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# FDI in Services: How Data Provisions are Shaping the New Global Economy

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# FDI in Services: How Data Provisions are Shaping the New Global Economy

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**Abstract**:

Coinciding with a process of slowbalization in goods, cross-border flows of services have experienced a sharp increase, with FDI through commercial presence emerging as the dominant mode of international services supply. At the same time, a growing number of trade agreements have incorporated binding data-related provisions aimed at regulating cross-border data flows and data protection. This paper investigates the impact of such provisions on bilateral foreign affiliates in services, with a focus on data-intensive services, using a structural gravity model. Our results reveal that the presence of data provisions in trade agreements does not uniformly promote FDI in services. Deeper data commitments in trade agreements are associated with increased FDI in services, particularly when data regulatory divergence exists between countries. Conversely, in the case of information services —a highly data-intensive sector—these provisions appear to enhance remote service delivery, thereby reducing the incentives for FDI, especially when countries have divergent data regulatory models. These results highlight how countries' data regulatory contexts and sectoral characteristics condition the effects of data-related provisions in trade agreements on FDI.

*Keywords*: data-intensive services, FDI, trade agreements, data-related provisions, data regulatory models, gravity model.

JEL codes: F13, F21, F23, L86.

Resumen:

Coincidiendo con un proceso de *slowbalization* en los bienes, los flujos transfronterizos de servicios han experimentado un fuerte incremento, siendo la inversión directa en el extranjero (IED) a través de la presencia comercial el modo dominante de suministro internacional de servicios. Al mismo tiempo, un número creciente de acuerdos comerciales ha incorporado disposiciones vinculantes relacionadas con los datos, destinadas a regular los flujos transfronterizos de datos y la protección de datos. Este artículo investiga el impacto de dichas disposiciones sobre las filiales extranjeras bilaterales en los servicios, con especial atención a los servicios intensivos en datos, utilizando un modelo gravitatorio estructural. Nuestros resultados revelan que la presencia de estas disposiciones no promueve de manera uniforme la IED en servicios. Unos compromisos más profundos en materia de datos en los acuerdos comerciales se asocian a un aumento de la IED en servicios, especialmente cuando existe divergencia regulatoria en materia de datos entre países. Por el contrario, en el caso de los servicios de información —un sector altamente intensivo en datos— estas disposiciones parecen fomentar la prestación remota de servicios, reduciendo así los incentivos para la IED, particularmente cuando los países presentan modelos regulatorios de datos divergentes. Estos resultados ponen de relieve la importancia de los contextos regulatorios de datos de los países y de las características sectoriales para determinar cómo las disposiciones relativas a los datos en los acuerdos comerciales afectan a la IED.

Palabras clave: servicios intensivos en datos, IED, acuerdos comerciales, disposiciones relacionadas con los datos, modelos regulatorios de datos, modelo gravitatorio.

## 1. Introduction

The global economy is undergoing a profound transformation. While the era of hyperglobalization—characterized by rapid expansion of trade in goods and the fragmentation of production across borders—has given way to a phase of slowbalization, the international exchange of services, particularly digital services, continues to accelerate. This divergence reflects a structural shift in the nature of globalization: as the potential for further fragmentation of goods production reaches its limits, services—especially those enabled by digital technologies—are becoming the new frontier of global economic integration (Baldwin et al., 2024).

At the heart of this transformation lies the increasing importance of data. Data has become a critical input for the production, delivery, and regulation of services. The rise of digital platforms, cloud computing, artificial intelligence, and other data-driven technologies has enabled services to be traded across borders with unprecedented ease. This has led to a surge in digitally delivered services, which are now among the most dynamic components of global trade (WTO, 2018). According to WTO estimates, exports of information services—those most reliant on data—have increased fivefold in recent years, underscoring their role as a new channel for globalization (Blázquez et al., 2023).

Importantly, the international supply of services does not occur solely through traditional cross-border trade (Mode 1 under GATS). Instead, commercial presence in another country (Mode 3) has emerged as the predominant mode of supply (Rueda Cantuche et al., 2016)[1]. WTO's Trade in Services by Mode of Supply (TISMOS) dataset indicates that approximately 55% of global trade in commercial services is delivered through foreign affiliates, and this share rises to 64% for information services. This highlights the relevance of foreign direct investment (FDI) as a key mechanism for international service delivery.

Despite signs of slowbalization in goods and aggregate FDI flows, FDI in ICT services has continued to grow. Data from UNCTAD and fDi Markets show that both the number and value of announced greenfield FDI projects in information and communication services doubled between 2010 and 2021, while investment in manufacturing declined. This trend reflects the strategic importance of data-intensive services and the role of FDI in their global expansion.

However, the regulatory environment surrounding data flows has become increasingly fragmented and restrictive. A growing number of countries are imposing conditions on cross-border data transfers, mandating local data storage, or adopting divergent models of data protection (Casalini

[1] Among the four GATS modes of supply, Modes 2 (consumption abroad) and 4 (presence of natural persons) play a more limited role.

et al., 2021; Cory and Dascoli, 2021; Del Giovane et al., 2023). These measures reflect national preferences regarding privacy, security, and digital sovereignty, but they also pose challenges for firms seeking to operate across borders. The OECD Digital Services Trade Restrictiveness Index confirms the rising restrictiveness of digital trade policies (Ferencz and Gonzales, 2019).

In response to these challenges, many governments have begun to incorporate binding data-related provisions into trade agreements. These provisions aim to regulate cross-border data flows and ensure data protection, thereby creating a more predictable and secure environment for digital trade and investment. According to the Trade Agreement Provisions on Electronic Commerce and Data (TAPED) dataset, there has been a proliferation of such provisions —particularly in recent years— with a new generation of Digital Economy Agreements also emerging (Casalini et al., 2021; Burri and Kugler, 2024; Burri and Vásquez, 2024).

The impact of these data-related provisions on trade flows has been explored in several recent studies. Suh and Roh (2023), Wu et al. (2023), Wang and Liu (2025), and Blázquez et al. (2025) find that such provisions are associated with increased trade in services. These studies argue that the establishment of data trade rules—defined as the inclusion of provisions that commit to the free flow of cross-border data—creates external conditions conducive to services trade.

However, the impact of data-related provisions on FDI remains largely unexplored, despite the fact that Mode 3 is the dominant channel for international service delivery. This paper seeks to address this gap by empirically examining the effect of trade agreements with data provisions on bilateral foreign affiliates in services, with a specific focus on information services, which are more data-intensive and increasingly delivered remotely.

