

A Practical Guide for Modeling Cross-Border Services Trade at the Sector Level

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Abstract

We provide a practical approach for estimating the ex-ante effects on cross-border services trade from trade agreements pursuing services liberalization. Our modeling framework consists of three separate elements: (1) estimating trade elasticities for services sectors; (2) estimating the effect of FTAs with services provisions on cross-border trade barriers; and (3) using a Partial Equilibrium (PE) model to assess sector-level impact from services liberalization policies. To demonstrate the practicality of our modeling template, we analyze the sector-specific effects of a hypothetical and stylized trade agreement that liberalizes services trade between India and the United Kingdom.

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1 Introduction

Digital technology continues to transform international trade in services, allowing firms to deliver many types of services across borders that were previously treated as non-tradable. These technological advancements have led services trade to account for more than 27 percent of total global trade and has spurred a large body of research on the determinants and consequences of trade in services.¹ Given the growing importance of services trade, some countries have focused on the removal of discriminatory and restrictive services measures during trade negotiations (Shingal, 2015; Baiker, Borchert, Echandi, Fernandes, Hans, Magdeleine, Marchetti and Colomer, 2025).² Based on these developments, there has been a greater demand from practitioners to provide policy makers with reliable and timely estimates on the economic effects from services-related provisions in free trade agreements (FTAs).

In practice, studies examining the prospective effects of services trade liberalization have relied on general equilibrium trade models, where the emphasis is on determining the economy-wide effects of policy changes on output, prices, employment, and welfare.³ However, a sector-specific analysis can often serve as a useful exercise prior to modeling economy-wide effects as it allows practitioners to quantify the direct economic effects, without getting unnecessarily bogged down on the data requirements and technical complexities of general equilibrium trade modeling. Moreover, these models can be designed to better

¹See World Trade Statistics (2024) for more information on the top services sectors and exporters.

²As noted in Gootiiz, Jonetzko, Magdeleine, Marchetti and Mattoo (2020), around 70 percent of trade agreements post-2015 included provisions on services trade. Recent work by the World Bank highlights a shift in services liberalization over time. The 2008–2016 period was characterized by services liberalization among high-income countries at the sector level. More recently (2016–2022), low-and-medium income countries have generally liberalized services trade policies and in contrast, high-income countries have trended towards more restrictiveness (Baiker et al., 2025).

³See Francois and Hoekman (2010) for a review of studies that rely on computable general equilibrium (CGE) models to quantify the effects of countries' liberalizing cross-border trade and FDI in services. More recently, Herman and Oliver (2023) utilize a general equilibrium model of trade based on the structural gravity equation and find that the inclusion of digital trade facilitation provisions in trade agreements can help increase trade and output of services for both high-income and low-income member countries.

capture the unique features of a particular sector such as imperfect competition or scale economies. Given these inherent advantages, the goal of this paper is to provide a practical framework for analyzing the ex-ante effects at the sector-level from FTAs that include provisions targeting cross-border services trade.

Our template for analyzing the ex-ante effects at the sector-level of a hypothetical FTA with services provisions has the following three elements:

1. Estimating trade elasticities: Trade elasticities capture how consumers shift between domestic and imported varieties of a product after a change in relative prices. In quantitative trade models, the chosen value for the trade elasticity thus plays a key role in determining how much effect policy changes can have on trade and welfare. Building on Ahmad and Schreiber (2024), we highlight a practical method for estimating trade elasticities for services sectors—one that leverages the theoretical relationship that exists between the elasticity of substitution and profit margins in a monopolistic competition model of trade.
2. Estimating the average effect on trade barriers from FTAs with services provisions: A structural gravity model, as proposed in Anderson and Van Wincoop (2003), can be used to determine the average effect on cross-border trade costs for countries that are members of an FTA with services provisions. To capture heterogeneity across services sectors, we suggest conducting the gravity estimations at the sector level and focusing only on the sectors that are typically covered within trade agreements. If feasible, the estimations should also try to control for the variation observed within FTAs containing services provisions including differences in the liberalization approach taken, the way market access is defined, and the inclusion of substantive obligations.
3. Employing a Partial Equilibrium (PE) model to assess sector-level effects: Given the sector-level focus of our analysis, a PE model is a useful tool to quantify the ex-

ante effects of the hypothetical FTA. The elasticity estimates from step 1 and the ad valorem equivalent reduction in trade costs from FTAs with services provisions from step 2 serve as the main inputs to the PE model. We propose choosing a PE model that best matches the features of the sector to which it applies. For instance, the PE model should account for the unique characteristics of the services sectors such as imperfect competition, fixed costs, and economies of scale.⁴

The paper is organized as follows. We first give an overview of each of the three components of our modeling framework including relevant literature. We then demonstrate the practicality of our modeling template by analyzing the sector-specific effects of a hypothetical and stylized trade agreement that liberalizes services trade between India and the United Kingdom. We conclude by identifying areas where our analysis can improve from additional research on the role services provisions in FTAs have on services sectors.

2 Estimating Trade Elasticity for Services Sectors

2.1 Background

The elasticity of substitution, or the trade elasticity, is often a key parameter in trade models as it captures how consumers shift between domestic and imported varieties of a product after a change in relative prices that may arise from policy actions such as an increase in tariffs. The chosen value for the elasticity of substitution can significantly impact the estimated effects on trade, output, and welfare from changes in trade policy in PE and CGE simulations (McDaniel and Balistreri, 2003; Ahmad, Montgomery and Schreiber, 2021).

Several factors have made it difficult to pin down empirically-grounded estimates of

⁴For instance, our ex-ante analysis of the UK-India FTA is based on a PE model with monopolistic competition and fixed entry costs. However, depending on market characteristics, modelers may prefer alternative types of imperfect competition in their PE analysis.

elasticities of substitution for the services sectors. First, popular methods used to estimate elasticities of substitution for goods require information on both price and quantity of the traded good (Feenstra, 1994) or knowledge on tariffs being charged (Fontagné, Guillin and Mitaritonna, 2011); data on these inputs do not exist for traded services. Trade data for disaggregated services is also often absent for most countries and over time which makes methods relying on estimation more challenging. Lastly, some services are just not traded across borders.

