54%	-0.63%	-0.63%	-0.62%
GDP	-0.63%	-0.69%	-0.22%	-0.84%
Production	-0.56%	-0.56%	-0.19%	-0.67%
Absorption	-0.58%	-0.66%	-0.18%	-0.79%
Household income	-0.62%	-0.68%	-0.16%	-0.82%

Increasing production costs imposed by the storage requirement decrease production in all sectors except for ICT services, which is not large enough to dominate the macroeconomic effects. Decreasing production also lowers income from production factors and final demand and especially households, who own the production factors, leading to income decreases.

Differences between regions

While the hypothetical shocks are similar for all regions, there is a noticeable difference in the level of effects, i.e., the EU is seen to be affected much more than India and the effects to the USA and Japan, in terms of GDP, lie between those of the EU and India.

Production costs in India increase most amongst the regions shocked but production effects are smaller (except for two service sectors). The ICTS sector has the same production share in India as in Japan and the EU, but the export share of ICTS intermediates, which increases by 4.8%, is, with 43%, considerably higher in India compared to other regions. In other main exporting sectors India's losses are comparable to those of other regions, but the positive effect to the large ICT service sector is enough to halve the negative impact on exports of intermediates (compared to final demand, Table 7) and this less negative effect on exports is transmitted throughout the economy. The aggregate impact of the hypothetical measures, while smaller in India is still negative. For the EU on the other hand, the effect is mostly the result of its strong integration in GVCs which makes it more sensitive to changes in production prices.

Effects on third party regions

Effects on other regions are relatively small but still present. On the one hand other regions benefit slightly from taking over export market shares from the regions imposing storage restrictions. On the other hand, the regulation results in a decrease in import demand from the country imposing the regulation, resulting in a decrease in production for its suppliers, in particular neighbouring countries which are often important trade partners (Table 8).

Table 8 production effects storage requirement

	storage USA	storage JPN	storage IND	storage EU
European Union	0.01%	0.01%	0.00%	***-0.67%***
Japan	0.01%	***-0.56%***	0.00%	0.02%
ASEAN	0.01%	0.00%	0.00%	0.02%
China	0.01%	0.00%	0.00%	0.02%
Canada	-0.06%	0.01%	0.00%	0.01%
Russia	0.00%	0.00%	0.00%	-0.02%
Oceania	0.00%	0.00%	0.00%	-0.01%
Latin America	-0.01%	0.00%	0.00%	0.00%
India	0.02%	0.01%	***-0.19%***	0.03%
USA	***-0.49%***	0.01%	0.00%	0.01%
Africa	0.00%	0.00%	0.00%	-0.01%
Other Asia	0.00%	-0.01%	0.00%	0.01%
Other Europe	0.00%	0.01%	0.00%	-0.11%
Other OECD	0.01%	0.01%	0.01%	0.02%
Rest of the World	0.00%	0.00%	0.00%	-0.01%

6 Conclusions

This paper attempts to identify the determinants of the opportunity costs and the spill over effects of emerging data localisation measures (these are not estimates of the costs of current measures). We distinguish between two types of measures: i) cross-border transfer restrictions; and ii)local storage requirements.

Cross-border transfer restrictions allow the transfer of data across borders provided certain requirements are met. Assuming that cross-border transfer restrictions increase export costs (e.g., in order to comply with the requirements), these are modelled as NTMs following the iceberg cost approach. Local storage requirements require a company to store data on servers located within the implementing country/region. To meet these measures, firms must incur costs associated with this storage. This second type of measure increases the cost of data services in the production process and is therefore modelled as a technology shift resulting in an increase in use of data management services as an input to produce a similar output quantity. To meet the localisation requirement, these data management services are modelled so that they are sourced domestically.

This paper runs various hypothetical scenarios aimed at identifying how the measures might translate into economic costs. Both types of measures are independently and hypothetically implemented in four different regions. The scale of the shocks is set as the average costs as perceived by the business community (Lopez-Gonzalez et al., *forthcoming*).

According to our assumptions, cross-border data transfer measures increase the costs of export resulting in a decrease in export flows from the implementing country. The impact spreads across all sectors but is especially strong in manufacturing given the sector's high engagement in international trade. Production decreases in most sectors, driven by three mutually reinforcing effects: first, a direct effect from falling export demand; second a decrease in domestic demand arising from decreasing income; and third, growing production costs which further dampen demand.