A key contribution of this paper is the exploration of heterogeneity in data regulatory model as a determinant of the effectiveness of data-related provisions. Countries differ significantly in their approaches to data governance, with some adopting open models (e.g., the US), others conditional models (e.g., the EU), and others restrictive models (e.g., China) (Ferracane and van der Marel, 2021). These differences can create institutional frictions that affect the feasibility and attractiveness of cross-border investment. While some trade agreements aim to bridge these gaps through harmonization or mutual recognition, the extent to which such provisions succeed in promoting FDI remains unclear. We explicitly examine whether the impact of data-related provisions in PTAs varies depending on whether the source and destination countries share the same data regulatory model or operate under divergent models.

By focusing on data-related provisions, sectoral heterogeneity, and regulatory divergence, this paper offers a novel perspective on how trade agreements can facilitate investment in a fragmented regulatory landscape.

Our approach builds on and extends the existing literature on the relationship between trade agreements and FDI. Previous empirical studies have yielded mixed evidence, depending on the specific provisions included, the nature of FDI (horizontal vs. vertical), the type of business activity, and the countries involved. For instance, Kox and Rojas-Romagosa (2021) find a positive effect of trade agreements on FDI, with no significant difference between deep and shallow agreements. Laget et al. (2021) show that various policy areas—such as investment, intellectual property rights, visa and asylum policies, capital movement, competition policy, labour market regulations, and environmental laws—promote FDI in service-related activities, while most have no significant effect on manufacturing. Larch and Yotov (2024) find that trade agreements positively affect bilateral FDI stocks only when they include specific provisions such as investment clauses, labour market regulations, export taxes, public procurement, and state-owned enterprises. Their estimates do not reveal a significant impact of deeper agreements—measured by the number of provisions—on FDI, which aligns with the findings of Kox and Rojas-Romagosa (2021). Bergstrand and Paniagua (2024) adopt a different approach, using the Shapley Value from cooperative game theory to estimate the effects of sets of substantive provisions on FDI. Their findings suggest that deep trade agreements positively affect both bilateral trade and FDI, although the effect is smaller for FDI. Moreover, they find that provisions that positively affect trade tend to negatively affect FDI, and vice versa, suggesting a substitutive relationship between the two.

The remainder of the paper is structured as follows. Section 2 describes the data used and provides a descriptive analysis of the key variables. Section 3 presents the specification of the econometric model. Section 4 offers the results of the empirical analysis. Section 5 discusses the findings in light of the existing literature. Section 6 concludes.

## 2. Data and main facts

### 2.1. Service FDI flows.

Data on bilateral foreign affiliates come from the *Multinational Revenue, Employment, and Investment Database* (MREID), developed by Ahmad et al. (2023). This dataset provides comprehensive and consistent information on international and domestic bilateral number of affiliates, revenues, assets and employment variables of MNEs for the pairings of 185 countries, across 25 NAICS 2-digit industries (17 of them are services), and 12 years (2010-2021). The MREID is constructed using firm-level data from the ORBIS database where the key variable used to identify

foreign ownership is the "Global Ultimate Owner" which allows for the identification of the controlling entity at the top of the ownership chain.

According to the MREID database, nearly 80% of total foreign affiliates are concentrated in the services sector [2]. Among them, we pay particular attention to data-intensive services. Given the lack of information regarding the amount of data used by each sector, proxies are employed for this purpose, although none of them are ideal. Van der Marel and Ferracane (2021) and Cory and Dascoli (2021) rank the sectors by data-intensity using a proxy for both capitalised and non-capitalised software expenditures. According to this criterion, *Telecommunications*, *Computer* services and *Information* services are the most data-intensive sectors. These service sectors correspond to NAICS code 51, Information services, which comprises establishments engaged in the following processes: (a) producing and distributing information and cultural products, (b) providing the means to transmit or distribute these products as well as data or communications, and (c) processing data.

Using the MREID database, we observe that the number of outward foreign affiliates—representing the extensive margin of multinational enterprise (MNE) activity—increased by 42% in goods sectors between 2010 and 2021. In contrast, total services experienced an 82% rise, and information services, the most data-intensive segment, grew by nearly 90%, making them the most dynamic component of international FDI flows.

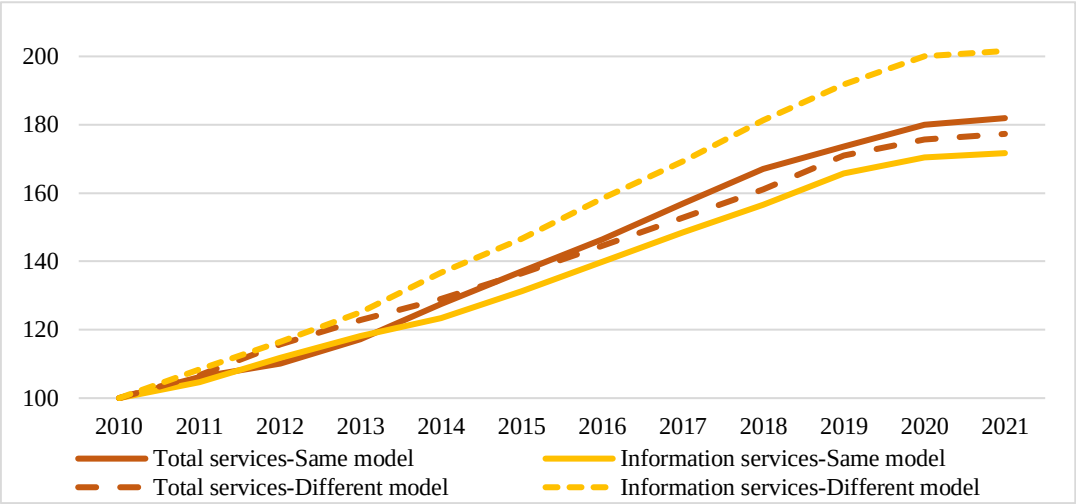
Figure 1 illustrates the evolution of FDI in services, distinguishing between FDI among countries that share the same data regulatory model and those between countries with different regulatory frameworks. To classify countries according to their data governance regimes, we follow Ferracane and van der Marel (2021), who categorize 116 countries into one of three models[3]: open (US-style), conditional (EU-style), and restrictive (China-style). Moreover, as a significant number of countries have modified their data governance frameworks over time, the authors identify "switching countries" that have transitioned to either the conditional or limited model since 2000. As a result, the classification of countries has evolved, particularly since 2010. Based on this categorization, we classify bilateral FDI according to whether they occur between countries with aligned data regulatory models or between countries with divergent models. For both total services and information services, FDI has grown more robustly between countries with different data

[2] Nearly half of foreign affiliates in services are concentrated in the six following sectors: wholesale trade (14%), legal services (13%), management of companies and enterprises (10.7%), real estate (6.6%), finance and insurance (5.3%), and information services (3.1%).
[3] The list of the countries included in those three regulatory models is displayed in Table A1 of the Statistical Appendix.

governance regimes than between those with similar ones. Notably, this growth differential is especially pronounced in data-intensive services, suggesting that regulatory heterogeneity does not necessarily act as a barrier to cross-border investment in these sectors[4].

