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 FDI flows 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 as a whole, 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 the importance of countries' data regulatory contexts and sectoral characteristics in shaping the FDI effects of data-related rules in trade agreements.

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

JEL codes: F13, F21, F23, L86.

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1. Introduction

Following the process of hyperglobalization that took place from the 1990s until the Great Recession, the global economy has entered a phase of *slowbalization*. This trend is particularly evident in goods trade, and it is related to the fact that there is hardly any room for further international fragmentation of production, which limits the expansion of Global Value Chains (GVCs). The phenomenon has been exacerbated in recent years by the risks of supply-chain disruptions due to global pandemics and rising geopolitical tensions. However, trade in services has not followed this pattern; its share of global GDP has continued to grow (Baldwin et al., 2024).

The increase in services trade can be attributed to three main factors. First, it is linked to the role of services within GVCs, as services such as transportation, logistics, communications, quality control, and management are essential for the proper functioning of GVCs. The coordination of increasingly complex and dispersed global production networks would not have been possible without significant improvements in the Information and Communication Technology (ICT) sector. Consequently, ICT services have been a fundamental enabler of the growth of cross-border production sharing (UNCTAD, 2017). A second factor is digitalization, which has enabled certain services to become tradable and has facilitated the digital sale of products, thereby fostering the growth of digital trade (WTO, 2018), which is defined as all trade that is digitally ordered and/or digitally delivered (López González et al., 2023). Due to this digitalization of production, parts or even entire GVCs are now digital—either digital by origin or in transition from physical to digital (UNCTAD, 2017). A third factor is the growing importance of services embedded in manufactured goods. This servicification enhances product differentiation by incorporating new specifications, technological improvements, or by providing customers with a perception of higher product quality, allowing manufacturing firms to escape price-based competition (Miroudot and Cadestin, 2017) and to improve competitiveness (Díaz-Mora et al., 2018).

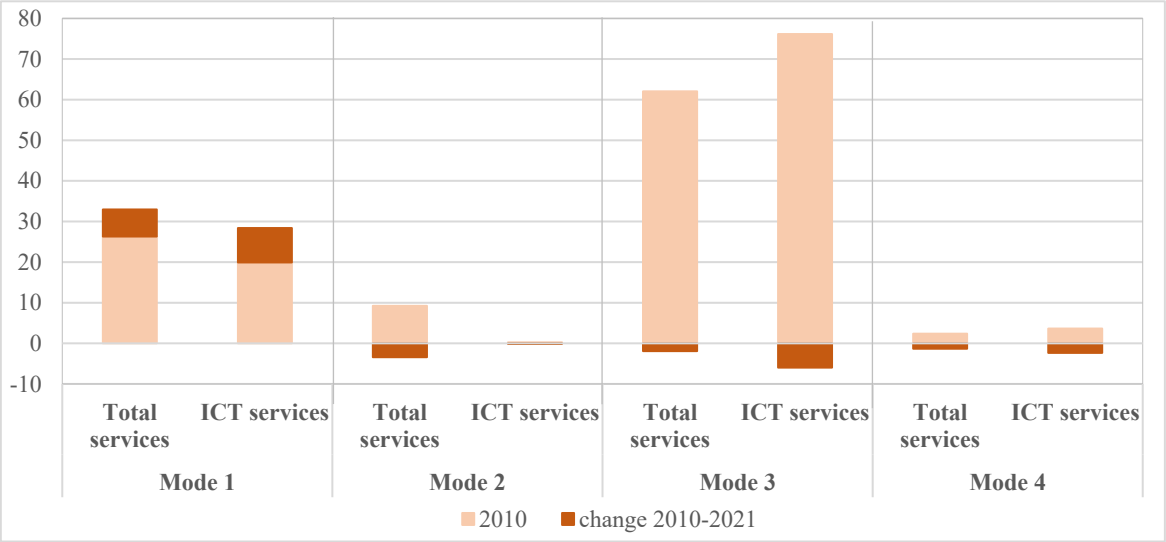
The ICT sector has played a crucial role in each of these factors by facilitating service flows between countries. This helps explain why, within the service sectors, information services have shown the most dynamic growth. According to WTO estimates for digitally delivered services, global exports of information services have increased fivefold, suggesting a new channel for the advancement of globalization (Blázquez et al., 2023).

However, it is important to emphasize that the international supply of services does not occur solely through traditional cross-border trade in services (Mode 1 in GATS: cross-border supply). Rather, commercial presence in another country (Mode 3) is the predominant mode (Rueda Cantuche

et al., 2016)[1]. According to the WTO's Trade in Services by Mode of Supply (TISMOS) dataset, approximately 55 percent of global trade in commercial services is delivered through foreign affiliates in the recipient country. This mode 3 is particularly significant for information services, where it accounts for 64% of total, although this share is decreasing in favour of mode 1 (Figure 1). The importance of FDI in ICT services is also reflected in UNCTAD's list of the top 100 MNEs, which includes ICT firms such as Microsoft, SAP, Google, Oracle, and IBM. Most ICT services firms are based in developed countries, particularly the United States (UNCTAD, 2017).