Data storage requirements increase ICTS demand and therefore results in a sizeable increase in production ranging from 4% to 7%. However, most other sectors in the economy experience increasing production costs which lower their competitiveness. This leads to a reduction in exports across these sectors in addition to a certain degree of substitution of domestic production with imports. The positive production effect in the data management sector is dominated by the negative competitiveness effects in the rest of the economy, resulting in a negative aggregate effect on the economy.

While the hypothetical simulation implements similar costs of data flow regulation, the effects differ across the four regions tested. The size of the opportunity costs of both types of measures seems to depend on the degree of integration of the economy into global value chains as well as from export patterns, making the respective regions more or less sensitive to changes in production prices. But maybe the most important result from this modelling exercise is that, data localisation measures do not only impact the implementing region. They also affect trade partners at a scale that, according to our assumptions, can even be larger than the effect on the implementing region in particular for important importing neighbours.

It should be mentioned that, as comprehensive as our model can be, some other potential pathways of impacts are mentioned in the literature analysing data localisation measures, ICT and innovation. This includes potentially non-negligible longer-terms impacts on innovation and productivity. Those span from the use of big data to management innovation supporting GVCs.

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Annex A: export and commodity supply effects of data flow restriction on imposing region, % change to base

	flow EU		flow India		flow Japan		flow USA	
	Interme-diates	Final demand	Interme-diates	Final demand	Interme-diates	Final demand	Interme-diates	Final demand
Export quantity								
Agriculture	-0.95%	-0.98%	-0.08%	-0.12%	-0.64%	-1.29%	-1.41%	-1.39%
Coal oil gas mining	-0.86%	-1.56%	-3.23%		-0.45%	-0.76%		
Food	-1.19%	-1.31%	-0.48%	-1.00%	-0.86%	-1.23%	-2.33%	-2.31%
Textles, wearing apparel, leather	-0.32%	-1.00%	-3.17%	-3.05%	-2.64%	-3.22%	-3.84%	-4.34%
Lumber and paper products	-1.12%	-1.42%	-2.12%	-2.64%	-1.43%	-1.48%	-2.88%	-3.04%
Heavy manufacturing	-1.24%	-1.87%	-3.73%	-3.91%	-2.58%	-3.15%	-3.27%	-3.65%
Motor vehicles, transport equipment	-1.10%	-0.61%	-3.07%	-3.30%	-1.77%	-1.98%	-3.80%	-2.34%
Electronic equipment	0.52%	0.03%	-4.80%	-4.98%	-2.26%	-2.34%	-4.61%	-4.50%