**Figure 1: Evolution of Services FDI Between Countries with Similar or Divergent Data Regulatory Models, 2010-2021**

(Number of foreign affiliates; Index number, 2010=100)




Source: Authors' calculations based on MREID Database.

## 2.2. Preferential Trade Agreements with data provisions.

To identify PTAs containing data provisions, we rely on the TAPED (Trade Agreement Provisions on Electronic Commerce and Data) dataset[5]. Specifically, we select two types of data provisions, those related to free flow of cross-border data and those related to data protection (Table A3 in the Statistical Appendix).

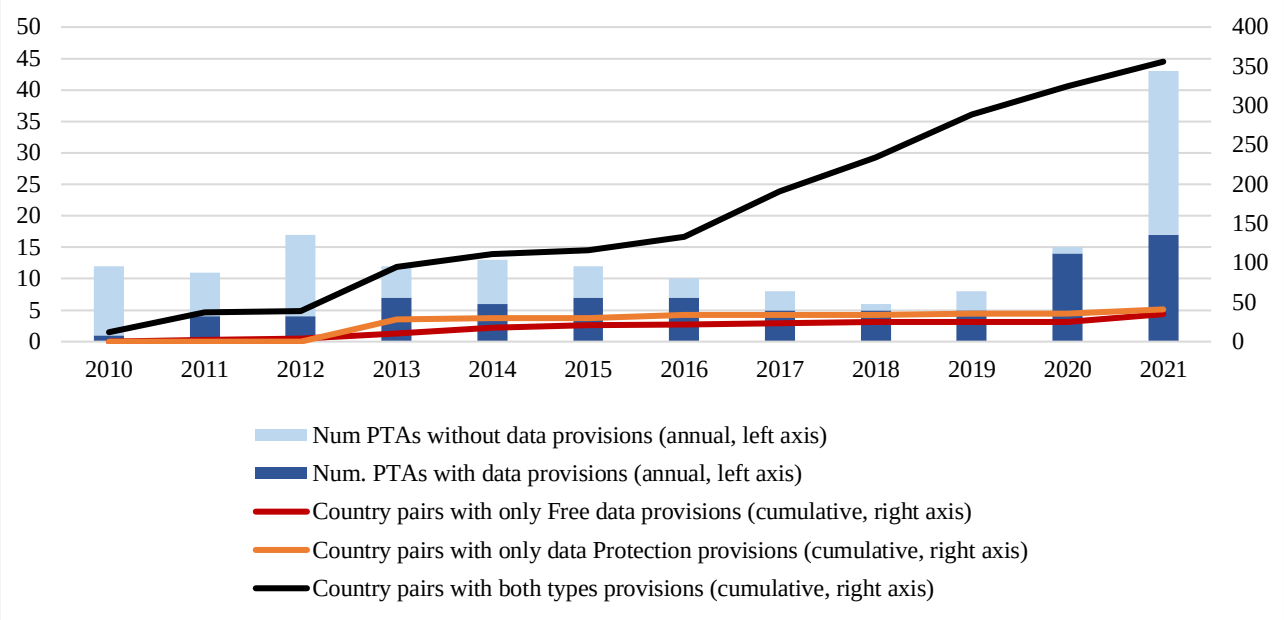
Figure 2 presents an overview of the evolution of data-related provisions in newly signed PTAs over the period 2010–2021. It distinguishes between the number of PTAs that include data provisions and those that do not, while also tracking the cumulative number of country pairs adopting specific types of data governance measures. The figure reveals a consistent upward trend across all categories, reflecting the increasing integration of data governance elements—such as data protection and the free flow of data—into trade policy frameworks. This expansion suggests an attempt by trading

[4] The bulk of FDI in data-intensive services is driven by countries following the open data model (US model) and the conditional model (EU model) because the main FDI sending and receiving countries are the US, the UK, and the EU-27 countries. In total services, EU-27 countries account for the highest values of outward FDI.

[5] The dataset includes a detailed mapping and coding of all PTAs that cover chapters, provisions, annexes, and side documents that directly or indirectly regulate digital trade. The latest version of TAPED (November 2024) covers over 465 new PTAs concluded since the year 2000. Detailed information is available at https://www.unilu.ch/en/faculties/faculty-of-law/professorships/burri-mira/research/taped/

partners to converge in their regulatory approaches to data governance, particularly in the absence of meaningful progress at the multilateral level. Notably, most country pairs include both types of provisions—those facilitating cross-border data flows and those ensuring data protection—indicating a dual commitment to digital openness and regulatory safeguards. These patterns underscore the growing importance of data-related rules in shaping international economic relations and the institutionalization of digital trade norms. Since not all countries in the MREID database report FDI flows in the specific sector of information services, it is important to note that restricting the sample to these countries results in a substantially smaller number of economies and country pairs with PTAs containing data-related provisions—approximately half as many.

**Figure 2: Evolution of Data-Related Provisions in PTAs: Number of Agreements and Country Pairs, 2010–2021**




Source: Authors' calculations based on MREID and TAPED databases and WTO statistics.

As previously explained, we are particularly interested in exploring the impact of PTAs with data provisions on foreign affiliates established between countries that do not share the same data regulatory model. These affiliates represent approximately 45% of total foreign affiliates in services and 55% in information services. In such cases, the inclusion of clear data trade rules in PTAs may be particularly relevant for facilitating investment flows across divergent regulatory environments.

## 3. Model specification

Although the gravity model was originally designed to study the determinants of bilateral international trade (Tinbergen, 1962; Anderson, 1979), it has also been utilized to analyse bilateral flows of FDI. The model's foundational principles, which consider the economic size of countries and

the distance between them, are equally applicable to understanding FDI flows. By adapting the gravity model to include factors specific to investment, such as market potential and investment barriers, researchers have been able to gain valuable insights into the patterns and determinants of FDI activity between countries (Blonigen and Piger, 2014). In this study, we propose estimating a gravity model to examine the effect of trade agreements that include data provisions on bilateral FDI in the period 2010–2021.