These constraints have led some studies to estimate trade elasticities for services sectors by adopting a monopolistic competition model of trade. Under a monopolistic competition framework, a firm's revenues and operating profits are linked with the elasticity of substitution in its sector. Thus, the only data requirement is to have information on revenues and profits for the firms operating in a given services sector. Such data can be obtained from either national accounts or from firm-level datasets.

Rouzet, Benz and Spinelli (2017) were one of the first studies to use this approach to estimate trade elasticities for services sectors. Using firm-level data on sales and operating profits from Statistics Finland and the UK Office of National Statistics, they find a median estimate of 2.30 across services sectors, with a range from 1.6 (banking) to 5.4 (distribution services). Similarly, Christen, Pfaffermayr and Wolfmayr (2019) use financial data from the Bureau van Dijk AMADEUS database for firms in Austria. They find a median estimate of 3.55 for the services sectors with a range from 1.33 (real estate activities) to 4.36 (computer and IT). Blank, Egger, Merlo and Wamser (2022) rely on the Deutsche Bundesbank for balance sheet information to estimate the elasticity of substitution with the mark-up method. Rather than taking the median ratio across all firms as their estimate, Blank et al. (2022) instead add up all firms' sales and divide it by the sum of operating profits in each services sector. The median services elasticity in Blank et al. (2022) is 4.86, ranging from 3.27 (other services, including financial services and insurance) to 6.00 (construction).

Instead of firm-level data, Gervais and Jensen (2019) rely on industry-level data from the U.S. Bureau of Economic Analysis to estimate trade elasticities for U.S. manufacturing and services sectors using the mark-up method. They find that the elasticity for manufacturing industries with this approach is in line with other estimates provided in the literature. For services sectors, they report a median elasticity estimate of 5.98, with a much larger range seen in services sectors than found in manufacturing sectors. They note that under the monopolistic competition framework, high elasticity values in a sector are associated with low profit margins as price sensitive consumers choose firms that charge lower markups over marginal production costs.

Differing from the approach described above that use firm markups to estimate elasticity parameters, Egger, Larch, Nigai and Yotov (2021) rely on a structural gravity framework to estimate the elasticities of substitution for services sectors. They first recover importer-sector-time specific parameters from the estimation of their structural gravity equation for trade flows. They then use these estimates, along with sales data from WIOD, to recover the elasticity estimates. Their estimates for 19 services sectors have a median of 3.77, with all estimates falling between 2.5 and 4.4.

2.2 Methodology

We next provides a brief overview of the mark-up approach that has been used to estimate trade elasticities for services sectors.⁵ The mark-up method relies on the relationship that exists between the elasticity of substitution and profit margins in a monopolistic competition model of trade.

Under a monopolistic competition model of trade, consumers are assumed to have constant elasticity of substitution (CES) preferences with an elasticity parameter σ_s that describes the level of substitutability, or tradability, across the different varieties of the service

⁵More technical details are available in Gervais and Jensen (2019) and Ahmad and Riker (2019).

offered by firms (domestic and foreign) in a given sector.⁶ Services industries s are segmented and behave under a monopolistic competition framework where there are a continuum of homogeneous firms, each producing a unique variety of the service provided. Each firm has a constant marginal cost and sell their service at a marked up price above their marginal cost.

Given these assumptions, it is easy to show that each firm's profits π_i will be determined by the following rule:

$$\pi_i = \left(\frac{R_i}{\sigma_s} \right) - F_i \quad (1)$$

where R_i are the revenues generated by the firm and F_i are the firm's fixed costs. Rearranging terms and aggregating by all firms in a sector, the elasticity of substitution is given as:

$$\sigma_s = \frac{Total_Revenues_s}{Gross_Operating_Profits_s} \quad (2)$$

Note that *Gross_Operating_Profits_s* is defined as the sum of profits and fixed costs ($\pi_s + F_s$) for each sector s . Thus, the trade elasticity under the mark-up approach is simply the industry's total output in a given year divided by its gross operating surplus. As discussed in Gervais and Jensen (2019), national statistical agencies, such as the Bureau of Economic Analysis (BEA) for the United States, can be a useful source of information information on revenues and gross operating surplus across sectors. We will follow a similar approach to estimate the trade elasticities for services sectors in India and the UK. A benefit of our proposed approach is that the elasticity of substitution estimates are country-specific, enabling us to capture potential heterogeneity in consumer preferences by country.⁷

⁶The elasticity of substitution parameter should be a positive number greater than one.

⁷Our estimates can also be thought of as a proxy of competitiveness within each sector and country as less competition among firms leads to larger markups and smaller elasticities of substitution. These market conditions may differ significantly by sector and country.

2.3 Elasticity Estimates for UK and India

Table 1 summarizes our estimates by broad ISIC sector for India and the UK using the methodology discussed in Section 2.2. The calculations are based on national accounts data on annual value added by ISIC sector for the UK and India.⁸ Both Gervais and Jensen (2019) and Ahmad and Schreiber (2024) relied on BEA data to compute their trade elasticity estimates for the U.S. services sectors; we show here that this approach can be similarly applied for estimating trade elasticities for services sectors for non-US countries.

Table 1 reinforces the importance of estimating trade elasticities by country and sector for policy applications. We find there is significant heterogeneity in estimates both within a country's services sectors and across countries. Except for construction, the UK has higher trade elasticities for its main services sectors compared to India. This indicates that services sectors in the UK are more competitive than India and that there are less barriers to entry. The UK's Transport and Storage sector has the highest trade elasticity of 9.23 while the rest of the sectors are between 4 and 6. Overall, the estimates for the UK services sectors are comparable to what was reported in Gervais and Jensen (2019) for the United States.