Figure 1: Structure of International Services Trade by Modes of Supply, 2010-2021

(shares of total trade)



Note: ICT services include telecommunications, computers, information and audiovisual services.
Source: Authors' calculation based on WTO's TISMOS dataset.

As with trade flows, signs of a slowdown in globalization are evident in FDI flows since the global financial crisis, with global FDI declining from around 3 percent of GDP between 2010 and 2017 to around 1 percent between 2018 and 2022 (IMF, 2023). However, using data from UNCTAD based on information from the Financial Times Ltd (fDi Markets), both the number and value of announced greenfield FDI projects in information and communication services doubled between 2010 and 2021, while remaining stagnant for the aggregate of service sectors and even declining for manufacturing.

[1] Among the four modes of supply identified in the General Agreement on Trade in Services (GATS), these two are dominant. The other two are consumption abroad (mode 2) and presence of natural persons (mode 4). Although it is not recognized as a mode of supply under the GATS, an additional channel in trading services refers to services which are incorporated into goods' exports (Cernat and Kutlina-Dimitrova, 2014.). This mode 5 is inherently linked to servicification.

Therefore, despite signs of *slowbalization*, ICT services trade and FDI have continued to grow rapidly. This occurs even as the regulatory environment becomes increasingly fragmented and restrictive at the global level. The increasingly restrictive regulatory environment is evidenced by the rise in the OECD Digital Services Trade Restrictiveness Index, which provides insights into the nature and extent of regulatory barriers affecting trade in digitally enabled services, including policies that impact cross-border data flows (Ferencz and Gonzales, 2019). More specifically, a growing number of countries are imposing conditions on cross-border data transfers or requiring local data storage (Casalini et al., 2021; Cory and Dascoli, 2021; Del Giovane et al., 2023). Furthermore, these data-related regulations vary across countries, reflecting differing national preferences regarding data protection and cross-border data flows (Casalini and López González, 2019).

Some countries attempt to address differences in data-related regulatory models and the rise in data protectionism by incorporating data provisions into trade agreements. These provisions aim to establish strong, binding rules on storage and cross-border data flows. According to the Trade Agreement Provisions on Electronic Commerce and Data (TAPED) dataset, the number of such provisions has increased over time, particularly in recent years (Casalini et al., 2021; Burri and Kugler, 2024). More recently, a new generation of Digital Economy Agreements has been spreading globally (Burri and Vásquez, 2024). The signing of trade agreements that include these data provisions may be especially necessary between countries with differing data regulatory models, as a means to foster a form of "Data Free Flow with Trust"[2] among signatory nations. The impact of these agreements on trade has recently been explored in a few studies, which find that such provisions are associated with increased trade flows (Suh and Roh, 2023; Wu et al., 2023; Wang and Liu, 2025; Blázquez et al., 2025). These studies argue that the establishment of data trade rules—defined as the inclusion of data provisions in trade agreements that commit to the free flow of cross-border data—creates external conditions conducive to services trade.

To the best of our knowledge, the impact of data trade rules on FDI flows remains largely unexplored to date, even though such rules are particularly relevant for trade services conducted through commercial presence. This paper aims to empirically examine through the estimation of a structural gravity model the impact of trade agreements with data provisions on bilateral FDI flows in services, with a specific focus on information services, which are more data-intensive. This analysis will be conducted through the estimation of a structural gravity model. Additionally, we aim to

[2] This concept, which was mentioned for the first time at the G20 OSAKA Summit in 2019, aims to promote the free flow of data while ensuring trust in privacy, security, and intellectual property rights. It is growingly recognised internationally, and G7 and G20 are committed to a policy agenda to advance this initiative (Christakis, 2024).

explore whether the impact differs depending on whether the source and destination countries of FDI share the same data regulatory model. The impact may be stronger when FDI partner countries do not share the same regulatory model, as in the context of geo-economic fragmentation, the inclusion of clear data trade rules in trade agreements becomes essential for the cross-border supply of services.