We estimate the gravity equation in its multiplicative form, rather than logarithmic form, using the Poisson Pseudo Maximum Likelihood (PPML) estimator with three types of (high-dimensional) fixed effects (exporter time, importer time, and country pair). This approach effectively addresses the presence of zero trade flows and accounts for heteroscedasticity. Our basic specification takes the following form:

$$FDI_{ij,t}^{k} = exp(\beta_1 Data\_prov_{ij,t} + \beta_2 Data\_prov_{ij,t}\#D\_Inf + \beta_3 Other\_PTAs_{ij,t} + \beta_4 WTO_{ij,t} + \beta_5 BIT_{ij,t} + +\sum_t \beta_t INTER_{ij,t}^{k} + \mu_{ij}^{k} + \chi_{i,t}^{k} + \lambda_{j,t}^{k}) \times \epsilon_{ij,t}^{k} \quad (1)$$

The dependent variable -$FDI^{k}_{ij,t}$- is the number of affiliates in the service sector *k* from country *i* (parent country) to country *j* (destination country) at time *t* from the MREID database. Following Yotov et al. (2016) and Yotov (2022), international and intra-national (domestic) FDI flows are included in the dependent variable. This approach mitigates bias in the evaluation of bilateral policies and addresses the 'distance puzzle' by accounting for both foreign and domestic distances. Moreover, it enables to capture the effects of national non-discriminatory policies (Heid et al., 2021), that is, policies that are not bilateral in nature and may not explicitly target foreign investment yet can influence the overall level of FDI.

The main explanatory variable of interest is $Data\_prov_{ij,t}$, which is introduced to capture data provisions in PTAs. This variable can take two different forms, depending on whether it captures the presence or absence of data provisions in the agreement (as a dummy variable), or whether it reflects the depth of the agreement in terms of such data-related provisions. As explained in section 2.2, we identify two different types of data provisions using the TAPED dataset: those related to the free flow of cross-border data and those related to data protection. Only binding provisions (hard commitments) are included in the analysis. Therefore, the dummy variable for PTAs with data provisions is defined as follows: $Data\_Prov_{ij,t}$, when both types of provisions are considered collectively; and $Free\_Data\_Flows_{ij,t}$ and $Data\_Protection_{ij,t}$, when distinguishing between both types of data provisions. Each of these are dummy variables that take the value 1 if the country pair *ij* has signed an agreement containing at least one data provision, and 0 otherwise.

To capture the depth of each PTA containing data-related commitments, we follow previous empirical literature which uses different measures to operationalize depth (Baccini et al., 2015; Dür et al., 2014; Orefice and Rocha, 2014; and Elsig and Klotz, 2021). Our measure of depth applies latent trait analysis[6] to account for the fact that not all provisions carry equal weight in determining the extent of countries' commitments. Specifically, we use the *Rasch* model, which assumes that all items capture one underlying latent dimension but with different discriminatory power. Consequently, the items contribute more or less to this latent dimension, that is, they have more or less discriminatory power.[7] Under this operationalization, provisions that are relatively uncommon in PTAs contribute more significantly to the depth of an agreement than those that are widely prevalent. This measure of depth is constructed both for the overall set of data provisions and for each of the two categories. Therefore, we have three variables which capture the depth of PTAs related to data provisions: $Data\_Depth_{ij,t}$, which include all data commitments; $Data\_Protection\_Depth_{ij,t}$, which measure commitments related to data protection; and $Free\_Data\_Flows\_Depth_{ij,t}$, which measure commitments related to free cross-border data flows. To facilitate the comparison of results, these variables are normalised to take values between 0 and 1.

Given that the aim of the paper is to analyse the impact of PTAs with data provisions on services-related FDI with particular attention to data-intensive services, we include as an explanatory variable an interaction term between the data provisions variable (the dummy variable or the depth variable) and a dummy for the information services sector ($Data\_prov_{ij,t}\#D\_Inf$).

To account for potential confounding factors, we incorporate further control variables into the empirical specification. These controls capture the influence of other institutional arrangements between countries that may affect bilateral FDI, ensuring a more accurate estimation of the primary variable of interest. First, we control for the existence of bilateral trade agreements that do not contain data-related provisions. These agreements may shape trade dynamics independently of data provisions and thus help isolate the specific effect of data-related commitments. This explanatory variable, denoted as $Other\_PTAs_{ij,t}$, is a dummy that takes the value 1 if the country pair *ij* has a bilateral trade agreement in force at time *t* that does not include data-related provisions and 0 if they do not have any type of trade agreement. Data are obtained from the CEPII gravity database.

Second, we include a dummy variable indicating whether a bilateral investment treaty ($BIT_{ij,t}$) exists between the country pair. BITs can influence investment flows and economic integration, potentially confounding the effects of the agreements under study. The primary objective of BITs is

[6] *Latent trait analysis* is a type of factor analysis for binary data (Bartholomew et al., 2011).
[7] Figure A.1 in the Statistical Appendix illustrates the frequency of data-dedicated provisions in PTAs.

to reduce the risks associated with FDI by enhancing transparency regarding the regulatory environment in host countries (Bergstrand and Egger, 2013). Including this variable in the gravity model is important, as countries with stronger trade or investment ties are more likely to enter into trade agreements. Thus, it helps to isolate the specific effect of PTAs that include data-related provisions, ensuring that their estimated impact is not confounded by other policy-related variables (Kox and Rojas-Romagosa, 2021). Data on BITs are sourced from the UNCTAD Investment Policy Hub, which provides comprehensive information on the existence and status of BITs globally. Based on this dataset, we construct a bilateral dummy variable, which takes the value 1 if the country pair *ij* has a BIT in force in year *t*, and 0 otherwise.

Third, we control for joint membership in the World Trade Organization (WTO), as WTO participation may reflect a broader commitment to trade liberalization and institutional alignment. It is well established that, in addition to addressing trade-related issues, the WTO also covers certain aspects related to FDI, even though it does not explicitly regulate FDI. Therefore, omitting WTO membership may introduce omitted variable bias. This variable $WTO_{ij,t}$ is a dummy that takes the value 1 if both countries *i* and *j* are members of the WTO at time *t*.

Additionally, three-way fixed effects and globalization effects are added to the empirical specification. We include sector-specific country pair fixed effects, denoted as $\mu^{k}_{ij}$, to address the potential endogeneity of the trade policy variable (Baier and Bergstrand, 2007) and to control for all time-invariant unobserved heterogeneity in flows between country pairs within each service sector (Egger and Nigai, 2015; Agnosteva et al., 2014). Furthermore, Anderson and van Wincoop (2003) emphasise the importance of considering multilateral resistance terms to prevent biased outcomes in gravity estimations. To manage these unobservable multilateral resistances and possibly any other observable or unobservable characteristics that fluctuate over time for each source and destination country and each service sector, we integrate time-varying country-sector specific fixed effects into our gravity estimation framework with panel data (Olivero and Yotov, 2012). Specifically, $\chi^{K}_{i,t}$ represents a vector of source country-sector-time fixed effects, and $\lambda^{K}_{i,t}$ is a vector of destination country-sector-time fixed effects.