On the other hand, India's services sectors, with the exception of construction, are found to have much lower trade elasticities. After construction, India's Information and Communication sector has the highest trade elasticity of 3.66. The remaining sectors are between 1 and 3 with India's Wholesale and Retail Trade sector having the lowest trade elasticity of 1.59. Thus, India's services sectors, apart from construction, are characterized by high profit margins which results in lower trade elasticity estimates using the mark-up approach. These low elasticity estimates suggest that firms may face significant barriers to entry in services

⁸Data for the UK was obtained from the OECD's annual value added and its components by economic activity indicator (<https://www.oecd.org/en/data/indicators/value-added-by-activity.html>). Data for India was obtained from India's Ministry of Statistics and Programme Implementation (<https://www.mospi.gov.in/publication/national-accounts-statistics-2024>). Gross operating profits was calculated as the sum of operating surplus and mixed income and consumption of fixed capital.

sector and consumers have less options to switch suppliers as a result of price shocks.

Table 1: Trade Elasticity Estimates for India and UK

ISIC	Description	India		UK	
		Mean	S.D.	Mean	S.D.
F	Construction	8.44	0.36	4.96	0.36
G	Wholesale/Retail Trade	1.59	0.02	5.76	0.41
H	Transportation & Storage	3.13	0.09	9.23	0.99
J	Information & Communication	3.66	0.49	4.70	0.55
K	Financial Services	2.05	0.08	4.04	0.29
M	Professional Services	2.01	0.15	4.74	0.25

Notes: The summary statistics are calculated using national accounts data on value added for India and the UK. The mean and standard deviation for the trade elasticities is based on annual data from 2011 to 2022 for India and from 2008 to 2022 for the UK.

A feature of the national accounts data is that we can compare the elasticity estimates across years and determine if they fluctuate over time. Thus, Table 1 reports the standard deviation observed in our annual services trade elasticity estimates. Based on the standard deviation values in Table 1, we can conclude that the trade elasticity estimates for most UK and Indian services sectors are relatively stable over time. The only sectors that have a high standard deviation for elasticity estimates across years are Construction and Information and Communication for India and Transportation and Storage for the UK.

3 Estimating Effects on Trade Barriers from FTAs

3.1 Background

There is a large body of work that examines the effects of FTAs using the gravity model of trade.⁹ Notable methodological advances in estimating the effects of FTAs with the gravity model have been to use panel data with a demanding set of fixed effects, to include domestic

⁹For a survey of this ever-growing literature, see Limao (2016), Larch and Yotov (2024) and Larch, Shikher and Yotov (2025).

trade flows along with international flows, and to capture the heterogeneity of FTAs through various means including by taking into account the depth of the agreement and the nature of its legal provisions. The general consensus from this literature is that FTAs have positive effects on trade even after accounting for endogeneity concerns and domestic trade (Baier and Bergstrand, 2007; Bergstrand, Larch and Yotov, 2015), with deeper agreements having stronger effects.¹⁰

While most studies have focused on the effects of FTAs on trade costs for goods, a small set of works have examined the effects of FTAs on services trade. In one of the earlier works on this issue, Shingal (2009) finds an increase of 16.1 percent on non-EU services trade from FTAs with services provisions (intra-EU trade increases by 26.1 percent). Similarly, Guillin (2013) finds that signing an FTA with services provisions has a positive and significant impact on trade in services of around 18 to 32 percent; however, only FTAs with a high degree of services liberalization have a substantial impact on trade. More recently, Borchert and Di Ubaldo (2021) leverage the Deep Trade Agreements database from the World Bank (Mattoo, Rocha and Ruta, 2020) to show that services provisions in deep FTAs can have a material impact on bilateral trade and value added in services.

Overall, the literature finds that with the necessary data, a gravity model can be a useful tool for determining the retrospective effects of an FTA on services trade. Such information can then help guide practitioners on the effects that prospective agreements with similar characteristics will have on the bilateral service trade costs of the negotiating countries.

3.2 Methodology

Based on the trade literature, we use the following specification for the gravity model when estimating the average effect of FTAs on services trade:

¹⁰See for instance, Kohl, Brakman and Garretsen (2016), Baier, Bergstrand and Feng (2014), and Dingra, Freeman and Mavroeidi (2018).

$$X_{ijt} = \exp(\beta_1 FTA_{ijt} + \beta_2 EU_{ijt} + S_{it} + D_{jt} + \gamma_{ij}) * \epsilon_{ijt} \quad (3)$$

On the left-hand side, X_{ijt} is the level of trade from country i to country j in time t for a given services sector.¹¹ The main variable of interest is FTA_{ijt} which takes a value of one if countries i and j have an FTA between them in time t with at least one services provision and 0 otherwise.¹² Since country-pairs may belong to more than one FTA, we keep the FTA with the most services provisions in a given year in the sample data. To account for possible lags in implementation, it may be better to include the FTA_{ijt} variable with a two-year lag. For example, a 2013 agreement with services provisions would equal one beginning in 2015.¹³ Membership to the EU is included as a separate control because of the importance of internal services market liberalization for EU member countries (Borchert and Di Ubaldo, 2021).

As is standard in recent gravity literature, the model includes importer-time and exporter-time fixed effects to account for the multilateral resistance terms present in structural gravity (Larch and Yotov, 2024). The inclusion of these fixed effects absorbs all possible observable and unobservable determinants of bilateral trade flows on the exporter and the importer side such as a country’s economic size (capturing demand) and its production capabilities and resource endowments (capturing supply). Further, country-pair fixed effects, as suggested by Baier and Bergstrand (2007), are used to control for unobserved time-invariant heterogeneity with panel data. These country-pair fixed effects can absorb all time-invariant factors that are likely to incentivize countries to form trade agreements (for instance strong economic or cultural ties). As noted in Larch et al. (2025), with country-pair fixed effects, the identification of the effects of an FTA comes solely from variation over time between

¹¹As noted in Larch et al. (2025), the ‘separability’ property of structural gravity enables estimations to be performed at any desired level of aggregation—so it is better to use disaggregated data when possible as the policy is usually implemented at the sector level.

¹²The variable has a value of 0 if either an agreement exists but does not contain any services provisions, or if i and j do not have any FTA between them.

¹³In our empirical exercise, we also estimated (3) without lags and do not find much difference in estimated coefficients.

pairs of countries.