Other machinery and equipment	-1.41%	-1.02%	-3.92%	-4.17%	-2.18%	-2.06%	-3.51%	-2.76%
Other manufacturing	-1.61%	-1.55%	-2.26%	-3.73%	-1.80%	-1.87%	-3.62%	-3.91%
Utilities	-1.27%	-1.26%	-0.70%	-0.84%	-1.21%	-1.57%	-2.61%	-2.57%
Construction	-0.68%	0.06%	-1.29%	-1.28%	-0.71%	-0.42%	-1.87%	-0.57%
Trade	-0.87%	-0.90%	-0.54%	-0.25%	-0.35%	-0.34%	-1.56%	-1.60%
Transport air water and other	0.15%	-1.14%	-0.44%	-1.34%	0.65%	-0.66%	-1.10%	-1.96%
Communications	-0.86%	-0.89%	-0.71%	-0.37%	-0.35%	-0.17%	-1.46%	-1.39%
Other financial services	-0.71%	-0.86%	-0.41%	0.03%	-0.20%	-0.03%	-1.28%	-1.48%
Insurance	-0.80%	-0.93%	-0.46%	-0.15%	-0.23%	-0.30%	-1.39%	-1.51%
ICT services	-1.34%	-0.90%	-0.68%	-0.58%	-0.17%	0.11%	-1.72%	-1.11%
Other business services	-0.72%	-0.33%	-0.36%	-0.37%	-0.43%	-0.28%	-1.51%	-1.15%
Recreation and other services	-0.86%	-0.90%	-0.23%	-0.53%	-0.39%	-0.29%	-1.58%	-1.61%
Other government services	-1.17%	-1.78%	-0.79%	-0.70%	-0.57%	-0.71%	-1.47%	-1.90%
Composite Supply - [QQ]								
Agriculture	-1.01%	-1.08%	-0.72%	-0.28%	-0.86%	-1.35%	-1.12%	-1.21%
Coal oil gas mining	-0.97%	-1.83%	-1.53%	-1.86%	-1.24%	-2.85%	-1.31%	-0.42%
Food	-1.06%	-1.11%	-0.72%	-0.76%	-0.96%	-1.34%	-1.25%	-1.25%
Textles, wearing apparel, leather	-0.69%	-1.51%	-1.59%	-1.25%	-0.79%	-2.32%	-0.87%	-1.77%
Lumber and paper products	-0.91%	-1.09%	-1.07%	-1.25%	-0.89%	-1.71%	-0.93%	-0.68%
Heavy manufacturing	-0.84%	-1.33%	-1.29%	-1.52%	-1.07%	-1.83%	-1.03%	-1.48%
Motor vehicles, transport equipment	-0.98%	-0.75%	-1.29%	-1.11%	-1.28%	-1.06%	-1.24%	-0.42%
Electronic equipment	-0.46%	-0.42%	-1.24%	-1.19%	-0.86%	-1.06%	-0.75%	-0.08%
Other machinery and equipment	-0.85%	-0.18%	-1.10%	-1.04%	-1.03%	-0.69%	-0.87%	0.18%
Other manufacturing	-0.95%	-1.24%	-1.50%	-1.23%	-1.06%	-1.21%	-1.08%	-1.61%
Utilities	-1.06%	-1.12%	-1.14%	-1.20%	-1.14%	-1.46%	-1.26%	-1.11%
Construction	-0.67%	0.21%	-1.00%	-0.98%	-1.08%	-0.58%	-1.33%	0.76%
Trade	-0.94%	-1.03%	-1.14%	-0.70%	-1.01%	-0.93%	-1.01%	-0.99%
Transport air water and other	-0.85%	-1.33%	-1.22%	-1.24%	-0.95%	-1.21%	-1.16%	-1.10%
Communications	-1.02%	-0.99%	-1.27%	-0.83%	-1.06%	-0.88%	-1.23%	-1.01%
Other financial services	-0.92%	-0.99%	-1.22%	-0.70%	-1.01%	-0.86%	-1.05%	-1.07%
Insurance	-0.96%	-1.01%	-1.26%	-0.82%	-0.91%	-0.98%	-1.11%	-1.23%
ICT services	-0.95%	-0.27%	-1.03%	-0.91%	-1.10%	-0.75%	-1.34%	-0.37%
Other business services	-0.94%	-0.29%	-1.01%	-1.17%	-1.03%	-0.78%	-1.19%	-0.37%
Recreation and other services	-1.03%	-1.04%	-0.65%	-1.04%	-1.11%	-0.95%	-1.26%	-1.23%
Other government services	-1.33%	-1.90%	-1.08%	-0.92%	-1.07%	-1.29%	-1.38%	-1.73%
Dwellings	-1.09%	-0.61%	-1.18%	-0.39%	-0.94%	-0.55%	-1.64%	-0.69%