Finally, following Bergstrand et al. (2015), we account for common globalisation effects. These authors argue that traditional estimates of trade agreements and other policy variables using the gravity equation may be biased—typically overestimated—they may inadvertently capture global trends in trade. To address this issue, domestic trade flows are incorporated into the gravity equation. These globalization effects should also be considered in a gravity model that estimates the determinants of bilateral FDI. Globalization effects are then captured by a vector of time-varying

border dummy variables, denoted as $INTER_{ij,t}^{k}$, which take the value of 1 for foreign affiliates ($i \neq j$) and are equal to zero for domestic affiliates ($i=j$) in each year $t$. Following Larch et al. (2022), since the gravity sample is pooled across different service sectors, these border effects should incorporate a sectoral dimension to control for sector-specific globalisation trends. Accordingly, these dummy variables control for improvements in transportation, communication, technology and so on that impact the international FDI flows—relative to internal flows—across all countries within a given service sector. Finally, the standard errors in all specifications are clustered by country pair following Larch et al. (2022), who argue that, given the rich structure of fixed effects in each of our specifications, it is safe to assume that the error term ($\epsilon_{ij,t}^{k}$) is just noise.

In a second step, we allow the effect of data-related provisions on FDI flows in services to vary depending on whether the source and destination countries follow the same or different data regulatory models. To capture this heterogeneity, we introduce interaction terms between the variable representing PTAs with data-related provisions and two dummy variables that indicate the nature of regulatory alignment between country pairs: $Data\_prov_{ij,t} \times D\_SameReg_{ij,t}$, for country pairs with similar data regulatory models, and $Data\_prov_{ij,t} \times D\_DiffReg_{ij,t}$, for those with divergent models. Finally, to assess whether the impact differs for FDI in information services, we include a triple interaction with a sector-specific dummy variable ($Data\_prov_{ij,t} \times D\_SameReg_{ij,t} \times D\_Inf$ and $Data\_prov_{ij,t} \times D\_DiffReg_{ij,t} \times D\_Inf$). To formally test for this heterogeneity, we estimate the following extended gravity model specification:

$$FDI_{ij,t}^{k} = exp\big(\beta_1 Data\_prov_{ij,t} \times D\_SameReg_{ij,t} + \beta_2 Data\_prov_{ij,t} \times D\_DiffReg_{ij,t} + \beta_3 Data\_prov_{ij,t} \times D\_SameReg_{ij,t} \times D\_Inf + \beta_4 Data\_prov_{ij,t} \times D\_DiffReg_{ij,t} \times D\_Inf + \beta_5 Other\_PTAs_{ij,t} + \beta_6 WTO_{ij,t} + \beta_7 BIT_{ij,t} + \sum_t \beta_t INTER_{ij,t}^{k} + \mu_{ij}^{k} + \chi_{i,t}^{k} + \lambda_{j,t}^{k}\big) \times \epsilon_{ij,t}^{k} \quad (2)$$

## 4. Estimation results

Tables 2, 3 and 4 report the results from PPML estimations of the gravity model, where the dependent variable is the number of MNE affiliates in the service sector $k$ from country $i$ to country $j$ at year $t$. In Table 2, the main explanatory variable captures the impact of any type of data-related provision within a PTA, encompassing both provisions related to cross-border data flows and those concerning personal data protection. This aggregated measure allows us to assess the overall impact of data-related provisions on bilateral FDI in services. These results are derived from the estimation of specifications (1) and (2). Columns (1a) and (1b) present the estimation results based on the presence of any type of data-related provisions in the PTA and the depth of the agreement,

respectively. Columns (2a) and (2b) report the heterogeneous effects of PTAs containing data-related provisions -both in terms of their presence and their depth-, depending on whether service FDI occur between countries that share the same regulatory model or operate under different ones. We further test for sector-specific heterogeneity by introducing interactions with the dummy for information services.

**Table 2. FDI and PTAs with data-related provisions. PPML estimates**

| VARIABLES | (1a) | (1b) | (2a) | (2b) |
|---|---|---|---|---|
| Data_Prov | -0.003 | | | |
| | (0.008) | | | |
| Data_Prov×D_Inf | -0.045 | | | |
| | (0.026)* | | | |
| Data_Depth | | 0.044 | | |
| | | (0.025)* | | |
| Data_Depth×D_Inf | | -0.090 | | |
| | | (0.077) | | |
| Data_Prov×D_SameReg | | | -0.020 | |
| | | | (0.010)** | |
| Data_Prov×D_SameReg×D_Inf | | | -0.014 | |
| | | | (0.030) | |
| Data_Prov×D_DiffReg | | | 0.031 | |
| | | | (0.011)*** | |
| Data_Prov×D_DiffReg×D_Inf | | | -0.095 | |
| | | | (0.034)*** | |
| Data_Depth×D_SameReg | | | | -0.014 |
| | | | | (0.031) |
| Data_Depth×D_SameReg×D_Inf | | | | 0.048 |
| | | | | (0.082) |
| Data_Depth×D_DiffReg | | | | 0.124 |
| | | | | (0.031)*** |
| Data_Depth×D_DiffReg×D_Inf | | | | -0.307 |
| | | | | (0.087)*** |
| Other_PTAs | -0.012 | 0.002 | -0.013 | -0.010 |
| | (0.011) | (0.012) | (0.010) | (0.013) |
| WTO | 0.046 | 0.049 | 0.046 | 0.047 |
| | (0.042) | (0.042) | (0.042) | (0.042) |
| BIT | 0.024 | 0.025 | 0.024 | 0.024 |
| | (0.022) | (0.022) | (0.023) | (0.022) |
| Constant | 6.475 | 6.470 | 6.476 | 6.473 |
| | (0.041)*** | (0.041)*** | (0.041)*** | (0.041)*** |
| Observations | 213.270 | 213.270 | 213.270 | 213.270 |

Notes. The regressand is the yearly number of MNE affiliates in the service sector *k* from country *i* to country *j*. Robust standard errors, clustered by dyad are in parentheses. ***p < 0.01, **p < 0.05, *p < 0.1. All regressions include country-sector-pair fixed effects, as well as source country-sector -time and destination country-sector-time fixed effects. To control for global trends in international trade, $INTER^{k}ij,t$ dummies are also included. All fixed effects and globalization dummies are not reported for brevity.