Following Santos Silva and Tenreyro (2006), the model employs a poisson pseudo maximum likelihood (PPML) estimator, which can provide consistent estimates even in the presence of unobserved heteroskedasticity in the trade data. PPML is also capable of dealing with zero trade flows, and so there is no loss in information unlike the case when the data is log linearized for OLS estimation. Lastly, PPML is perfectly consistent with the theory of gravity, with the exporter-year and importer-year fixed effects fully capturing the multilateral resistance terms of structural gravity (Fally, 2015).

3.2.1 Capturing heterogeneous effects of FTAs

In identifying the effect of FTAs with services provisions using equation (3), we have followed the convention and used an indicator variable to reflect the presence of such an agreement. A drawback of this approach is that it treats all FTAs with services provisions as the same. Building on new databases that categorize the content of trade agreements across various policy dimensions¹⁴, recent studies have looked more directly at the content of FTAs and attempted to disentangle the effects on trade by the individual provisions in the different policy areas.¹⁵ With the use of advanced statistical techniques, including machine learning algorithms, these studies aim to isolate the effects of individual provisions and allow for the possibility of heterogeneous impacts across different sets of FTA provisions.¹⁶

As noted in Herman (2024), while these newer statistical techniques can be useful in grouping similar provisions, they may not be able to identify the effects from individual

¹⁴Much of this work has been supported by the release of new databases cataloging the content of trade agreements. A few notable databases include Horn, Mavroidis and Sapir (2010), the World Bank Deep Trade Agreement database (Mattoo et al., 2020), and the DESTA database (Dür, Baccini and Elsig, 2014).

¹⁵Common policy areas considered include sanitary and phytosanitary measures (SPS); technical barriers to trade (TBT); intellectual property rights (IPR); investment; rules of origin; services trade; environment; and labor rights.

¹⁶For instance, Breinlich, Corradi, Rocha, Ruta, Santos Silva and Zylkin (2022) use machine learning methods to show that provisions in FTAs related to antidumping, competition policy, technical barriers to trade, and trade facilitation play an important role in enhancing trade.

provisions on trade. Instead, they may only be identifying the provisions that are closely correlated with the ones that matter most and offer the best fit of the data. An alternative approach for identifying heterogeneous effects is to group the FTA provisions using some prior trade expertise and industry knowledge on how certain provisions can help facilitate trade. Although this approach is more subjective, as pointed by Borchert and Ubaldo (2022), it can leverage the experience of researchers with services trade policies, it is more transparent compared to a black box machine learning algorithm, and easier to test for false positives. In the next section, we give an example of how some prior classification of services provisions can assist in determining which FTAs will have a larger effect on services trade.

3.3 Estimates on trade costs from FTAs with Services Provisions

Bilateral services trade data from 2000–2019 is obtained from the USITC’s International Trade and Production Database for estimation (ITPD-E).¹⁷ Data on trade agreements and services provisions are collected from the World Bank’s Deep Trade Agreement (DTA) dataset.¹⁸ There are 16 services sectors in the ITPD-E database, though not all of them are traded across borders or covered by trade agreement provisions. We focus on the “core” tradable services sectors in the analysis below, defined as sectors that are traded across borders and typically addressed in provisions of trade agreements.¹⁹ These sectors are: construction; financial services; telecommunications, computer and information services; other business services; and wholesale and retail trade services. All estimations are performed at the ITPD sector-level, allowing FTAs with services provisions to have differential effects across the individual services sectors.

Results of the gravity regressions are reported in table 2. With the exception of construc-

¹⁷Data can be downloaded here: https://www.usitc.gov/data/gravity/gravity_portal

¹⁸Data can be downloaded here: <https://datatopics.worldbank.org/dta/table.html>

¹⁹For example, a number of services sectors such as travel, education and health care services are typically not traded across borders, but instead supplied via mode 2 (travel of consumers to suppliers’ territory).

tion, all other ITPD core services sectors see a statistically significant increase in bilateral trade when trading partners have an FTA with services provisions between them.²⁰ The largest effect is found for the Wholesale & Retail sector, with trade increasing by around 116 percent, on average, when countries are members of an FTA with services provisions.²¹ Overall, the effect of a trade agreement is likely to be heterogeneous by service sector.

We next convert our estimated FTA coefficients in table 2 into ad valorem equivalents (AVEs) so that they can be used as the policy shock in the PE simulations. As discussed in Benz and Jaax (2020), the computation of the AVEs also requires information on the trade elasticity.²² Since we have already shown in section 2 that UK and India have different elasticities of substitution for services sectors, the same expected increase in trade from an FTA will lead these countries to have different AVE changes. The calculated AVEs in table 2 show that an FTA between the UK and India will lead to a reduction in trade costs in the range of 11 percent to 15 percent for Indian firms exporting to the UK and around 15 percent to 73 percent for UK firms exporting to India. Thus, UK services firms are expected to benefit more than Indian services firms from a UK-India agreement on services trade.

Our analysis so far does not distinguish between FTAs with services provisions and assumes that they have the same average effect on cross-border services trade. However, the gravity framework of section 3.2 can be easily extended to capture heterogeneity across services FTAs. To demonstrate how a gravity analysis can be used in such a manner, we next conduct a simple exercise where Services FTAs are distinguished by the liberalization approach taken.²³ An FTA is classified as taking a “full liberalization approach” if it has a

²⁰For brevity, we do not report the estimates of EU membership on bilateral trade in table 2. All the estimates for EU membership were found to be positive and statistically significant.

²¹The trade effect from an FTA with services provisions is computed as $(e^{\hat{\beta}_{FTA}} - 1) * 100$

²²Specifically, the estimated FTA coefficients are converted to AVEs using the formula: $(e^{\frac{\hat{\beta}_{FTA}}{1-\sigma}} - 1) * 100$. Here σ is the sector-level elasticity of substitution estimated in Section 2.

²³The U.S. International Trade Commission (2021a) report on the Economic Impact of Trade Agreements used a similar approach of classifying services FTAs by the degree of liberalization undertaken.