This hypothesis is based on the idea that differences in data-related regulatory models and increasing data protectionism may be contributing to geo-economic fragmentation. This term was coined by Aiyar et al. (2023) to describe a policy-driven reversal of global economic integration, often motivated by strategic considerations such as national or economic security. Empirical evidence suggests that FDI is becoming more responsive to these strategic considerations, with bilateral flows increasingly concentrated among countries with similar geopolitical and geoeconomic orientations (IMF, 2023; Gopinath et al., 2024). Although FDI flows between opposing blocs have remained relatively limited, there is evidence that firms have increased investments across blocs in anticipation of protectionist trade measures (Boeckelmann et al., 2024). A relevant example in the information services sector is the investment announced by U.S. companies such as Microsoft and Amazon to expand their data center capacity in Europe—not only to comply with European regulations but also to protect local customers from perceived U.S. threats. Therefore, while FDI fragmentation is not yet a widespread phenomenon, it has occurred in specific countries and sectors particularly those considered to have strategic value. Among these are information services, which have shown evidence of geo-economic fragmentation in the most recent period (2018–2021) (Tan, 2024).

Our paper contributes to the literature on the impact of trade agreements on FDI flows. Previous empirical studies yield mixed evidence depending on the specific provisions, the vertical or horizontal nature of FDI (which determines whether FDI and exports are complements or substitutes), the type of business activity, and the countries involved. Kox and Rojas-Romagosa (2021) empirically estimate the effect of trade agreements on FDI and find a positive impact, which does not significantly differ between deep and shallow agreements. Using the World Bank's dataset on the content of Preferential Trade Agreements (PTAs) and bilateral cross-border data on greenfield investments compiled by the Financial Times, 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-related activities. Larch and Yotov (2024) find that trade agreements positively affect bilateral FDI stocks only when they include investment provisions and other specific clauses such as 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). Instead of using the number of provisions to measure agreement depth, Bergstrand and Paniagua (2024) apply the Shapley Value approach from cooperative game theory to estimate the effects of sets of substantive provisions on FDI by multinational enterprises (MNEs). For this analysis, they use a new dataset—the Multinational Revenue, Employment and Investment Database (MREID)—developed by Ahmad et al. (2023). Their findings suggest that deep trade agreements positively affect both bilateral trade flows and bilateral FDI from origin to destination countries, although the effect is smaller for FDI. According to their results, provisions that positively (negatively) affect bilateral trade flows tend to negatively (positively) affect MNEs' FDI flows. In other words, trade and FDI appear to be predominantly substitutes in relation to the provisions of deep trade agreements. Furthermore, the authors identify the channels through which these effects operate, finding that sets of provisions that positively (negatively) affect bilateral FDI flows are associated with decreasing (increasing) marginal costs per employee at affiliates.

The rest of the paper is structured as follows. After this introduction, Section 2 describes the data used and provides a descriptive analysis of the key variables of our model. Section 3 presents the specification of the econometric model. Section 4 offers the results of the empirical analysis, focusing on the impact of the entry in force of PTAs with data provisions on FDI flows of services. Section 5 provides a discussion of the results of the empirical analysis. Section 6 concludes.

2. Data and main facts

2.1. Service FDI flows.

Data on bilateral FDI flows 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 revenues, costs, employment, numbers of affiliates, and investment variables of MNEs for the pairings of 185 countries, across 25 NAICS 2-digit industries (16 of them are services), and 12 years (2000-2021). The MREID is constructed using firm-level data from the ORBIS database where the key variable used to identify foreign ownership in is the "Global Ultimate Owner" which allows for the identification of the controlling entity at the top of the ownership chain.

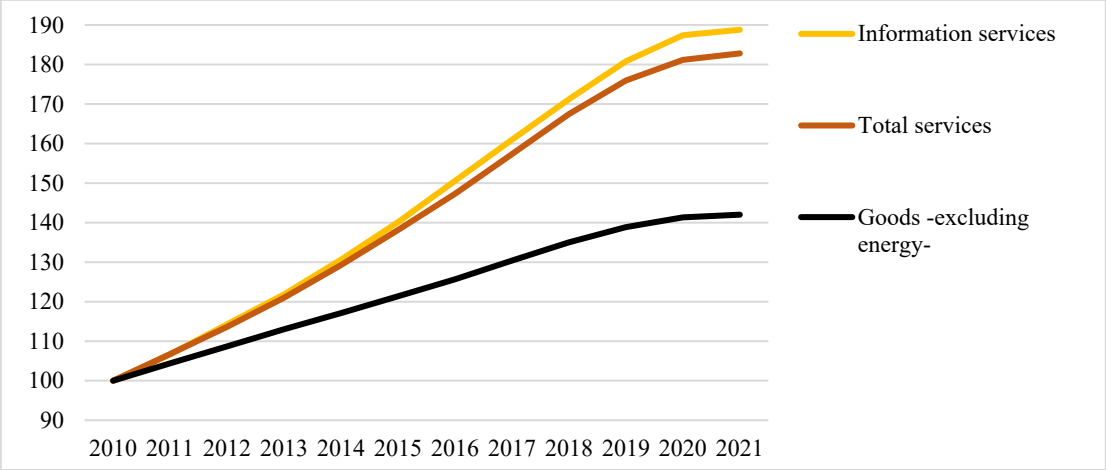
Among services, we pay particular attention to data-intensive services. Given the lack of information regarding the amount of data used by each sector, proxies are employed for this purpose, although none of them are ideal. Van der Marel and Ferracane (2021) and Cory and Dascoli (2021) rank the sectors 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[3].