In column (1a), the coefficient on the binary PTA variable is not statistically significant, suggesting that, on average, the presence of data-related provisions in PTAs does not have a discernible effect on FDI in services. The interaction term *Data_Prov×D_Inf*, which captures the

differential effect of data-related provisions specifically for the information services sector, yields a negative and statistically significant coefficient (−0.045). This indicates that the effect of data-related provisions is not uniform across sectors: the presence of such provisions is associated with a significantly lower level of FDI in the information services sector compared to the average across all services (approximately 4.4% lower).

In column (1b), the depth of data-related provisions is positively associated with services FDI. This coefficient is statistically significant, indicating that a one-unit increase in the depth index of data provisions is associated with an approximate 4.4% increase in foreign affiliates in the services sector. In contrast, the interaction term between the depth of data-related provisions and the information services dummy is negative but not statistically significant. This indicates that the estimated effect in this sector is not statistically different from the average effect observed in the service sector as a whole. In other words, while the depth of data-related provisions is associated with increased FDI in services overall, there is no robust evidence that this relationship differs systematically for the information services sector.

Columns (2a) and (2b) extend the baseline specification by introducing interactions between data-related provisions and indicators of regulatory alignment in cross-border data governance—specifically, whether the source and destination countries follow the same or different regulatory models. These interactions are further interacted with a dummy for the information services sector to assess sector-specific heterogeneity. As in the previous specifications, column (a) estimates the effect of the presence of any data-related provisions in PTAs on FDI in services, while column (b) focuses on the depth of those provisions. This distinction allows for a more nuanced analysis of how the intensity of data governance commitments may influence investment patterns across service sectors.

The coefficients on $Data\_prov_{ij,t} \times D\_DiffReg_{ij,t}$ in column (2a), and on $Data\_Depth_{ij,t} \times D\_DiffReg_{ij,t}$ in column (2b), are positive and statistically significant, indicating that PTAs with data-related provisions are associated with foreign affiliates in services when the partner countries follow different regulatory models. However, the triple interactions $Data\_prov_{ij,t} \times D\_DiffReg_{ij,t} \times D\_Inf$ and $Data\_Depth_{ij,t} \times D\_DiffReg_{ij,t} \times D\_Inf$ are negative and highly significant, implying that the positive effect does not extend to the information services sector. In fact, FDI in these data-intensive services between countries with different data regulatory model are negatively affected by the data-related provisions in PTAs. The effects are notably stronger for deeper PTAs commitments in data. The interactions involving $D\_SameReg_{ij,t}$ predominantly exhibit statistically insignificant coefficients, indicating that data-related provisions do not have a differential effect when countries are already aligned in their data governance models.

The coefficients on the control variables—Other PTAs, WTO, and BIT—are small and statistically insignificant across all specifications. This suggests that, once data-related provisions are accounted for, other trade or investment agreements do not have a significant independent effect on bilateral FDI in services.

Table 3 and Table 4 disaggregate the effects of cross-border data flow provisions and data protection provisions, thereby enabling a more nuanced analysis of how different types of data-related commitments influence FDI patterns across service sectors. Table 3 presents the estimation results for the impact of the presence of data-related provisions in PTAs, whereas Table 4 focuses on the effects associated with the depth of those provisions.

Results from Table 3 reveal substantial heterogeneity in both types of data-related provisions affect FDI in services, depending on the regulatory alignment between partner countries and the sectoral intensity of data use. The results show that provisions promoting the free flow of data do not have a statistically significant effect on FDI in services overall. Moreover, the interaction term between these provisions and regulatory divergence ($FreeDataFlows_{ij,t} \times D\_DiffReg_{ij,t}$) is not statistically significant, indicating that there is no robust evidence that the impact is different when countries follow different data governance models. However, the triple interaction term ($FreeDataFlows_{ij,t} \times D\_DiffReg_{ij,t} \times D\_Inf$) is negative and statistically significant at the 1% level, suggesting that, relative to the service sector as a whole, the information services sector experiences a significantly lower level of FDI when free flow provisions are included in PTAs between countries with divergent regulatory models. No statistically significant effects are found for interactions involving regulatory alignment ($D\_SameReg_{ij,t}$), either in general or for the information services sector, suggesting that shared regulatory frameworks do not significantly alter the investment impact of free flow provisions.

A similar pattern emerges for data protection provisions. The average effect on FDI in services is not statistically significant, and the interaction with regulatory divergence ($DataProtection_{ij,t} \times D\_DiffReg_{ij,t}$) is the only statistically significant double interaction, indicating that such provisions are associated with higher FDI flows when countries have different regulatory models. However, the triple interaction with the information services sector ($DataProtection_{ij,t} \times D\_DiffReg_{ij,t} \times D\_Inf$) is again negative and statistically significant at the 1% level, indicating that the positive effect observed in the overall service sector is reversed for the case of information services. As with free flow provisions, the interactions under regulatory alignment are not statistically significant, implying that harmonized regimes do not significantly amplify or mitigate the investment effects of data protection clauses.

**Table 3. FDI and PTAs by type of data-dedicated provisions. PPML estimates.**

| VARIABLES | (1a) | (1b) | (2a) | (2b) |
|---|---|---|---|---|
| Free_Data_Flows | -0.011 | | | |
| | (0.008) | | | |
| Free_Data_Flows×D_Inf | -0.036 | | | |
| | (0.027) | | | |
| Data_Protection | | -0.003 | | |
| | | (0.008) | | |
| Data_Protection×D_Inf | | -0.049 | | |
| | | (0.027)* | | |
| Free_Data_Flows×D_SameReg | | | -0.023 | |
| | | | (0.010)** | |
| Free_Data_Flows×D_SameReg ×D_Inf | | | -0.010 | |
| | | | (0.030) | |
| Free_Data_Flows×D_DiffReg | | | 0.015 | |
| | | | (0.011) | |
| Free_Data_Flows×D_DiffReg ×D_Inf | | | -0.094 | |
| | | | (0.034)*** | |
| Data_Protection×D_SameReg | | | | -0.019 |
| | | | | (0.010)** |
| Data_Protection×D_SameReg ×D_Inf | | | | -0.021 |
| | | | | (0.030) |
| Data_Protection×D_DiffReg | | | | 0.033 |
| | | | | (0.012)*** |
| Data_Protection×D_DiffReg ×D_Inf | | | | -0.098 |
| | | | | (0.035)*** |
| Other_PTAs | -0.015 | -0.011 | -0.018 | -0.012 |
| | (0.011) | (0.011) | (0.011)* | (0.010) |
| WTO | 0.046 | 0.047 | 0.045 | 0.046 |
| | (0.042) | (0.042) | (0.042) | (0.042) |
| BIT | 0.024 | 0.024 | 0.024 | 0.025 |
| | (0.022) | (0.022) | (0.023) | (0.023) |
| Constant | 6.476 | 6.475 | 6.476 | 6.475 |
| | (0.041)*** | (0.041)*** | (0.041)*** | (0.041)*** |
| Observations | 213.270 | 213.270 | 213.270 | 213.270 |

Notes: see notes in Table 2.