Table 2: Average Impact of an FTA with Services Provisions on Trade Barriers

IITPD	Description	FTA Estimate	Std. Error	Trade Effect (%)	UK AVE (%)	India AVE (%)
158	Construction	-0.063	0.22			
160	Financial Services	0.513***	0.10	67.04	15.53	38.69
162	Information & Communication	0.441***	0.08	55.43	11.06	15.27
163	Professional Services	0.516***	0.13	67.53	12.89	40.00
163	Wholesale & Retail	0.770***	0.24	115.98	14.93	72.89

Notes: All estimations include importer-year, exporter-year, and country-pair fixed effects. Robust standard errors clustered at the importer-exporter level in parenthesis.

negative list structure and includes both a ratchet and a standstill provision.²⁴ Services FTAs are classified as following a “partial liberalization approach” if it either has a negative list approach, but without ratchet and standstill provisions; or it takes a positive list structure. All other Services FTAs are classified as ones having "no liberalization approach."

Table 3 reports our estimates on the effects on cross-border trade from Services FTAs having different liberalization approaches. We find that services FTAs that include a full liberalization approach have positive and significant impacts on cross-border trade in all four core services sectors.²⁵ Agreements that take a partial liberalization approach are found to have no effect in the Financial Services sector, and smaller effects in the Information & Communication and Wholesale & Retail sectors. Lastly, only the Wholesale & Retail and Professional Services sectors see a small and positive effect on trade from agreements that are not taking a full or partial approach to liberalization. Overall, these results show that the gravity approach can easily be modified to capture heterogeneity across Services FTAs and practitioners can distinguish between agreements with different services provisions if

²⁴Negative list agreements assume that all sectors are open to foreign services firms unless explicitly listed on a "negative list" of restricted sectors. They typically include a ratchet provision, which indicates that future liberalizations by parties to the agreement are legally bound by the agreement, and a standstill provision, so that reservations to member countries' obligations do not become more restrictive in the future.

²⁵Borchert and Di Ubaldo (2021) also find that ambitious policy configurations related to the agreement's liberalization approach, scope, and meaningful disciplines are the most effective in increasing services trade among FTA partners.

desired when conducting the ex-ante analysis.

Table 3: Effect of FTAs with different forms of services liberalization

	Financial Services			Information & Communication		
	Full Lib	Partial Lib	No Lib	Full Lib	Partial Lib	No Lib
Estimate	0.574***	0.236	0.377	0.725***	0.377***	0.252
Std Error	(0.13)	(0.20)	(0.24)	(0.14)	(0.13)	(0.18)

	Professional Services			Wholesale & Retail		
	Full Lib	Partial Lib	No Lib	Full Lib	Partial Lib	No Lib
Estimate	0.458***	0.643**	0.288*	0.997***	0.678*	0.638*
Std Error	(0.11)	(0.28)	(0.17)	(0.38)	(0.40)	(0.34)

Notes: All estimations include importer-year, exporter-year, and country-pair fixed effects. Robust standard errors clustered at the importer-exporter level in parenthesis.

4 Simulating Sector-Level Effects with a PE Model

4.1 Background

In policy applications, partial equilibrium models can play a key role in examining the impact of the policy changes on specific industries (Francois and Hall, 1997). Compared to the larger Computable General Equilibrium (CGE) models, PE models have specific advantages when it comes to examining trade policies that target specific sectors and industries such as non-tariff measures (NTM), rules of origin (ROOs), intellectual property rights, and services and investment regulations. Some recent policy applications of PE models include the impact of CBERA preferences on U.S. domestic industries (U.S International Trade Commission, 2025a); the effect of USMCA Rules of Origin on the auto sector (U.S. International Trade Commission, 2025b); and the impact on the U.S. domestic raspberries processing industry from higher imports of raspberries (U.S. International Trade Commission, 2021b).²⁶

First, these smaller-scale models can be constructed to better capture the unique features of the market such as imperfect competition among firms or scale economies. Second, there is

²⁶Reports published by the U.S. International Trade Commission are available here: https://www.usitc.gov/commission_publications_library.

greater flexibility when it comes to designing the policy experiment so that it more accurately reflects the nuances of the policy change and focuses on the narrowly defined products or industries to which it applies. As noted in Narayana, Hertel and Horridge (2010), most trade negotiations are conducted at the tariff line and so changes in tariffs and other barriers for specific products may not be easily identified among the more aggregate sectors in a CGE analysis. Third, PE models can be adapted to practical limitations on available data, substituting structure for data when necessary.

There are a handful of studies in the literature that developed a partial equilibrium model of services trade. Khachaturian and Riker (2017) presents a partial equilibrium model of multiple modes of services trade with firm heterogeneity, based on the model in Helpman, Melitz and Yeaple (2004). In Khachaturian and Riker (2017), firms decide whether they will serve foreign markets through cross-border exports or foreign affiliate sales, capturing the feature that the most productive firms are largest and able to establish foreign affiliate sales. The model is calibrated and applied for architectural and engineering service and legal services. Khachaturian and Riker (2018) similarly applies the model to international insurance services, and Khachaturian and Riker (2019) again to legal services.²⁷ They find that changing trade costs of imports in the U.S. market has large effects on both cross-border imports and foreign affiliate sales, but small impacts on sales of domestic producers due to their large U.S. market share.

Thus, PE models can provide trade analysts a convenient option for conducting ex-ante quantification of both tariff and non-tariff policy changes.²⁸ The primary limitation of PE models is that they analyze an industry in isolation and so are unable to estimate spillover

²⁷The 2019 paper uses the same modeling approach as the 2017 paper, with some modifications. First, the model allows for differences by country in variable services costs. The model also uses updated estimates of the elasticity of substitution. Third, the model equations in the 2017 paper are log-linear approximations whereas the 2019 paper has exact form non-linear equations.

²⁸For instance, the WITS Simulation Module allows users to conduct a PE analysis of trade policy changes at the industry level: <https://wits.worldbank.org/simulationtool.html>

effects on other parts of the economy, which may be important for large countries or countries with services sectors contributing to a large share of the economy.