To illustrate how FDI flows have evolved in last years, Figure 2 shows the evolution in the number of outward foreign affiliates (extensive margin of MNE activity) from 2010 to 2021 for *Goods* -excluding energy-, total *Services* (which accounts for almost 80% of total FDI flows[4]) and *Information* services. During this period, FDI in goods increased by 42%, while total services saw an 82% increase, and information services experienced nearly a 90% rise. Thus, the data-intensive services sector emerged as the most dynamic.

Figure 2: Evolution of FDI Flows by Sector, 2010-2021

(Number of Outward Foreign Affiliates; Index number, 2010=100).



Source: Authors' calculations based on MREID Database.

Next, we examine the evolution of FDI flows in services since 2010, distinguishing between flows among countries with the same data regulatory model and those with different data regulatory model. As explained in the Introduction, countries differ in their approaches to regulating cross-border data flows and data storage. We follow Ferracane and van der Marel (2021) to identify the data regulatory model adopted in each country. These authors categorize 116 countries into one of the

[3] According to the NAICS code description, the top businesses by annual sales for 51 are the following: AT&T Inc, Twdc Enterprises 18 Corp, Microsoft Corporation Cellco Partnership, Meta Platforms Inc, Charter Communications Inc, Comcast Corporation, Oracle Corporation, T-Mobile Us Inc and NBCUniversal Media LLC.

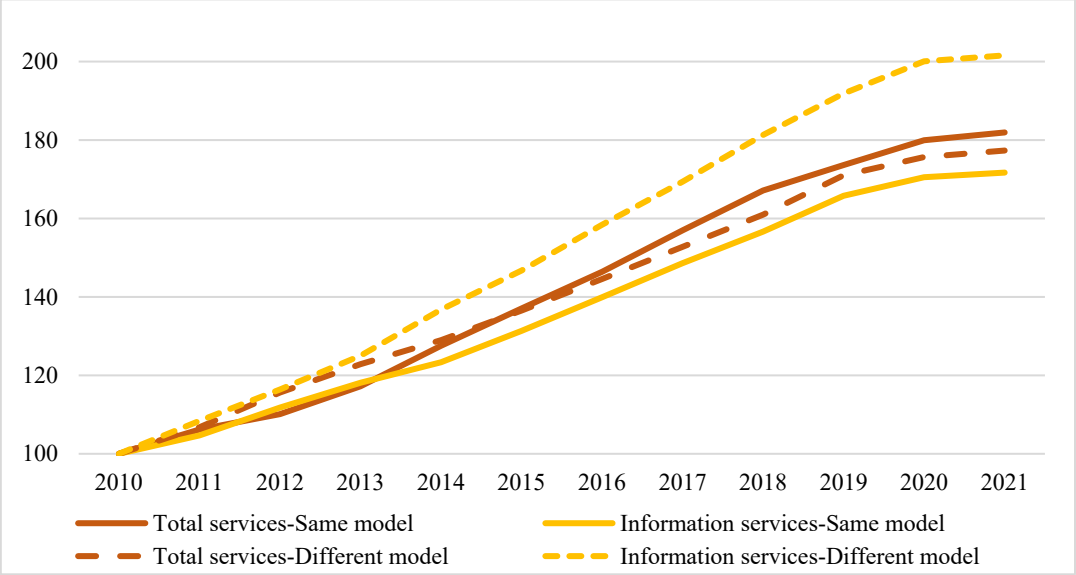
[4] Nearly half of FDI in services is concentrated in the six following sectors: wholesale trade (14%), legal services (13%), and management of companies and enterprises (10.7%), followed by real estate (6.6%), finance and insurance (5.3%), and information services (3.1%).

three models[5]. Moreover, as a substantial number of countries have changed their regulatory regimes for data over time, the authors identify the switching countries that, since 2000, have changed their governing frameworks to either the conditional model or the limited model. Consequently, the categorization of these countries has evolved over time. These changes have occurred primarily since 2010 (Ferracane and van der Marel, 2021). With this information, we classify bilateral FDI flows between those that occur between countries sharing the same regulatory data model and those with different regulatory model[6].

Based on this classification, Figure 3 presents the evolution of FDI flows in total services and in information services between countries with same and different data regulatory models. For both total services and information services, FDI flows have grown more between countries with different data regulatory models than between countries with the same data regulatory model. However, the growth difference has been much greater for data-intensive services. This suggests that regulatory heterogeneity does not appear to be an impediment to FDI flows between countries.

Figure 3: Evolution of Services FDI Flows 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.