Table 4 presents PPML estimates that examine the relationship between the depth of data-related provisions in PTAs and foreign affiliates in the service sector. The results show that, when considered in isolation, deeper commitments to either free data flows or data protection do not have a statistically significant effect on FDI across the full sample of services. However, the interaction terms reveal important sector-specific dynamics. In particular, for the information services sector, the interaction between data protection depth and sectoral classification is significantly negative. This suggests that stronger data protection rules may deter FDI in this sector, likely due to the heightened sensitivity of data-intensive services to regulatory constraints and compliance burdens. The analysis further reveals that regulatory divergence between countries plays a critical role. When countries have different regulatory regimes, deeper provisions on free data flows and data protection are associated with a significant increase in FDI across the overall service sector. However, this positive effect is

significantly reversed in the information services sector. Under regulatory divergence, the interaction terms for both types of provisions become significantly negative when applied to this sector.

**Table 4. FDI flows and depth of PTAs by type of data-dedicated provisions. PPML estimates.**

| VARIABLES | (1a) | (1b) | (2a) | (2b) |
|---|---|---|---|---|
| Free_Data_Flows_Depth | 0.044 | | | |
| | (0.028) | | | |
| Free_Data_Flows_Depth ×D_Inf | -0.071 | | | |
| | (0.083) | | | |
| Data_Protection_Depth | | 0.046 | | |
| | | (0.035) | | |
| Data_Protection_Depth ×D_Inf | | -0.169 | | |
| | | (0.100)* | | |
| Free_Data_Flows_Depth ×D_SameReg | | | -0.014 | |
| | | | (0.035) | |
| Free_Data_Flows_Depth ×D_SameReg ×D_Inf | | | 0.067 | |
| | | | (0.087) | |
| Free_Data_Flows_Depth ×D_DiffReg | | | 0.128 | |
| | | | (0.036)*** | |
| Free_Data_Flows_Depth ×D_DiffReg ×D_Inf | | | -0.315 | |
| | | | (0.097)*** | |
| Data_Protection_Depth ×D_SameReg | | | | -0.076 |
| | | | | (0.043)* |
| Data_Protection_Depth ×D_SameReg ×D_Inf | | | | 0.076 |
| | | | | (0.128) |
| Data_Protection_Depth ×D_DiffReg | | | | 0.117 |
| | | | | (0.045)*** |
| Data_Protection_Depth ×D_DiffReg ×D_Inf | | | | -0.295 |
| | | | | (0.129)** |
| Other_PTAs | 0.001 | -0.003 | -0.011 | -0.012 |
| | (0.013) | (0.010) | (0.013) | (0.010) |
| WTO | 0.049 | 0.048 | 0.047 | 0.047 |
| | (0.042) | (0.042) | (0.042) | (0.042) |
| BIT | 0.025 | 0.024 | 0.024 | 0.024 |
| | (0.022) | (0.022) | (0.022) | (0.022) |
| Constant | 6.470 | 6.472 | 6.474 | 6.474 |
| | (0.041)*** | (0.041)*** | (0.041)*** | (0.041)*** |
| Observations | 213.270 | 213.270 | 213.270 | 213.270 |

Notes: see notes in Table 2.

## 5. Discussion of Results

The empirical findings presented above offer nuanced insights into the relationship between data-related provisions in PTAs and bilateral foreign affiliates in the services sector. While the inclusion and depth of such provisions do not appear to significantly affect FDI across all service sectors uniformly, the results reveal important heterogeneity when distinguishing between the overall service sector and the information services sector.

In the aggregate, deeper commitments to data-related provisions—those concerning the free flow of data and data protection—are associated with increased FDI when data regulatory regimes between partner countries diverge. This suggests that such provisions may help reduce uncertainty

and transaction costs associated with regulatory fragmentation, thereby facilitating FDI in the services sector. However, this positive effect is not observed uniformly across sectors.

A key finding is the negative and significant interaction between data provisions and the information services sector, especially under conditions of data regulatory divergence. This pattern is consistent across both the presence and depth of data-related commitments. These results suggest that, for data-intensive services, PTAs with strong data provisions may reduce the reliance on foreign affiliates by enabling remote service delivery (mode 1 of services trade).

This interpretation aligns with the theoretical literature on the substitutability of modes of service supply. In sectors such as ICT, where services can be delivered digitally and at scale, the facilitation of cross-border data flows may reduce the strategic necessity of investing in physical infrastructure or subsidiaries in foreign markets. Thus, while data provisions may enhance market access, they may simultaneously dampen the incentives for FDI in these sectors. In contrast, for less data-intensive services—where remote delivery is less feasible—FDI remains a necessary channel for market entry and operation. In these cases, data provisions may complement rather than substitute FDI, particularly when data regulatory divergence is present. This is reflected in the positive and significant coefficients for the interaction between data provisions and regulatory divergence in the full sample. Furthermore, the absence of significant effects under data regulatory alignment suggests that the harmonization of data governance frameworks alone does not necessarily stimulate FDI. Instead, it is the interaction between regulatory divergence and the enabling role of data provisions that appears to be most relevant for foreign investment decisions.

These findings are consistent with the recent work by Paniagua and Bergstrand (2024), who show that the effects of deep trade agreement provisions depend on whether trade and FDI act as complements or substitutes. Specifically, they find that provisions that positively (negatively) affect trade flows may simultaneously negatively (positively) affect FDI flows, suggesting a substitutive relationship between the two. Our results reflect this mechanism: in the case of the information services sector—where digital delivery can replace physical presence—data-related provisions that facilitate trade may reduce the need for foreign investment, thus explaining the negative effect observed on FDI. These results are also consistent with the findings of Blázquez et al. (2025), who show that PTAs with data-related provisions significantly enhance trade in data-intensive services embedded in GVCs. Taken together, both studies suggest that such provisions may facilitate cross-border service delivery (mode 1), while simultaneously reducing the need for commercial presence abroad (mode 3), particularly in sectors where digital delivery is technologically feasible. This

evidence supports the hypothesis of substitutability between modes of service supply in the digital economy.