4.2 PE Model and Data Inputs

We next describe the PE model that we will use to simulate the effects on the services sectors from a potential UK-India services trade agreement. The PE model is based on trade in differentiated products under monopolistic competition as introduced by Krugman (1980). Consumers are assumed to have a love of variety and substitute between the different varieties at a constant elasticity of substitution (CES demand). On the supply side, there is a continuum of homogeneous firms that produce a unique variety and have some pricing power on their product. The assumption of a continuum of varieties simplifies the pricing decision of the firms as each firm takes the industry price index as given. Each firm faces a constant marginal cost of production and charges a mark-up that is equal to the reciprocal of the absolute value of the constant own-price elasticity. Along with the variable production costs, firms also incur a fixed cost of production such that the number of firms in the market adjust until there are zero profits. Production thus takes place under increasing returns to scale.

We follow Balistreri and Rutherford (2013) to turn the theory of the Krugman model into a computational framework suitable for policy analysis. To simplify our analysis, the model only assumes three regions: UK, India and the Rest of the World (ROW). Firms in each region produce the services domestically and all regions trade with one another. When supplying services to foreign markets, firms incur iceberg trade costs and this is also reflected in the firm's real cost of production. The underlying demand parameters are calibrated using the initial sales to each region from source region.

To run the Krugman PE model, we require the following data inputs:

1. Trade and domestic production data
2. Elasticity parameters
3. Ad valorem change in trade costs from a Services FTA

We rely on the International Trade and Production Database for Simulation (Borchert, Larch, Shikher and Yotov, 2024) to obtain our baseline trade and domestic production data for the three regions. Table 4 reports the trade and domestic production values for the four core services being modeled. From the baseline data, we can see that Financial Services and Professional Services have the highest level of trade between UK and India. Trade plays a smaller role for both countries in the Wholesale & Retail Sector. Estimates of the trade elasticity for each services sector is obtained from table 1 while the reduction in AVEs from Services FTAs come from table 2.

Table 4: Benchmark Trade and Production Data for Krugman PE Model

Finance	UK	India	ROW	Info	UK	India	ROW
UK	77,969	281	68,595	UK	261,456	265	33,786
India	148	81,265	1,140	India	1,079	239,860	22,840
ROW	60,250	2,167	2,552,772	ROW	52,086	4,235	5,260,893
Prof	UK	India	ROW	Retail	UK	India	ROW
UK	449,661	976	116,397	UK	466,698	15	6,841
India	7,034	131,779	20,446	India	17	395,962	1,480
ROW	92,585	6,094	8,958,371	ROW	3,055	209	10,600,000

Notes: Finance = Financial Services, Prof = Professional Services, Info = Information and Communication Services, Retail = Wholesale and Retail Trade; All values are given in millions of dollars in 2019. For each sector, the rows represent source region and columns represent destination region of traded services.

4.3 PE Results

Having all the necessary information on trade elasticities and trade costs, we can now use the Krugman PE model to determine the ex-ante effects on services sectors from a

Services FTA between India and the UK. Figure 1 shows the effects on UK's exports in the four core services sectors from the PE simulation. Panel 1a shows that the largest gain for UK's exports to India, in dollar terms, from a potential Services FTA with India comes in Financial Services (increase by around \$900 million dollars) and in Professional Services (increase by around \$600 million dollars). There are smaller gains seen for UK's exports to India in Information and Communication sector (increase of around \$300 million dollars) and in Wholesale & Retail Trade (increase of around \$100 million dollars). Looking at UK's exports to the ROW region, we do not find much impact, except in Financial Services (a drop of around \$200 million). Panel 1b shows the same trade effects, in percent terms, on UK's exports. The largest increase in UK's exports to India is seen in the Wholesale & Retail Trade sector (more than 600 percent), reflecting the much smaller baseline trade value that is used for this sector in the simulation.

Figure 1 shows the effect on India's services exports from a UK-India Services FTA. From Panel 1a, we see that the largest gain in India's exports to UK, in dollar terms, comes in Professional Services (increase by around \$1 billion dollars) and in Information and Communication (increase by around \$650 million dollars). Smaller gains are seen in India's exports to UK in Financial Services (increase of around \$100 million dollars), while there are marginal gains for India's exports to UK in Wholesale & Retail Trade (increase of around \$20 million dollars). We do not find much impact on India's services exports to ROW from the simulation with a slight reduction seen in Information and Communication (a drop of around \$50 million). Panel 1b shows that the largest increase in India's exports to UK is seen in the Wholesale & Retail Trade sector (more than 600 percent), again reflecting the much smaller baseline trade value that is used for this sector in the simulation.

Along with trade effects, the PE model can also provide us information on the prices and quantity of services sold in each region. Table 5 reports these price and quantity effects from a services FTA between UK and India for all 3 regions and 4 core services sectors. For the

UK, we see a muted effect on prices and quantity which is consistent with India not being a major trading partner for the UK in these services sectors. We find more pronounced effects for India, especially in Professional Services, with prices decreasing by 1.14 percent and quantity increasing by 1.70 percent. Lastly, there are no price and quantity effects for the ROW region as its internal trade dwarfs its trade with UK and India in these services sectors.

Table 5: Effects on Price and Quantity from UK-India Services FTA (%)

		Financial Services	Information and Comm	Professional Services	Wholesale, Retail Trade
UK	Price Index	0.06	-0.07	-0.13	0.01
	Quantity	-0.10	0.11	0.20	-0.01
India	Price Index	-0.69	0.04	-1.14	-0.10
	Quantity	1.05	-0.05	1.70	0.02
ROW	Price Index	0.01	0.00	0.00	0.00
	Quantity	-0.01	0.00	0.00	0.00

It will be helpful to contextualize our main findings with other assessments of the UK-India FTA that have been recently conducted. For instance, the UK government published an impact assessment on the likely impacts of a UK-India free trade agreement (Department for Business and Trade, 2025). They utilize the Global Trade Analysis Project (GTAP) model, a multi-region and multi-sector comparative static CGE model with perfect competition and constant returns to scale, to assess the economy-wide and sectoral effects of the proposed trade agreement.²⁹ For the services sectors, they assume that FTAs reduce trade costs by providing services firms greater legal certainty that member countries will maintain their current regulatory commitments on imported services in the future. They use the OECD's Services Trade Restrictiveness Index (STRI) scores for the UK and India to capture the current level of restrictiveness in each country's services sector and then combine it with the

²⁹Along with the CGE results, the report also includes a PE analysis to quantify the potential direct impact for goods trade at a more disaggregated product level. However, the PE model is not used to analyze the trade impact on service sectors.