[5] The list of the countries included in those three regulatory models is displayed in Table A1 of the Statistical Appendix.
[6] The bulk of FDI flows in data-intensive services are driven by countries following the open data model (US model) and the conditional model (EU model) because, as shown in Table A2, the main FDI sending and receiving countries are the US, the United Kingdom, and the EU-27 countries. In total services, EU-27 countries account for the highest values of outward FDI flows. Table A2 in the Statistical Appendix offers information about the (fifteen) main parent countries which account for more than 85% of FDI flows in data-intensive services, and their (three) main partners in 2021 and changes 2010-2021.

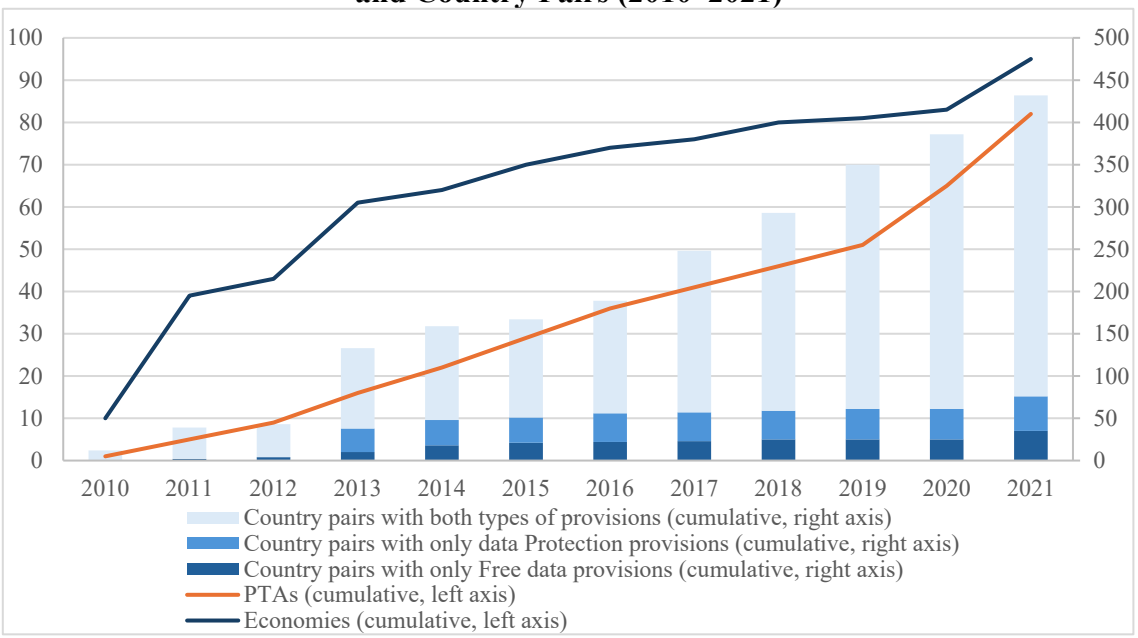
2.2. Preferential Trade Agreements with data provisions.

To identify PTAs containing data provisions, we rely on the TAPED (Trade Agreement Provisions on Electronic Commerce and Data) dataset[7]. 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). Although the updated TAPED dataset spans from the year 2000 onward, our analysis is confined to the period between 2010 and 2021 to ensure consistency with the coverage of the MREID database.

Figure 4 presents the cumulative evolution of PTAs incorporating data-related provisions, as well as the number of economies from MREID dataset and country pairs affected —restricted to those included in the MREID database—, over the period 2010–2021. 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 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.

[7] 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. Based on DESTA database, the latest version of TAPED (November 2024) covers over 465 new PTAs concluded since the year 2000. A total of 124 different items were coded, including provisions on digital trade, intellectual property, key service sectors, government procurement, trade in goods, general and specific exceptions and new cross-cutting data economy issues. The dataset is used to describe how to classify the agreements according to their legal characteristics. Detailed information is available at https://www.unilu.ch/en/faculties/faculty-of-law/professorships/burri-mira/research/taped/

Figure 4: Evolution of Data-Related Provisions in PTAs: Number of Agreements, Economies, and Country Pairs (2010–2021)