Annex B: Sensitivity to trade elasticities

The sensitivity of model outcomes to trade elasticities (import and export) is explored in Table 9. The inelastic specification of the ICTS sector has no effect on storage effects and only slightly affects trade in the data flow restrictions scenario. Unsurprisingly effects are smaller when trade elasticities are more inelastic (i.e., halved '*0.5' in Table 9), and stronger the more elastic trade elasticities are (i.e., doubled '*2' in Table 9). However, the relationships analysed before are maintained. Due to the nature of the shock, data flow regulation effects are more responsive to variations in trade elasticities compared to storage measures.

Table 9 Effects of trade elasticities on modelling results (effects on imposing region, % change to the base)

	USA				Japan				India				EU			
	base setup	elastic ICTS	inelastic (base *0.5)	elastic (base*2)	base setup	elastic ICTS	inelastic (base *0.5)	elastic (base*2)	base setup	elastic ICTS	inelastic (base *0.5)	elastic (base*2)	base setup	elastic ICTS	inelastic (base *0.5)	elastic (base*2)
FLOW																
Real GDP	-0.96	-0.96	-0.60	-1.23	-0.77	-0.77	-0.52	-0.95	-0.62	-0.58	-0.36	-0.79	-0.87	-0.87	-0.54	-1.10
Imports	-2.55	-2.52	-1.19	-4.72	-3.31	-3.27	-1.68	-5.85	-2.81	-2.64	-1.35	-4.61	-1.42	-1.42	-0.76	-2.27
Exports	-2.80	-2.76	-1.18	-5.70	-1.81	-1.76	-0.61	-4.14	-2.42	-2.27	-0.98	-4.67	-0.96	-0.97	-0.46	-1.73
Absorption	-1.02	-1.01	-0.63	-1.29	-1.02	-1.02	-0.70	-1.25	-0.90	-0.86	-0.52	-1.16	-1.06	-1.06	-0.66	-1.33
STORAGE																
Real GDP	-0.63	-0.63	-0.53	-0.72	-0.69	-0.69	-0.61	-0.74	-0.22	-0.21	-0.18	-0.26	-0.84	-0.83	-0.72	-0.92
Imports	-0.18	-0.18	-0.10	-0.24	-0.42	-0.42	-0.29	-0.51	-0.16	-0.14	-0.08	-0.21	-0.54	-0.54	-0.42	-0.62
Exports	-0.49	-0.48	-0.43	-0.53	-0.62	-0.63	-0.64	-0.63	-0.30	-0.29	-0.22	-0.36	-0.65	-0.65	-0.58	-0.70
Absorption	-0.58	-0.57	-0.47	-0.66	-0.66	-0.66	-0.56	-0.72	-0.19	-0.18	-0.14	-0.23	-0.79	-0.79	-0.65	-0.88

Annex C: Effects of macroeconomic assumptions (closure sensitivity)

The labour market specification has strong effects on the size but not the direction of the outcomes (Table 9). With **full employment** the effects are smaller for both flow and storage regulations. This highlights the importance of labour market flexibility for the ability to cope with changes in the policy environment. Falling domestic and export demand lead to a production contraction.

There are two adjustment scenarios. The first is where wages are defined as rigid and unemployment is allowed and the second is where unemployment is fixed and wages are allowed to vary. In the first case, the preferred simulation, wages are rigid and production can source additional workers from unemployment until full employment is reached. The labour supply is perfectly elastic and factor prices are fixed until, if the shock permits, and in case of increase in labour demand, full employment is reached. In the second, with full employment, factor demand changes can only be satisfied through changes in wages (which are now flexible).

The use of one assumption over another has been at the centre of a long debate in the CGE community. A growing literature investigates the relationship between trade and employment. Increasingly, the consensus is that trade can have lasting employment effects (e.g. Felbermayr et al. 2009; Belenkiy and Riker,2015; Dutt et al 2009), which supports a closure where unemployment is not fixed. It is also important to highlight that, while our model allows for an increase in wages once full employment is reached in an unemployment scenario, wages are rigid in case of increasing unemployment. This assumption is coherent with empirical evidence showing that in the medium term wages tend to be downwardly rigid (Howitt, 2002; Fehr and Goette, 2005; ECB, 2009). We therefore set unemployment as standard closure.

The other macroeconomic assumptions have only moderate effects on the results, i.e., production and GDP effects remain in the same range (Table 9). The assumptions affect less the level of GDP but the distribution among the components which define GDP: a trade component and final demand (absorption) which is further distinguished into private, government and investment.

The standard closure assumes a flexible exchange rate which balances a fixed capital balance. **When the exchange rate is fixed** (and the capital balance flexible) this has no considerable effects on the storage requirement results[30]. The assumption does, however, have an impact on the flow regulation shock. A fixed exchange rate decreases the GDP effect considerably relative to a flexible exchange rate scenario (and even increases GDP in India) by strongly increasing the negative effect on exports, allowing for higher imports (or lower decrease) and strong increasing investment. With this assumption the capital balance is fixed and foreign investment increases to maintain the balance. This means that countries can lend money, thus transferring the cost into the future, which is not captured in a static model.

The other two assumptions under examination do in sum not have considerable effects, i.e., absorption does not change, but distribute costs differently: when **government expenditure is fixed** (fix share of final demand), the income tax is defined to vary (increase) in order to balance the government account. Thus, a part of the burden on governments is shifted to households. When **investment is fixed** (nominal) savings adjust and households save relatively more or less, depending on their income development. This assumption also becomes more interesting in a dynamic model.[31]

[30] Which is not per se a trade shock; absorption is slightly more negative and exports decrease less while GDP is constant.

[31] This assumption also becomes more interesting in a dynamic model.