To demonstrate the robustness of our empirical results, we perform several sensitivity analyses. First, following Damgaard et al. (2019), not all FDI reflects real economic integration. It is important to consider investments into empty corporate shells with no link to the local real — so-called Phantom FDI — because, as those authors pointed out, the share of Phantom FDI in total FDI has been growing steadily in recent years. We re-estimate the model excluding phantom FDI, using two thresholds: one more restrictive and one less so. In the first case, all origin and destination countries with a phantom FDI share exceeding 40% of total FDI are excluded; in the second, the threshold is set at 70%. In both scenarios, the main conclusions remain unchanged. The second robustness check limits the analysis period to 2010–2019 for several reasons: (i) to avoid potential biases in the results related to the COVID-19 year (2020), and (ii) to exclude all agreements signed by the United Kingdom in recent years following its exit from the European Union. Under this restriction, the results remain robust. Finally, we use alternative clustering methods for the standard errors — by country pair and for EU countries. Clustering the errors in a gravity model with panel data improves the accuracy of statistical inferences by accounting for the potential dependence between observations within each group. The results for this check show that the standard errors become slightly larger, but the significance remains unchanged. While alternative clustering seems to matter for the magnitude of the standard errors, the changes are not large, and our main results and conclusions remain valid.[8]

## 6. Concluding remarks.

This paper contributes to the growing literature on digital trade governance by examining how data-related provisions in PTAs affect bilateral FDI in services, with a particular focus on data-intensive sectors. While previous studies have primarily explored the impact of data governance on cross-border trade in services (mode 1), this study shifts the focus to mode 3—commercial presence—which remains the dominant channel for delivering services internationally.

Using a structural gravity model, we provide robust empirical evidence that the depth and type of data-related provisions in PTAs matter for FDI. Our findings reveal that deeper commitments—rather than the mere presence of data provisions—are associated with higher FDI in the services sector, particularly when partner countries operate under different data regulatory models. This suggests that comprehensive and enforceable data provisions can help bridge institutional gaps and reduce the transaction costs associated with regulatory divergence.

[8] The results of the estimations conducted for each of these robustness checks are available upon request.

However, this positive effect is not uniform across sectors. In the information services sector, which is highly data-intensive and digitally deliverable, the inclusion of data provisions—especially under regulatory divergence—is associated with a lower number of foreign affiliates. This result is consistent with the hypothesis that facilitating cross-border data flows may substitute for FDI in these sectors, as firms can increasingly serve foreign markets remotely without establishing a local presence. In contrast, for less digitalized services, FDI remains a necessary mode of supply, and cross-border trade in services may act as a complement rather than a substitute.

The analysis also highlights that regulatory alignment between countries does not significantly amplify the effect of data provisions on FDI. The investment-enhancing role of data provisions appears to be most relevant when countries do not share the same data governance model, reinforcing the idea that such provisions serve as institutional bridges in fragmented digital environments.

From a policy perspective, this study provides new evidence that data governance provisions in trade agreements are not neutral. Our findings underscore the importance of considering sectoral characteristics and regulatory context when evaluating the investment effects of data-related provisions in PTAs. They also highlight the need for policymakers to recognize that PTAs commitments in data may have differentiated effects across sectors, potentially reshaping the geography and mode of service delivery in the global economy. Policymakers should therefore consider the substitutability between trade and FDI in data-intensive services when designing data provisions in trade agreements.

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## Statistical Appendix

**Table A1. Countries included in the sample by data regulatory model in 2019.**

| Regulatory blocs | Countries |
|---|---|
| US-model (38 countries) (*Open Transfers and Processing Model*) | AFG, ARE, AUS, BGD, BOL, CAN, CMR, COD, EGY, ETH, GHA, GMB, HKG, HND, HTI, IRQ, JOR, KHM, LAO, LBN, LBR, LKA, MEX, MMR, MWI, NPL, NZL, OMN, PAK, PHL, PNG, QAT, RWA, SAU, SLE, TWN, TZA, USA |
| EU-model (66 countries) (*Conditional Transfers and Processing Model*) | AGO, ARG, ARM, AUT, BEL, BEN, BFA, BGR, BRA, CHE, CHL, COL, CRI, CYP, CZE, DEU, DNK, DOM, ESP, EST, FIN, FRA, GAB, GBR, GEO, GRC, HRV, HUN, IND, IRL, ISL, ISR, ITA, JPN, KGZ, KOR, LTU, LUX, LVA, MAR, MDA, MDG, MLI, MLT, MUS, MYS, NIC, NLD, NOR, PER, POL, PRT, ROU, SEN, SGP, SVK, SVN, SWE, TGO, THA, TJK, TUR, UGA, UKR, URY, ZAF |
| China-model (12 countries) (*Limited Transfers and Processing Model*) | BRN, CHN, CIV, IDN, IRN, KAZ, KEN, NGA, RUS, TUN, UZB, VNM |

Note: The blocs are based on Ferracane and van der Marel (2021). There are five countries do not include in any regulatory model: Ecuador (ECU), Bahamas (BHS), Jamaica (JAM), Liechtenstein (LIE) and Saint Kitts and Nevis (KNA).

**Table A2. Data-dedicated provisions from TAPED dataset.**

| **DATA PROTECTION** | | |
|---|---|---|
| Does the agreement include provisions on data protection? [2.1.1]<br>Does the agreement include provisions on data protection with no qualifications? [2.1.2]<br>Does the agreement include provisions on data protection according to domestic law? [2.1.3]<br>Does the agreement include provisions on data protection recognising certain key principles? [2.1.4]<br>Does the agreement include provisions on data protection recognising certain international standards? [2.1.5]<br>Does the agreement include provisions on data protection as a least restrictive measure? [2.1.6] | | |
| **FREE CROSS-BORDER DATA FLOWS** | | |
| In the e-commerce/digital trade | Outside the e-commerce /digital trade chapter | Reference to data flows in service chapters/provisions |
| Does the agreement include a provision on the free movement of data? [2.2.1; 2.3.1]<br>Does the agreement include a mechanism to address barriers to data flows? [2.2.2; 2.3.2]<br>Does the agreement include a provision banning or limiting data localisation requirements? [2.2.3; 2.3.3]<br>Does the agreement contain a provision on a future discussion/provisions or agreement on the free flow of data? [2.2.4; 2.3.4] | | In the telecommunications chapter/provisions [2.4.1]<br>In computer and related services chapter/provisions [2.4.2]<br>In audiovisual services chapter/provisions [2.4.3]<br>In the financial services chapter/provisions [2.4.4] |

Note: Item in Codebook TAPED in square brackets

**Figure A.1. Operationalizing Rasch' depth**