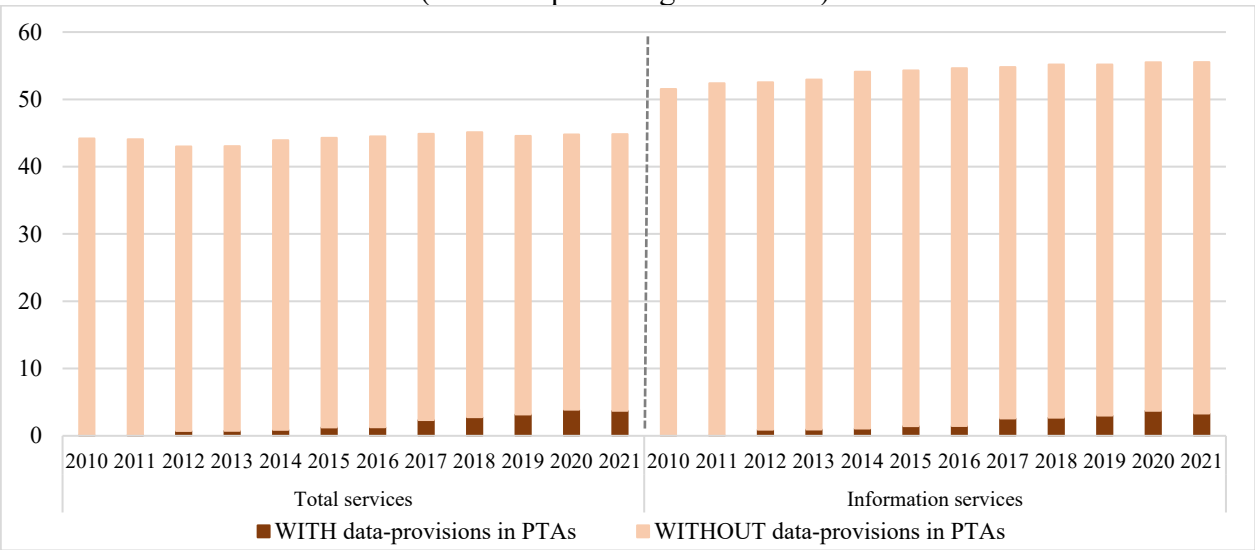
Source: Authors' calculations based on MREID Database and TAPED database.

As previously explained, we are particularly interested in exploring the impact of PTAs with data provisions on FDI flows, especially in relation to whether the source and destination countries of FDI share the same data regulatory model. Including clear data trade rules in PTAs might be particularly important for enhancing FDI flow between partner countries with different data regulatory models.

Given that the data regulatory framework might play a significant role in shaping FDI flows in data-intensive services, Figure 4 illustrates the share of total FDI represented by FDI flows between countries with different data regulatory models, distinguishing between flows involving countries with PTAs containing data provisions and those without such provisions. This share is provided for both total services and information services from 2010 to 2021. Around 45 percent of services FDI flows and around 55 per cent of FDI flows in information services are between countries with different data regulatory models. The majority of them occur outside the scope of PTAs with data-provisions. From 2012 onward, there is an increase in the share of FDI flows between countries involved in PTAs with data provisions.

Figure 4. FDI flows between countries with different regulatory model, with and without data provisions in PTAs, 2010-2021

(shares in percentage over total)



Source: Authors' calculation based on MREID Database and TAPED dataset

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 flows 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:

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

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. As already explained, these data come from the MREID database. Accordingly, the sectoral superscript (k) denotes each of the service sectors included in the dataset. 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[8]. 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[9] 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.[10] 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:

[8] Only binding provisions (hard commitments) are included in the analysis.
[9] *Latent trait analysis* is a type of factor analysis for binary data (Bartholomew et al., 2011).
[10] Figure A.1 in the Statistical Appendix illustrates the frequency of data-dedicated provisions in PTAs.

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 ($Data\_prov_{ij,t}\#D\_Inf$).

In order 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 flows, 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. The data for this variable are sourced from the *Centre d'études prospectives et d'informations internationales* (CEPII) gravity database.

Second, we include a dummy variable indicating whether a bilateral investment treaty (BIT) 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 to reduce the risks associated with FDI by enhancing transparency regarding the regulatory environment in host countries (Bergstrand and Egger, 2013). Including BITs in the gravity model is important, as countries with stronger trade or investment ties are more likely to enter into trade agreements. Controlling for BITs thus 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, denoted as $BIT_{ij,t}$, 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, following the latest recommendations for estimating gravity models (Yotov et al., 2016). We include sector-specific country pair fixed effects, denoted as μ^{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 taken into account in a gravity model that estimates the determinants of bilateral FDI flows. Globalization effects are then captured by a vector of time-varying border dummy variables, denoted as $INTER^{k}_{ij,t}$, 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 PTAs with 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 flows 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*. All specifications include a comprehensive set of fixed effects and globalization controls, as detailed above and in the table notes.

In Table 2, the 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 commitments in PTAs on bilateral FDI in services. Sector-specific heterogeneity is examined by interacting the main explanatory variable with a dummy for information 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 flows occur between countries that share the same regulatory model or operate

under different ones. We further test for sector-specific heterogeneity by introducing a triple interaction with a dummy for information services.