Table 10 Effects of macroeconomic assumptions on modelling results (effects on imposing region, % change to the base)

	USA					Japan					India					EU				
	Unemployment (standard)	Full employment	fix exchange rate	fix government expenditure	fix investment	Unemployment (standard)	Full employment	fix exchange rate	fix government expenditure	fix investment	Unemployment (standard)	Full employment	fix exchange rate	fix government expenditure	fix investment	Unemployment (standard)	Full employment	fix exchange rate	fix government expenditure	fix investment
	Flow restriction																			
Production	-1.03	-0.15	-0.40	-0.93	-1.08	-0.90	-0.23	-0.59	-0.86	-0.86	-0.90	-0.37	-0.02	-0.85	-0.79	-0.88	-0.14	-0.57	-0.80	-0.91
Real GDP (expenditure)	-0.96	-0.01	-0.29	-0.85	-0.99	-0.77	-0.05	-0.26	-0.73	-0.75	-0.62	-0.03	0.12	-0.58	-0.54	-0.87	-0.04	-0.50	-0.77	-0.88
Import demand	-2.55	-2.23	0.09	-2.49	-2.62	-3.31	-2.93	-0.01	-3.29	-3.26	-2.81	-2.49	0.39	-2.66	-2.61	-1.42	-0.89	0.06	-1.43	-1.46
Export demand	-2.80	-2.01	-5.13	-2.73	-2.97	-1.81	-1.24	-7.04	-1.80	-1.75	-2.42	-1.76	-5.72	-2.29	-2.18	-0.96	-0.36	-2.18	-0.98	-1.01
Final Domestic Demand	-1.02	-0.15	0.33	-0.90	-1.03	-1.02	-0.33	0.87	-0.98	-1.00	-0.90	-0.40	1.21	-0.85	-0.83	-1.06	-0.26	0.38	-0.96	-1.07
Private consumption	-1.21	-0.24	-0.43	-1.40	-0.94	-1.06	-0.34	-0.34	-1.15	-1.12	-0.86	-0.37	-0.14	-0.82	-0.95	-1.09	-0.29	-0.63	-1.45	-0.98
Government consumption	-2.20	-0.30	-0.74	-0.84	-2.21	-1.36	-0.22	-0.52	-0.91	-1.32	-0.95	-0.24	0.23	-0.77	-0.79	-2.08	-0.31	-1.28	-0.90	-2.09
Investment consumption	0.76	0.34	4.15	0.91	-0.30	-0.58	-0.43	5.76	-0.56	-0.33	-0.98	-0.53	4.04	-0.93	-0.61	0.25	-0.12	5.46	0.51	-0.14
	Storage regulation																			
Production	-0.49	-0.03	-0.57	-0.45	-0.50	-0.56	-0.08	-0.57	-0.54	-0.54	-0.19	-0.01	-0.18	-0.17	-0.15	-0.67	-0.07	-0.69	-0.60	-0.68
Real GDP (expenditure)	-0.63	-0.16	-0.71	-0.58	-0.64	-0.69	-0.24	-0.70	-0.67	-0.68	-0.22	-0.09	-0.21	-0.21	-0.19	-0.84	-0.21	-0.86	-0.76	-0.84
Import demand	-0.18	0.02	-0.47	-0.16	-0.20	-0.42	-0.03	-0.49	-0.42	-0.39	-0.16	0.00	-0.14	-0.13	-0.11	-0.54	-0.03	-0.64	-0.54	-0.56
Export demand	-0.49	0.02	-0.22	-0.47	-0.52	-0.62	-0.04	-0.51	-0.62	-0.59	-0.30	-0.02	-0.26	-0.28	-0.24	-0.65	-0.03	-0.58	-0.66	-0.68
Final Domestic Demand	-0.58	-0.15	-0.73	-0.53	-0.58	-0.66	-0.24	-0.70	-0.63	-0.65	-0.18	-0.08	-0.18	-0.17	-0.16	-0.79	-0.20	-0.88	-0.71	-0.79
Private consumption	-0.62	-0.16	-0.71	-0.71	-0.57	-0.67	-0.24	-0.69	-0.74	-0.72	-0.16	-0.08	-0.15	-0.15	-0.19	-0.82	-0.24	-0.85	-1.08	-0.72
Government consumption	-1.26	-0.31	-1.42	-0.64	-1.26	-1.04	-0.28	-1.05	-0.71	-1.02	-0.23	0.08	-0.22	-0.20	-0.18	-1.64	-0.28	-1.69	-0.72	-1.62
Investment consumption	0.22	0.03	-0.16	0.29	0.01	-0.24	-0.17	-0.38	-0.23	-0.07	-0.22	-0.14	-0.23	-0.21	-0.10	0.29	-0.01	-0.05	0.48	-0.04