General Agreement of Trade in Services Trade Restrictiveness Index (GTRI) to determine how binding these commitments at current levels affect trade costs.

Given the differences in data, modeling framework (CGE vs PE), and the assumptions made on how FTAs impact services trades, we are unable to do a sector by sector comparison between their results with our own findings. Still, on a broader level, they find that, among the GTAP services sectors, the largest increase in UK exports to India were for Business services (£474 million), Wholesale and Retail Trade (£395 million), and Financial Services (£233 million). These are the same sectors that have the largest trade impact in our PE analysis, though the magnitude of effects are different. Similarly for India's exports to the UK, the UK impact assessment finds largest value increases for Communications (£443 million) and Business Services (£229 million) sectors, the same two sectors highlighted in our analysis. So, despite significant differences in data and methodology, we find positive trade effects from the UK-India FTA for the same set of services sectors as the UK study.

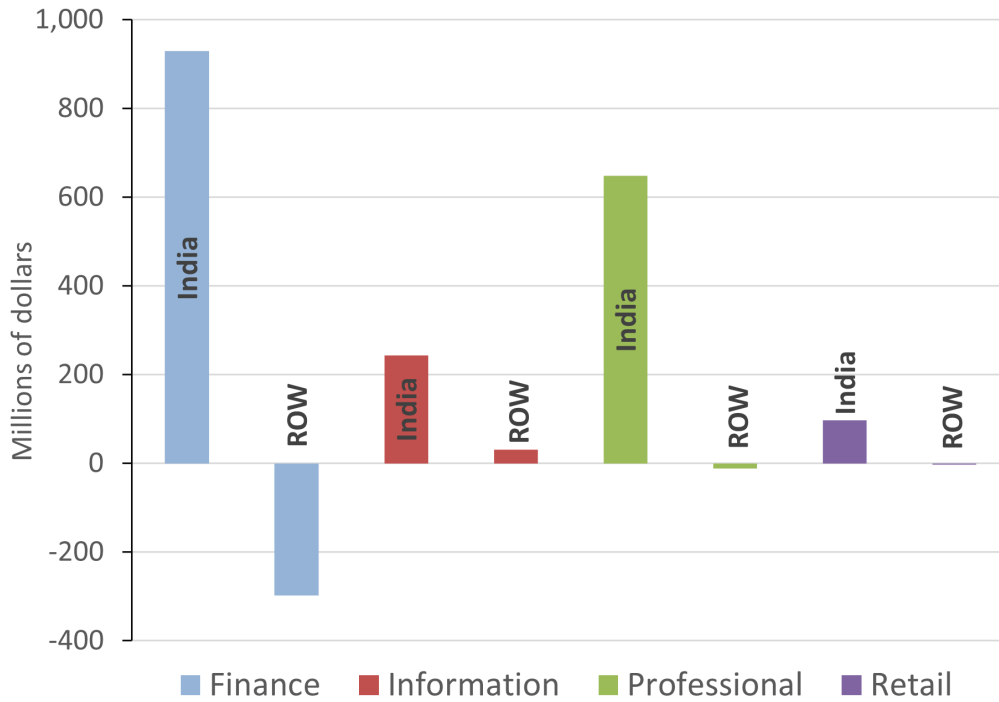
5 Conclusion

This paper presents a practical approach for identifying the ex-ante effects of FTAs with services provisions on services sectors. The key elements of the analysis are: (1) estimating trade elasticities for services sectors; (2) estimating the effects of FTAs with services provisions on cross-border trade costs; and (3) applying a sector-specific PE model with monopolistic competition to determine an economic impact. We demonstrate the feasibility of our approach by analyzing a hypothetical India-UK services FTA. Our results show economically meaningful trade effects for key services sectors with the biggest gains in exports seen for Indian firms in Professional Services and for UK firms in Financial Services. Our findings are also consistent with other ex-ante analyses done on the UK-India FTA such as the recent impact assessment performed by the UK's Department on Business and Trade.

Our framework can be extended in several directions. First, the empirical analysis can consider the observed heterogeneity across FTAs with services provisions and try to isolate the services provision that matter most for cross-border trade in a more systemic manner. The PE model can also be modified to examine the effects of non-tariff provisions in FTAs that tend to target a firm's fixed, rather than variable, costs of production. Lastly, our focus has been on cross-border services, but some services sectors require firms to have a commercial presence to serve the foreign market (mode 3). For those services sectors, our approach will have to be adjusted to capture the unique characteristics of this type of services trade.

Figure 1: Effect on UK's Exports to India and ROW from Services FTA

(a) Change in UK exports (value)



(b) Change in UK exports (percent)