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 flows across the service sector as a whole. The interaction term *Data_Prov*×*D_Inf* captures the differential effect of data-related provisions specifically for the information services sector. The estimated coefficient is negative and statistically significant. This indicates that the effect of data-related provisions is not uniform across sectors: for the information services sector specifically, the presence of such provisions is associated with a significantly lower level of FDI compared to the service sector as a whole. The estimated coefficient of −0.045 implies that, relative to the average effect across all services, FDI flows in the information services sector are approximately 4.4% lower when data-related provisions are present in a PTA.

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 FDI flows 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 flows in services, while column (b) focuses on the depth or comprehensiveness 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 coefficient on $Data\_prov_{ij,t} \times D\_DiffReg_{ij,t}$ from column (2a) is positive and statistically significant, indicating that PTAs with data-related provisions are associated with higher FDI flows in

services when the partner countries follow different regulatory models. However, the triple interaction $Data\_prov_{ij,t} \times D\_DiffReg_{ij,t} \times D\_Inf$ is negative and highly significant, implying that this positive effect does not extend to the information services sector. In fact, for this sector, the presence of data-related provisions in PTAs between countries with divergent regulatory models is associated with a substantial reduction in FDI flows (approximately −9.06%). The interactions $Data\_prov_{ij,t} \times D\_SameReg_{ij,t}$ from column (2a) are negative or close to zero and not statistically significant, suggesting that regulatory alignment alone does not amplify the effect of data-related provisions on FDI, nor does it significantly alter the outcome for information services.

Table 2. FDI flows 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 flow of FDI (number of 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 (2b), the coefficient on $Data\_Depth_{ij,t} \times D\_DiffReg_{ij,t}$ is positive and highly significant, indicating that deeper data-related provisions in PTAs are particularly effective in promoting FDI when countries have different regulatory frameworks. However, the triple interaction $Data\_Depth_{ij,t} \times D\_DiffReg_{ij,t} \times D\_Inf$ is strongly negative and statistically significant, suggesting that in the information services sector, deeper data-related provisions in PTAs between countries with divergent regulatory models are associated with a sharp decline in FDI flows (approximately −26.5%). The interactions involving $D\_SameReg_{ij,t}$ remain statistically insignificant, indicating that the depth of data-related provisions does 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 data-related provisions to distinguish between 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 flows 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 sector. 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 4 presents PPML estimates that examine the relationship between the depth of data-related provisions in PTAs and bilateral FDI flows 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 3. FDI flows 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. The regressand is the yearly flow of FDI (number of 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.

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. The regressand is the yearly flow of FDI (number of 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.

5. Discussion of Results

The empirical findings presented above offer nuanced insights into the relationship between data-related provisions in PTAs and bilateral FDI flows 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 flows 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, the liberalization of cross-border data flows may substitute for the need to establish a commercial presence abroad. In other words, by enabling remote service delivery (mode 1 of services trade), PTAs with strong data provisions may reduce the reliance on foreign affiliates (mode 3), which is the form of FDI captured in the dependent variable.

This interpretation aligns with the theoretical literature on the substitutability of modes of service supply. In sectors such as information and communication technologies, 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.

Overall, our findings underscore the importance of considering sectoral characteristics and regulatory context when evaluating the investment effects of digital trade provisions. They also highlight the need for policymakers to recognize that the liberalization of digital trade may have differentiated effects across sectors, potentially reshaping the geography and mode of service delivery in the global 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 want to determine whether the results on the impact of PTAs with data provisions on services FDI flows remain consistent when flows related to phantom FDI are excluded. To achieve this, two scenarios are considered, one more restrictive and one less restrictive. In the first case, all countries (both origin and destination) with a maximum share of phantom FDI exceeding 40% of total FDI are excluded. In the second case, the threshold is set at 70%. In both cases, the results uphold the main conclusions. 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 investigate the strength of our results using 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.[11]

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 flows 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 and drawing on novel datasets (TAPED and MREID), 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 clauses—are associated with higher FDI flows 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.

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 significant reduction in FDI flows. This result is consistent with the hypothesis that liberalizing 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 data provisions 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, these findings underscore the importance of tailoring digital trade rules to sectoral realities and regulatory contexts. While embedding robust data provisions in PTAs can promote investment in many service sectors, they may also reshape the geography and mode of service delivery, particularly in digital industries. Policymakers should therefore consider the

[11] The results of the estimations conducted for each of the robustness checks discussed in the paper are available upon request.

substitutability between trade and investment in data-intensive services when designing digital trade agreements.

In conclusion, this study provides new evidence that data governance provisions in trade agreements are not neutral: their design, depth, and interaction with regulatory regimes and sectoral characteristics critically shape their impact not only on cross-border trade in services, but also on FDI, which remains a key channel for delivering services globally. As digital protectionism rises and regulatory fragmentation deepens, well-crafted data provisions can play a strategic role in sustaining global FDI flows in services—provided they are aligned with the technological and institutional realities of the sectors they aim to govern.

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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. Main FDI parent countries and their main partners, 2021 and changes 2010-2021

Ranking	Parent country	Share of total foreign affiliates, 2021 (%)	Regulatory data model	Main partners 2021	Share of total parent FDI, 2021 (%)	Regulatory model	Main change from 2010	Share of total increase in 2010-2021	Regulatory data model
1	USA	41,8	USA-model	GBR	44,4	EU model	GBR	53,2	EU model
				BRA	4,9		BRA	5,5	
				FRA	4,8		SGP	4,1	
2	GBR	6,9	EU-model	USA	11,1	US model	USA	11,0	US model
				FRA	9,3	EU model	SGP	9,4	EU model
				DEU	6,6		SWE	8,0	
3	FRA	5,4	EU-model	GBR	23,9	EU model	GBR	31,1	EU model
				BEL	9,0		BEL	7,8	
				ESP	7,6		DEU	7,4	
4	JPN	5,1	EU-model	GBR	31,5	EU model	GBR	39,9	EU model
				CHN	13,2	China model	SGP	13,0	
				USA	7,7	US model	CHN	8,7	China model
5	DEU	4,6	EU-model	GBR	19,9	EU model	GBR	26,2	EU model
				AUT	8,6		SGP	7,3	
				FRA	6,8		USA	7,3	US model
6	CYM	3,7		CHN	65,9	China model	CHN	70,4	China model
				GBR	10,0	EU model	GBR	11,9	EU model
				SGP	6,1		SGP	7,0	
7	SWE	3,5	EU-model	GBR	16,5	EU model	DNK	13,6	EU model
				NOR	14,2		GBR	13,6	
				DNK	11,6		NOR	13,0	
8	NLD	2,8	EU-model	GBR	15,3	EU model	GBR	16,7	EU model
				FRA	10,7		DEU	9,8	
				DEU	10,4		ESP	8,8	
9	LUX	2,2	EU-model	FRA	36,6	EU model	FRA	34,2	EU model
				ESP	7,4		ESP	9,0	
				DEU	6,6		ITA	8,1	
10	AUS	1,9	EU-model	GBR	42,6	EU model	GBR	30,8	EU model
				DEU	10,1		SGP	15,4	
				SGP	7,1		DEU	9,6	
11	ESP	1,8	EU-model	GBR	41,5	EU model	GBR	44,8	EU model
				PRT	11,8		COL	14,6	
				COL	11,8		BRA	8,3	
12	BEL	1,5	EU-model	FRA	24,8	EU model	FRA	24,1	EU model
				GBR	17,0		GBR	20,7	
				NLD	11,5		NLD	10,3	
13	CHE	1,5	EU-model	GBR	18,8	EU model	GBR	25,8	EU model
				DEU	13,4		USA	13,4	US model
				USA	12,4	US model	DEU	10,3	EU model
14	CAN	1,5	USA-model	GBR	32,9	EU model	GBR	40,9	EU model
				USA	24,8	US model	USA	18,2	US model
				SWE	8,7	EU model	SWE	12,1	EU model
15	ITA	1,2	EU-model	ESP	20,6	EU model	GBR	26,0	EU model
				GBR	20,6		USA	16,0	US model
				BRA	11,8		SWE	12,0	EU model

Source: Authors' elaboration based on MREID dataset.

Table A3. Data-dedicated provisions from TAPED dataset

<table>
<tr><th colspan="3">DATA PROTECTION</th></tr>
<tr><td colspan="3">Does the agreement include provisions on data protection? [2.1.1]
Does the agreement include provisions on data protection with no qualifications? [2.1.2]
Does the agreement include provisions on data protection according to domestic law? [2.1.3]
Does the agreement include provisions on data protection recognising certain key principles? [2.1.4]
Does the agreement include provisions on data protection recognising certain international standards? [2.1.5]
Does the agreement include provisions on data protection as a least restrictive measure? [2.1.6]</td></tr>
<tr><th colspan="3">FREE CROSS-BORDER DATA FLOWS</th></tr>
<tr><td>In the e-commerce/digital trade</td><td>Outside the e-commerce /digital trade chapter</td><td>Reference to data flows in service chapters/provisions</td></tr>
<tr><td colspan="2">Does the agreement include a provision on the free movement of data? [2.2.1; 2.3.1]
Does the agreement include a mechanism to address barriers to data flows? [2.2.2; 2.3.2]
Does the agreement include a provision banning or limiting data localisation requirements? [2.2.3; 2.3.3]
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]</td><td>In the telecommunications chapter/provisions [2.4.1]
In computer and related services chapter/provisions [2.4.2]
In audiovisual services chapter/provisions [2.4.3]
In the financial services chapter/provisions [2.4.4]</td></tr>
</table>

Note: Item in Codebook TAPED in square brackets

Figure A.1. Operationalizing Rasch' depth