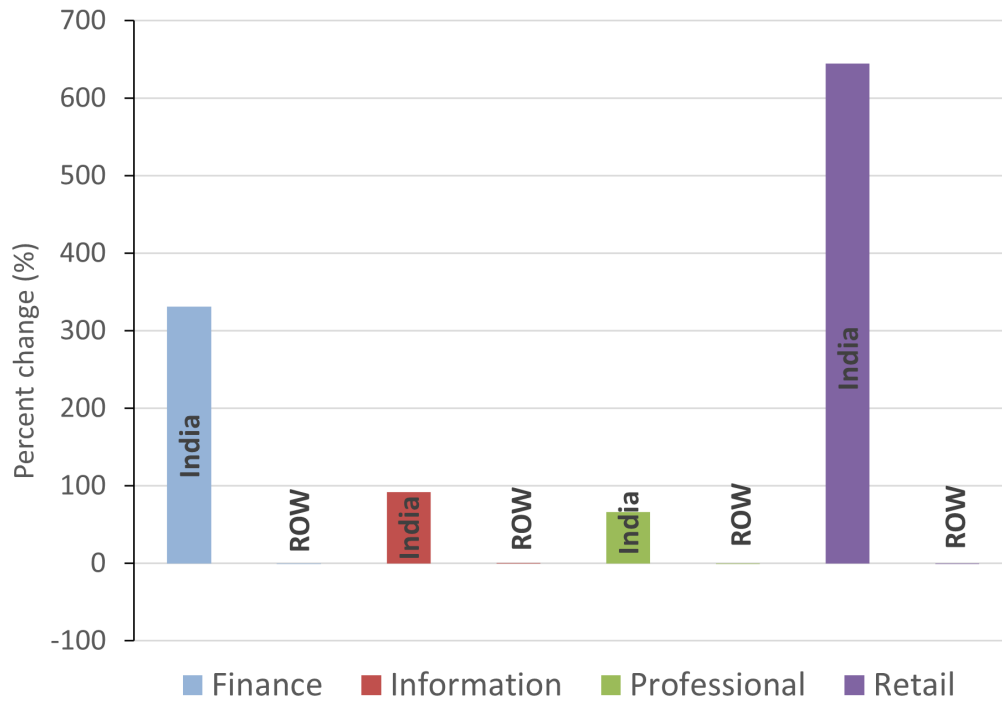
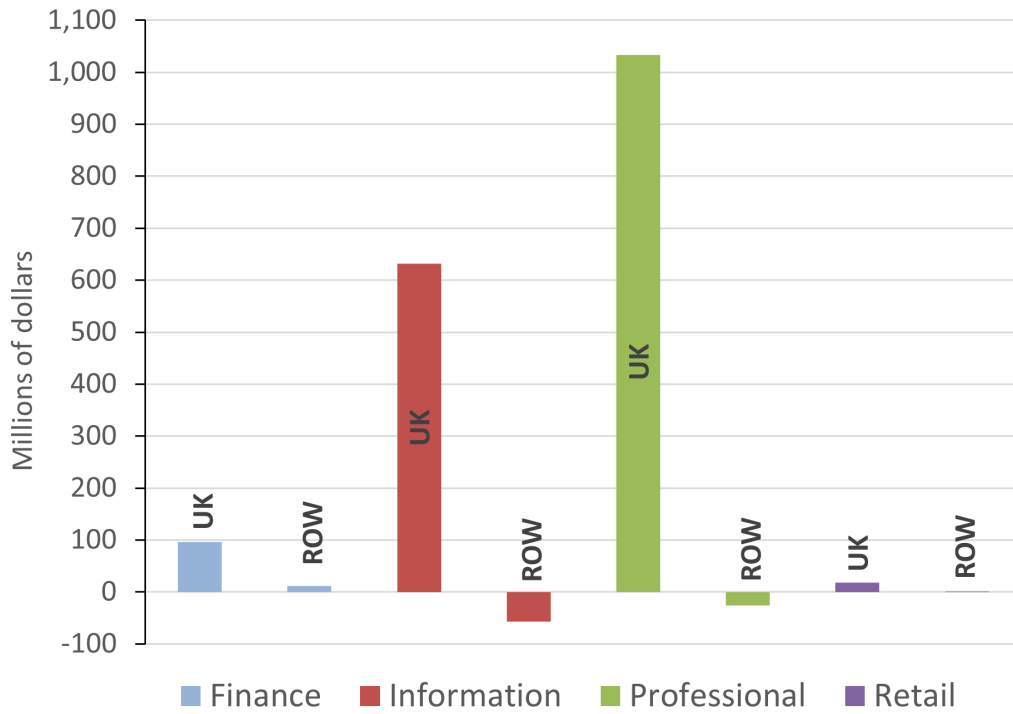
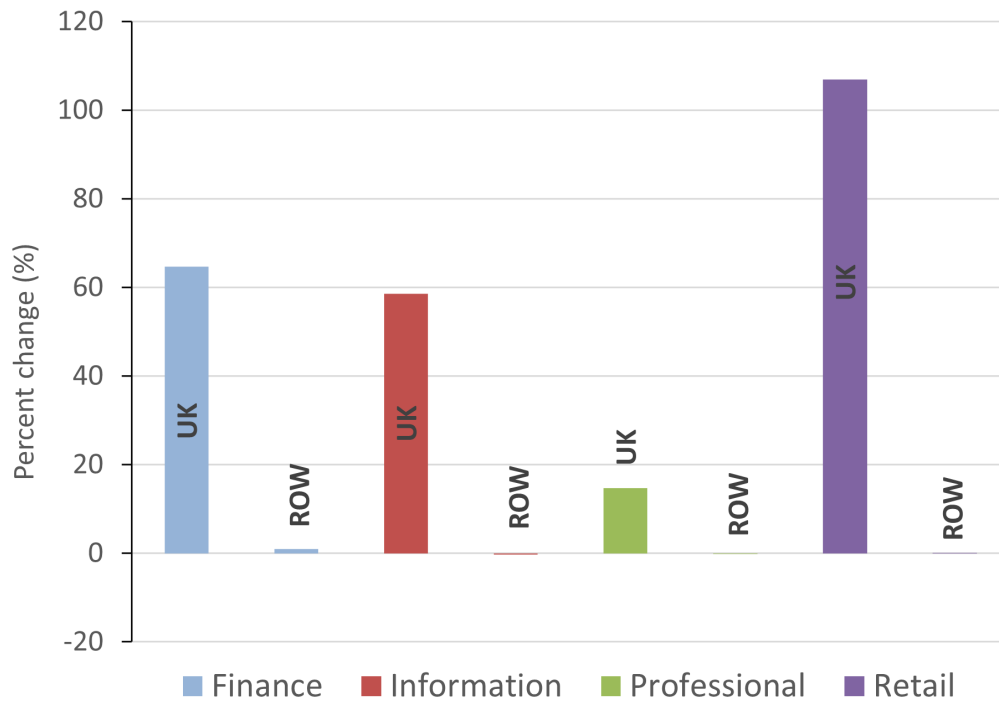


Figure 2: Effect on India's Exports to UK and ROW from Services FTA

(a) Change in Indian exports (value)



(b) Change in Indian exports (percent)



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